FLOOD OF APRIL 1987

IN MAINE, MASSACHUSETTS, AND NEW HAMPSHIRE

By Richard A. Fontaine

U.S. GEOLOGICAL SURVEY

Open-File Report 87-460

Augusta, Maine

1987

DEPARTMENT OF THE INTERIOR

DONALD PAUL HODEL, *Secretary*

U.S. GEOLOGICAL SURVEY

Dallas L. Peck, *Director*

For additional information
write to:

Chief, Maine Office
U.S. Geological Survey, WRD
26 Ganneston Drive
Augusta, Maine 04330

Copies of this report can be
purchased from:

U.S. Geological Survey
Books and Open-file Reports
Box 25425, Federal Center
Denver, CO 80225

CONTENTS

ILLUSTRATIONS

TABLES

CONVERSION FACTORS and ABBREVIATIONS

For readers who prefer metric (International System) units, conversion factors for inch-pound terms used in this report are listed below.

Multiply Inch-Pound Unit	By	To Obtain Metric Unit
	Length	
inch (in.)	25.40	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square mile (mi^2)	2.590	square kilometer (km^2)
	Flow	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
cubic foot per second per square mile $[(ft^3/s)/mi^2]$	0.01093	cubic meter per second per square kilometer $[(m^3/s)/km^2]$

Sea level: In this report "sea level" refers to the 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 "Mean Sea Level of 1929".

DEFINITION OF TERMS

Terms related to streamflow characteristics described in this report are defined below:

Cubic feet per second is the rate of discharge representing a volume of 1 cubic foot passing a given point during 1 second and is equivalent to approximately 7.48 gallons per second.

Discharge is the volume of water that passes a given point within a given period of time.

Drainage area of a stream at a specified location is that area, measured in a horizontal plane, enclosed by a topographic divide from which direct surface runoff from precipitation normally drains by gravity into the stream upstream from the specified location.

Gage height is the water-surface elevation referred to some arbitrary gage datum. Gage height is commonly used interchangeably with the general term "stage," although gage height is more appropriate when used with a reading on a gage.

Gaging station is a particular site on a stream, canal, lake, or reservoir where systematic observations of gage heights and discharges are determined.

Recurrence interval, or frequency, of a flood is the average number of years between exceedances of a particular flood event. It is emphasized that this is an average interval, and does not imply that there cannot be another flood of that magnitude within a shorter time. The reciprocal of recurrence interval is the probability of a flood equal to or greater than the specified magnitude in any year. Recurrence intervals were determined from individual station records according to procedures described by the Water Resources Council (1981).

FLOOD OF APRIL 1987 IN MAINE, MASSACHUSETTS, AND NEW HAMPSHIRE

by Richard A. Fontaine

ABSTRACT

Widespread flooding occurred through a large part of New England in early to mid-April 1987. The States affected most by these floods were Maine, Massachusetts, and New Hampshire. The flooding was the result of two distinct storms--one that brought heavy rains to the area from March 30 through April 2 and the other that brought additional precipitation from April 4 through April 8. Fortunately for the residents of Maine, Massachusetts, and New Hampshire, the two storms developed their greatest intensity and dropped the most precipitation over different parts of the three-State area. The first storm combined with meltwater from the snowpack to produce major flooding primarily in the western and south-central parts of Maine. The second storm produced flooding primarily in southern New Hampshire and in northeastern and northwestern Massachusetts. Many streams in the affected area produced peaks that exceeded previously known flood heights and discharges; the recurrence interval of many peak discharges exceeded 100 years.

INTRODUCTION

Purpose and Scope

The flood of April 1987, affected parts of western and south-central Maine, southern New Hampshire, and northeastern and northwestern Massachusetts.

The purpose of this report is to provide an early release of peak stage and discharge data for 74 gaging stations and miscellaneous sites in the affected area. Rainfall data for 142 sites are included as are results of snow surveys conducted at 120 sites in March, prior to the storm. All data contained in this report should be considered provisional and, therefore are, subject to revision.

Acknowledgements

Streamflow data, peak stages, discharges, and recurrence intervals were compiled by personnel in U.S. Geological Survey State offices in Maine, Massachusetts, and New Hampshire. The three State offices are part of the New England District of the U.S. Geological Survey. Precipitation and snow survey data were provided by the National Weather Service, the U.S. Army Corps of Engineers, Central Maine Power Company, Georgia-Pacific Corporation, Great Northern Paper Company, Kennebec Water Power Company, Maine Public Service Company, Union Water Power Company, New Hampshire Water Resources Board, and Massachusetts Department of Environmental Management. Special recognition is given to the personnel from all of the above agencies who worked long and hard during the flood to provide the critical data such as that incorporated in this report.

HYDROMETEOROLOGIC SETTING

Antecedent Conditions

In the few days prior to the arrival of the two April storm systems, northern New England was enjoying pleasant spring weather. Days were sunny and temperatures in the 50's to the middle 60's (°F) were common. These warm temperatures served to ripen or increase the density of the existing snowpack and to initiate the movement of meltwater from the snow. A ripened snowpack has little or no ability to absorb additional moisture. The rains that fell in late March and early April were not retained by the existing snowpack to any appreciable extent and actually accelerated the melting of the snowpack, thereby intensifying runoff during the storm periods within the watersheds of the study area.

Data from snow surveys conducted at 120 sites in northern New England prior to the April flood are summarized in table 1. Included in table 1 are site numbers that correspond to the numbers on figure 1 which show the location of each snow survey site. General information shown in table 1 includes the station name, snow depth, water content of the snow, and the density. Density is water content of the snow divided by the snow depth. Data from snow samples taken in the middle as well as the end of March 1987 are included when available. These data allow the reader to compare changes in the snowpack prior to the storms. When no data in March are available, data from the most recent snow survey are included.

Storm Characteristics

A storm that brought blizzard conditions and heavy snow to the area from the Dakotas to the Texas panhandle moved northeastward to Ohio on March 30. This storm brought heavy snow to Ohio and continued northeastward to Quebec on March 31. A cold front trailed southward from this storm system. The first of the two April storms to hit the New England area formed as a new area of low pressure on this trailing cold front over Virginia. This new low pressure system moved slowly to the northeast, bringing heavy rain to the New England area. The slow speed of this low-pressure system caused a long period of southeasterly winds to affect the area. The track of the southeasterly winds was almost perpendicular to the mountain ranges of central New Hampshire and western Maine. Resultant orographic effects augmented the storm rainfall totals on the eastern slopes of these areas. As a result, precipitation totals for the first storm were greatest in the mountainous headwaters of the rivers and streams that flow into and through Maine. The highest rainfall totals observed during the first storm were 8.30 in. at Pinkham Notch, New Hampshire, and 7.33 in. at Blanchard, Maine (Fred Ronco, National Weather Service, written commun. 1987). Runoff from the first storm was augmented by the meltwater from the snowpack, which was at or close to maximum density just prior to the storm.

Table 1.--Snow-survey data for March 1987 for selected sites

[A dash indicates data are not available]

Site no. (see figure 1)	Station name	Mid-March			End of March		
		Snow depth, in inches	Water content, in inches	Density[1/]	Snow depth in inches	Water content in inches	Density[1/]
			MAINE				
1	Albion	26.0	6.7	0.26	--	--	--
2	Allagash	35.3	9.7	.27	18.6	6.4	0.34
3	Ashland	46.4	9.0	.19	--	--	--
4	Augusta	12.0	--	--	2.0	--	--
5	Aziscohos Dam	26.0	7.3	.28	7.0	2.4	.34
6	Bangor	8.0	--	--	No snow	--	--
7	Big Machias	18.4	6.7	.36	--	--	--
8	Brassua	30.7	7.0	.23	--	--	--
9	Brunswick	6.0	--	--	No snow	--	--
10	Canoose	--	--	--	29.0	7.5	.26
11	Caribou	19.0	--	--	2.0	--	--
12	Carrabassett	30.4	7.6	.25	--	--	--
13	Caucumgamoc Lake	28.0	6.0	.21	--	--	--
14	Chain of Ponds	24.3	5.5	.23	--	--	--
15	Clayton Lake	19.9	6.1	.31	--	--	--
16	Clifford	--	--	--	28.0	10.0	.36
17	Crawford Pond	30.0	9.0	.30	--	--	--
18	Daaquom	16.8	5.3	.32	--	--	--
19	Dallas	25.1	5.8	.23	--	--	--
20	Dobsis	--	--	--	20.0	5.0	.25
21	East Grand Lake	--	--	--	19.7	5.5	.28
22	East Hiram	31.0	10.3	.33	15.0	6.0	.40
23	Eustis	24.7	6.0	.24	--	--	--
24	Flagstaff	25.0	5.9	.24	--	--	--
25	Fort Kent	18.0	--	--	3.0	--	--
26	Grand Falls	--	--	--	19.9	6.0	.30
27	Greenville	32.4	7.2	.22	--	--	--
28	Guilford	25.0	--	--	4.0	--	--
29	Guerette	34.1	6.2	.18	--	--	--
30	Harmony	22.0	--	--	2.0	--	--
31	Houlton	4.0	--	--	3.0	--	--
32	Hurd Pond	26.0	7.0	.27	--	--	--
33	Jackman	30.8	7.7	.25	--	--	--
34	Jones Pond	26.0	7.0	.22	--	--	--
35	Knowles Corner	39.5	7.8	.20	--	--	--

Table 1.--Snow-survey data for March 1987 for selected sites (Continued)

Site no. (see figure 1)	Station name	Mid-March			End of March		
		Snow depth, in inches	Water content, in inches	Density[1/]	Snow depth in inches	Water content in inches	Density[1/]
		MAINE--continued					
36	Kokadjo	30.0	7.6	0.25	--	--	--
37	Lobster Lake	25.0	6.0	.24	--	--	--
38	Long Pond-(Penobscot)	30.0	8.0	.27	--	--	--
39	Long Pond-(Kennebec)	30.3	7.2	.24	--	--	--
40	Middle Dam	28.0	7.8	.28	--	--	--
41	Millinocket	28.0	7.0	.25	--	--	--
42	Millinocket Lake	27.0	7.0	.26	--	--	--
43	Moosehead	31.1	8.0	.26	--	--	--
44	Musquacook	16.8	5.5	.33	--	--	--
45	New Sharon	26.0	--	--	No snow	--	--
46	Parlin Pond	36.5	9.1	.25	--	--	--
47	Penobscot Lake	30.0	7.0	.23	--	--	--
48	Portage Lake	37.4	8.0	.21	--	--	--
49	Portland	17.0	6.0	.35	--	--	--
50	Ragged Lake	27.0	7.0	.26	--	--	--
51	Ripogenus	29.0	8.0	.28	--	--	--
52	Rockwood	31.5	7.8	.25	--	--	--
53	Rumford	23.0	--	--	5.0	--	--
54	Seven Islands	32.1	5.6	.17	--	--	--
55	Smiley Hill	38.0	8.7	.23	--	--	--
56	Sourdnahank	29.0	8.0	.28	--	--	--
57	Spednic	--	--	--	22.0	6.5	.30
58	Squa Pan Dam C	40.7	9.4	.23	21.3	8.4	.39
59	Squa Pan Dam D	33.1	8.3	.25	14.8	6.4	.43
60	St. Pamphile	32.1	5.7	.18	--	--	--
61	Stratton	23.0	5.9	.26	--	--	--
62	Telos	31.5	6.0	.19	--	--	--
63	Umbazooksus Lake	28.0	7.0	.25	--	--	--
64	Upper Dam	21.0	6.5	.31	--	--	--
65	Washburn	37.8	6.8	.18	--	--	--
66	West Grand Lake	--	--	--	18.5	5.0	.27
67	West Paris	16.0	--	--	No snow	--	--
68	Winterville	45.4	11.2	.25	--	--	--

Table 1.--Snow-survey data for March 1987 for selected sites (Continued)

Site no. (see figure 1)	Station name	Mid-March Snow depth, in inches	Mid-March Water content, in inches	Mid-March Density[1/]	End of March Snow depth in inches	End of March Water content in inches	End of March Density[1/]
			NEW HAMPSHIRE				
69	Ayers Lake	14.4	3.8	0.26	No snow	--	--
70	Beech	22.9	6.8	.30	8.8	3.4	.39
71	Bennington	24.8	7.3	.29	--	--	--
72	Berlin	20.0	--	--	No snow	--	--
73	Blackwater	16.2	6.1	.38	Traces	--	--
74	Center Harbor	13.0	4.0	.31	0.9	0.2	.22
75	Chase Village	18.2	6.9	.38	7.3	3.1	.42
76	Childs Bog	22.3	6.3	.28	No snow	--	--
77	Comerford Dam	17.0	4.3	.25	--	--	--
78	Concord	9.0	--	--	No snow	--	--
79	Day Pond	20.9	7.1	.34	No snow	--	--
80	Everett Dam	20.7	7.1	.34	10.7	4.2	.39
81	First Connecticut Lake	25.0	6.8	.27	--	--	--
82	Franklin Falls	15.0	--	--	2.0	--	--
83	Gilford	20.9	6.3	.30	4.6	1.6	.35
84	Goose Pond	12.2	3.5	.29	1.6	0.4	.25
85	Granliden	21.6	6.6	.31	6.4	1.4	.22
86	Hopkinton Dam	13.0	--	--	No snow	--	--
87	Lebanon	8.0	--	--	No snow	--	--
88	Little Sunapee	22.0	6.9	.31	Traces	--	--
89	McDowell Dam	20.5	6.0	.29	8.5	3.2	.38
90	Mendums Pond	9.6	2.5	.26	No snow	--	--
91	Meredith	15.6	3.7	.24	No snow	--	--
92	Merrymeeting	9.4	3.1	.33	No snow	--	--
93	Mont Vernon	18.1	7.3	.40	No snow	--	--
94	Moore Dam	16.0	3.5	.22	--	--	--
95	Moose Falls	33.0	9.0	.27	--	--	--
96	Nashua	No snow	--	--	No snow	--	--
97	Nelson Brook	16.4	4.4	.27	Traces	--	--
98	New London	27.6	8.8	.32	13.8	4.3	.31
99	North Conway	16.0	--	--	No snow	--	--
100	North Wolfeboro	22.6	7.4	.33	11.1	3.4	.31
101	Owl Brook	21.1	6.0	.28	5.3	1.8	.34
102	Portsmouth	4.0	--	--	No snow	--	--
103	Scribner Brook	20.0	5.3	.26	3.2	1.8	.56

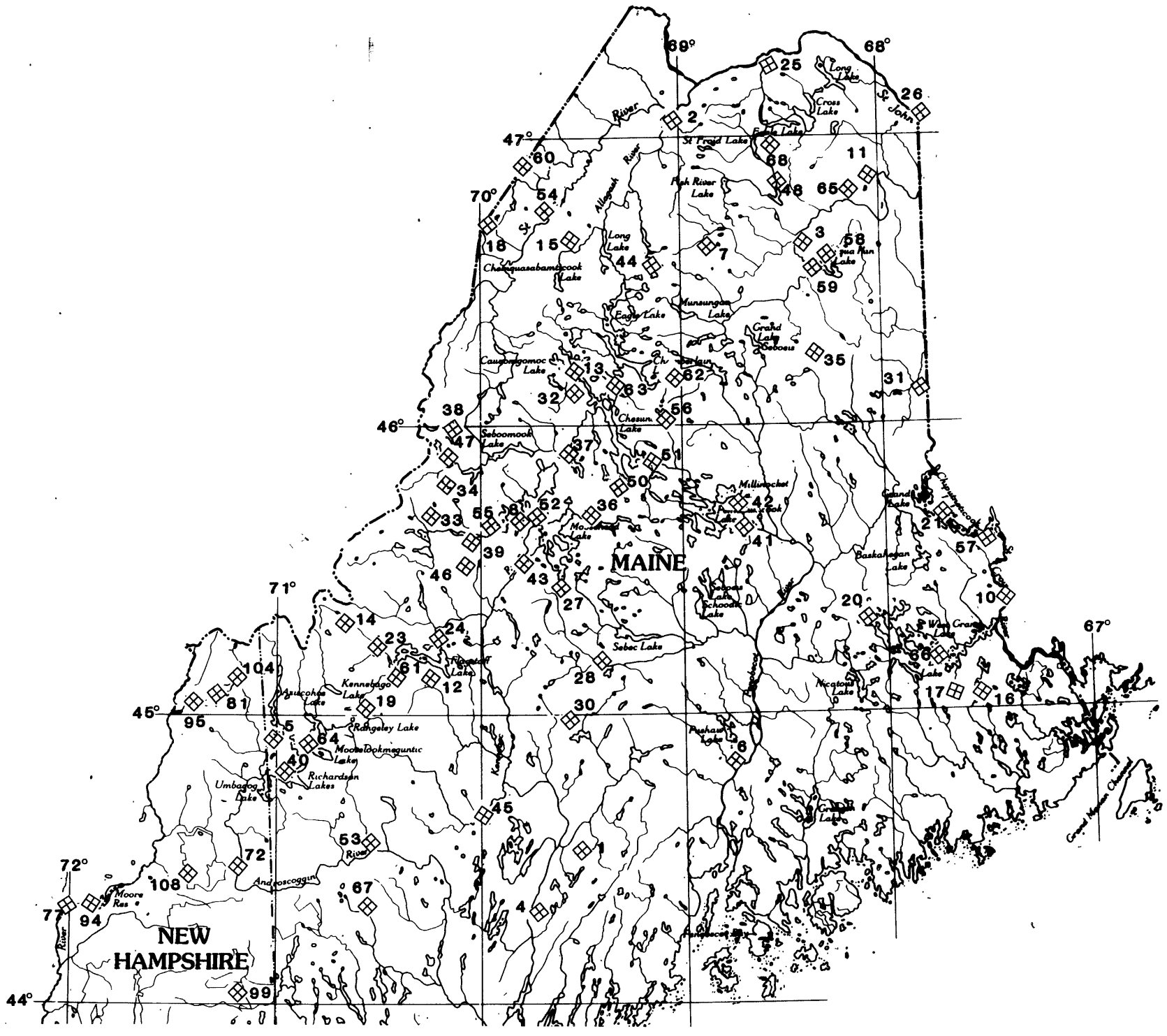
Table 1.--Snow-survey data for March 1987 for selected sites (Continued)

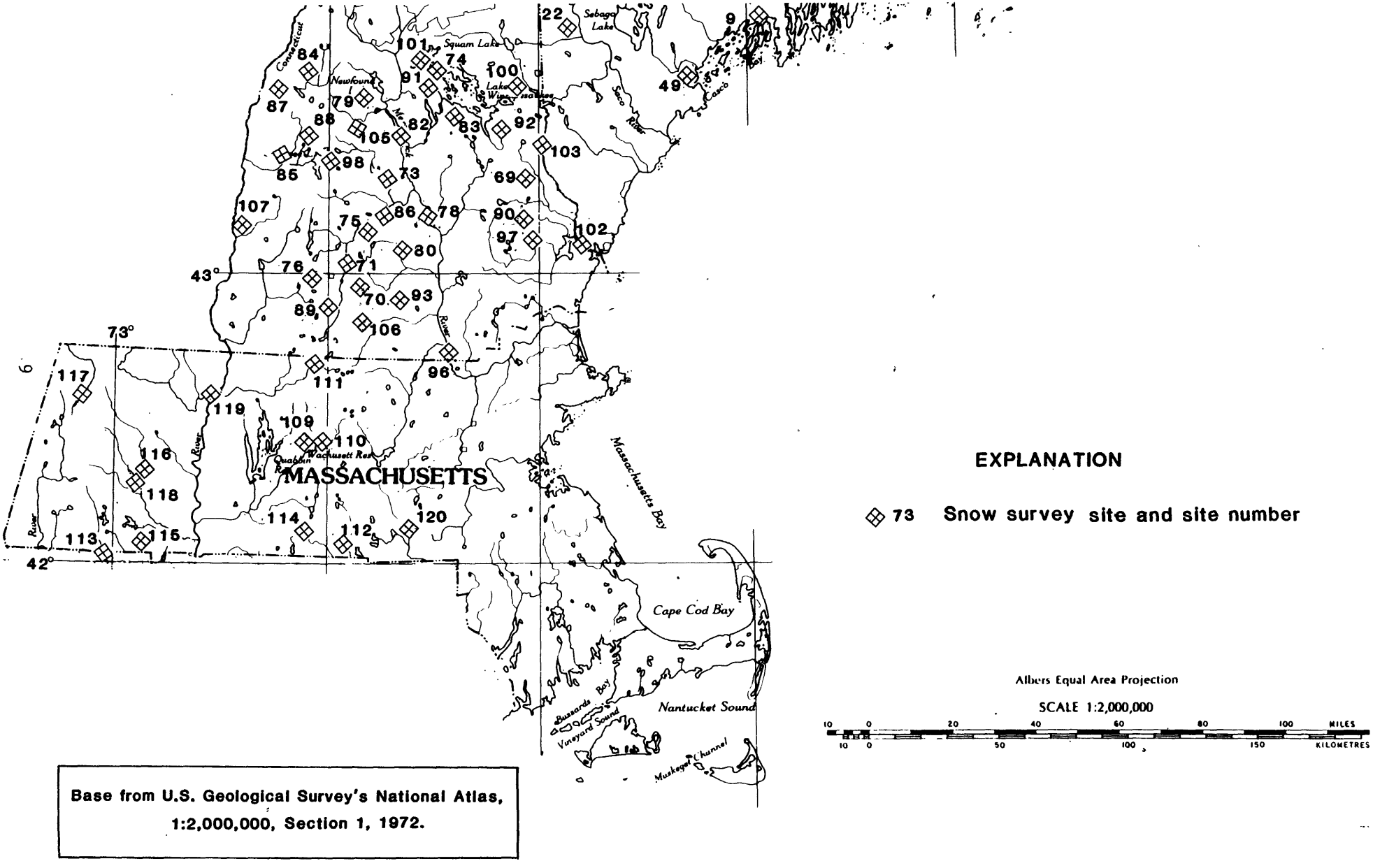
Site no. (see figure 1)	Station name	Mid-March Snow depth, in inches	Mid-March Water content, in inches	Mid-March Density[1/]	End of March Snow depth in inches	End of March Water content in inches	End of March Density[1/]
			NEW HAMPSHIRE--continued				
104	Second Connecticut Lake	31.0	8.4	0.27	--	--	--
105	South Danbury	25.5	7.9	.31	No snow	--	--
106	Temple	18.9	5.6	.30	No snow	--	--
107	Walpole	16.0	--	--	No snow	--	--
108	York Pond	21.0	4.2	.20	--	--	--
			MASSACHUSETTS				
109	Bakersville	7.0	--	--	No snow	--	--
110	Barre Falls	10.0	--	--	No snow	--	--
111	Birch Hill	4.0	--	--	No snow	--	--
112	Buffumville	3.0	--	--	No snow	--	--
113	Colebrook	5.0	--	--	No snow	--	--
114	East Brimfield	7.0	--	--	No snow	--	--
115	Granville	10.0	--	--	No snow	--	--
116	Knightville	8.0	--	--	No snow	--	--
117	Lanesborough	9.0	--	--	No snow	--	--
118	Littleville	12.0	--	--	No snow	--	--
119	Montague City	11.0	--	--	No snow	--	--
120	West Hill Dam	6.0	--	--	No snow	--	--

[1/] Density is the water content of the snow divided by the snow depth.

6

(p. 8 follows)


MAINE
NEW HAMPSHIRE
69°
68°
67°
47°
46°
45°
44°
70°
71°
72°
St. John River
Allagash River
Fish River Lake
St Froid Lake
Long Lake
Cross Lake
Eagle Lake
Munsungan Lake
Grand Lake Seboeis
Chesuncook Lake
Seboomook Lake
Millinocket Lake
Baskahegan Lake
Pushaw Lake
Sebec Lake
Schoodic Lake
Kennebago Lake
Rangeley Lake
Mooselookmeguntic Lake
Richardson Lakes
Umbagog Lake
Androscoggin River
Moore Res
Grand Lake
Grand Manan Channel



Base from U.S. Geological Survey's National Atlas, 1:2,000,000, Section 1, 1972.

Figure 1.--Snow-survey data-collection sites

Just as river levels were receding from the first storm, another area of low pressure developed over the Carolinas. This low moved very slowly to the northeast, and from April 4 to April 8 brought more heavy rains to the three-State area. Storm totals from the second storm were the greatest in south central New Hampshire and over parts of northeastern and northwestern Massachusetts. The areas hit the hardest by the precipitation from the second storm were not the same as those from the first storm. The highest rainfall totals observed from the second storm were 6.86 in. at Francestown in south-central New Hampshire, 8.65 in. at both Ashfield and Charlemont in northwestern Massachusetts, and 8.52 in. at Newburyport in northeastern Massachusetts.

Provisional rainfall data from the several cooperating agencies and organizations listed in the acknowledgments section of this report, are given in table 2. Included in table 2 are site numbers that correspond to the numbers on figure 2 which show the location of each site. Also included in table 2 are the station name and the accumulated rainfall totals for the periods March 30 to April 2 and April 4 to April 8. Data in table 2 represent that available at the time this report was prepared. Additional data are likely to be available at some future date.

DESCRIPTION OF FLOOD

Peak Stages and Discharges

Peak stages and discharges were determined at many gaging stations and miscellaneous sites throughout the three-state area affected by the flooding. Provisional data for these sites are given in table 3. Included in table 3 are site numbers that correspond to the numbers on figure 3 which show the location of each site. General information shown in table 3 includes the downstream order station number, station name and location, drainage area, and period of record for which peak stage and discharge data are available. Also included are peak date, stage, discharge for the maximum flood previously known and for the April 1987 flood, and the recurrence interval for the 1987 flood.

The recurrence interval or frequency of the floods, (table 3), is the average number of years between floods equal to or greater than the April 1987 flood. It is emphasized that this is an average number of years, and it does not imply that it will be that many years before another event of that magnitude occurs. In fact, similar or greater events can occur within the same year. The reciprocal of the frequency is the probability of the event occurring in any one year. For instance, a 100-year flood has a 0.01 probability, or 1-percent chance, of occurring in any year. All frequencies and recurrence intervals were determined from station data, unless otherwise noted. Log Pearson III procedures, as described by the Water Resources Council (1981), were used to compute individual station frequency curves.

Table 2.--Cumulative rainfall for March 30 to April 2, 1987, and April 4-8, 1987, for selected stations.
[A dash indicates data are not available].

Site no. (see figure 2)	Station name	Cumulative rainfall, in inches: March 30-April 2	April 4-8
	MAINE		
1	Albion	3.91	--
2	Augusta	3.65	1.12
3	Baileyville	1/ .42	.58
4	Bangor	2.78	.57
5	Bethel	6.94	.73
6	Blanchard	7.33	--
7	Bonny Eagle	4.13	3.57
8	Brassua Lake	3.13	.94
9	Brunswick	3.11	1.85
10	Caribou	.37	.69
11	Clayton Lake	1.58	.45
12	East Hiram	3.38	2.82
13	Eddington	2.63	.48
14	Ellsworth	1.31	.66
15	Eustis	2.20	1.03
16	Farmington	5.26	--
17	Flagstaff Lake	4.54	1.13
18	Forest City	1/ .61	.60
19	Fort Kent	1.24	.94
20	Fox Brook	1.00	.20
21	Grand Falls	1/ .51	.48
22	Grand Lake	3.17	1.16
23	Greenville	3.30	--
24	Guilford	4.11	1.00
25	Gulf Island	4.41	1.29
26	Harmony	4.70	.80
27	Harris Dam	2.99	.50
28	Houlton	.32	.44
29	Jackman	1.60	--
30	Kingfield	5.74	0.78
31	Livermore Falls	5.17	.82
32	Lovell	4.25	1.73
33	Machias	.26	.76
34	Medway	2.09	.90
35	Middle Dam	1.73	.47
36	Milford	3.09	.22
37	Millinocket	2.91	1.13
38	Milo	3.75	--
39	Moosehead Lake	2.98	.55
40	New Sharon	4.56	1.77
41	Phillips	3.78	1.43
42	Portage Lake	.92	.61
43	Portland	3.49	3.04
44	Presque Isle	.57	.46
45	Ripogenus	2.73	.51
46	Rumford	5.50	.88
47	Seboomook	2.10	.15
48	Skowhegan	4.02	.79
49	Smith Brook	1.20	1.50
50	St. Aurelie	1.70	.20
51	Telos Lake	1.14	1.05
52	Upper Dam	1.43	.52
53	Vanceboro	1/ .45	.82
54	Waterville	3.97	1.06
55	West Buxton	3.78	3.39
56	West Enfield	2.28	.63

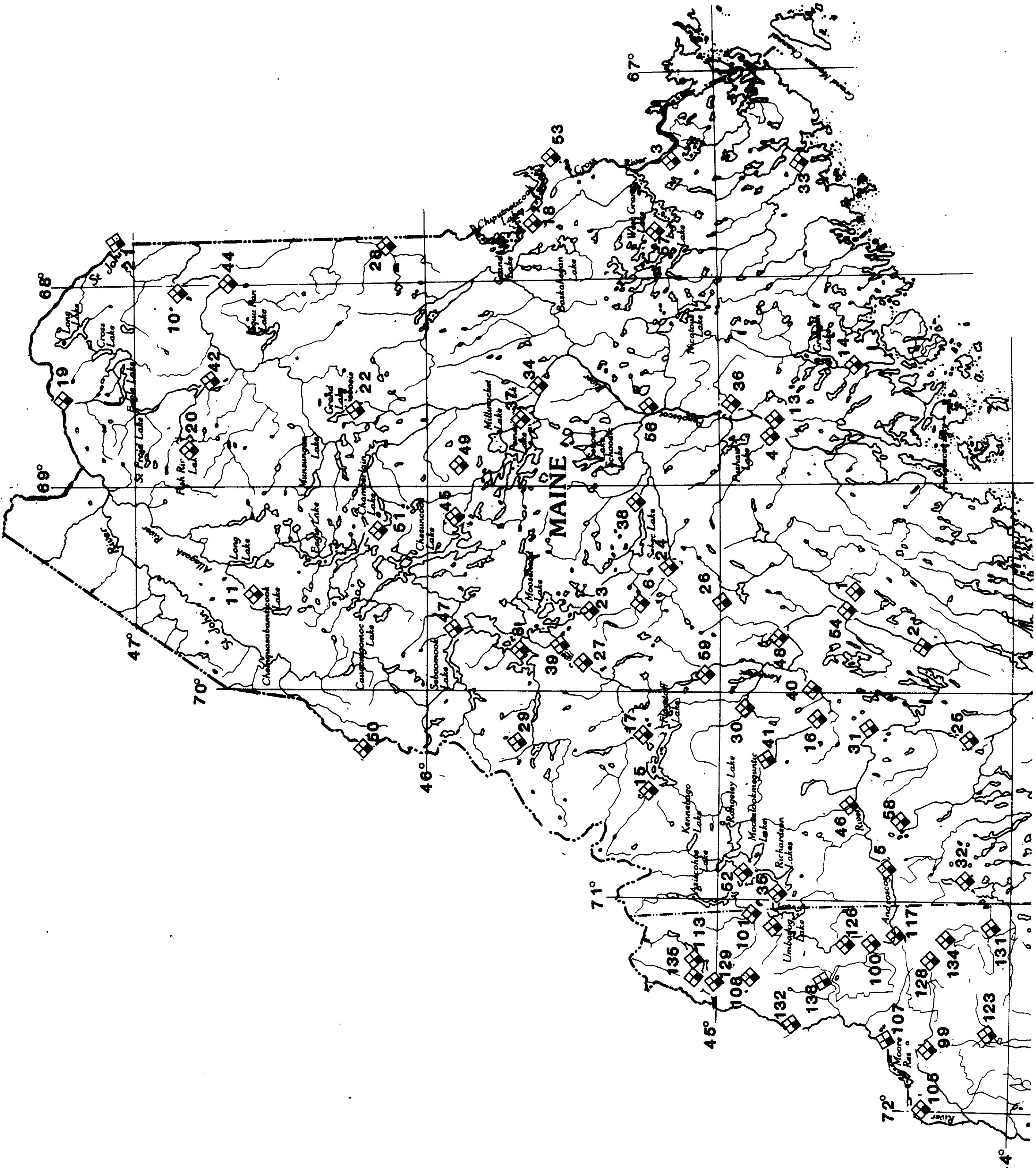
Table 2.--Cumulative rainfall for March 30 to April 2, 1987, and April 4-8, 1987, for selected stations.--(continued)

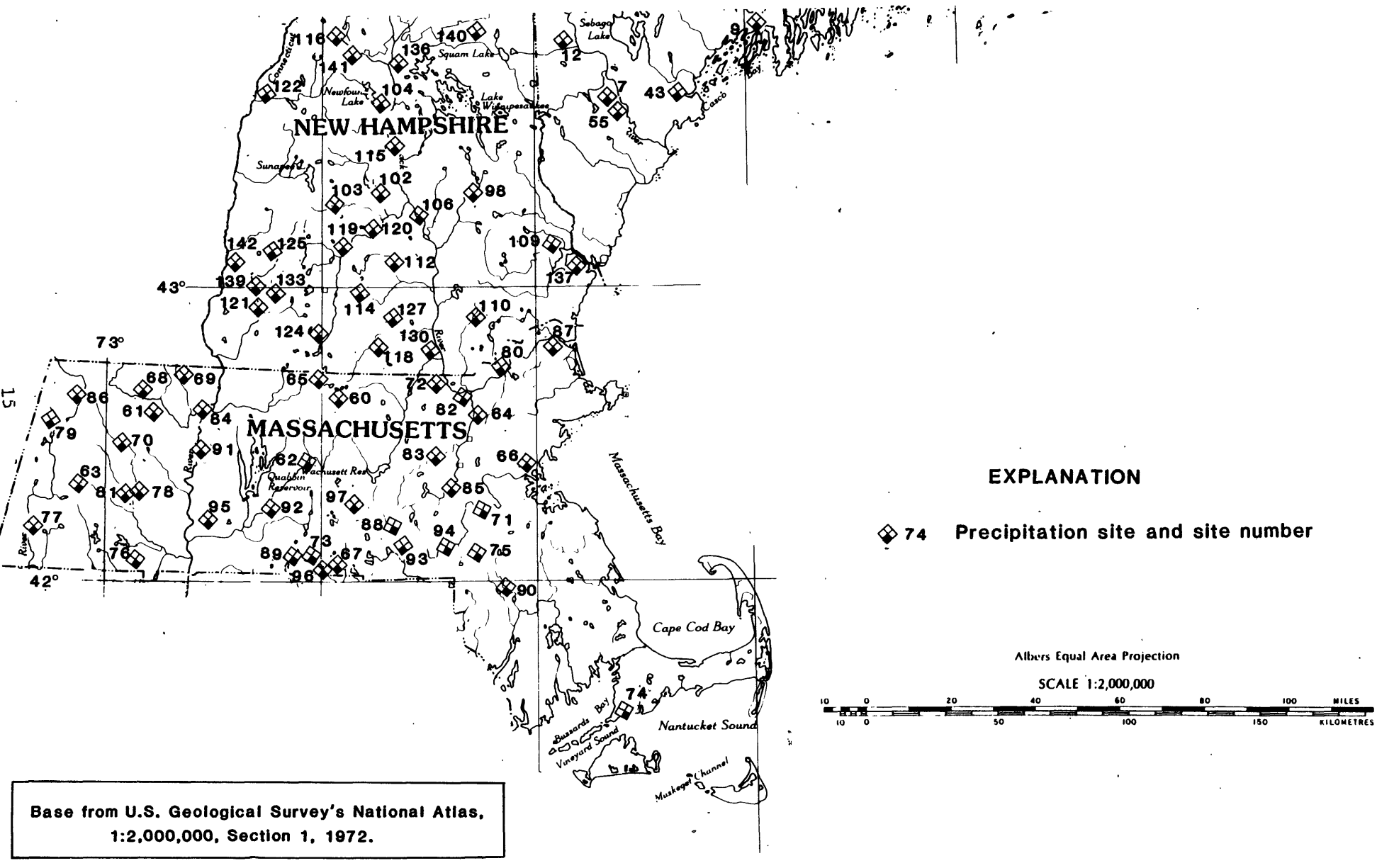
Site no. (see figure 2)	Station name	Cumulative rainfall, in inches: March 30-April 2	April 4-8
	MAINE--continued		
57	West Grand Lake	1/ 0.84	0.73
58	West Paris	4.91	.87
59	Wyman Dam	6.38	.35
	MASSACHUSETTS		
60	Ashburnham	3.06	7.23
61	Ashfield	2.86	8.65
62	Barre Falls	3.21	5.10
63	Becket	1/ .34	1/ 1.25
64	Billerica	3.61	6.07
65	Birch Hill	2.55	3.78
66	Boston	2.96	5.14
67	Buffumville	4.90	4.72
68	Charlemont	2.26	8.65
69	Colrain	2.31	4.43
70	Cummington Hill	2.05	4.53
71	Dover	1/ 3.21	5.22
72	Dunstable	2.40	5.81
73	East Brimfield	3.98	4.45
74	Falmouth	3.05	4.47
75	Foxboro	3.29	4.80
76	Granville	3.48	6.46
77	Great Barrington	1.66	1/ 2.80
78	Knightville	3.10	5.06
79	Lanesboro	1.35	.65
80	Lawrence	2.78	7.44
81	Littleville	3.10	5.10
82	Lowell	3.17	5.86
83	Maynard	3.07	5.87
84	Montague City	1/ 1.21	1/ 1.02
85	Natick	2.84	6.12
86	North Adams	1.86	1/ 3.35
87	Newburyport	2.92	8.52
88	Northbridge	1.79	4.84
89	Southbridge	4.37	4.86
90	State Farm	1/ .85	1 3.29
91	Sunderland	2.97	2.84
92	Ware	2.28	4.23
93	West Hill Dam	4.00	5.26
94	West Medway	3.66	5.65
95	Westover AFB	2.93	3.15
96	Westville	4.30	4.45
97	Worcester	4.66	5.24
	NEW HAMPSHIRE		
98	Barnstead	3.31	3.60
99	Bethlehem	1/ 1.05	--
100	Berlin	3.83	.88
101	Big Diamond	2.72	.35
102	Blackwater Dam	1.72	4.41
103	Bradford	1/ 1.99	5.88
104	Bristol	1/ 2.73	2.24

Table 2.--Cumulative rainfall for March 30 to April 2, 1987, and April 4-8, 1987, for selected stations.--(continued)

Site no. (see figure 2)	Station name	Cumulative rainfall, in inches: March 30-April 2	April 4-8
	NEW HAMPSHIRE--continued		
105	Comerford	1.19	0.52
106	Concord	2.32	2.84
107	Dalton	1.06	.37
108	Dixville	2.72	.57
109	Durham	3.50	--
110	East Derry	2.75	5.57
111	Errol	1.72	.70
112	Everett	1.99	5.70
113	First Connecticut Lakes	1.94	1/ .07
114	Francestown	1/ 2.58	6.86
115	Franklin Falls	1.85	2.15
116	Glencliff	1/ 1.50	1/ 2.35
117	Gorham	4.34	2.21
118	Greenville	1/ 3.36	1/ 6.34
119	Hillsborough	2.50	--
120	Hopkinton Dam	1.86	5.77
121	Keene	1/ 1.83	2.38
122	Lebanon	1.02	1.84
123	Lincoln	1/ 3.97	1/ 1.66
124	Macdowell Dam	2.60	6.70
125	Marlow	1/ 1.95	3.86
126	Milan	1.94	.33
127	Mont Vernon	1/ 2.63	6.12
128	Mount Washington	5.13	1.78
129	Murphy	1.66	.18
130	Nashua	2.15	4.69
131	North Conway	4.80	2.22
132	North Stratford	1/ 2.27	0.16
133	Otter Brook	1.88	3.70
134	Pinkham Notch	8.30	--
135	Pittsburg	1.64	1/ .18
136	Plymouth	1/ 3.02	1/ 1.76
137	Portsmouth	2.58	5.00
138	Stark Pond	2.09	--
139	Surry Mountain	2.21	2.18
140	Tamworth	4.45	1.51
141	West Rumney	1/ 4.10	--
142	Walpole	2.08	2.25

1/ Some missing record during period.


MAINE
Moosehead Lake
Chesuncook Lake
Chamberlain Lake
Eagle Lake
Long Lake
Cross Lake
Munsungan Lake
Millinocket Lake
Baskahegan Lake
Nicatous Lake
Rangeley Lake
Kennebago Lake
Richardson Lakes
Umbagog Lake
Seboomook Lake
Caucomgomoc Lake
Chemquasabamticook Lake
Allagash River
St. John River
Androscoggin River
Kennebec
Moore Res.
Penobscot
Machias
67°
68°
69°
70°
71°
72°
47°
46°
45°
44°



Base from U.S. Geological Survey's National Atlas, 1:2,000,000, Section 1, 1972.

Figure 2.--Precipitation data-collection sites

Table 3.--Provisional peak stages and discharges at selected sites in Maine, Massachusetts, and New Hampshire

Site number (see figure 3)	Station number	Stream and place of determination	Drainage area (square miles)	Period of record or known floods	Maximum flood previously known			Maximum during April 1987 flood				
										Discharge		
					Date	Gage height (feet)	Discharge (cubic feet per second)	Date	Gage height (feet)	Cubic feet per second	Cubic feet per second per square mile	Estimated recurrence interval (years)
					PENOBSCOT RIVER BASIN							
1	01030000	Penobscot River near Mattawamkeag, Me.	3,356	1940-	4-29-73	16.89	66,000	4-02-87	12.90	55,400	17	25
2	01030500	Mattawamkeag River near Mattawamkeag, Me.	1,418	1934-	3-23-36	15.34	29,200	4-05-87	13.10	23,300	16	10
3	01031500	Piscataquis River near Dover-Foxcroft, Me.	298	1902-	11-04-66	17.89	22,800	4-01-87	22.60	33,000	111	>100
4	01033000	Sebec River at Sebec, Me.	326	1924-82 1985-	3-20-36	14.46	11,400	4-02-87	12.90	12,000	37	>100
5	01034000	Piscataquis River at Medford, Me.	1,162	1924-82	11-04-66	15.58	60,100	--	18.65a	85,000	73	>100
6	01034500	Penobscot River at West Enfield, Me.	6,671	1901-	5-01-23	25.15	153,000	4-02-87	23.58	145,000	22	75-100
7	01036390	Penobscot River at Eddington, Me.	7,764	1979-	6-03-84	20.60	136,000	4-03-87	23.60	153,000	20	<75
8	01036500	Kenduskeag Stream near Kenduskeag, Me.	176	1941-79	9-12-54	14.83	6,400	--	15.84a	7,400	42	>100
					SHEEPSCOT RIVER BASIN							
9	901038000	Sheepscot River at North Whitefield, Me.	148	1938-	12-18-73	12.52	6,420	4-01-87	13.76	7,400	50	>100

Table 3.--Provisional peak stages and discharges at selected sites in Maine, Massachusetts, and New Hampshire--continued

Site number (see figure 3)	Station number	Stream and place of determination	Drainage area (square miles)	Period of record or known floods	Maximum flood previously known			Maximum during April 1987 flood				
					Date	Gage height, (feet)	Discharge, (cubic feet per second)	Date	Gage height, (feet)	Discharge		Estimated recurrence interval (years)
										Cubic feet per second	Cubic feet per second per square mile	
				KENNEBEC RIVER BASIN								
10	01042500	Kennebec River at The Forks, Me.	1,590	1901-	6-01-84	13.78	30,300	4-01-87	9.87	20,400	13	15
11	01046500	Kennebec River at Bingham, Me.	2,715	1907-10 1930-	6-01-84	15.61	65,200	4-01-87	15.46	63,400	23	>100
12	01047000	Carrabassett River near North Anson, Me.	353	1925-	3-19-36	21.17	30,800	4-01-87	25.87	41,000	116	100
13	01048000	Sandy River near Mercer, Me.	514	1928-79	3-19-36	16.75	38,600	4-01-87	19.27	46,000	89	>100
14	01049000	Sebasticook River near Pittsfield, Me.	572	1928-	3-22-36	13.18	14,400	4-03-87	15.53	17,500	31	>100
15	01049130	Johnson Brook at South Albion, Me.	2.92	1980-	4-25-83	11.60	159	4-01-87	12.34	175	60	--
16	01049265	Kennebec River at North Sidney, Me.	5,403	1978-	6-01-84	26.60	113,000	4-02-87	39.36	220,000	41	>100
17	01049373	Mill Stream at Winthrop, Me.	32.7	1977-	6-02-84	4.76	671	4-02-87	6.16	1,250	38	25
18	01049500	Cobbosseecontee Stream at Gardiner, Me.	217	1890-1964 1976	3-21-36	--	5,020	4-01-87	10.04	4,240	20	40
19	01049550	Togus Stream at Togus, Me.	23.7	1981-	4-25-83	6.92	850	4-01-87	7.50	1,010	43	--

Table 3.--Provisional peak stages and discharges at selected sites in Maine, Massachusetts, and New Hampshire--continued

Site number (see figure 3)	Station number	Stream and place of determination	Drainage area (square miles)	Period of record or known floods	Maximum flood previously known			Maximum during April 1987 flood				Estimated recurrence interval (years)
					Date	Gage height, (feet)	Discharge, (cubic feet per second)	Date	Gage height, (feet)	Discharge		
										Cubic feet per second	Cubic feet per second per square mile	
		ANDROSCOGGIN RIVER BASIN										
20	01052500	Diamond River near Wentworth Location, N.H.	152	1941	6-16-43	10.66	8,630	4-01-87	10.31	8,370	55	70
21	01053500	Androscoggin River at Errol, N.H.	1,046	1905-	5-22-69	--	16,100	4-02-87	6.69	8,780	8.4	3
22	01054000	Androscoggin River at Gorham, N.H.	1,361	1913-	6-18-17	--	20,000	4-01-87	9.17	16,100	12	10
23	01054200	Wild River at Gilead, Me.	69.6	1964	4-05-84	12.95	13,400	3-31-87	13.10	19,000	273	75
24	01054500	Androscoggin River at Rumford, Me.	2,069	1892-	3-20-36	--	74,000	4-01-87	22.20	57,000	28	100
25	01055000	Swift River near Roxbury, Me.	96.9	1929-	10-24-59	12.87	16,800	4-01-87	12.54	15,900	164	25
26	01055500	Nezinscot River at Turner Center, Me.	169	1941	3-27-53	11.18	13,900	4-01-87	10.10	11,000	65	100
27	01057000	Little Androscoggin River near S. Paris, Me.	73.5	1931-	3-27-53	12.41	8,000	4-01-87	12.22	9,300	127	>100
28	01059000	Androscoggin River near Auburn, Me.	3,263	1928-	3-20-36	27.57	135,000	4-02-87	23.73	102,000	31	100

Table 3.--Provisional peak stages and discharges at selected sites in Maine, Massachusetts, and New Hampshire--continued

Site number (see figure 3)	Station number	Stream and place of determination	Drainage area (square miles)	Period of record or known floods	Maximum flood previously known			Maximum during April 1987 flood				
					Date	Gage height, (feet)	Discharge, (cubic feet per second)	Date	Gage height, (feet)	Discharge		Estimated recurrence interval (years)
										Cubic feet per second	Cubic feet per second per square mile	
		ROYAL RIVER BASIN										
29	01060000	Royal River at Yarmouth, Me.	141	1949-	3-13-77	8.46	11,500	4-01-87	7.83	8,440	60	30
		PRESUMPSCOT RIVER BASIN										
30	01064140	Presumpscot River near West Falmouth, Me.	598	1975-84	3-14-77	21.11	12,500	4-01-87b	20.83b	5,920b	10b	--
		SACO RIVER BASIN										
31	01064500	Saco River near Conway, N.H.	385	1929-	3-27-53	17.20	43,900	4-03-87	17.07	43,000	112	50
32	01065500	Ossipee River at Cornish, Me.	452	1916-	3-21-36	16.32	17,200	4-02-87	10.90	9,460	21	25
33	01066000	Saco River at Cornish, Me.	1,293	1916-	3-21-36	21.90	45,000	4-03-87	16.54	31,300	24	40
		PISCATAQUA RIVER BASIN										
34	01073000	Oyster River near Durham, N.H.	12.1	1934-	9-11-54	6.47	862	4-06-87	5.62	600	50	10-25
35	01073500	Lamprey River near Newmarket, N.H.	183	1934-	3-20-36	14.88	5,490	4-07-87	15.14	7,500	41	>100

Table 3.--Provisional peak stages and discharges at selected sites in Maine, Massachusetts, and New Hampshire--continued

Site number (see figure 3)	Station number	Stream and place of determination	Drainage area (square miles)	Period of record or known floods	Maximum flood previously known			Maximum during April 1987 flood				
					Date	Gage height, (feet)	Discharge, (cubic feet per second)	Date	Gage height, (feet)	Discharge		Estimated recurrence interval (years)
										Cubic feet per second	Cubic feet per second per square mile	
		MERRIMACK RIVER BASIN										
36	01076500	Pemigewasset River at Plymouth, N.H.	622	1903-	3-19-36	29.0	65,400	4-01-87	23.43	48,100	77	35
37	01078000	Smith River near Bristol, N.H.	85.8	1918-	3-19-36	16.09	8,100	4-01-87	10.21	3,600	42	20
38	01085000	Contoocook River near Henniker, N.H.	368	1768, 1939-77	9-21-38	21.3	22,200	4-06-87	16.0b	16,000	43	>100
39	01094000	Souhegan River at Merrimack, N.H.	171	1909-	3-19-36	16.20	16,900	4-06-87	10.20	6,600	39	10
40	01094400	North Nashua River at Fitchburg, Mass.	63.4	1972-	4-05-84	7.02	2,740	4-05-87	7.78	3,400	54	>100
41	01094500	North Nashua River near Leominster, Mass.	110	1850, 1935-	3-18-36	20.53	16,300	4-05-87	9.97	7,400	67	22
42	01096000	Squannacook River near West Groton, Mass.	63.7	1949-	10-16-55	8.04	4,010	4-06-87	8.16	4,220	66	55
43	01096500	Nashua River at East Pepperell, Mass.	316	1935-	3-20-36	19.1	20,900	4-07-87	16.19c	11,700	36	45
44	01097000	Assabet River at Maynard, Mass.	116	1886, 1941-	8-20-55	8.94	4,250	4-07-87	7.17	2,120	18	10

Table 3.--Provisional peak stages and discharges at selected sites in Maine, Massachusetts, and New Hampshire--continued

Site number (see figure 3)	Station number	Stream and place of determination	Drainage area (square miles)	Period of record or known floods	Maximum flood previously known			Maximum during April 1987 flood				
					Date	Gage height, (feet)	Discharge, (cubic feet per second)	Date	Gage height, (feet)	Discharge		Estimated recurrence interval (years)
										Cubic feet per second	Cubic feet per second per square mile	
				MERRIMACK RIVER BASIN--(Continued)								
45	01097300	Nashoba Brook near Acton, Mass.	12.8	1963-	1-26-79	5.57	679	4-07-87	4.89	331	26	5
46	01098530	Sudbury River at Saxonville, Mass.	106	1979-	6-07-82	13.30	2,420	4-07-87d	13.5d	2,220d	--	--
47	01099500	Concord River below River Meadow Brook at Lowell, Mass.	307	1936-	1-28-79	9.60	5,410	4-10-87	9.60	5,410	18	50
48	01100000	Merrimack River below Concord River at Lowell, Mass	4,425	1735, 1923-	3-20-36	68.4	173,000	4-07-87	57.16	84,700	19	35
				PARKER RIVER BASIN								
49	01101000	Parker River at Byfield, Mass.	21.3	1945-	3-19-68	5.61	489	4-07-87	7.35	790	37	>100
				IPSWICH RIVER BASIN								
50	01101500	Ipswich River at South Middleton, Mass.	44.5	1938-	1-26-79	7.12	839	4-07-87	7.51	1,000	22	60
51	01102000	Ipswich River near Ipswich, Mass.	125	1886, 1930-	3-20-36	8.41	2,680	4-08-87	9.43	3,550	27	>100

Table 3.--Provisional peak stages and discharges at selected sites in Maine, Massachusetts, and New Hampshire--continued

Site number (see figure 3)	Station number	Stream and place of determination	Drainage area (square miles)	Period of record or known floods	Maximum flood previously known			Maximum during April 1987 flood				
										Discharge		
					Date	Gage height, (feet)	Discharge, (cubic feet per second)	Date	Gage height, (feet)	Cubic feet per second	Cubic feet per second per square mile	Estimated recurrence interval (years)
					MYSTIC RIVER BASIN							
52	01102500	Aberjona River at Winchester, Mass.	24.1	1886, 1939-	1-25-79	15.46	1,330	4-07-87	14.20	877	36	27
					CHARLES RIVER BASIN							
53	01103500	Charles River at Dover, Mass.	183	1886, 1937-	8-23-55 3-22-68	9.24 8.72	3,220 3,220	4-08-87	8.05	2,810	15	22
54	01104500	Charles River at Waltham, Mass.	227	1886, 1931-	1-25-79 2-03-76	6.48 6.54	3,480 4,150e	4-07-87	5.51	2,800	12	20
					NEPONSET RIVER BASIN							
55	01105000	Neponset River at Norwood, Mass.	34.7	1886, 1939-	8-19-55	14.65	1,490	4-07-87	9.38	691	20	10
					NORTH RIVER BASIN							
56	01105730	Indian Head River at Hanover, Mass.	30.2	1966-	3-18-68	7.13	1,390	4-07-87	5.47	716	24	2.3
					TAUNTON RIVER BASIN							
57	01109000	Wading River near Norton, Mass.	43.3	1925-	3-19-68	11.47	1,460	4-06-87	10.10	810	19	10

Table 3.--Provisional peak stages and discharges at selected sites in Maine, Massachusetts, and New Hampshire--continued

Site number (see figure 3)	Station number	Stream and place of determination	Drainage area (square miles)	Period of record or known floods	Maximum flood previously known			Maximum during April 1987 flood				
										Discharge		
					Date	Gage height, (feet)	Discharge, (cubic feet per second)	Date	Gage height, (feet)	Cubic feet per second	Cubic feet per second per square mile	Estimated recurrence interval (years)
		BLACKSTONE RIVER BASIN										
58	01110000	Quinsigamond River at North Grafton, Mass.	25.6	1939-	8-20-55	5.15	820	4-07-87	3.95	486	19	17
59	01110500	Blackstone River at Northbridge, Mass.	139	1900, 1939-77	8-20-55	16.74	16,900	4-05-87	9.42f	3,750	27	12
		CONNECTICUT RIVER BASIN										
60	0116100	Ashuelot River at Hinsdale, N.H.	420	1914-	3-19-36	20.2	16,600	4-06-87	7.55	5,170	12	5
61	01162500	Priest Brook near Winchendon, Mass.	19.4	1916-	9-21-38	9.90	3,000	4-01-87	6.55a	871	45	14
62	01168500	Deerfield River at Charlemont, Mass.	361	1913-	9-21-38	20.17	65,300	4-04-87	16.25	36,200	100	25
63	01169000	North River at Shattuckville, Mass.	89.0	1939-	10-15-55	10.37	13,200	4-05-87	11.19	15,300	172	60
64	01170000	Deerfield River near West Deerfield, Mass.	557	1940-	12-31-48	15.3	48,500	4-05-87	17.71	61,700	111	>100
65	01170500	Connecticut River at Montague City, Mass.	7,860	1904-	3-19-36	49.2	236,000	4-01-87	35.89	126,000	16	8

Table 3.--Provisional peak stages and discharges at selected sites in Maine, Massachusetts, and New Hampshire--continued

Site number (see figure 3)	Station number	Stream and place of determination	Drainage area (square miles)	Period of record or known floods	Maximum flood previously known			Maximum during April 1987 flood				
					Date	Gage height, (feet)	Discharge, (cubic feet per second)	Date	Gage height, (feet)	Discharge		Estimated recurrence interval (years)
										Cubic feet per second	Cubic feet per second per square mile	
				CONNECTICUT RIVER BASIN--(Continued)								
66	01174500	East Branch Swift River near Hardwick, Mass.	43.7	1937-	9-21-38	--	6,780	4-01-87	21.16	1,030	24	4
67	01181000	West Branch Westfield River at Huntington, Mass.	94.0	1935-	9-12-38	11.61	19,900	4-05-87	11.1	14,000	149	11
68	01183500	Westfield River near Westfield, Mass.	497	1914-	8-19-55	34.2	70,300	4-05-87	17.8	21,000	42	6
69	01185500	West Branch Farmington River nr New Boston, Mass.	91.7	1913-	8-19-55	14.06	34,300	4-04-87	9.51	8,630	94	23
				HOUSATONIC RIVER BASIN								
70	01197000	East Branch Housatonic at Coltsville, Mass.	57.6	1755, 1936-	9-21-38	10.80	6,400	4-05-87	8.21	5,010	87	33
71	01197500	Housatonic River near Great Barrington, Mass.	282	1913-	1-01-49	12.08	12,200	4-06-87	9.12	6,560	23	8

Table 3.--Provisional peak stages and discharges at selected sites in Maine, Massachusetts, and New Hampshire--continued

Site number (see figure 3)	Station number	Stream and place of determination	Drainage area (square miles)	Period of record or known floods	Maximum flood previously known			Maximum during April 1987 flood				
					Date	Gage height, (feet)	Discharge, (cubic feet per second)	Date	Gage height, (feet)	Discharge		Estimated recurrence interval (years)
										Cubic feet per second	Cubic feet per second per square mile	
		HUDSON RIVER BASIN										
72	01332000	North Branch Hoosic River at North Adams, Mass.	40.9	1927, 1931-	9-28-38	12.05	8,950	4-05-87	11.64	6,800	166	27
73	01332500	Hoosic River near Williamston, Mass.	126	1940-	12-31-48	14.85	13,000	4-05-87	12.45	9,370	74	18
74	01333000	Green River at Williamstown, Mass.	42.6	1948, 1949-	12-31-73	5.68	4,060	3-31-87	4.96	2,050	48	4

a From floodmarks.

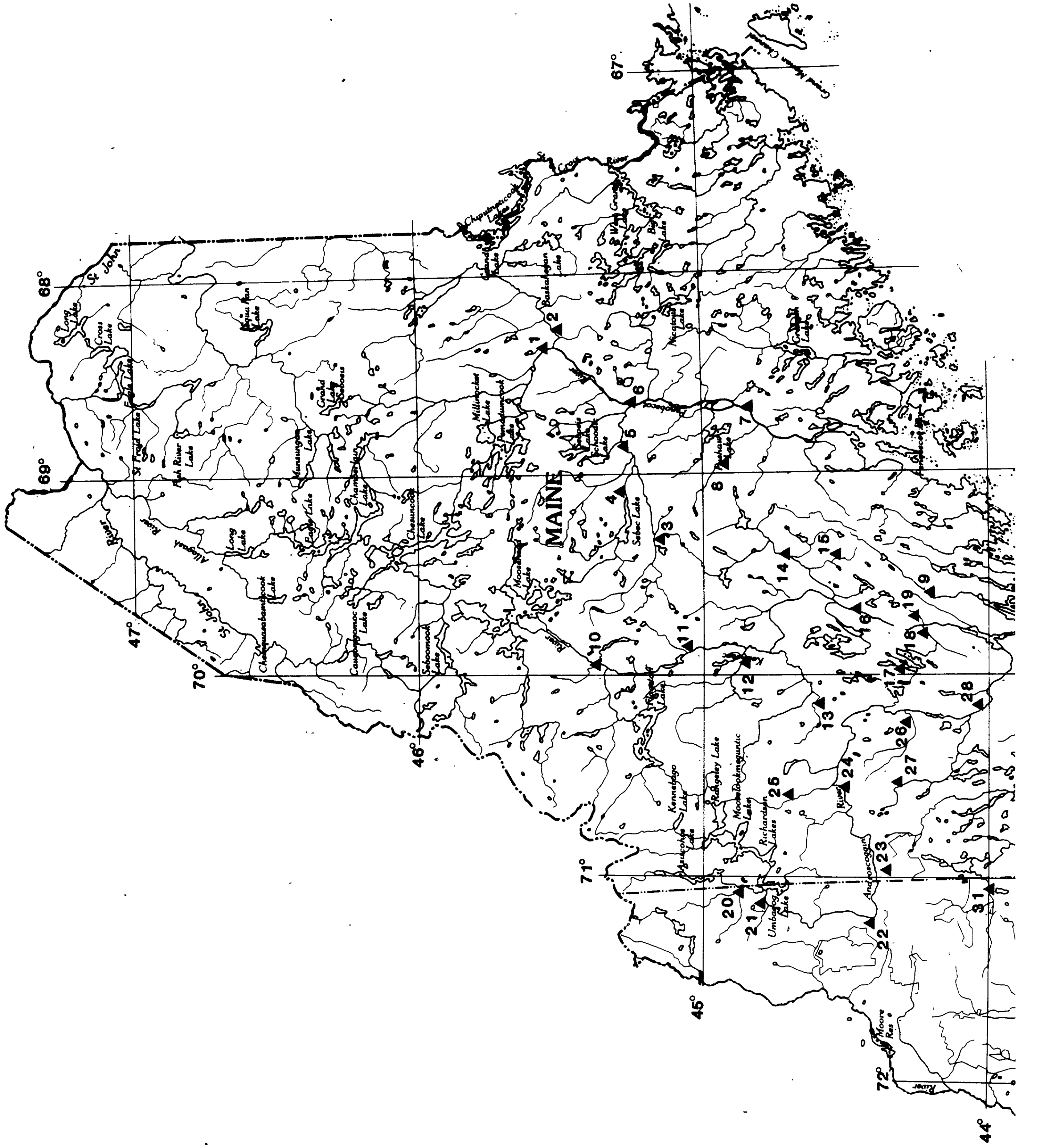
b At new site located just upstream in Westbrook, drainage area equals 578 mi^2?

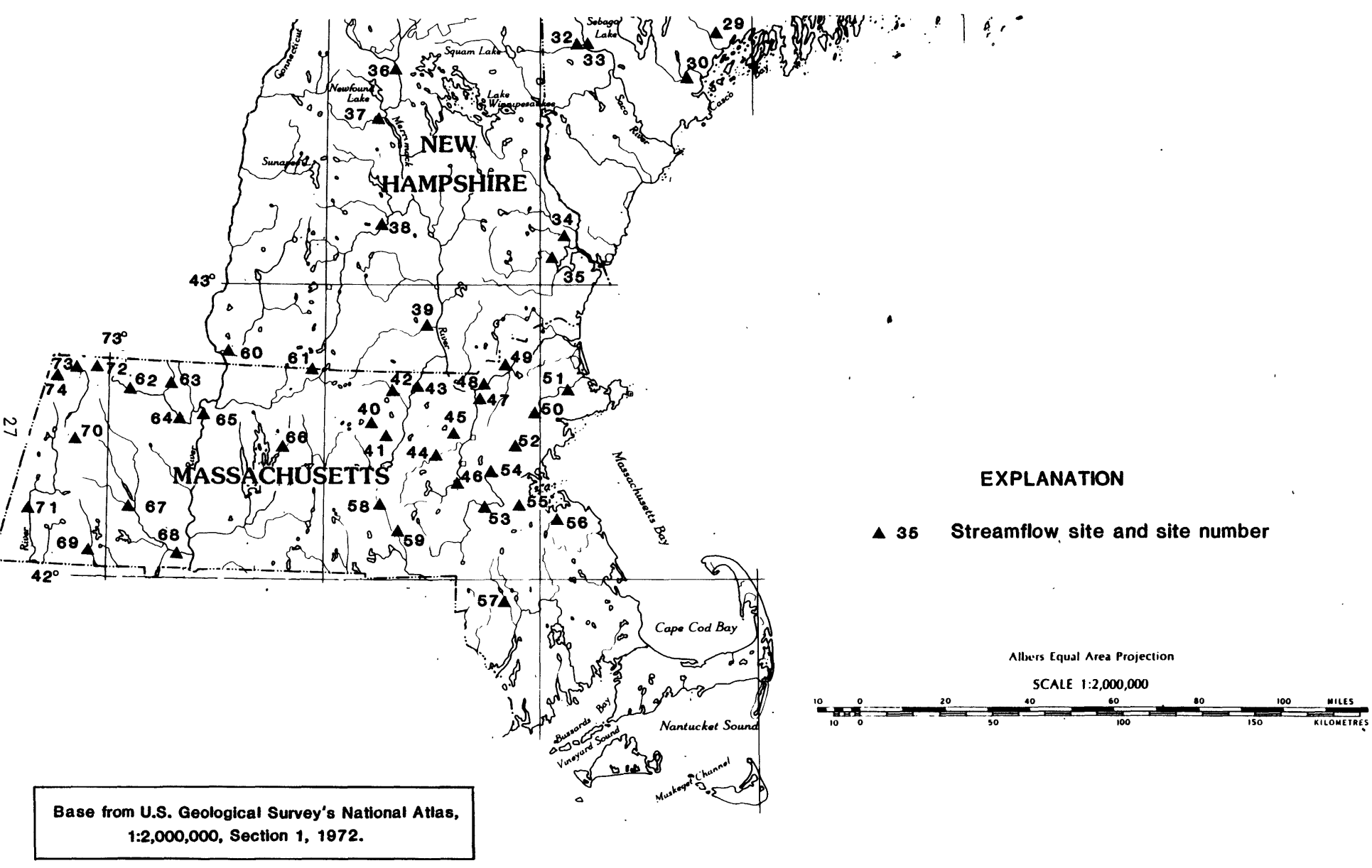
c From floodmark in gage house, confirmed by mark on nearby tree.

d Date and stage of discharge measurement; peak not yet determined.

e Caused by release of water behind ice jam.

f From U.S. Army Corps of Engineers data collection platform.


MAINE
67°
68°
69°
70°
71°
72°
47°
46°
45°
44°
St. John
Allagash River
Moosehead Lake
Sebec Lake
Rangeley Lake
Richardson Lakes
Umbagog Lake
Androscoggin
Moore Res.
Chiputneticook Lakes
St. Croix River
Penobscot
Chamberlain Lake
Chesuncook Lake
Long Lake
Eagle Lake
Cross Lake
Long Lake
Mooselookmeguntic Lake
Kennebago Lake
Aziscohos Lake
Seboomook Lake
Millinocket Lake
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
31



Base from U.S. Geological Survey's National Atlas, 1:2,000,000, Section 1, 1972.

Figure 3.--Streamflow data-collection sites

Flood Hydrographs

Discharge hydrographs for the April 1987 flood are shown in figures 4-9. These hydrographs are for selected gaging stations to show the relative magnitude of flooding for the two distinct April storms in various parts of the three-state study area. The hydrographs illustrate that Maine had the most severe flooding from the first April storm and Massachusetts and New Hampshire generally had the most severe flooding from the second April storm. The hydrographs also illustrate the minor but increasing role of snowmelt runoff that was taking place prior to the flood.

Additional Information

Additional information on floods during April 1987 and streamflow data in general can be obtained by writing to the Office Chief, U.S. Geological Survey, Water Resources Division, at the following addresses:

Maine

26 Ganneston Drive
Augusta, Maine 04330

Massachusetts

150 Causeway Street, Suite 1001
Boston, Massachusetts 02114

New Hampshire

525 Clinton Street
RFD 12
Bow, New Hampshire 03301

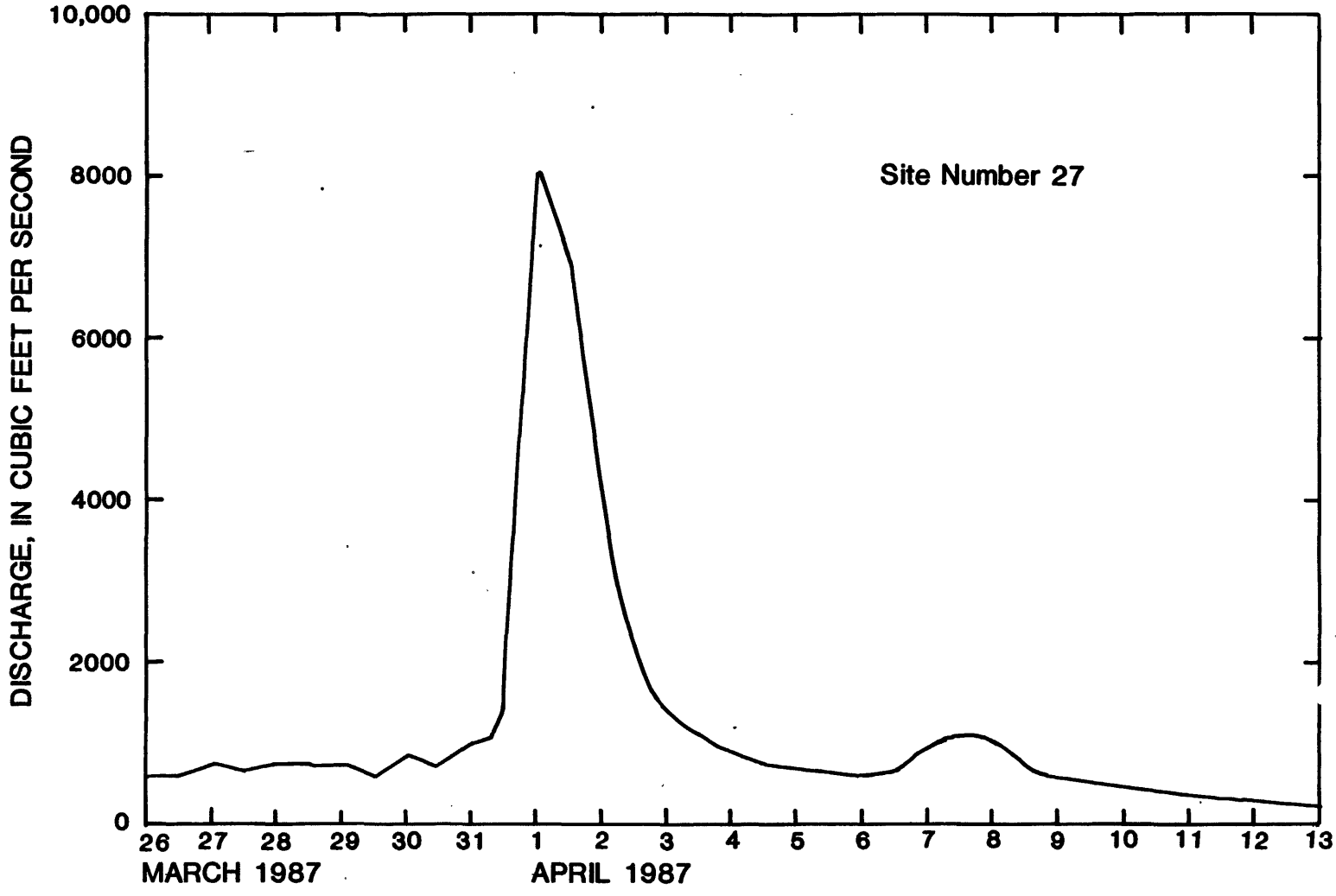


Figure 4.--Discharge hydrograph for Little Androscoggin River near South Paris, Maine, station number 01057000

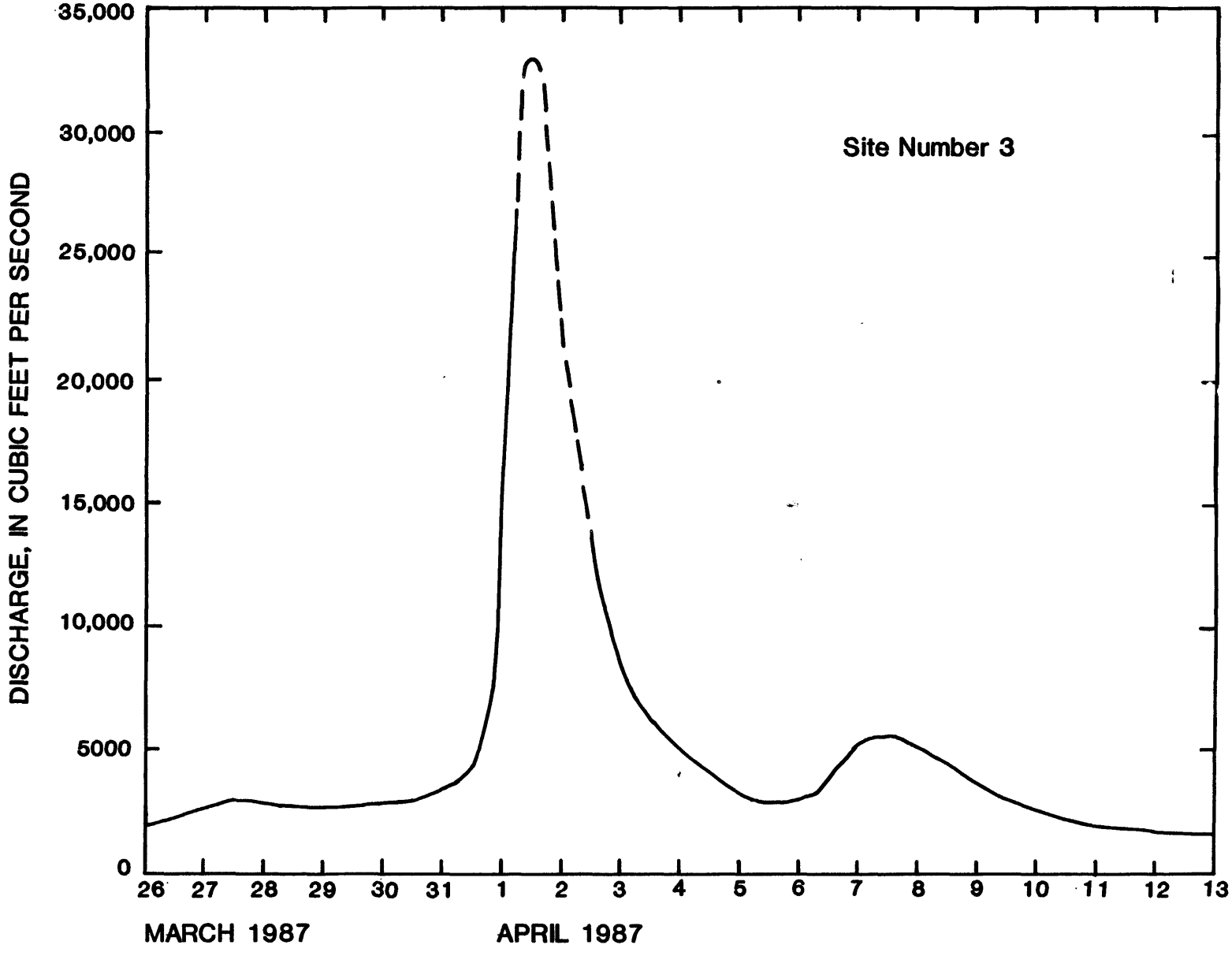


Figure 5.–Discharge hydrograph for Piscataquis River near Dover-Foxcroft, Maine, station number 01031500

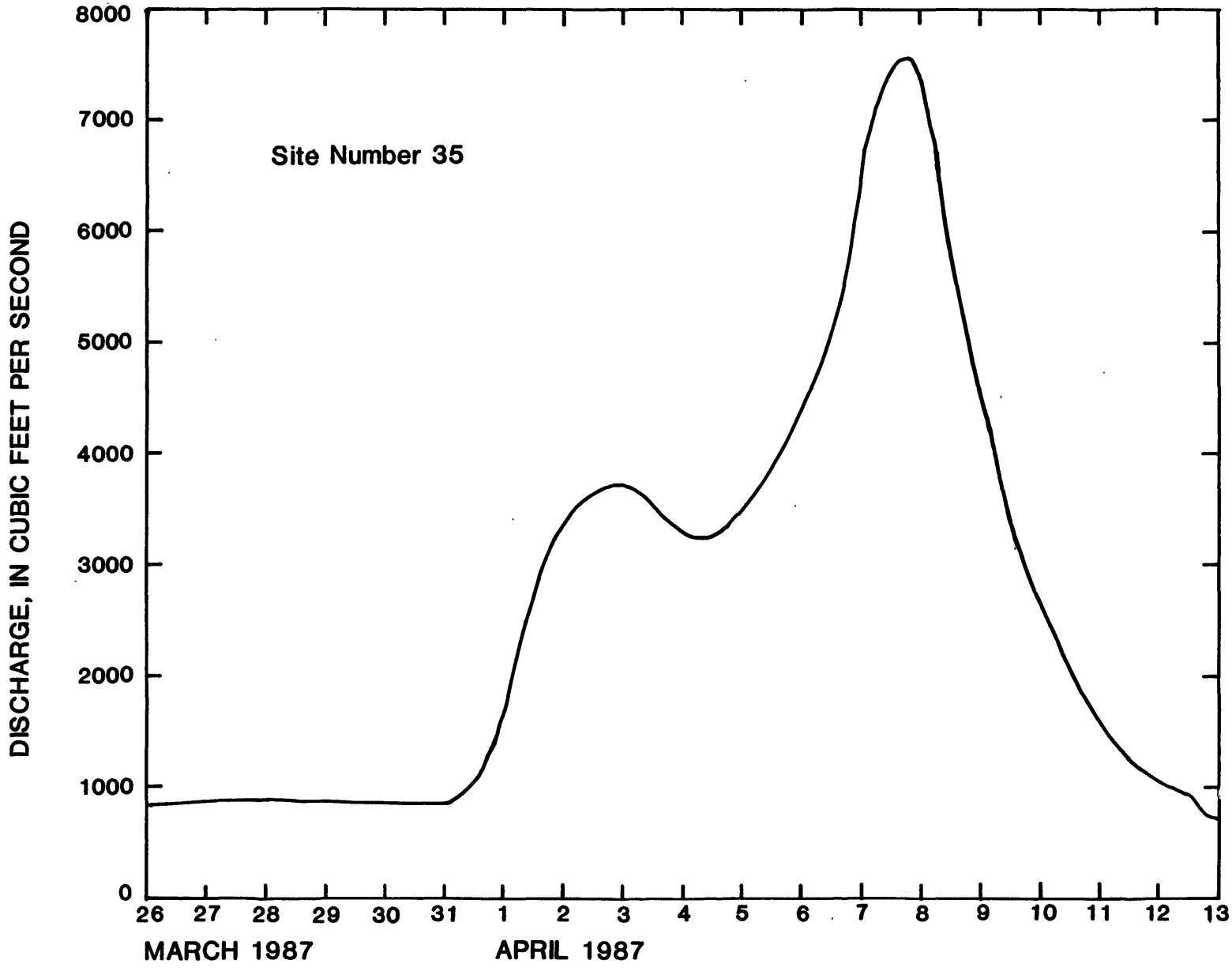


Figure 6.–Discharge hydrograph for Lamprey River near Newmarket, New Hampshire, station number 01073500

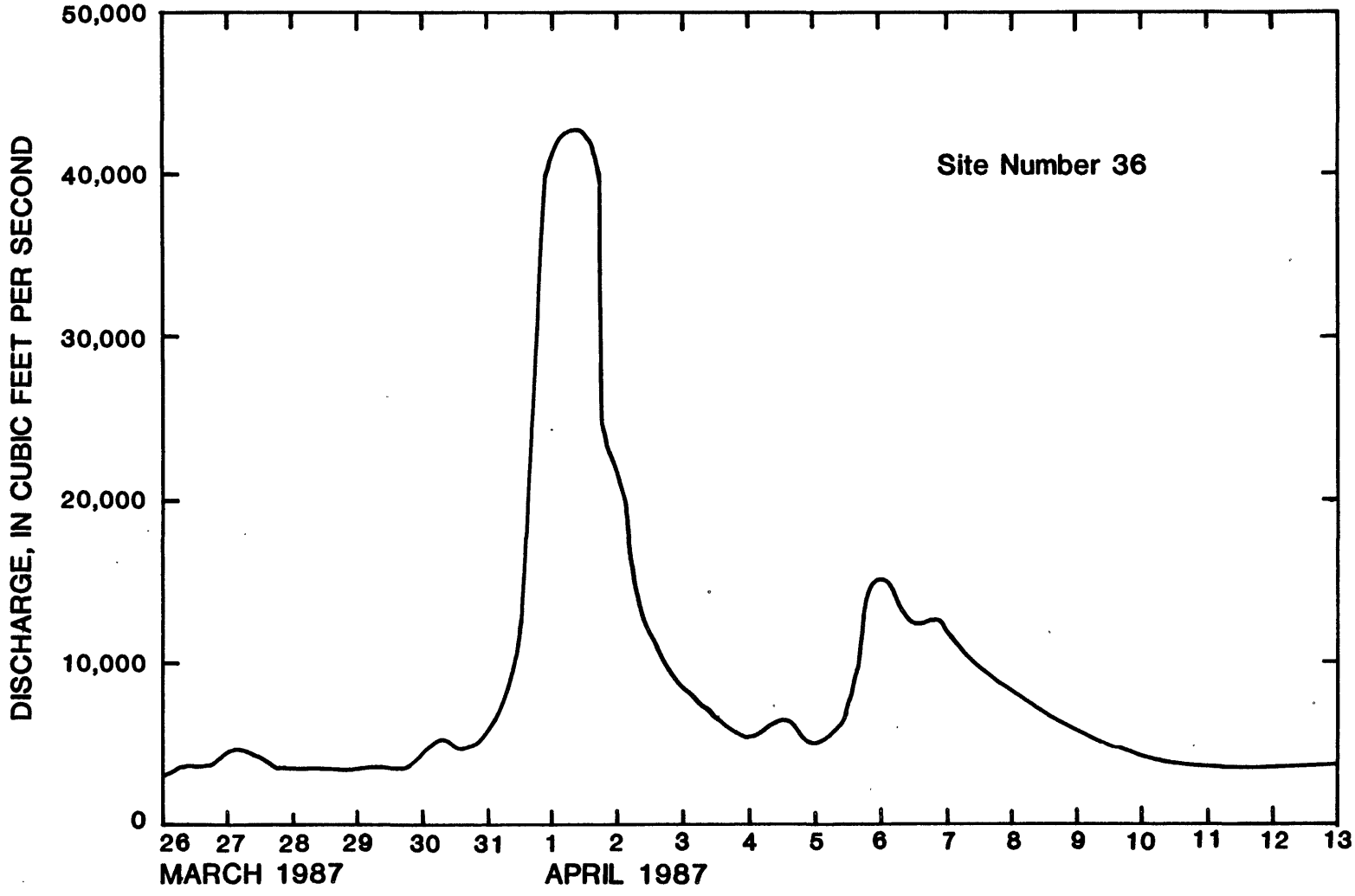


Figure 7.–Discharge hydrograph for Pemigewassett River at Plymouth, New Hampshire, station number 01076500

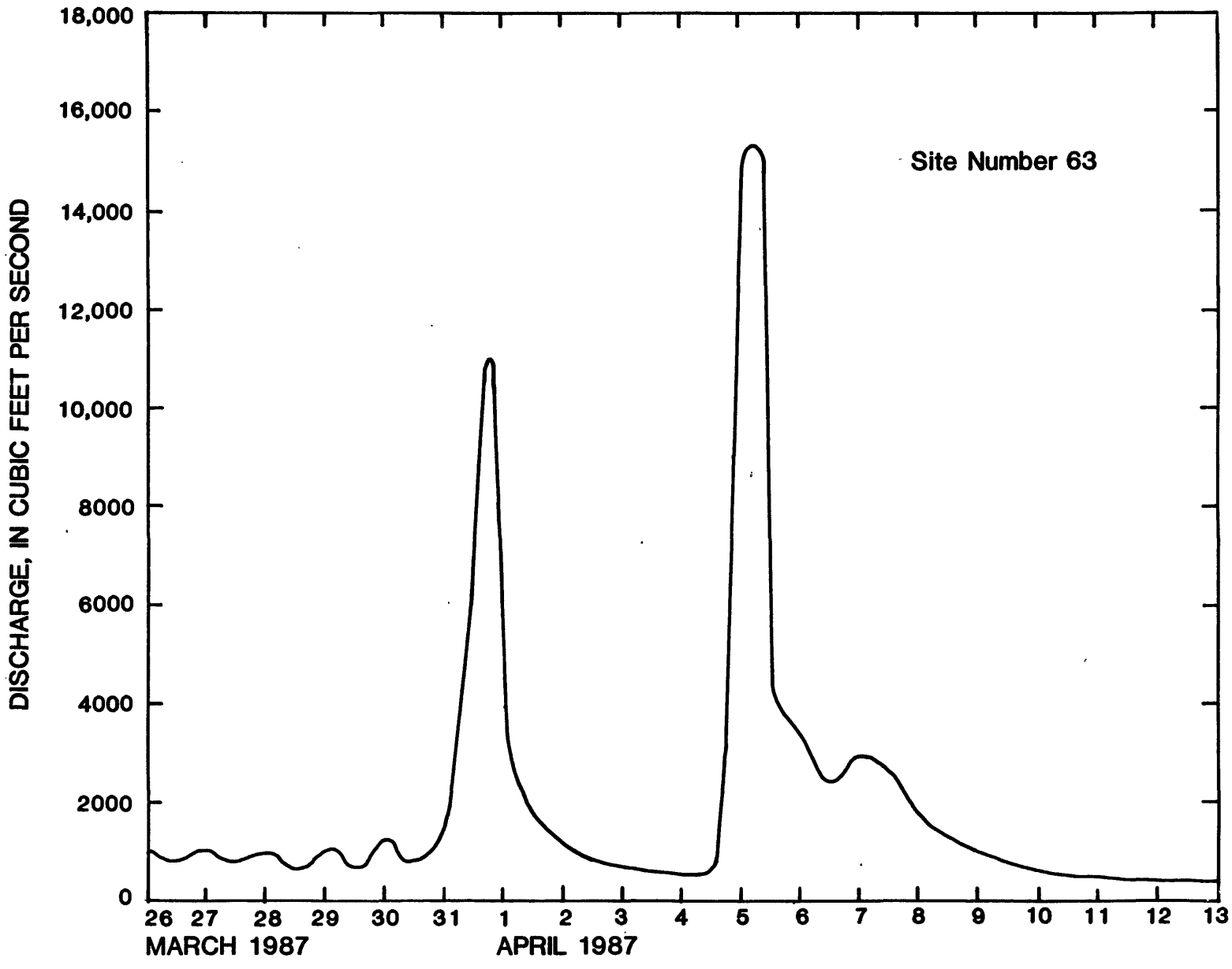


Figure 8.–Discharge hydrograph for North River at Shattuckville, Massachusetts, station number 01169000

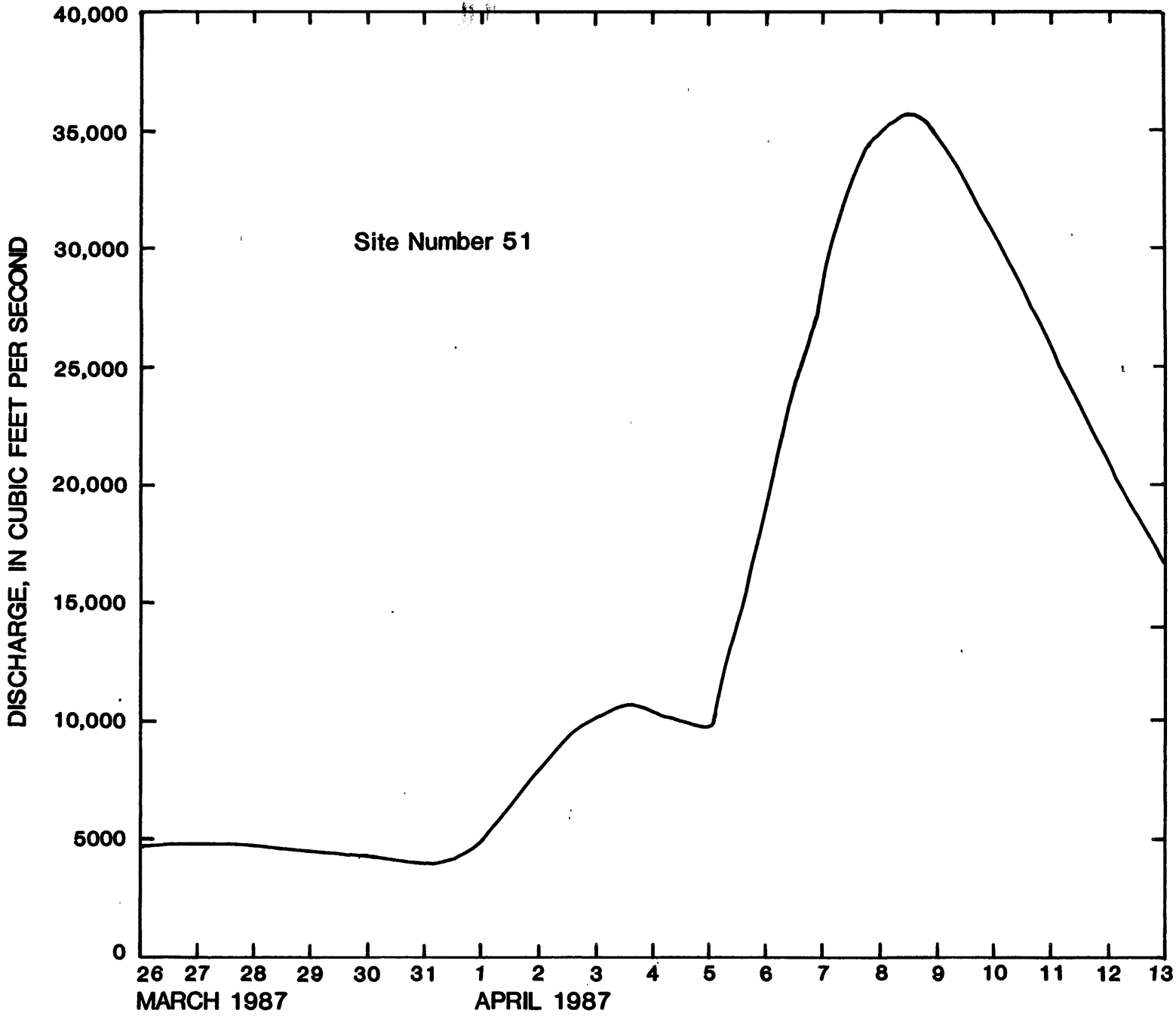


Figure 9.–Discharge hydrograph for Ipswich River near Ipswich, Massachusetts, station number 01102000

SELECTED REFERENCES

Fontaine, R. A., and Haskell, C. R., 1981, Floods of Maine, April-May 1979: U.S. Geological Survey Water Resources Investigations Reports 81-68, 65 p.

Gadoury, R. A., 1979, Coastal flood of February 7, 1978, in Maine, Massachusetts, and New Hampshire: U.S. Geological Survey Water Resources Investigations Report 79-61, 57 p.

Grover, N. C., 1937, The floods of March 1936, part 1 New England rivers: U.S. Geological Survey Water-Supply Paper 798, 466 p.

LeBlanc, D. R., 1978, Progress report on hydrologic investigations of small drainage areas in New Hampshire--Preliminary relations for estimating peak discharges on rural, unregulated streams: U.S. Geological Survey Water Resources Investigations Report 78-47, 9 p.

Lescinsky, J. B., 1987, Flood of November 1985 in West Virginia, Pennsylvania, Maryland, and Virginia: U.S. Geological Survey Open-File Report 86-486, 33 p.

Morrill, R. A., 1975, A technique for estimating the magnitude and frequency of floods in Maine, U.S. Geological Survey Open-File Report 75-292, 44 p.

Morrill, R. A., Chin, E. H., and Richardson, W. S., 1979, Maine Coastal storm and flood of February 2, 1976: U.S. Geological Survey Professional Paper 1087, 20 p.

Sauer, V. B. and Fulford, J. M., 1983, Floods of December 1982 and January 1983 in central and southern Mississippi River basin: U.S. Geological Survey Open-File Report 83-213, 41 p.

Thomson, M. T., Gannon, W. B., Thomas, M. P., Hayes, G. S., and others 1964, Historical floods in New England: U.S. Geological Survey Water-Supply Paper 1779-M, 105 p.

Wandle, S. W., Jr., 1983, Estimating peak discharges of small, rural streams in Massachusetts: U.S. Geological Survey Water-Supply Paper 2214, 26 p.

Water Resources Council, 1981, Guidelines for determining flood flow frequency: U.S. Water Resources Council Bulletin 17B, 28 p.