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Dickey-Lincoln School Lakes, Maine, U.S.A. and Quebec, Canada: Design Memorandum No. 5: Water Quality

New England Division

United States Army Corps of Engineers

SAINT JOHN RIVER BASIN

DICKEY-LINCOLN SCHOOL PROJECT

MAINE, U.S.A. AND QUEBEC, CANADA

DESIGN MEMORANDUM NO. 2

HYDROLOGY AND HYDRAULIC ANALYSIS

SECTION 1 - CLIMATOLOGY AND STREAM FLOW

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

APRIL 1967

NOTE

THIS PUBLICATION IS A TECHNICAL WORKING PAPER AND CONTAINS DATA SUBJECT TO REVISION AND MODIFICATION IN ACCORDANCE WITH NEW INFORMATION DEVELOPED IN CURRENT STUDIES.

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IN REPLY REFER TO

NEDED-H

21 April 1967

SUBJECT: Design Memorandum No. 2 - Hydrology and Hydraulic Analysis, Section I - Climatology and Streamflow

TO: Chief of Engineers
ATTN: ENGCW-E

There is submitted herewith for review and approval Design Memorandum No. 2 - Hydrology and Hydraulic Analysis, Section I - Climatology and Streamflow for Dickey-Lincoln School Project, Saint John River Basin, Maine, U.S.A. and Quebec, Canada in accordance with EM 1110-2-1150.

FOR THE DIVISION ENGINEER:

1 Incl
as (5 cys)

JOHN WM. LESLIE
Chief, Engineering Division

DICKEY-LINCOLN SCHOOL PROJECT
SAINT JOHN RIVER, MAINE

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HYDROLOGY AND HYDRAULIC ANALYSIS
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GENERAL

1. SCOPE

Section I is the first of four sections comprising Design Memorandum No. 2. The other sections are: II - Dickey Dam - Spillway Design Flood, III - Lincoln School Dam - Spillway Design Flood and IV - Flood Analysis and Reservoir Regulation. In section I, hydrologic studies will be confined generally to the drainage area of the Saint John River above the gaging station at Fort Kent, Maine.

2. PURPOSE

The purpose of section I is to present the climatological and streamflow data for the Saint John River above Fort Kent in order to establish hydrologic criteria for the design of the Dickey and Lincoln School dams.

BASIN DESCRIPTION

3. GENERAL

The Saint John River basin is located in northern Maine and the adjacent Canadian Provinces of Quebec and New Brunswick between the watersheds of the St. Lawrence River to the north and the Penobscot River to the south. It has a total drainage area of 21,600 square miles, of which 5,960 are upstream of the gaging station at Fort Kent, Maine. The area above Fort Kent is roughly rectangular, with a length of about 115 miles and an average width of about 50 miles. Plate 2-1 is a map of the basin above Fort Kent. Description of the basin is divided into six parts: the main stream exclusive of the principal tributaries, Allagash, Big Black, Little Black, St. Francis and Fish Rivers. Profiles of the Big Black, Little Black and Allagash Rivers and of the Saint John River above the Lincoln School damsite are shown on plate 2-2. Plate 2-3 shows

the profile of the Saint John River between the Lincoln School damsite and the pool of the Grand Falls dam in New Brunswick.

4. MAIN STREAM

The Saint John River rises in Little Saint John Lake in the extreme southwestern corner of the basin on the international boundary between Quebec and Maine. As the Southwest Branch, it flows in a general northerly direction along the boundary for about 38 miles and then through Maine for about 12 miles to its confluence with Baker Branch. From this point, as the main Saint John River, the river flows in a general northeasterly direction through Maine for a distance of about 95 miles to the mouth of the St. Francis River, then easterly along the international boundary for about 17 miles to the gaging station at Fort Kent, Maine. The total fall in the river between its source at Little Saint John Lake and Fort Kent is about 1,110 feet. The Dickey damsite is located on the river about a mile above the mouth of the Allagash River and about 29 miles above Fort Kent. The present drainage area at the site is 2,712 square miles, but with construction of a dike across Falls Brook, a tributary of the St. Francis River, the project will have a gross drainage area of 2,725 square miles. The Lincoln School damsite is located on the Saint John River about 11 miles downstream of the Dickey damsite, about 2 miles above the mouth of the St. Francis River and about 18 miles above Fort Kent. The drainage area at the Lincoln School damsite is 4,086 square miles, of which 1,360 are below the Dickey damsite, including the drainage area of the Allagash River.

A USGS gaging station, located on the Saint John River at Ninemile Bridge, Maine, about 87 miles above Fort Kent, has a drainage area of 1,345 square miles. The gage is also located about 8 miles upstream of the backwater of the full pool of Dickey Reservoir. The stream pattern above this point is basically fan-shaped. The westerly portion of this drainage area, mostly in Quebec, is essentially a plateau with significant storage in the form of swamps and small ponds and lakes. The easterly portion is more mountainous, with a number of fairly large lakes and ponds. Below Ninemile Bridge the slopes are steep, with narrow valleys and a number of rapids along the main river. Elevations vary from about 1,900 feet msl in the southeast portion of the drainage area to 580 feet msl at the Dickey damsite to 490 feet msl at the Fort Kent gage.

5. ALLAGASH RIVER

The Allagash River rises in Churchill Lake in northern Piscataqua

County, Maine and flows northerly about 63 miles from the outlet of Churchill Lake to its confluence with the Saint John River, 1 mile below the Dickey damsite, and 12 miles above St. Francis, Maine. It has a drainage area of about 1,230 square miles, exclusive of 240 square miles of drainage area upstream from the outlet of Chamberlain Lake which has been diverted to the East Branch of the Penobscot River. The fall in the river from Churchill Lake to the mouth is approximately 340 feet. The drainage area is somewhat mountainous, with steep short slopes and short tributaries, but with large amounts of storage areas in numerous good-sized lakes and ponds. Elevations vary from about 2100 feet msl in the southeast portion of the drainage area to about 580 feet msl at the mouth.

6. BIG BLACK RIVER

The Big Black River rises in Lac du Dos-de-Cheval in Montmagny, Quebec and flows northeasterly for about 12 miles, flows easterly about 7 miles to the international boundary, then continues in Maine generally northeasterly about 28 miles to its confluence with the Saint John River, about 29 miles above Dickey, Maine. It has a drainage area of about 660 square miles and a total fall of about 490 feet. The upper portion of the basin is fairly flat or rolling terrain with some storage in the form of a few small ponds and swamps. The lower portion of the drainage area is more hilly, with steeper slopes and narrower valleys. Elevations vary from about 1500 feet msl in the northerly and westerly portions of the drainage area to about 760 feet msl at the mouth.

7. LITTLE BLACK RIVER

The Little Black River rises in Quebec about 4 miles east of LaPointe Station and about 14 miles southwest of Estcourt, Quebec at the northwest corner of the State of Maine. Identified as the Riviere Noire in Canada, it runs southeasterly for about 12 miles to the international boundary where it enters Maine as the Little Black River. It then flows generally southeasterly about 25 miles to its confluence with the Saint John River nearly opposite Dickey, Maine. It has a drainage area of about 280 square miles and a total fall of about 630 feet. The drainage area is mostly mountainous, with steep slopes, short tributaries and narrow valleys. Elevations vary from about 2200 feet msl in the westerly portion of the drainage area to about 590 feet msl at the mouth.

8. ST. FRANCIS RIVER

The St. Francis River rises in St. Francis Lake about 10 miles southeast of Riviere du Loup, Quebec and follows a general southerly course for about 19 miles and through Lake Pohenegamook to its outlet at Estcourt, Quebec on the international boundary. Acting as the international boundary from this point to the mouth, the river flows in a general easterly direction about 9 miles, then southerly about 12 miles and through Beau Lake to its outlet. It then flows in a southeasterly direction for about 9 miles through Glazier Lake to its confluence with the Saint John River opposite St. Francis, Maine, about 15 miles above Fort Kent. The river has a drainage area of about 550 square miles and a total fall of about 400 feet, about 150 feet of which occur below Lake Pohenegamook. Steep slopes and narrow valleys characterize the drainage area, but flow is considerably modified by the large storage areas of Pohenegamook and Beau Lakes. Elevations vary from about 1800 feet msl in the central part of the basin to about 540 feet msl at the mouth.

9. FISH RIVER

The Fish River is formed by the junction of several small streams in Central Aroostook County, Maine, follows an irregular course through Fish River, Portage and St. Froid Lakes to Eagle Lake, a distance of about 51 miles and then, from the outlet of Eagle Lake flows northerly about 12 miles to its confluence with the Saint John River at Fort Kent. It has a drainage area of about 892 square miles and a total fall of about 225 feet, of which 145 are between its source and Eagle Lake. This stream has an easterly branch consisting of a series of lakes - Long, Mud, Cross and Square Lakes which are connected by short waterways. This tributary branch and its chain of lakes empty into Eagle Lake and its drainage area is characterized by large swamp areas, thus providing considerable natural storage. The remainder of the Fish River drainage area is hilly and mountainous with steep slopes and short tributaries. Elevations vary from about 2,000 feet msl in the southwesterly portion of the basin to about 490 feet msl at the mouth.

10. STORAGE BODIES

Principal storage bodies with their approximate surface areas are as follows:

Basin and Storage Body	Approximate Area (sq.mi.)
Saint John River	
Saint John Ponds	3.0
Baker Lake	1.9
Lac de L'Est	2.9
Allagash River	
Chemquasobamticook Lake	4.4
Eagle Lake	10.7
Indian Pond	2.2
Haymock Lake	1.5
Churchill Lake	4.1
Spider Lake	1.4
Pleasant Lake	1.5
Priestley Lake	1.0
Musquacook Lakes	4.6
Umgaskis Lake	1.9
Long Lake	1.5
Round Pond	1.4
Big Black River	
Depot Lake	1.3
St. Francis River	
Pohenegamook Lake	2.8
Beau Lake	2.9
Glazier Lake	1.4
Fish River	
Fish River Lake	4.1
Portage Lake	3.9
St. Froid Lake	3.3
Eagle Lake	8.1
Square Lake	12.3
Cross Lake	3.7
Mud Lake	1.4
Long Lake	10.4

CLIMATOLOGY

11. GENERAL

The Upper Saint John River basin has a humid continental climate which in general can be described as severe with short, cool summers and long, cold, windy winters. It is subject to continental and to a lesser degree maritime air masses whose influences vary with elevation and location. The prevailing northwesterly winter winds bring in masses of cold air, contributing to low temperatures and severe winter conditions. About 30 percent of the annual precipitation is in the form of snowfall. Maximum precipitation generally occurs in July when the prevailing winds are southwesterly.

12. TEMPERATURE

The temperature over the watershed varies considerably. In winters, subzero temperatures occur approximately 50 times each year. Summers are cool, with average daily temperatures between 50° and 70° Fahrenheit, rising occasionally into the 90's. Extreme temperatures range from 40° F. below zero in winter to 99° F. in summer. The mean, maximum and minimum monthly temperatures through 1965 at several stations in or near this region are summarized in table 2-1. Locations of these stations are indicated on plate 2-1.

13. PRECIPITATION

The region is subjected to short frequent periods of precipitation distributed rather uniformly throughout the year. The monthly precipitation averages from 2 to 4 inches with a small but definite maximum occurring during the summer months. The annual average is about 36 inches. Monthly and annual precipitation through 1965 for several locations in or near the Upper Saint John River basin are shown in table 2-2. Station locations are shown on plate 2-1.

14. SNOWFALL

Winter precipitation is practically all in the form of snowfall, with a total snowfall averaging about 100 inches. Table 2-3 lists the mean, monthly and annual snowfall through the season of

TABLE 2-1

MONTHLY TEMPERATURES
(Degrees Fahrenheit)

	Fort Kent, Maine Elevation 530 feet msl 30 Years of Record			Ripogenus Dam, Maine Elevation 965 feet msl 32 Years of Record			Armagh, Quebec Elevation 900 feet msl 49 Years of Record			Ste. Rose du Dégelé, Quebec Elevation 500 feet msl 34 Years of Record		
Month	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum
January	11.2	57	-42	12.5	52	-32	10.3	57	-32	9.3	57	-41
February	13.2	53	-41	13.1	55	-42	12.4	56	-32	11.5	55	-36
March	24.1	77	-31	23.4	74	-28	23.0	68	-25	22.3	74	-30
April	38.1	83	- 9	37.5	79	- 7	36.8	82	- 8	36.0	76	-10
May	51.9	91	17	50.4	90	19	50.2	88	11	48.7	90	14
June	61.4	95	29	60.8	96	29	59.9	90	28	58.5	93	26
July	66.5	96	33	66.3	97	37	63.6	96	30	63.6	95	32
August	64.1	97	33	64.4	99	32	62.6	91	26	61.6	97	30
September	55.8	91	19	56.3	94	26	54.5	88	22	53.6	90	21
October	44.6	83	7	46.1	85	15	43.6	87	10	43.4	82	10
November	30.9	73	-14	32.8	74	- 4	30.8	71	-13	30.5	71	-12
December	16.1	56	-28	17.5	58	-34	15.7	65	-35	15.3	55	-34
ANNUAL	39.7	97	-42	40.1	99	-42	39.1	96	-35	38.0	97	-41

TABLE 2-2

MONTHLY PRECIPITATION RECORD
(Inches)

Month	Fort Kent, Maine Elevation 530 feet msl 30 Years of Record			Clayton Lake, Maine Elevation 1000 feet msl 18 Years of Record			Ripogenus Dam, Maine Elevation 965 feet msl 41 Years of Record			Armagh, Quebec Elevation 900 feet msl 50 Years of Record			Ste. Rose du Dégelé, Quebec Elevation 500 feet msl 34 Years of Record		
	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum
January	2.15	4.63	0.38	2.37	3.86	1.25	2.58	5.34	0.60	3.11	5.50	0.95	2.47	4.78	0.40
February	2.09	4.09	0.88	2.39	3.80	1.17	2.33	6.01	0.73	2.61	5.41	0.49	2.33	4.60	0.61
March	2.24	5.86	0.55	2.23	4.36	0.81	2.62	7.44	0.40	2.28	5.54	0.71	2.13	4.85	0.40
April	2.22	4.41	0.74	2.70	4.77	0.93	3.27	6.99	1.20	2.71	5.42	0.20	2.29	4.15	0.78
May	2.71	5.87	0.81	2.57	4.66	0.93	3.42	6.99	0.84	2.78	5.43	1.03	2.57	5.69	0.76
June	3.64	6.86	0.47	3.64	8.03	1.12	4.01	8.78	0.74	4.06	9.80	0.82	3.72	8.43	1.16
July	4.26	10.51	1.42	3.73	7.48	2.10	4.11	8.27	1.32	4.33	8.65	1.26	4.16	8.79	2.02
August	3.86	9.97	0.35	3.73	6.99	1.58	3.89	6.74	1.09	3.80	8.48	1.37	3.37	7.30	0.66
September	3.37	7.28	0.41	3.11	6.35	1.50	3.65	11.00	0.82	3.69	7.18	0.63	3.54	8.24	1.25
October	3.21	5.77	0.48	2.92	4.84	1.20	3.94	7.55	0.55	3.29	7.33	0.78	3.05	5.79	0.50
November	2.73	7.00	0.21	3.38	6.41	1.14	3.71	9.21	0.76	3.03	6.23	1.01	3.07	7.25	0.51
December	2.52	5.24	0.07	2.68	5.47	0.85	2.78	5.39	0.64	2.88	5.92	1.00	2.77	5.57	1.10
ANNUAL	36.01	49.58	25.49	36.52	51.62	27.66	40.15	54.98	26.38	38.93	54.27	30.01	35.54	48.32	25.74

TABLE 2-3

MEAN MONTHLY SNOWFALL
(Average Depth in Inches)

Month	Fort Kent, Maine Elevation 530 feet msl 30 Years of Record	Ripogenus Dam, Maine Elevation 965 feet msl 41 Years of Record	Armagh, Quebec Elevation 900 feet msl 50 Years of Record	Ste. Rose du Dégelé, Quebec Elevation 500 feet msl 34 Years of Record
January	20.1	24.4	24.6	17.8
February	21.3	36.2	22.9	21.3
March	16.1	19.5	17.2	16.1
April	5.5	9.1	8.3	2.6
May	0.4	0.5	0.7	0.1
June	0	0	0	0
July	0	0	0	0
August	0	0	0	0
September	0	0	0	0
October	1.5	2.6	3.0	2.0
November	8.7	9.5	11.6	11.0
December	18.0	21.6	21.4	19.5
ANNUAL	101.4	111.6	106.8	95.9

1965-1966 for representative stations. Locations of these stations are shown on plate 2-1.

15. SNOW COVER

Snow cover of 20 to 40 inches often is present in early spring. The water content may exceed 10 inches in this portion of the basin, the maximum usually being attained late in March. Maximum, minimum and mean amounts of snowfall are shown graphically on plates 2-4 and 2-5. Locations of snow courses are shown on plate 2-1.

16. WINDS

The nearest weather observation station to the Dickey-Lincoln School project is located at the municipal airport, Caribou, Maine. This station is located about 50 airline miles to the east-southeast of the project. The station is not equipped with automatic recording wind instruments. Elevation of ground at station is 624 feet msl.

Hourly wind speeds and directions were recorded at this station for the 11-year period, August 1952 to July 1963, inclusive. Based on the analysis of these 96,408 observations, a frequency wind rose was constructed and is shown on plate 2-6.

The prevailing wind direction is northwest, with 10.6 percent of the observations from that direction. The fastest observed 1-minute wind speeds during this 11-year period are given as follows:

Month	Speed (mph)	Direction
May	63	West
January	60	West-southwest
March	60	West

17. STORMS

The Upper Saint John River basin is frequently affected by storms coming from the Great Lakes area which travel down the St. Lawrence River. Less frequent but more severe are Atlantic

coastal storms, some of tropical origin, traveling northward through New England or along the coast of Maine. There is a tendency for storms to slow down near the Gulf of St. Lawrence, causing unsettled windy weather to persist, for several days at a time.

RUNOFF

18. DISCHARGE RECORDS

There are six gaging stations in the Saint John River basin at or above Fort Kent, five of which are maintained by the U. S. Geological Survey. Three of these are located on the Saint John River: Ninemile Bridge, Dickey, and Fort Kent below the Fish River, all in Maine. Other are: the Allagash River near Allagash, Maine, Fish River at Fort Kent, Maine and St. Francis River at the outlet of Glazier Lake near Connors, New Brunswick. The station on the St. Francis River is international, maintained by Canada under agreement with the United States. The station below the Fish River at Fort Kent is also international, maintained by the United States under agreement with Canada. The locations of these stations are shown on plate 2-1.

19. STREAMFLOW DATA

The mean, maximum and minimum monthly discharges at the six stations in the basin are summarized in table 2-4. Hydrographs of daily flows at the Dickey and Allagash gaging stations are under preparation and will be included in Section IV, a later section.

HISTORY OF FLOODS

20. GENERAL

Based on 37 years of streamflow data, major floods on the Upper Saint John River have apparently developed either from snowmelt runoff alone, or from snowmelt in conjunction with rainfall, but never from rainfall alone. On several occasions ice jams, either upstream or downstream of Fort Kent, have contributed to high stages in the river, however, none of these produced inundation within the developed areas of the town. Records further indicate that damaging floods have occurred only in the springtime.

TABLE 2-4

MONTHLY DISCHARGES
(cfs)

Month	Saint John River at Ninemile Bridge, Maine DA = 1,290 square miles 1952 - 1966			Saint John River at Dickey, Maine DA = 2,700 square miles 1947 - 1966			Allagash River near Allagash, Maine DA = 1,230 square miles 1932 - 1966			St. Francis River at Outlet of Glazier Lake near Connors, New Brunswick DA = 496 square miles 1952 - 1965			Fish River near Fort Kent, Maine DA = 871 square miles 1930 - 1966			Saint John River below Fish River at Fort Kent, Maine DA = 5,690 square miles 1930 - 1966		
	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum
January	576	1,325	207	1,210	2,696	341	642	1,865	192	311	839	117	597	1,891	157	2,950	7,438	871
February	396	899	143	856	1,949	201	435	1,144	119	207	346	117	410	982	119	1,946	4,230	562
March	524	1,327	180	1,095	2,498	378	582	3,560	181	236	531	107	510	3,104	107	2,874	23,590	669
April	5,348	10,460	2,328	12,233	22,500	3,989	3,921	8,699	623	1,808	4,187	585	2,912	5,974	390	22,156	45,570	3,298
May	7,245	16,550	3,173	15,759	35,100	7,812	6,821	13,550	3,440	3,302	5,620	1,640	5,020	8,828	2,520	34,432	68,100	15,600
June	2,158	4,705	529	4,872	10,840	1,186	2,457	4,544	1,266	1,030	1,690	540	1,797	3,696	1,068	11,166	21,800	5,374
July	1,132	2,737	174	2,823	6,516	904	1,532	4,053	365	507	1,138	225	1,045	3,075	294	6,560	14,770	2,214
August	1,258	3,699	113	2,427	8,718	265	1,171	4,535	241	513	1,781	101	704	3,571	135	5,021	19,130	1,038
September	1,240	3,030	102	2,331	7,655	397	944	3,133	213	435	1,162	105	577	2,492	91	4,636	14,700	1,105
October	1,520	3,225	347	2,813	8,980	690	1,096	3,776	242	462	1,650	123	638	2,215	90	5,883	17,610	1,408
November	2,227	5,717	540	4,315	10,180	605	1,565	4,628	279	753	1,890	175	1,184	3,014	134	8,386	22,720	1,367
December	1,209	3,281	311	2,762	9,781	624	1,227	4,549	271	556	1,393	127	1,071	4,688	103	5,469	22,900	1,232
ANNUAL	2,118	2,759	1,336	4,469	6,565	2,843	1,844	2,703	989	846	1,285	485	1,492	4,840	800	9,319	13,220	5,663

21. FLOODS OF RECORD

The Fort Kent urban area has experienced seven consequential floods during the past 37 years of record. The greatest of these occurred on 16 May 1961, with a peak discharge of 131,000 cfs. Table 2-5 summarizes the peak discharges at the six gaging stations.

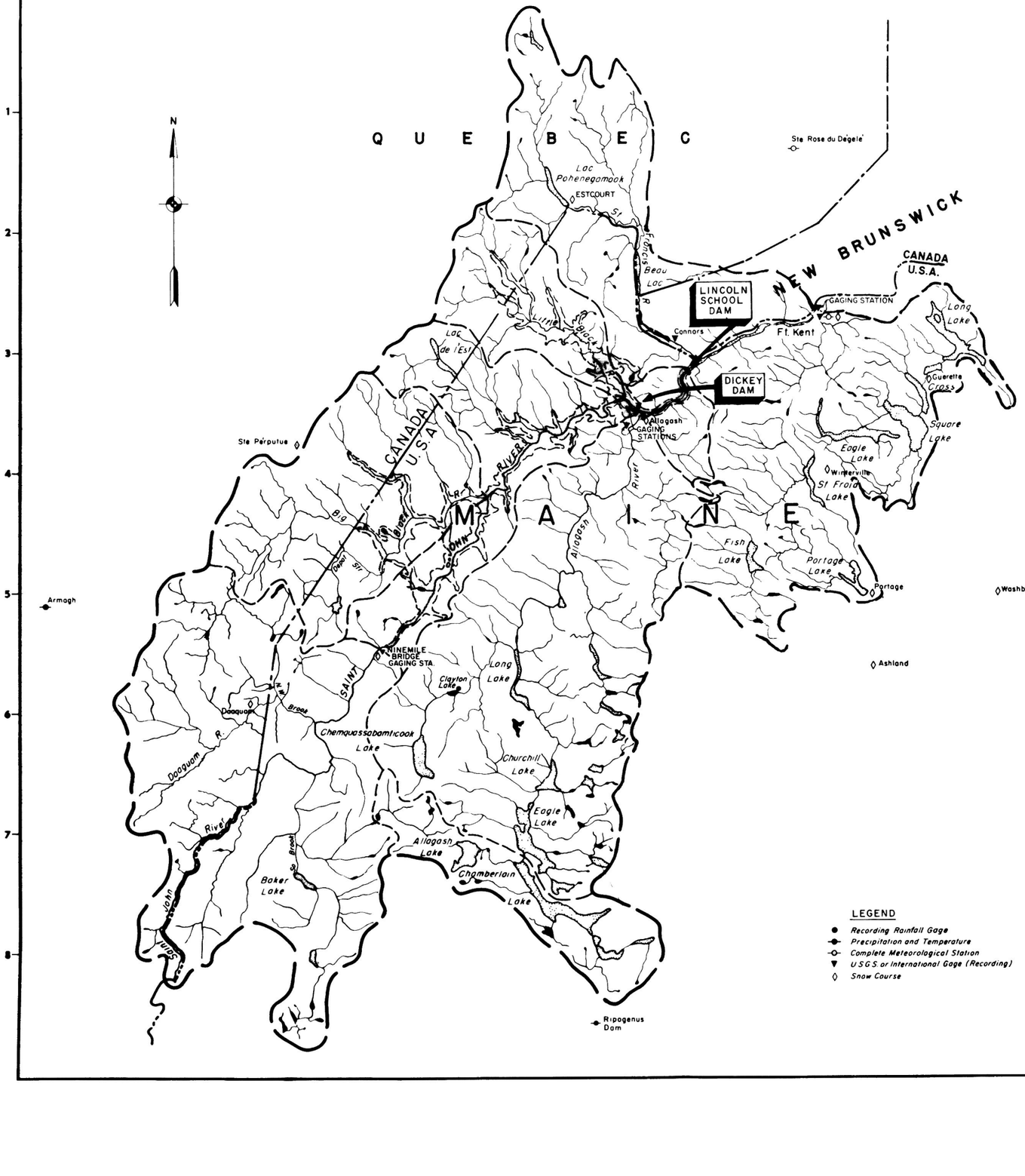
TABLE 2-5

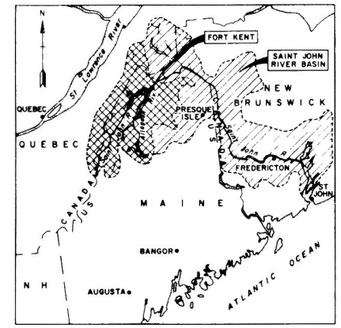
RECORD FLOODS
(Peak Discharges in cfs)

Date	St. John River at Ninemile Bridge, Maine	St. John River at Dickey, Maine	St. Francis River at Glazier Lake, New Brunswick	Allagash River at Allagash, Maine	Fish River near Fort Kent, Maine	St. John River at Fort Kent, Maine
16 May 1961	31,300(2)	71,700(2)	11,500	28,800(1)	13,400	131,000
5 May 1933	No Record	No Record	No Record	23,400	9,980	121,000
26 Apr 1958	34,200(3)	71,200(3)	10,800	19,000(3)	12,000	118,000
11 May 1959	No Record	No Record	No Record	21,500	10,700	115,000
5 May 1942	No Record	No Record	No Record	22,500	10,600	115,000
9 May 1947	No Record	68,700	No Record	16,900(4)	11,000(4)	114,000
21 Apr 1941	No Record	No Record	No Record	17,600	8,460	109,000

(1) 17 May 1961
(2) 15 May 1961
(3) 25 Apr 1958
(4) 8 May 1947

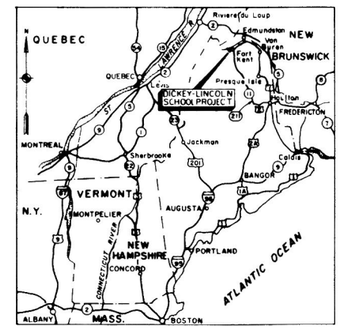
CORPS OF ENGINEERS — U. S ARMY





VICINITY MAP

SCALE 1" = 50 MI



LOCATION MAP

SCALE IN MILES

50 0 50 100 150

LEGEND

- Recording Rainfall Gage
- Precipitation and Temperature
- Complete Meteorological Station
- U.S.G.S. or International Gage (Recording)
- Snow Course

GRAPHIC SCALES

1" = 5 MI: 5 0 5 10 MI

1" = 50 MI: 50 0 50 100 MI

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS

DES. BY | DR. BY | CK. BY

SUBMITTED

CHIEF, SECTION

APPROVAL RECOMMENDED

CHIEF, TECH. ENG. BRANCH

REVIEWED

CHIEF, PLANNING BRANCH

APPROVED

CHIEF, ENGINEERING DIVISION

SAINT JOHN RIVER BASIN
DICKEY-LINCOLN SCHOOL PROJECT
UPPER SAINT JOHN RIVER
BASIN MAP
SAINT JOHN RIVER — MAINE

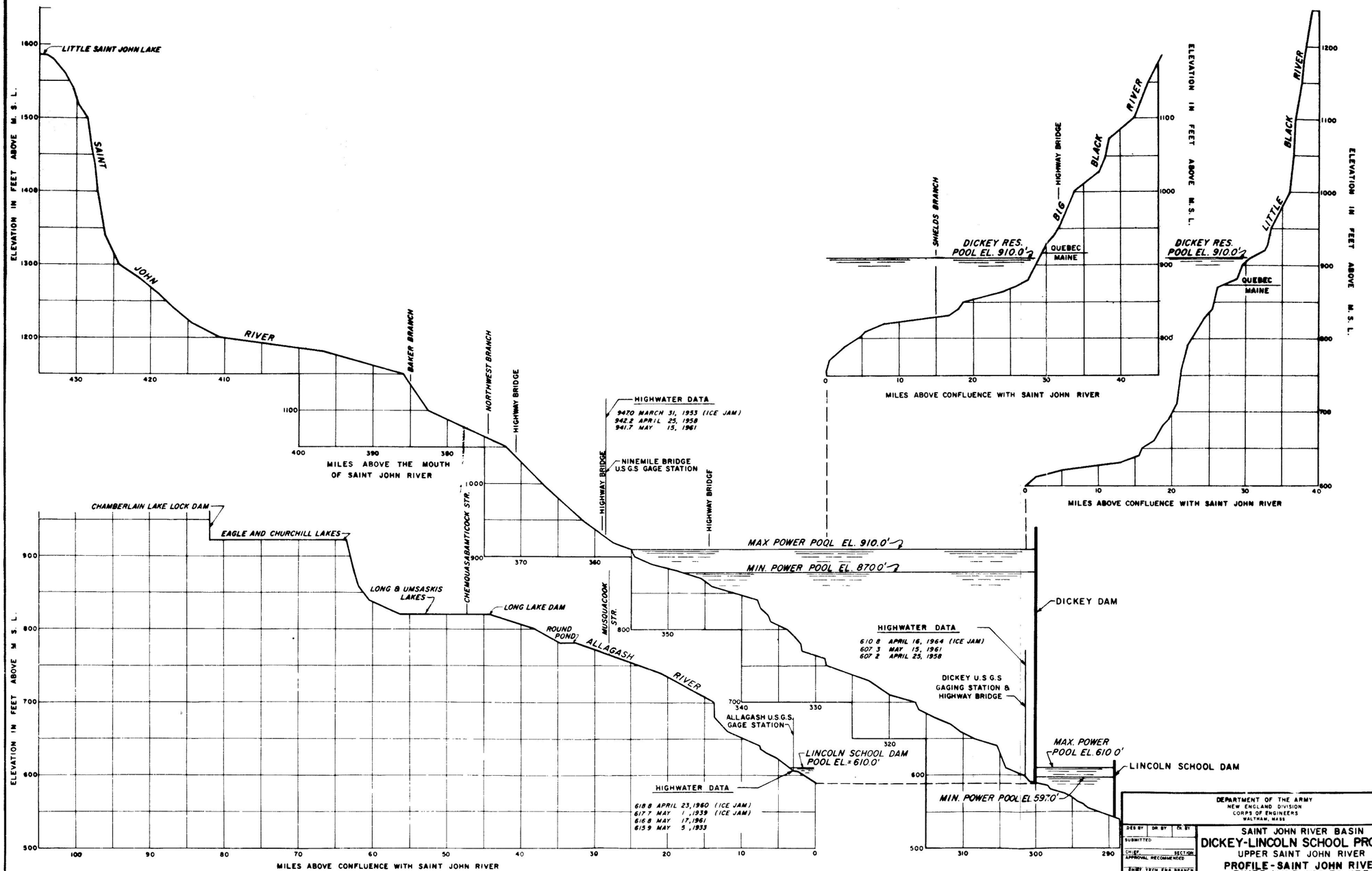
DATE APRIL 1967

SCALE AS SHOWN | SPEC. NO.

DRAWING NUMBER

SHEET

PLATE NO 2-1



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DES BY | DR BY | CK BY
SUBMITTED
CHIEF, SECTION
APPROVAL RECOMMENDED
CHIEF, TECH ENG BRANCH
REVIEWED
APPROVAL RECOMMENDED

SAINT JOHN RIVER BASIN
DICKEY-LINCOLN SCHOOL PROJECT
UPPER SAINT JOHN RIVER
PROFILE - SAINT JOHN RIVER RIVER MILE 289 TO 435
SAINT JOHN RIVER MAINE

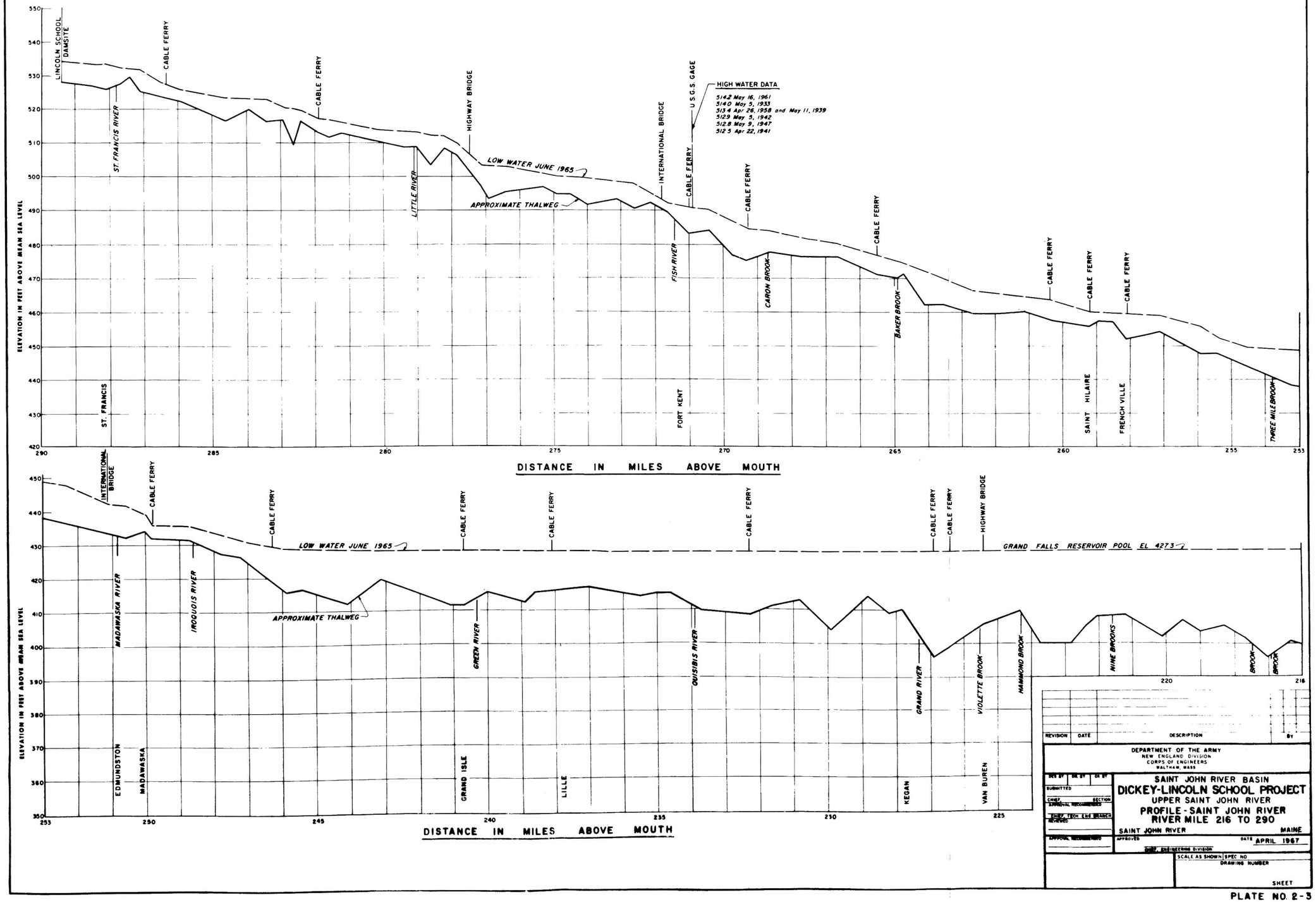
APPROVED
DATE APRIL 1967
CHIEF, ENGINEERING DIVISION

SCALE AS SHOWN | SPEC NO
DRAWING NUMBER

PLATE NO. 2-2

CORPS OF ENGINEERS

U S ARMY



REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS

DES BY | DR. BY | CK BY

SUBMITTED

CHIEF SECTION
APPROVAL RECOMMENDED

CHIEF, TECH. ENG. BRANCH
REVIEWED

APPROVAL RECOMMENDED

SAINT JOHN RIVER BASIN
DICKEY-LINCOLN SCHOOL PROJECT
UPPER SAINT JOHN RIVER
PROFILE - SAINT JOHN RIVER
RIVER MILE 216 TO 290

SAINT JOHN RIVER — MAINE

APPROVED

DATE APRIL 1967

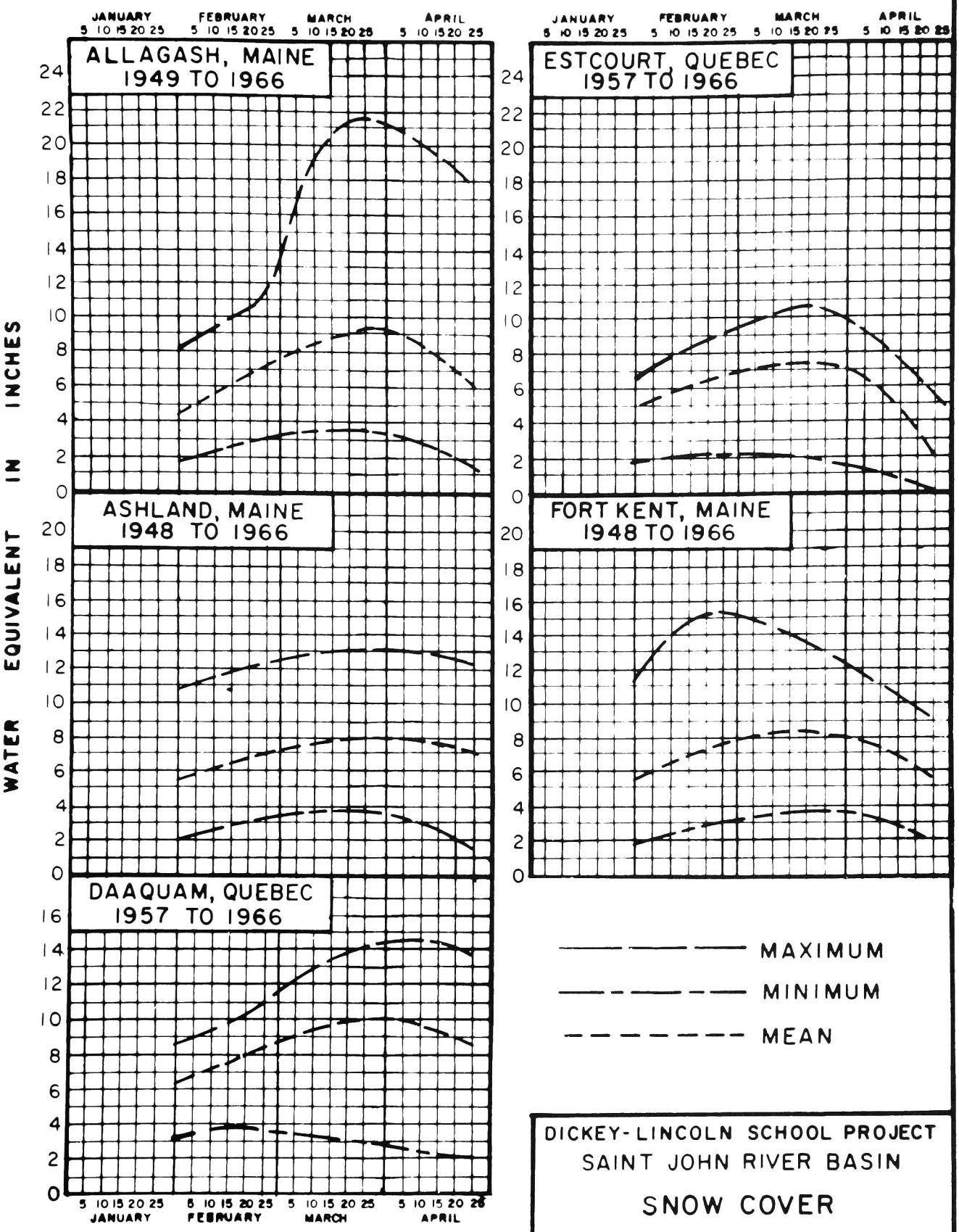
CHIEF, ENGINEERING DIVISION

SCALE AS SHOWN | SPEC NO

DRAWING NUMBER

SHEET

PLATE NO. 2-3



DICKEY-LINCOLN SCHOOL PROJECT

SAINT JOHN RIVER BASIN

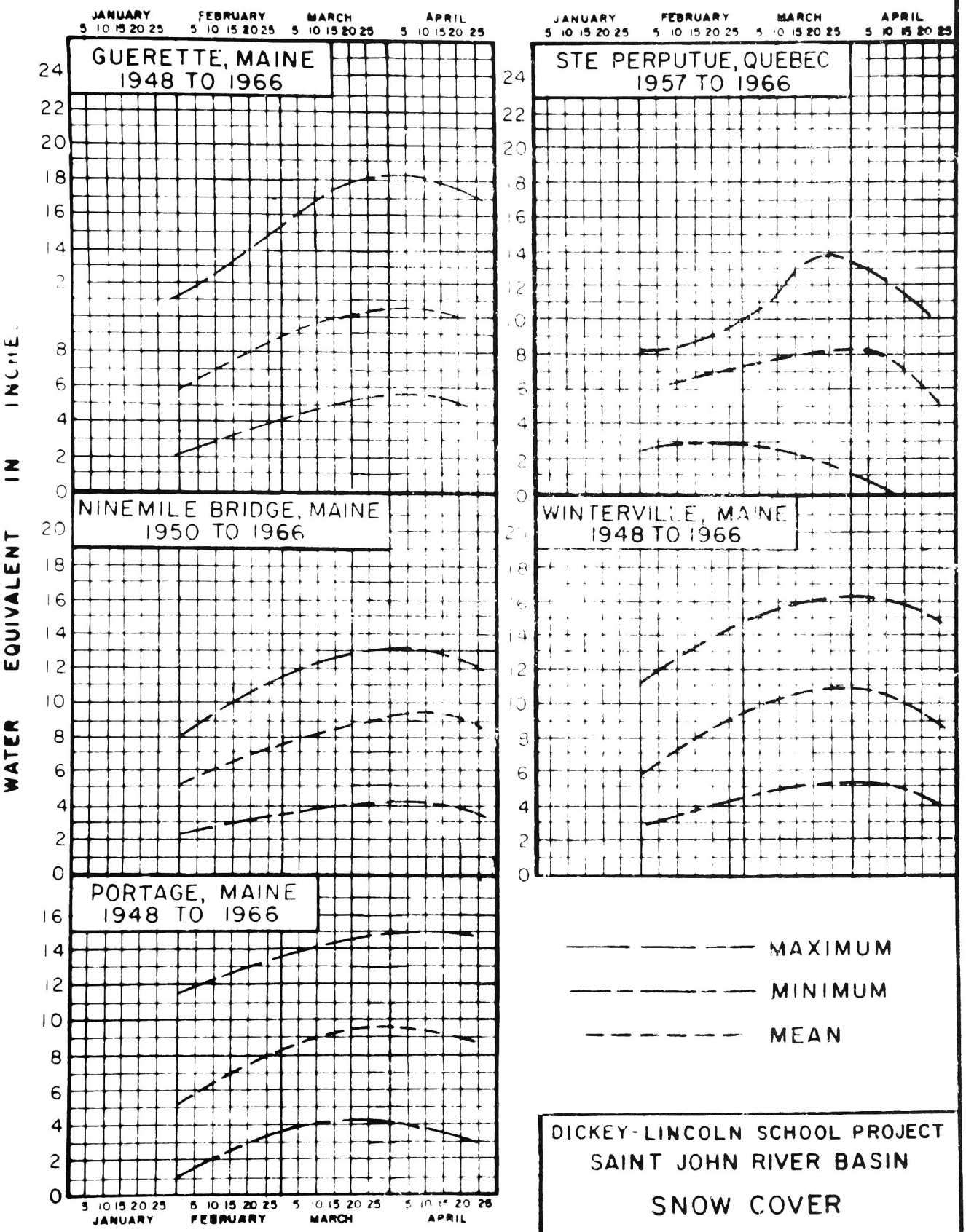
SNOW COVER

APRIL 1967

DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

PLATE NO. 2-4



DICKEY-LINCOLN SCHOOL PROJECT

SAINT JOHN RIVER BASIN

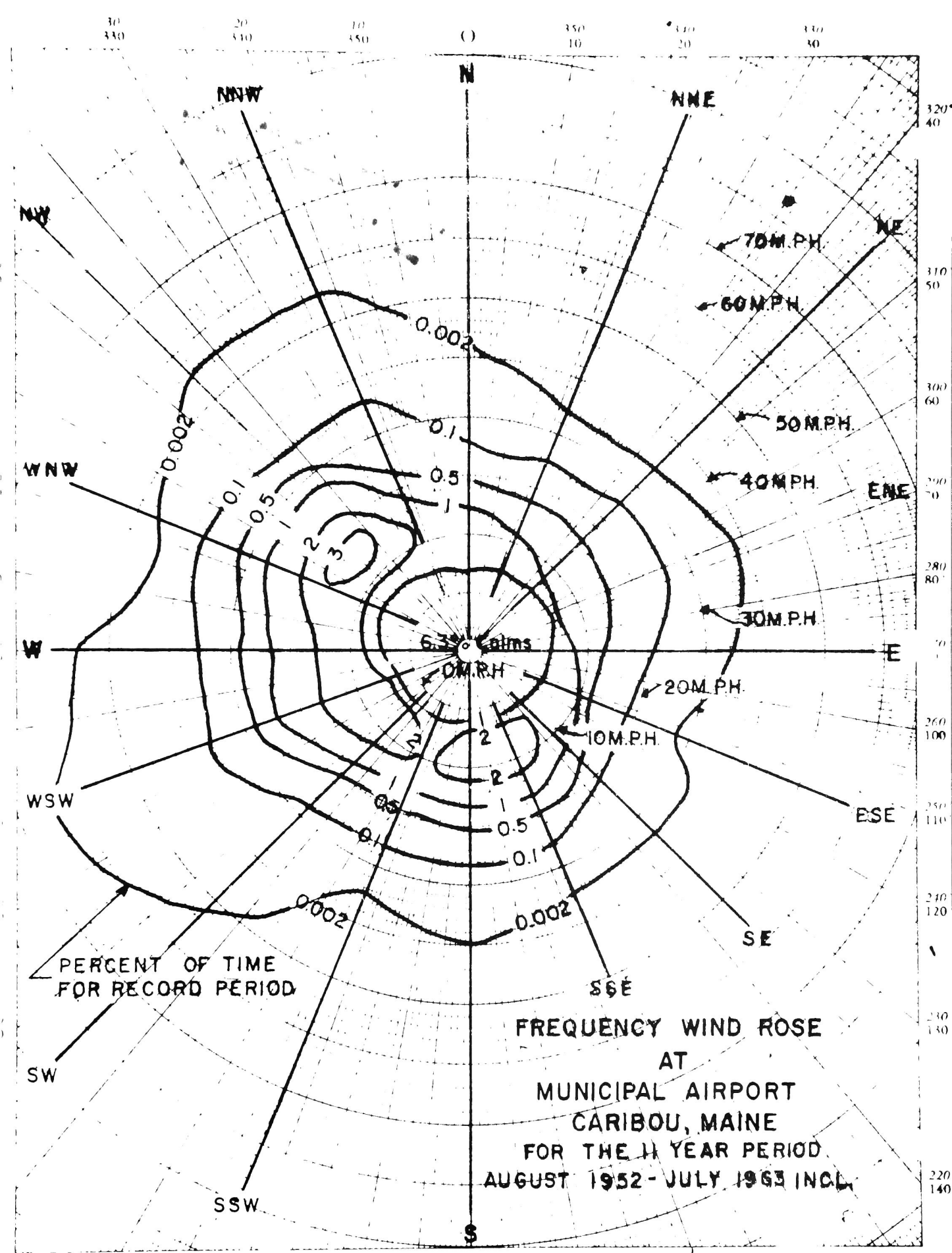
SNOW COVER

APRIL 1967

DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

PLATE NO. 2-5


N
NNE
NE
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SW
WSW
W
WNW
NW
NNW
70M.P.H.
60M.P.H.
50M.P.H.
40M.P.H.
30M.P.H.
20M.P.H.
10M.P.H.
0M.P.H.
6.3% Calms
0.002
0.1
0.5
1
2
3
PERCENT OF TIME
FOR RECORD PERIOD
FREQUENCY WIND ROSE
AT
MUNICIPAL AIRPORT
CARIBOU, MAINE
FOR THE 11 YEAR PERIOD
AUGUST 1952 - JULY 1963 INCL.

PLATE 2-6