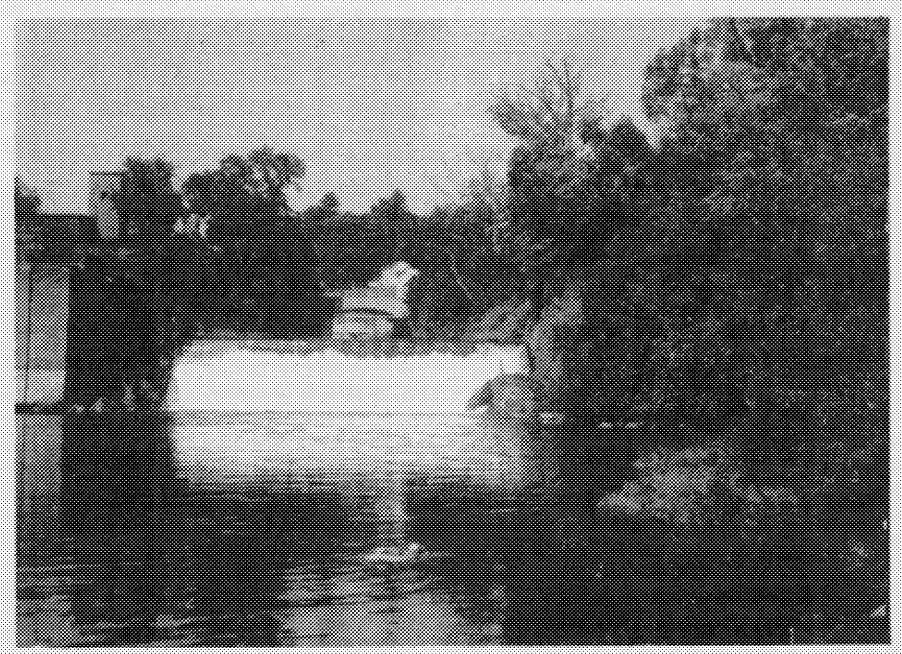
FLOOD PLAIN INFORMATION

BLACK RIVER

SPRINGFIELD

VERMONT



PREPARED FOR
THE TOWN OF SPRINGFIELD
BY
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

FLOOD PL

CONTENTS

CONTENTS (Continued)

TABLES

FIGURES

PLATES

INTRODUCTION

This report concerns the flood situation along the Black River in Springfield, Vermont. It was prepared at the request of the Town of Springfield to aid in the solution of local flood problems and to assist in the determination of the best uses of lands subject to overflow. The report is based upon information on past flood discharges and high water heights, bridges, dams and other technical data relating to the size of floods on the Black River.

The study is divided into two basic sections. Records and hydraulic data for historic floods in the area are first considered. The second section contains a discussion of the probability and magnitude of possible future floods. These are called the Intermediate Regional and Standard Project Floods and reflect the reduction or modifying effect of storage in North Springfield Reservoir during a major storm.

The Intermediate Regional Flood has an average frequency of occurrence of once in 100 years and is determined statistically from data on past floods. The Standard Project Flood is the greatest flow considered in this study. While it may occur in any year, a flood of this size must be regarded as a remote possibility, but should be considered, however, in planning for use of the flood plains. Flood flows of record, along with the two study flows should lay the basis of future planning in connection with flood

plain development on the Black River.

Maps and profiles showing the extent and height of flooding that may occur in Springfield in the future are included in this report. This information should prove useful in guiding development away from areas subject to flooding or in planning the floor levels of buildings high enough to avoid inundation. Development of the lower parts of the flood plain should proceed only with proper regard for the flood hazard.

This report does not include plans for the solution of flood problems. Basic data is presented to enable the town of Springfield to adopt suitable measures for minimizing future flood damage. Such measures typically include the construction of flood protection works and/or a form of zoning to control the type of use made of the flood plains.

This report was prepared by Dufresne-Henry Engineering Corp. North Springfield, Vermont under the direction of the New England Division, Corps of Engineers, located in Waltham, Massachusetts. Representatives from the Corps of Engineers will, upon request of State and local governmental agencies, provide technical assistance in the interpretation and use of the information contained herein and provide other available flood data related thereto.

SUMMARY OF FLOOD SITUATION

Springfield, Vermont is located in the southeast corner of Windsor County on the west bank of the Connecticut River. It is an extensive industrial community where many mills have been constructed along the Black River running through the center of the town. This study covers nearly 9 miles of the Black River from the North Springfield flood control dam to the confluence with the Connecticut River shown on Plate 1.

Past development and industrial growth centered along the banks of the river where the fall was steepest and water power readily available. There is no appreciable flood plain in this section as the river is restricted to a narrow ledge-lined channel. However, in recent years several significant projects have been constructed in low-lying areas with encroachment of the flood plain.

Since 1929 the U.S. Geological Survey has maintained a gaging station on the Black River at North Springfield and excellent flow records are available. In addition, numerous high water marks for several floods have been found, local residents interviewed and newspaper and historical documents searched. From these records and research and from studies of possible future floods on the Black River, the past and future flood situation has been developed.

The following paragraphs summarize the significant findings of the study and these are discussed in more detail in succeeding sections of the report.

* * *

THE GREATEST FLOOD in recent Black River history occurred in November, 1927. That flood is believed to have been comparable in magnitude to the Great Flood of 1869. An estimated peak flow of 24,000 cubic feet per second occurred in the lower valley and caused extensive damage.

* * *

TWO OTHER MAJOR FLOODS in recent times were the March, 1936 and September, 1938 floods. Peak flows of nearly 17,000 cubic feet per second were estimated near the mouth of the Black River with recorded flows at the gaging station in North Springfield (some 9 miles upstream) showing nearly 16,000 cubic feet per second. The resulting high waters were approximately two feet lower than the 1927 flood in the upper reaches of the study.

* * *

OTHER NOTABLE FLOODS occurred on the Black River in the 1800s. The river overflowed its banks more than a dozen times in that century and caused widespread damages. The more severe floods chronologically occurred in February, 1824; September, 1828; July, 1830; January, 1841; August, 1862; October, 1869; July, 1883; and June, 1884.

* * *

RECENT FLOODS occurred in December, 1948 and June, 1952. These floods were much smaller in magnitude than either the 1927, 1936 or 1938 floods. Nevertheless, highways and streets sustained appreciable damages. The Black River watershed escaped the record storm of August, 1955 which created disasters in other parts of New England.

* * *

INTERMEDIATE REGIONAL FLOOD is a flood with a frequency of occurrence in the order of once in 100 years, or in each year there is a 1% chance of occurrence and could occur twice in the same year. It is determined from a statistical analysis of floods on this stream and other streams in the same general area and with the realization that North Springfield Dam will be in operation at the time of storm. A flow of 12,000 cubic feet per second represents this flood in this study.

* * *

STANDARD PROJECT FLOOD on the Black River represents the largest flood to be expected from the most severe combination of conditions. It is an estimated flood condition which is considered to be possible while extremely rare. In this study, this flood is 25% greater than the 100 Year Flood and is approximately equal in magnitude to the experienced 1936 and 1938 floods, which took place before the construction of the North Springfield Flood Control Dam.

* * *

FLOOD DAMAGE would result from the recurrence of either of the two study floods. Such damage would be in proportion to the magnitude of flood flow and would be substantial due to recent development. The hazard can reasonably be expected to increase unless future development is properly guided.

* * *

MAIN FLOOD SEASON for the Black River is generally in the spring when rains and melting snow occur simultaneously. It is significant to note, however, that over the years sizable floods have occurred in most every month illustrating that floods can occur in any season. Heavy spring thaws, intense summer storms, heavy fall rains, and tropical storms, and even midwinter rains or thaws may lead to large floods at any time.

* * *

FUTURE FLOOD FLOWS for the Intermediate Regional (100 Year) and Standard Project Floods, all modified by North Springfield Dam, are presented in Table 1. The table further compares these predicted discharges and elevations with those experienced in the 1927, 1936 and 1938 floods and relates them all to the recent flood in June 1952.

* * *

TABLE 1

RELATIVE FLOOD HEIGHTS

LOVEJOY DAM

FLOOD	PEAK DISCHARGE cfs	ELEV. M.S.L.	RELATION TO 1952 FLOOD ft.
June 1952	13,000 *	353.0	0
Intermediate Regional	12,000 °	352.0	-1.0
Standard Project	15,000 °	353.5	+0.5
Sept. 1938	16,800 *	353.6	+0.6
Mar. 1936	17,000 *	354.2	+1.2
Nov. 1927	24,000 *	355.6	+2.6

* Experienced peak discharges

° Estimated peak discharges reduced by North Springfield Dam

GENERAL CONDITIONS AND PAST FLOODS

Settlement

Springfield, Vermont is located in the southeast corner of Windsor County on the west bank of the Connecticut River which separates it from Charlestown, New Hampshire. It is further bounded on the south by Rockingham, on the west by Chester and on the north by Weathersfield. The township has an area of approximately 44 square miles.

A small number of pioneers settled in what is now Springfield as early as 1753 but it was not until 1761 that the town was chartered. The first settlers located in the eastern part of the town on the high ground between the Black and Connecticut Rivers. As industrial development progressed, the growth of the town became centered along the banks of the Black River which was used as a source of power.

The first recorded census (taken of Cumberland County of the Province of New York in January, 1771) gave Springfield a population of 141. At the time of the first census taken by the U.S. Bureau of Census, Springfield had a population of 1,097. The 1960 census shows a population of 9,934, and the present population is estimated at 10,750.

Springfield is a leading industrial community in southern Vermont. The major industries are involved in the manufacture of machines and machine tools. These industries were built by local men who, until recent years, needed the Black River for their power supply. There are other important industries in Springfield including printing, concrete products, castings, plastics, and electronic and computer components.

Flood Damage Prevention Measures

In 1953 the Connecticut River Flood Control Compact was formed for the purpose of co-ordinating a flood control plan which included the construction of dams on upstream tributaries. Member states include Connecticut, Massachusetts, New Hampshire and Vermont. The Connecticut River Valley Flood Control Commission was established to administer the provisions of the compact.

Through the Commission and the U.S. Army Corps of Engineers, a flood control dam was constructed on the Black River at North Springfield. This structure was completed in 1960 and is about 8.5 miles upstream from the confluence of the Connecticut and Black Rivers. The North Springfield Dam is one of a system of structures designed to provide comprehensive flood control in the Connecticut River Basin. A considerable degree of protection is now afforded the industrial community along the river below the dam.

Between the floods of 1927 and 1930, a dam was built at Bellows Falls on the Connecticut River. This dam, designed primarily for hydro electric generation, affects water levels on the lower end of the Black River below Gould's Mills during minor flows. During major flows the backwater effect in the Black River can be regulated by means of the gates at the Bellows Falls dam.

Since 1960, land development has progressed in the flood plain below the North Springfield Dam mostly in the reach between North Springfield and Springfield. There are presently no regulations which govern land usage in the flood plain.

On the basis of this study, and the information contained herein, it seems that areas already developed, as well as places of probable future use, could experience flooding. Therefore, the Springfield community may wish to consider future uses of flood plain areas which insure some protection against flooding. Future development might be limited to forms of industrial and commercial usage which provide flood-proofing of buildings situated in hazard areas. By elevating building floors above flood level while employing low ground for functions such as parking, the flood problem can be obviated.

On the other hand, open-space development of areas subject to flooding may also be feasible. In this instance only structures which can be inundated without damage would be built in the low zones.

But in general, under this concept, the usage of the land would not involve buildings. Certain forms of recreation facilities are examples of open-space development.

This discussion is offered to suggest that some consideration of future land utilization in the flood plain which will minimize risk of flood damage is needed. It is the purpose of this report to aid such an effort by showing the future flood conditions which may be expected along the study reach.

Flood Warning and Forecasting Services

The River Forecast Center of the Weather Bureau at Bradley Field near Hartford, Connecticut is responsible for preparing and disseminating flood forecasts for the Connecticut River and some of its principal tributaries. Although flood forecasts are not given specifically for the Black River, they are indicative of conditions existing in the basin.

With this type of warning, the Police Department or the local Civil Defense Office would be on an alert status. Staff gages installed by local interests at two or three locations along the river would provide a visual index of the rate of rise. It would then be possible to prescribe critical elevations at which time certain areas should be evacuated before the flood is at its worst.

The Stream And Its Valley

The Black River watershed of approximately 206 square miles is generally rugged and with steep slopes. It is long and narrow with only a few small lakes in the upper valley to retard runoff. The headwaters are on the slopes of the Green Mountains where rainfall is of sufficient intensity and duration to produce frequent freshets. Snow cover is also fairly heavy with consequent heavy runoff following a thaw.

The physical characteristics of the Black River Drainage Basin have a definite influence on the intensity and duration of floods along the stream. Flood records show that the runoff per square mile is high as compared with other river basins. A relatively short interval of time elapses between the occurrence of a storm on the watershed and its effect on water levels in the stream. In a severe flood involving the Connecticut River and its tributaries, the Black River will reach its flood crest (peak) in advance of the Connecticut River. Consequently, water levels in the upper reaches of the Black River will be dropping before the levels below Gould's Mills have crested. This is due to the influence of the Connecticut backwater below the rapids at Gould's Mills.

This study deals with the lower portion of the Black River watershed from the North Springfield Dam to the mouth of the river. In this reach of approximately 8.5 miles the river falls about 186

feet making the average slope 21 feet per mile. The steepest segment of the reach is through the heart of Springfield where the fall is approximately 93 feet in 0.65 miles.

Below the dam at North Springfield the only significant tributary is Great Brook with a drainage area of 21 square miles. Watershed data for pertinent drainage areas of the Black River are given in Table 2.

TABLE 2

DRAINAGE AREAS IN BLACK RIVER WATERSHED

Watershed	Drainage Area (Sq. Mi.)	
	Tributary	Total
Black River Above North Springfield Dam (Includes North Branch)		158
Great Brook	21	179
Black River At Mouth		206

Development in the Flood Plain

Plate 2 is an index map of the sheets that show the flooded areas of Black River and Great Brook. Plates 3, 5, 6, 7, 8, 10, 11 and 12 show the flood plains of Black River for the reach covered by

this report.

Commercial and industrial growth along the Black River in Springfield has historically been related to the availability of water power. The development of the business and industrial community has naturally been centered along that part of the stream where the fall is steepest. It is shown elsewhere in this report that the sharpest drop is 93 feet in 0.65 miles, and in this stretch at least six dams have been constructed over the years to serve industrial establishments. There is no appreciable flood plain in this section of the valley where the river is restricted to a narrow channel bounded by steep banks and ledges.

Since 1960 several significant projects have been constructed in the major flood plain of the study reach which lies upstream of the Fellows Gear Shaper dam. A shopping plaza has been located within an oxbow of the river immediately above the Fellows dam. Several commercial establishments and an apartment complex are ranged along the two and one-half mile stretch between Springfield and North Springfield. Accelerated development in this area has probably been due to the completion in 1960 of the North Springfield Flood Control Dam. It is anticipated that future development in this stretch will be further enhanced by the recently completed four-lane highway between Community House bridge and Interstate 91.

Bridges Across The Stream

Fourteen bridges span the reach of the Black River in this study. Views of some of these bridges are shown in Figures 1 and 2. Pertinent elevations relating to the bridges are listed in Table 3. The Table also indicates the relation of these elevations to the Intermediate Regional and Standard Project Floods.

Inspection of the water surface profiles indicates that the bridges crossing the Black River would not significantly restrict flood flows. The river is restricted in the vicinity of the Park Street Bridge by the natural ledge which forms the channel but not by the bridge structure which is supported by the ledge.

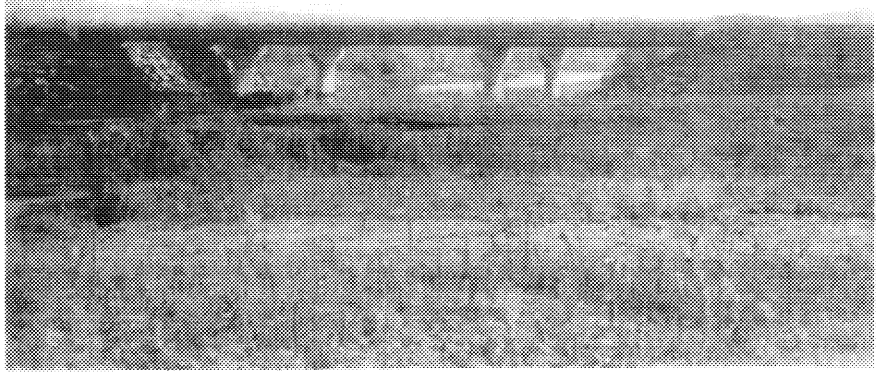
The Fairgrounds Bridge would restrict flow confined to the channel to some extent but flood flows are expected to inundate the overbank areas adjacent to the bridge. This means that the bridge approaches will probably be flooded along with the extensively developed plain just below the bridge. However, the bridge deck will not be inundated.

The River Street Bridge to the Fellows Gear Shaper Plant would be completely inundated by the Standard Project Flood. Lesser floods would pass this bridge unless debris were to catch on the bridge and restrict the flood waters.

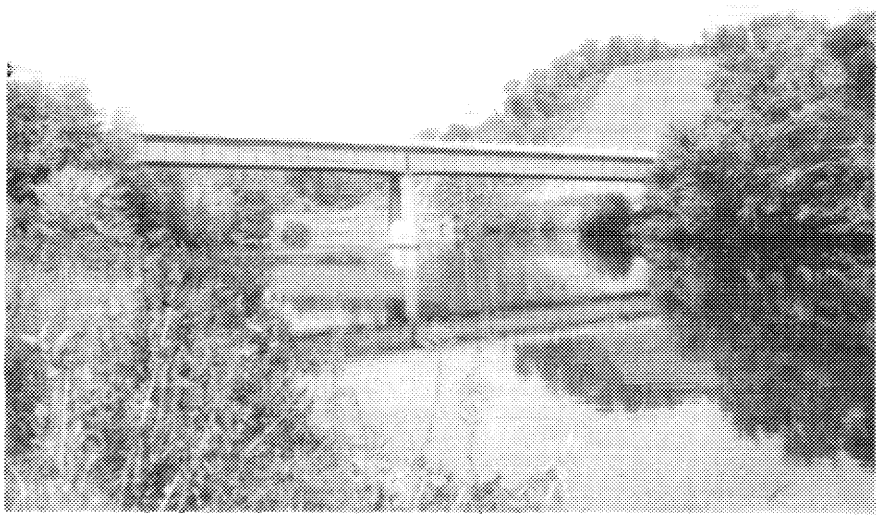
The Bridge Street bridge and adjacent railroad bridge are situated such that flooding of the overbank areas will inundate the approaches while not putting the bridge decks underwater.

The 100 Year Flood will not affect the old steel bridge or the new Route 11 and 106 bridge at Gould's Mills. However, the Standard Project Flood would completely inundate both structures. This condition would be due to a Standard Project Flood on the Connecticut River occurring at the same time causing backwater in the lower reach of the Black River.

The indicated flood crests relating to the bridge elevations depend upon the hydraulic characteristics of the river. These do not take into account occurrences such as ice jams or other types of stoppages which could cause flooding in certain areas. During a minor flood, an obstruction at a bridge such as ice or debris could cause flooding in the adjacent flood plains.

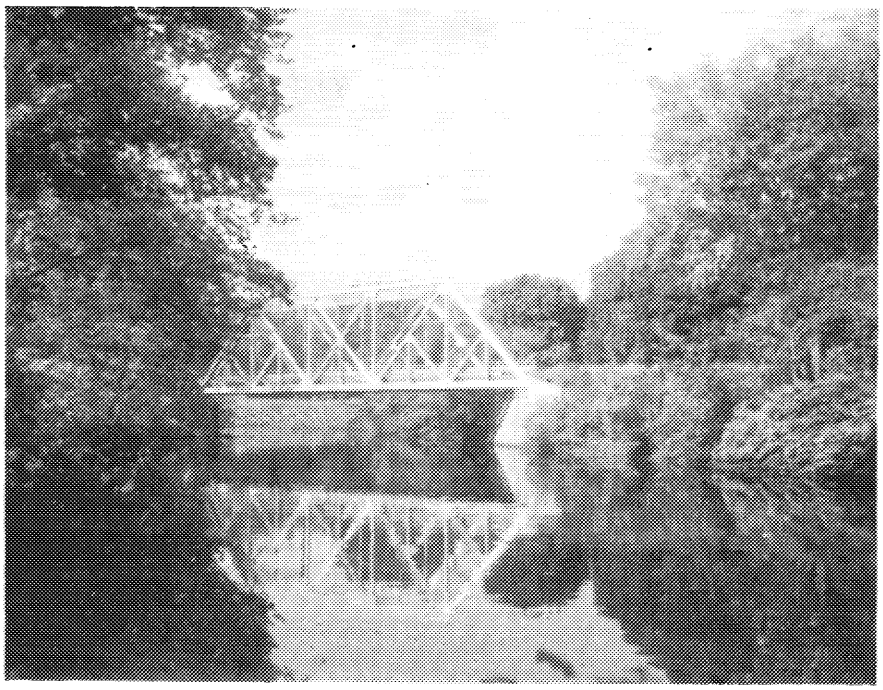


TWIN BRIDGES ON I-91 LOOKING DOWNSTREAM

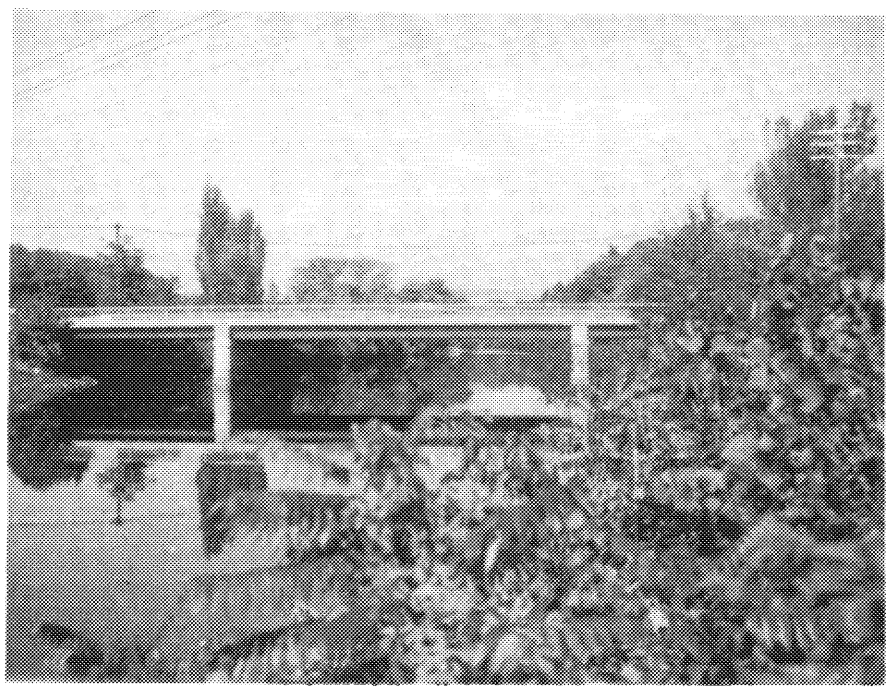


"WHITE'S BRIDGE" ON U.S. 5 LOOKING UPSTREAM

FIGURE 1



GOULDS MILLS BRIDGE LOOKING UPSTREAM



"FAIRGROUNDS BRIDGE" LOOKING UPSTREAM

FIGURE 2

TABLE 3

BRIDGES ACROSS BLACK RIVER

STATION	IDENTIFICATION	STREAM BED ELEV. feet	BRIDGE ELEV. DECK feet	BRIDGE ELEV. LOW STEEL feet	FLOOD CRESTS IRF feet	FLOOD CRESTS SPF feet	UNDERCLEARANCE RELATION TO IRF BELOW feet	UNDERCLEARANCE RELATION TO IRF ABOVE feet
14+40	Interstate 91	285.0	325.0	318.0	304.0	312.5		14.0
15+40	Interstate 91	285.0	325.0	318.0	304.0	312.5		14.0
24+00	U.S. Rt. 5	286.0	326.4	316.4	304.0	312.5		12.4
45+40	Vt. Rt. 11 & 106	287.0	312.2	305.2	304.0	312.5		1.2
82+20	Gould's Mills	287.0	312.1	308.1	304.0	312.5		4.1
179+20	Railroad Bridge	318.0	336.5	332.5	335.0	335.9	2.5	
180+00	Bridge St.	318.5	340.1	334.5	335.2	336.1	0.7	
207+80	Community House	326.0	354.9	351.0	341.0	342.3		10.0
227+40	Park St.	353.0	407.2	403.8	377.5	380.6		26.3
242+00	FGS River St.	420.0	435.3	434.1	434.0	435.7		0.1
255+40	Footbridge	432.0	449.0	445.5	444.6	446.1		0.9
280+40	Fairgrounds	432.5	451.8	446.8	447.0	449.0	0.2	
413+00	No. Springfield	446.0	466.6	462.2	458.5	460.5		3.7
417+50	Vt. Rt. 10 & 106	446.0	469.0	464.2	459.8	461.8		4.4

Dams on the Black River

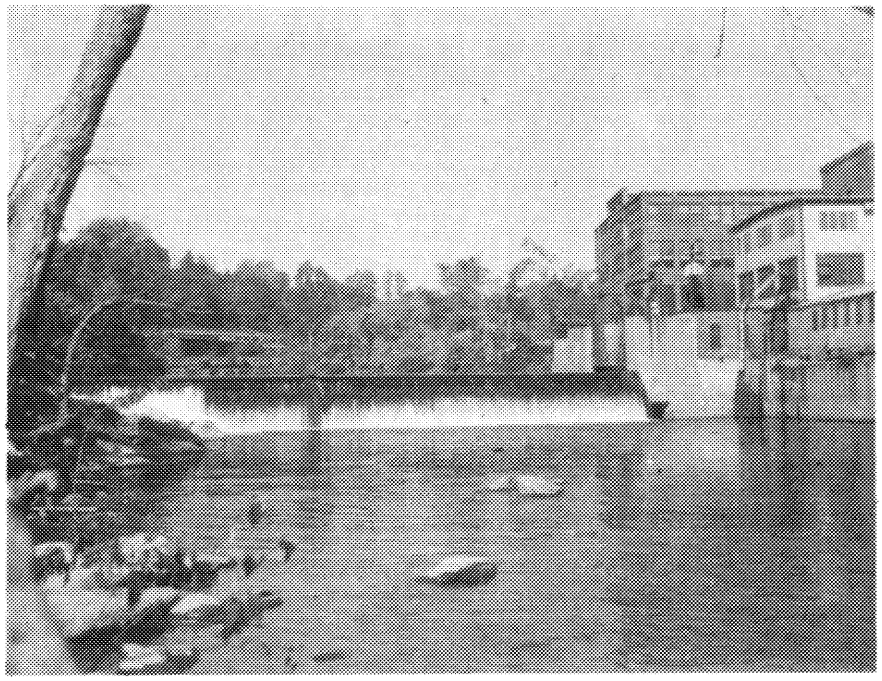
Over the years ten dams have been constructed along the reach covered in this study. The dams of the Vermont Snath Company and the Heald Mill have been destroyed. The crib-fill dam of the Springfield Electric Railway Company was also demolished in connection with the recent relocation of Vermont Route 11. In addition the small Slack Company dam above Comtu Falls has been abandoned. The locations of these structures are indicated in Table 4.

Of the existing six dams along the reach, five are diversion structures for industrial plants. The other is a large flood control structure located in North Springfield about 8.5 miles above the confluence of the Black and Connecticut Rivers. Views of some of these dams are shown in Figures 3, 4 and 5. Table 4 lists pertinent elevations regarding the dams and shows their relationship to the floods under consideration in this study.

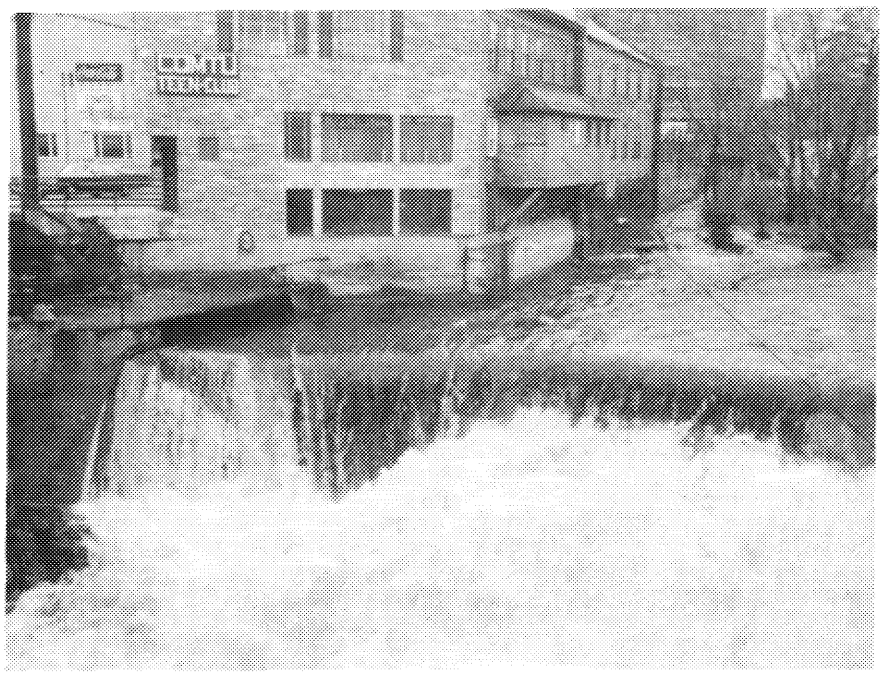
The North Springfield flood control dam shown in Figure 5 was completed in 1960 and is one of a system of dams in the Connecticut River Basin designed for comprehensive flood control. The dam extends nearly 3,000 feet across the Black River Valley and has a maximum height above the stream bed of 120 feet. A side channel spillway with a crest length of 384 feet was constructed at the east end of the dam. In the event of an extreme flood, water will overflow the

spillway into a rock gorge and then continue down the reach below the dam. Under flood conditions discharge from the dam is controlled by gates which allow the water to pass under the dam and into the downstream reach through a tunnel about 660 feet in length.

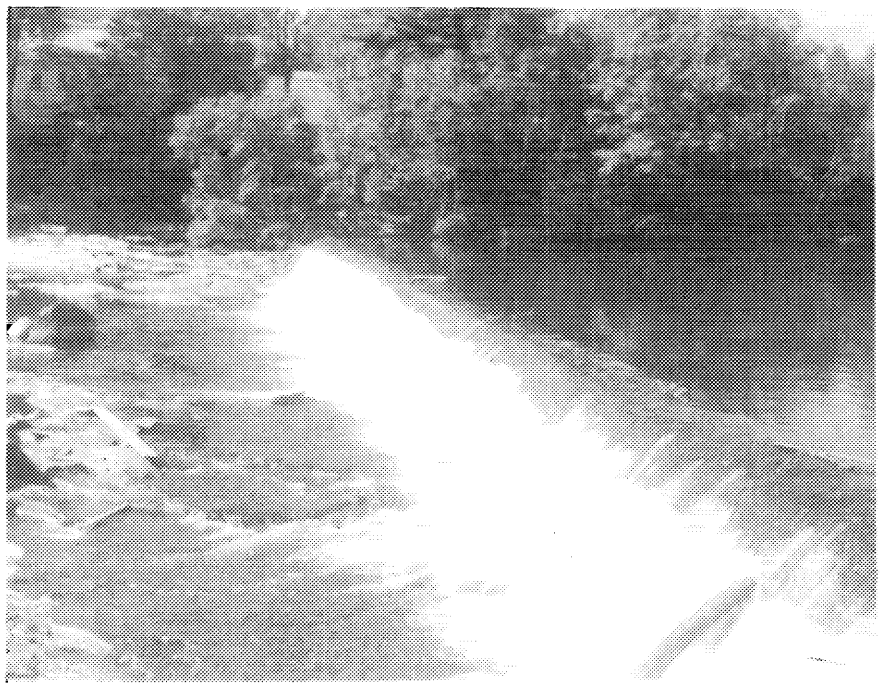
The five existing dams below the flood control dam in North Springfield are shown on Plates 7, 8 and 9. It can be seen on the river profile that the five structures are located along a steep segment of the reach where the fall is approximately 93 feet in 0.65 miles. The profiles also indicate the flow of water over the dams for two flood conditions.



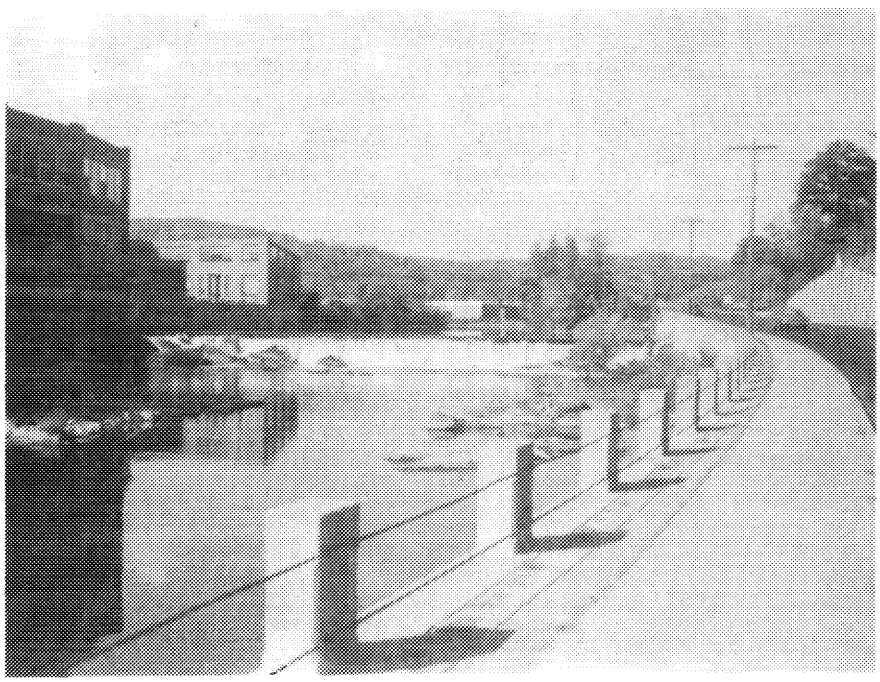
VIEW OF LOVEJOY DAM FROM DOWNSTREAM



DAM AT TOP OF COMTU FALLS

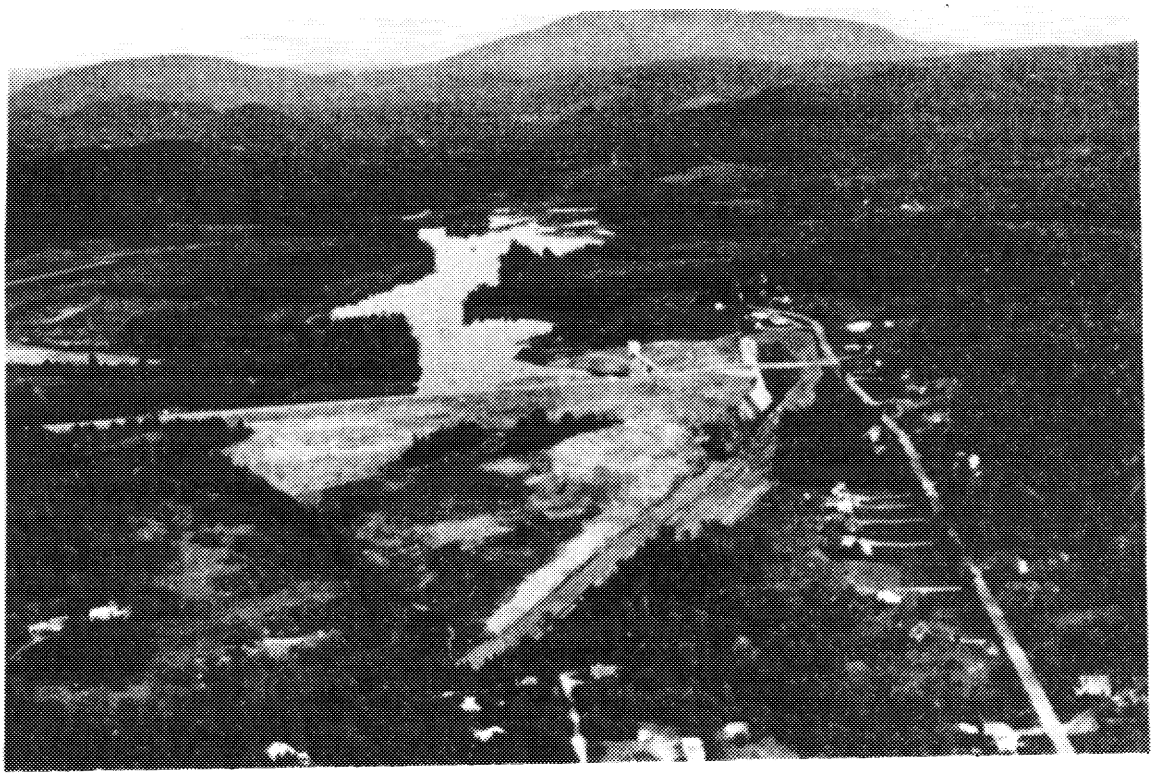


VIEW FROM EAST END OF GILMAN DAM



FELLOWS GEAR SHAPER DAM FROM DOWNSTREAM

FIGURE 4



AERIAL VIEW OF NORTH SPRINGFIELD DAM

FIGURE 5

TABLE 4

DAMS ON BLACK RIVER

STATION	IDENTIFICATION	DAM ELEV. TOE feet	DAM ELEV. CREST feet	FLOOD ELEV. IRF feet	FLOOD ELEV. SPF feet	DEPTH OVER DAM IRF feet	DEPTH OVER DAM SPF feet
94+70	Springfield Elec. Railway Co.	Destroyed					
187+80	Vermont Snath Co.	Destroyed					
211+80	Lovejoy Tool Co.	331.3	343.6	352.0	353.4	8.4	9.8
223+20	Slack Shoddy Mill	339.0	364.5	374.2	375.8	9.7	11.3
228+00	Slack Comtu Falls	385.4	392.8	401.3	402.8	8.5	10.0
230+50	Slack Co.	Abandoned					
233+00	Gilman & Sons	414.9	424.2	428.8	429.9	4.6	5.7
246+20	Fellows Gear Shaper	424.2	435.5	442.3	443.4	6.8	7.9
424+00	Heald	Destroyed					

FLOOD SITUATION

Flood Records

Records on the Black River prior to 1929 exist mainly in the form of old newspaper accounts, pamphlets and similar articles to be found in the library. However, official records of discharge on flood flows do not exist for the years before the establishment of the North Springfield Gaging Station. The record 1927 flood discharge has been estimated from high water marks and the characteristics of the several dams on the Black River.

Since 1929 the U.S. Geological Survey has maintained a gaging station at North Springfield about one quarter mile upstream from Great Brook. This station provides excellent discharge data for the stream. As of 1966 the average discharge at the gaging station for a 37 year period was 272 cubic feet per second.

Flooded Areas, Flood Profiles and Cross Sections

The approximate areas along the Black River that would be inundated during the floods studied are shown on Plates 3, 5 through 8 and 10 through 12. Overflow areas are drawn for the Intermediate Regional and Standard Project Floods. The actual limits of flooding on the ground may vary from those shown on the maps since the 10 and 15 foot contour intervals and relatively small map scale do not

permit precise plotting.

High water profiles of the two study floods are shown on Plates 4 through 7, 9 through 11 and 13. These profiles may be used to determine the depth of flooding at a particular location by standard survey methods. Crest and deck elevations for the dams and bridges, respectively, are indicated on the profiles.

Plate 14 shows four cross sections that are typical of the many sections taken across the Black River for this study plus one cross section typical of the three taken across Great Brook. The locations of these five cross sections are shown on Plates 3, 5, 10 and 12. The elevation and extent of overflow of the Intermediate Regional Flood, November 1927 Flood as modified by North Springfield Flood Reservoir, and Standard Project Flood are indicated on these sections.

FLOOD DESCRIPTIONS

Descriptions of some of the more notable floods on the Black River in Springfield are presented on the next several pages.

The 1800s

Probably the earliest flood to cause widespread destruction in the basin occurred in 1801. This was followed by the floods of

February 1807 and May 1818 which undoubtedly caused some damage. In February 1824 a flood raised havoc with bridges, roads and mills along the Black River. One report indicates that all bridges over the river were gone. The floods of September 1828 and July 1830 were even more disastrous in their effects on the river. High water is known to have occurred in January 1841, and a quick thaw of heavy snow cover caused a very strong freshet in April 1862.

A very severe flood called the Great Flood or Great Freshet occurred in October 1869. The Black River rose 15 to 20 feet and every bridge crossing the river in Springfield was swept away. One man was drowned while several mills and numerous homes were completely destroyed. Municipal and private losses were estimated in excess of $100,000 based on the dollar value at that time.

In July 1883 and again in June 1884, cloudbursts caused severe flooding in the lower portions of the Black River basin. Some roads were gullied 4 or 5 feet deep and culverts and bridges swept away. One or two dams went out and several houses were undermined and overturned.

November 1927

This famous flood was the greatest in recent Black River history and probably of comparable magnitude to the 1869 flood.

The U.S. Army Corps of Engineers estimated that a peak flow of 24,000 cfs occurred in the lower river. Extensive damage was done to both public and private properties. Estimates at the time placed losses from $500,000 to $700,000.

March 1936

The high water of March 1936 was not near as damaging as the 1927 disaster, although losses were put at near $100,000. A portion of the damages were attributable to ice jams in the river. A peak flow of 15,700 cfs was recorded at the U.S. Geological Survey gaging station at North Springfield. This discharge is nearly identical with the Standard Project Flood considered in this report.

September 1938

A tropical hurricane in September of 1938 produced heavy rain on the Black River watershed. The resulting high waters were approximately two feet lower than the 1927 maximum and flood damage was correspondingly less. A peak flow of 15,500 cfs was noted at the Geological Survey gaging station at North Springfield. Again, this discharge is about identical with the Standard Project Flood.

Circa 1950

Lesser floods occurred on the Black River in December 1948

and June 1952. These floods were much smaller in both magnitude and damages than the 1927, 1936, or 1938 floods. Inundated highways and streets sustained the heaviest damage, while private property was largely unaffected.

Observations and Comments

It is significant that most every sizable flood on the Black River has occurred in a different month of the year, illustrating that floods can happen at any season. Heavy spring rains and/or rapid thawing of the snow cover, intensive summer storms, heavy fall rains and tropical storms and even midwinter rains or thaws have led to devastating high waters.

It should also be noted that a dam was constructed on the Connecticut River at Bellows Falls between 1927 and 1936. The operation of this structure has had a pronounced effect upon water levels and flood conditions in the lower Black River. For example, the water levels in the lower Black River were approximately the same during both the 1927 and 1936 floods even though the peak flow in 1936 was only two-thirds that in 1927. The water levels in 1936 were elevated from the Connecticut River as water backed up behind the Bellows Falls dam.

FUTURE FLOODS

Large floods have been experienced in Springfield. Storms equal to or even greater than those which caused this flooding could appear again. Planning now for these events could prevent severe damages and even loss of life when they occur. A flood control dam has been constructed on the Black River in North Springfield and will be in operation at the time of a future major storm. This will afford a considerable amount of protection to the industrial community along the river below the dam but will not prevent all damage in a major storm.

In this study, flood data and hazards of two major high water conditions are discussed. These conditions are called the Intermediate Regional and Standard Project Floods. A flood comparable to the Standard Project Flood can be expected. The Intermediate Regional Flood may be expected to occur more frequently but resulting high water levels will not be as high as those of the Standard Project Flood.

DETERMINATION OF INTERMEDIATE REGIONAL FLOODS

The Intermediate Regional Flood is defined as a flood having an average frequency of occurrence in the order of once in 100 years, at a designated location, although the flood may occur in any year.

For this reason, the Intermediate Regional Flood is better described as a flood with a 1% chance of occurring each year.

In order to determine the Intermediate Regional Flood for the Black River, statistical studies were made using the 39 year record of known flood data at the U.S. Geological Survey gaging station.

Results of this study indicate that the Intermediate Regional Flood on the Black River would have a peak discharge of 12,000 cubic feet per second at the Lovejoy dam. This flood would be about one foot lower than the experienced June 1952 flood. It is assumed, however, that there are no ice jams and the bridges are free from debris.

DETERMINATION OF STANDARD PROJECT FLOODS

The largest flood that is likely to occur on a specific stream has been experienced only in rare instances. It is an accepted fact that, as severe as the maximum known flood may have been, sooner or later a larger flood can and probably will occur. The Corps of Engineers, in cooperation with the Weather Bureau, has made broad and comprehensive studies and investigations based on the vast records of experienced storms and floods and has evolved generalized procedures for estimating the flood potential of streams. These procedures have been used in determining the Standard Project Flood. It is defined as the largest flood that can be expected from the most severe combination of meteorological and hydrological conditions

that are considered reasonably characteristic of the geographical regions involved.

A Standard Project Flood has been estimated for the Black River. This flood would be about 25% greater than the Intermediate Regional Flood and 50% greater than the November 1927 flood modified by North Springfield Flood Control Dam.

Frequency

It is not practical to assign a frequency to the Standard Project Flood. The occurrence of such a flood would be a rare event; however, it could occur in any year.

Possible Larger Floods

Floods larger than the Standard Project Flood are possible, however, the combination of factors that would be necessary to produce such floods would seldom occur. For this reason floods of this magnitude have not been considered in this report.

HAZARDS OF GREAT FLOODS

The amount of damage caused by any flood depends upon how much area is flooded and the height of flooding.

Areas Flooded and Heights of Flooding

The approximate areas along the Black River flooded by the Standard Project Flood and the Intermediate Regional Flood are shown on Plates 3, 5 through 8 and 10 through 12. Depths of water can be determined from the profiles which are shown on Plates 4 through 7, 9 through 11 and 13.

Profile computations are based on hydraulic properties and characteristics of selected stream reaches as determined from topographic maps and valley cross sections. The overflow areas shown on the plans and the elevations on the profiles have been determined with an accuracy consistent with the purposes of this study and the accuracy of the basic data.

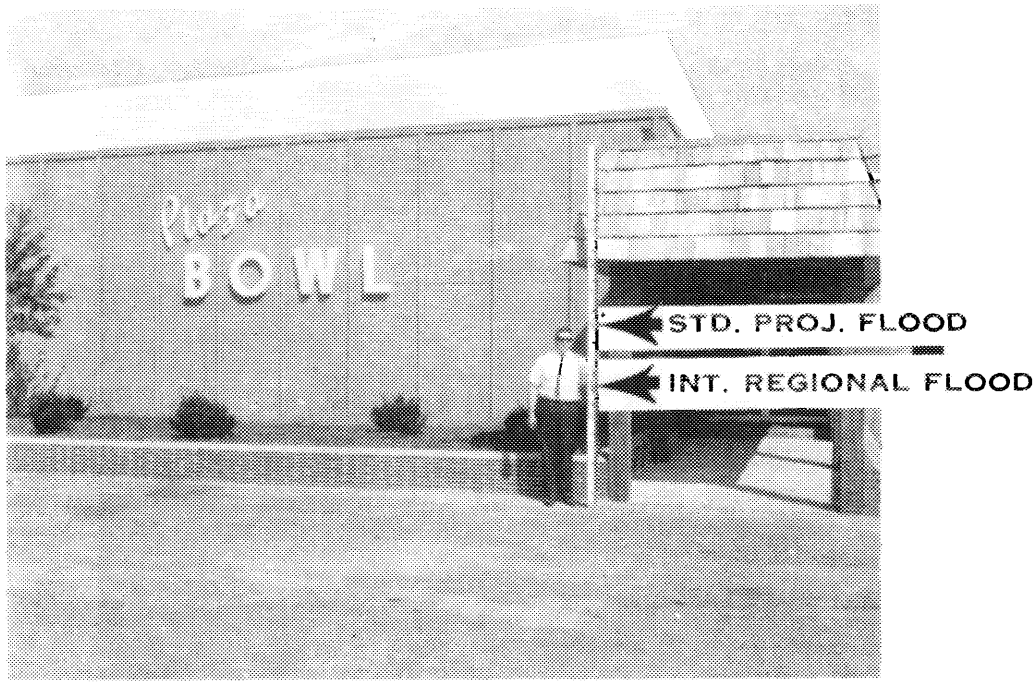
The profiles for all these study floods depend in some areas upon the degree of destruction or clogging of various bridges during a flood. Trees and other large debris, or ice in the spring, can seriously clog a structure and restrict the flood flow. Because these events cannot be forecast, it was assumed that all bridges would stand and no clogging would occur.

The Standard Project Flood would put nearly 10 feet of water over both the Fellows and the Lovejoy dams. This flood is still some 7½ feet below the 1927 high water mark at the Fellows Dam

and 2½ feet below a similar mark at the Lovejoy dam.

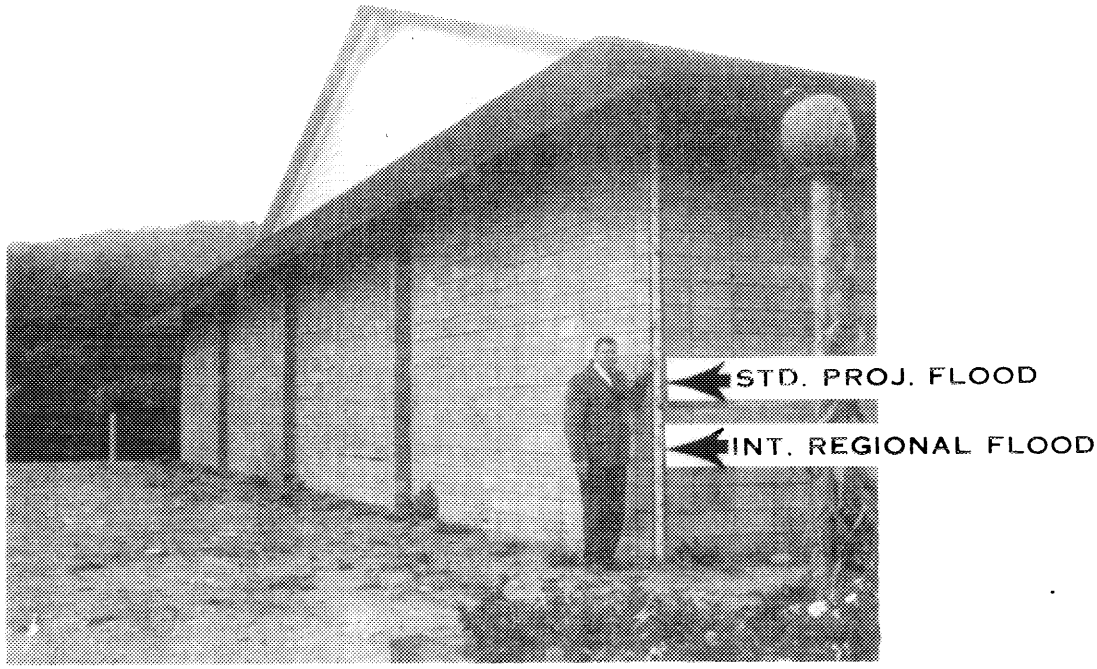
The Intermediate Regional Flood profile is generally 1 to 2 feet lower than the Standard Project Flood profile.

Figure 6 shows the heights that would be reached by the various study floods on buildings now constructed within the flood plain at the shopping plaza at Fairground's Bridge. Lesser floods would inundate the parking lot more frequently but would cause much less damage. Figures 7 and 8 show heights of flooding on buildings in other sections of the study area.

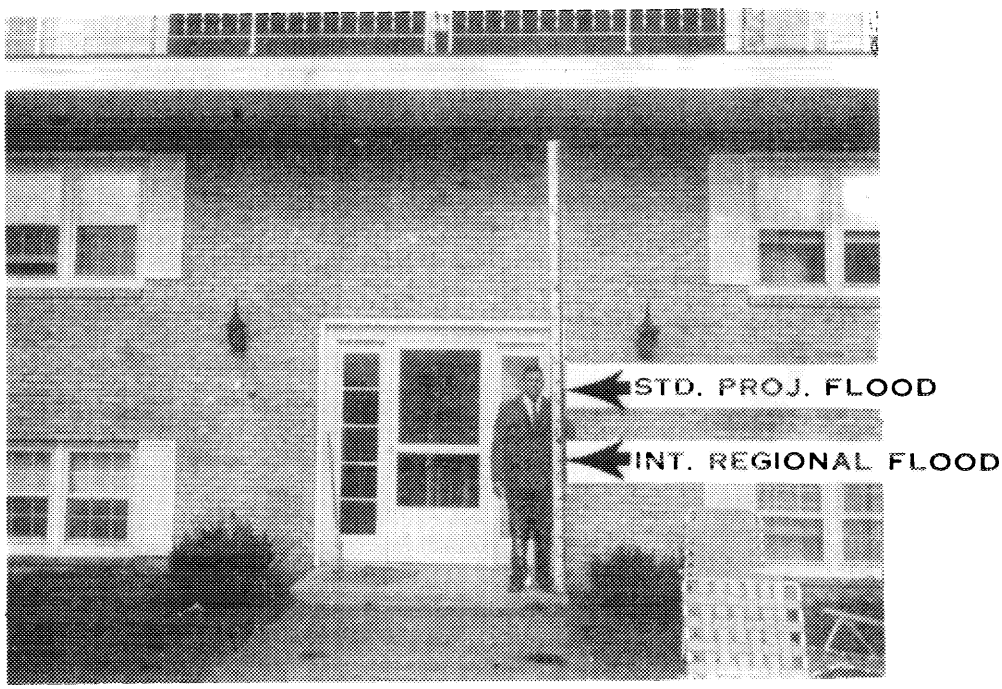


FLOOD HEIGHTS AT PLAZA BOWL

FLOOD HEIGHTS AT SHOPPING PLAZA

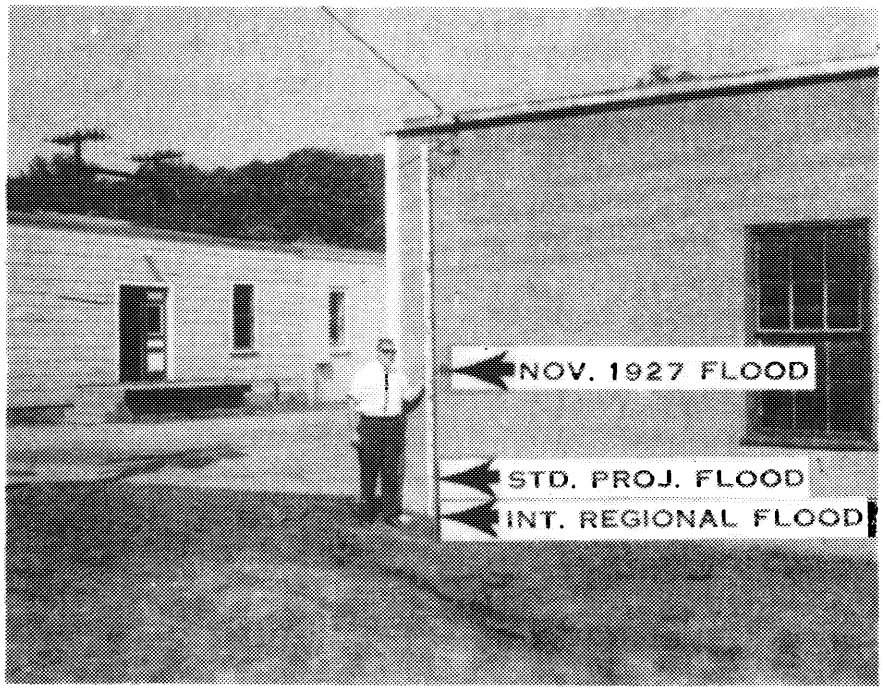


FLOOD HEIGHTS AT IGA STORE



FLOOD HEIGHTS AT GARDEN APARTMENTS

FIGURE 7



FLOOD HEIGHTS AT C.V.P.S. GARAGE

The above photograph shows the height of water reached in the 1927 flood as well as the Intermediate Regional Flood and Standard Project Flood computed heights. The heights reached by the March 1936 and September 1938 floods were approximately the same as that shown for the Standard Project Flood.

FIGURE 8

GLOSSARY OF TERMS

Flood

An overflow of water onto lands not normally covered by water and that are used or usable by man. Floods have two essential characteristics: the inundation of land is temporary; and the land is adjacent to and inundated by overflow from a river or stream or an ocean, lake, or other body of standing water.

Normally a "flood" is considered as any temporary rise in stream flow or stage, but not the ponding of surface water that results in significant adverse effects in the vicinity. Adverse effects may include damages from overflow of land areas, temporary backwater effects in sewers and local drainage channels, creation of unsanitary conditions or other unfavorable situations by deposition of materials in stream channels during flood recessions, rise of ground water coincident with increased stream flow, and other problems.

Flood Crest

The maximum stage or elevation reached by the waters of a flood at a given location.

Flood Peak

The maximum instantaneous discharge of a flood at a given location. It usually occurs at or near the time of the flood crest.

Flood Plain

The relatively flat area or low lands adjoining the channel of a river stream or watercourse or ocean, lake, or other body of standing water, which has been or may be covered by flood water.

Flood Profile

A graph showing the relationship of water surface elevation to location, the latter generally expressed as distance above mouth for a stream of water flowing in an open channel. It is generally drawn to show surface elevation for the crest of a specific flood, but may be prepared for conditions at a given time or stage.

Flood Stage

The stage or elevation at which overflow of the natural banks of a stream or body of water begins in the reach or area in which the elevation is measured.

Head Loss

The effect of obstructions, such as narrow bridge openings or buildings that limit the area through which water must flow, raising the surface of the water upstream from the obstruction.

Intermediate Regional Flood

A flood having an average frequency of occurrence in the order of once in 100 years although the flood may occur in any year. It is based on statistical analyses of stream flow records available for the watershed and analyses of rainfall and runoff characteristics in the "general region of the watershed".

Left Bank

The bank on the left side of a river, stream, or watercourse, looking downstream.

Low Steel (or Underclearance)

See "underclearance".

Right Bank

The bank on the right side of a river, stream, or watercourse,

looking downstream.

Standard Project Flood

The flood that may be expected from the more severe combination of meteorological and hydrological conditions that are considered reasonably characteristic of the geographical area in which the drainage basin is located, excluding extremely rare combinations. Peak discharges for these floods are generally about 40% to 60% of the Probable Maximum Floods for the same basins. Such floods, as used by the Corps of Engineers, are intended as practicable expressions of the degree of protection that should be sought in the design of flood control works, the failure of which might be disastrous.

Underclearance

The lowest point of a bridge or other structure over or across a river, stream, or watercourse that limits the opening through which water flows. This is referred to as "low steel" in some regions.

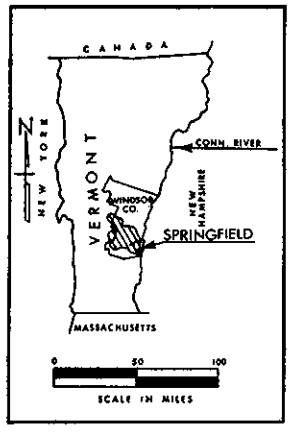
AUTHORITY, ACKNOWLEDGEMENTS, AND INTERPRETATION OF DATA

This report has been prepared in accordance with the authority granted by Section 206 of the Flood Control Act of 1960 (P.L.86-645), as amended.

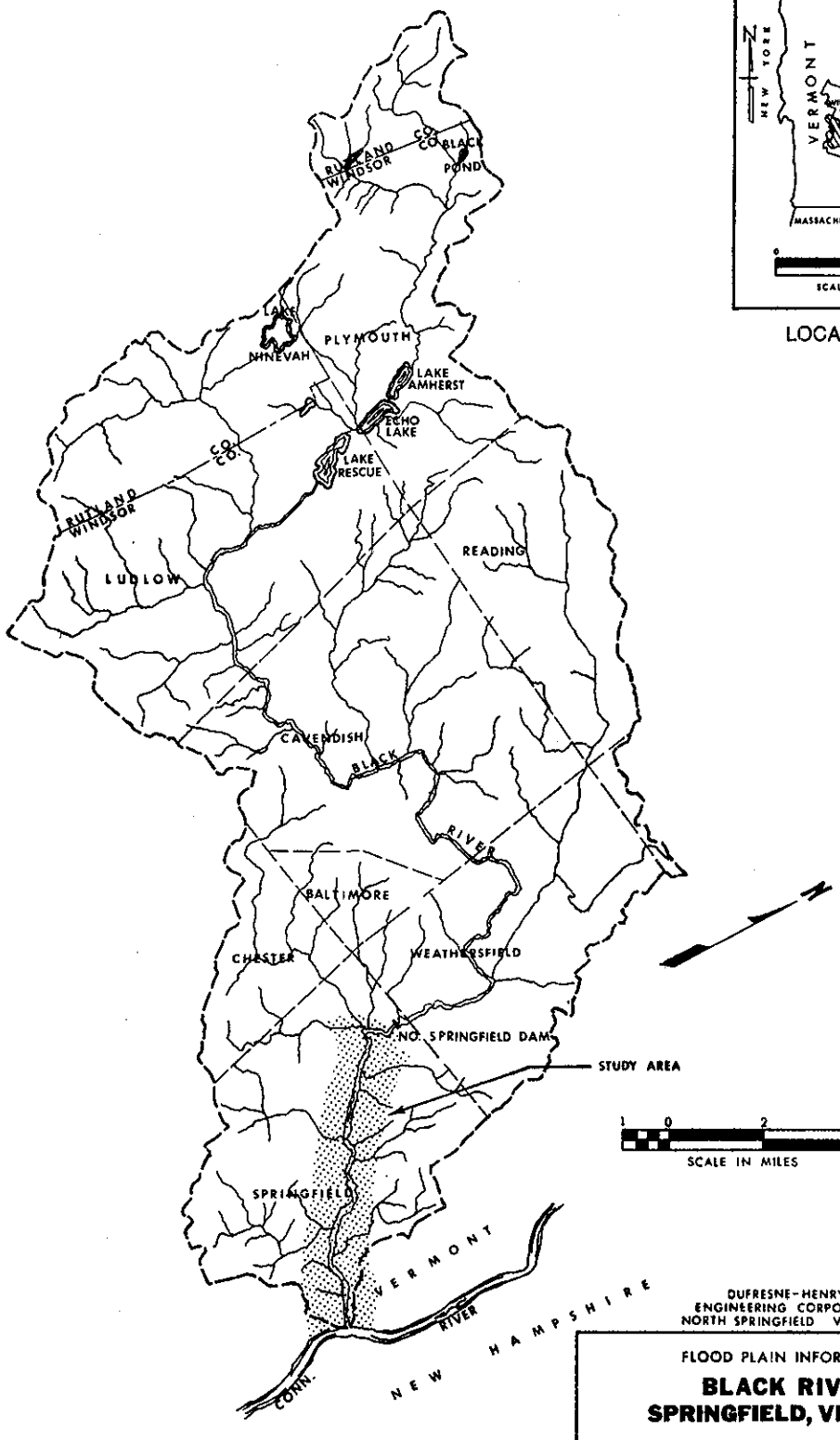
Assistance and cooperation of the U.S. Weather Bureau, U.S. Geological Survey, local libraries and private citizens in supplying useful data are sincerely appreciated.

This report presents the local flood situation in Springfield on the Black River. It was prepared by Dufresne-Henry Engineering Corp., North Springfield, Vermont, under the direction of the New England Division, Corps of Engineers, located in Waltham, Massachusetts. Representatives from the Corps of Engineers will, upon request of State and local governmental agencies, provide technical assistance in the interpretation and use of the information contained herein and will provide other available flood data related thereto.

CORPS OF ENGINEERS U.S. ARMY



LOCATION MAP



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FLOOD PLAIN INFORMATION

BLACK RIVER
SPRINGFIELD, VERMONT

BASIN MAP

MARCH 1969

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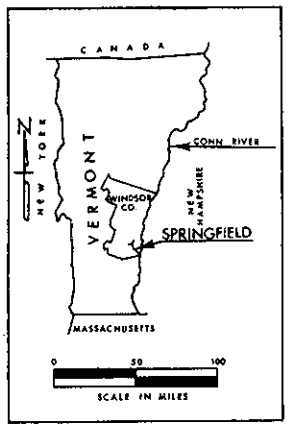
PLATE NO. 1

CORPS OF ENGINEERS U.S. ARMY



LOCATION MAP

NORTH SPRINGFIELD FLOOD CONTROL RESERVOIR

RESERVOIR RD.

FAIRGROUNDS RD.

CHALEY RD.

NUT HILL RD.

PLATE 12

PLATE 11

PLATE 10

PLATE 8

PUDDING HILL RD.

CRAIGUE HILL RD.

HIGHLAND RD.

PLATE 7

SPRINGFIELD

WOODBURY RD.

PLATE 6

SCRABBLE RD.

SEAVERS BRK. RD.

DEAN RD.

PLATE 5

PARK RD.

BISHOP RD.

VT. RT 143

VT. RT 11

GOULDS MILLS

SPENCER HOLLOW RD.

PLATE 3

I-91

OLD CANAL

POINT

CONNECTICUT RIVER

WHITES COVE

N

2000 0 2000 4000 6000
SCALE IN FEET

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NORTH SPRINGFIELD, VERMONT

FLOOD PLAIN INFORMATION

BLACK RIVER
SPRINGFIELD, VERMONT

INDEX MAP

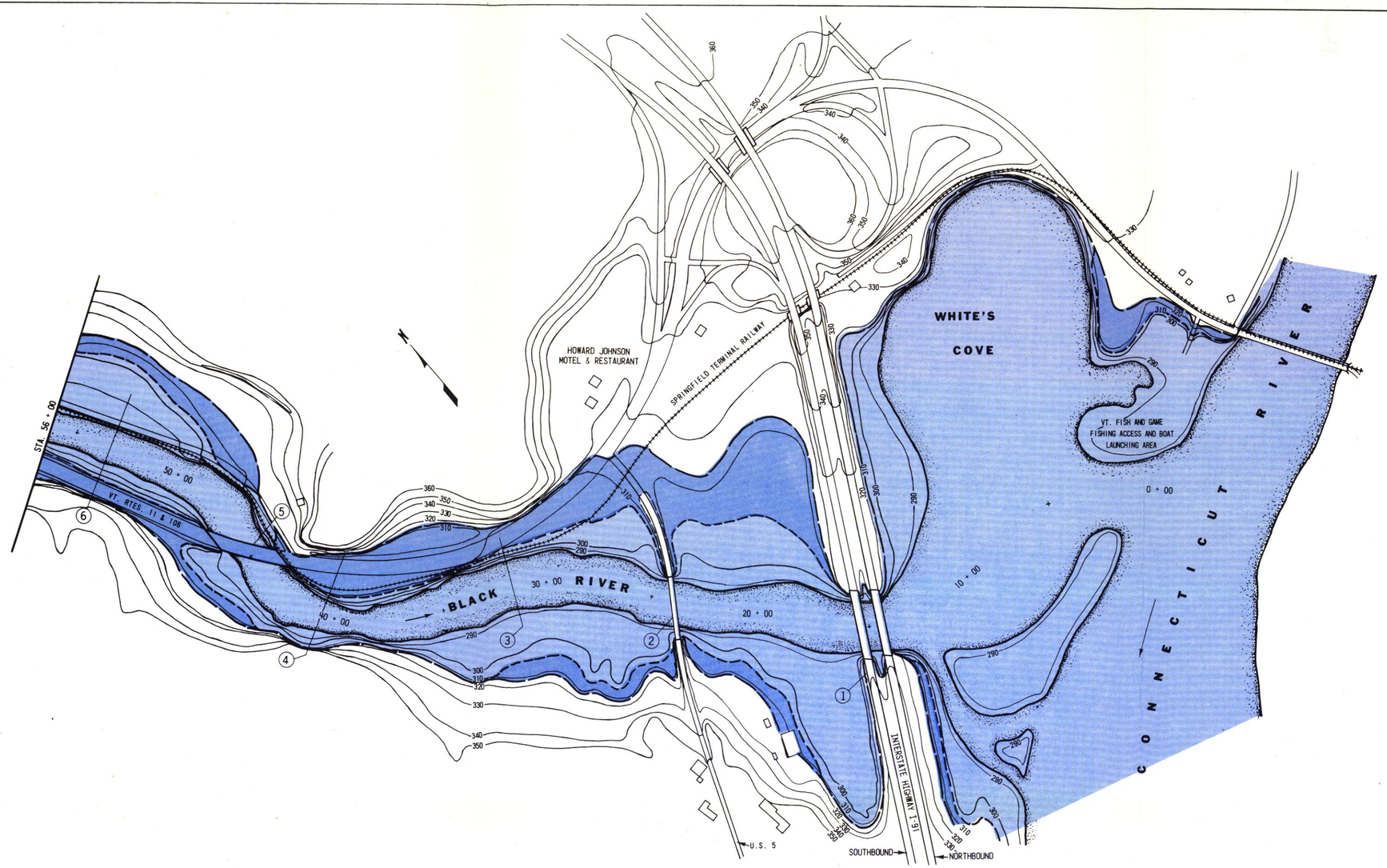
MARCH 1969

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

PLATE NO. 2

CORPS OF ENGINEERS

U.S. ARMY



LEGEND

NORMAL FLOW | INTERMEDIATE REGIONAL FLOOD | STANDARD PROJECT FLOOD

(2) RIVER CROSS-SECTION

SCALE IN FEET

200 0 200 400

NOTES:

LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON THE GROUND AS EXPLAINED IN THE REPORT.

ELEVATIONS REFER TO MEAN SEA LEVEL DATUM.

CONTOUR INTERVAL EQUALS 10 FEET.

TOPOGRAPHY IS BASED ON PHOTOGRAMMETRY, HIGHWAY PLANS AND FIELD SURVEYS.

FOR PROFILE, SEE PLATE 4.

DUFRESNE-HENRY ENGINEERING CORPORATION NORTH SPRINGFIELD, VERMONT

FLOOD PLAIN INFORMATION

BLACK RIVER

SPRINGFIELD, VERMONT

PLAN

MARCH, 1969 STA. 0+00 - 56+00

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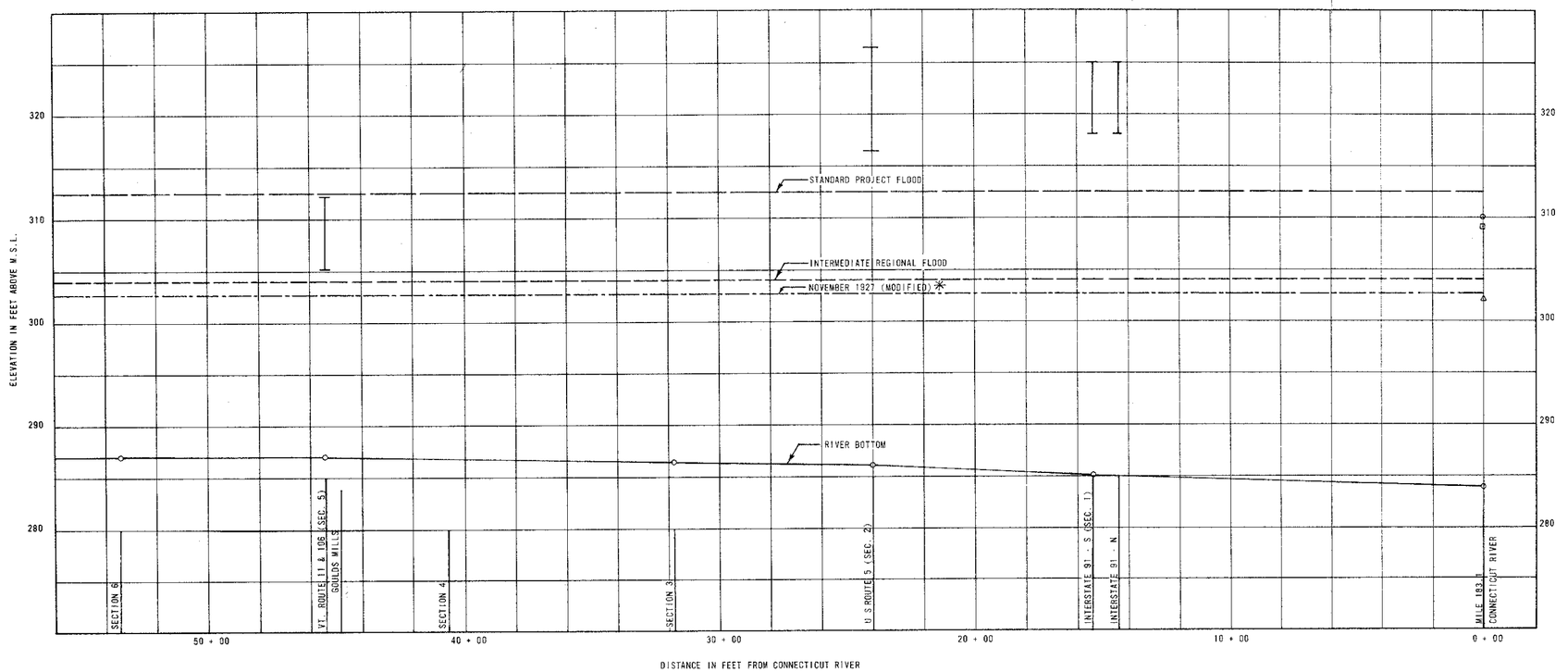
PLATE NO. 3

CORPS OF ENGINEERS

U.S. ARMY



LEGEND

I BRIDGE
HIGH WATER EXPERIENCED
o NOV. 1927
□ MAR. 1936
△ SEPT. 1938

* MODIFIED BY NORTH SPRINGFIELD FLOOD CONTROL RESERVOIR

NOTES:

FOR PLAN, SEE PLATE 3.

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FLOOD PLAIN INFORMATION

BLACK RIVER

SPRINGFIELD, VERMONT

PROFILE

MARCH, 1969 STA. 0+00 - 56+00

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NEW ENGLAND DIVISION, CORPS OF ENGINEERS
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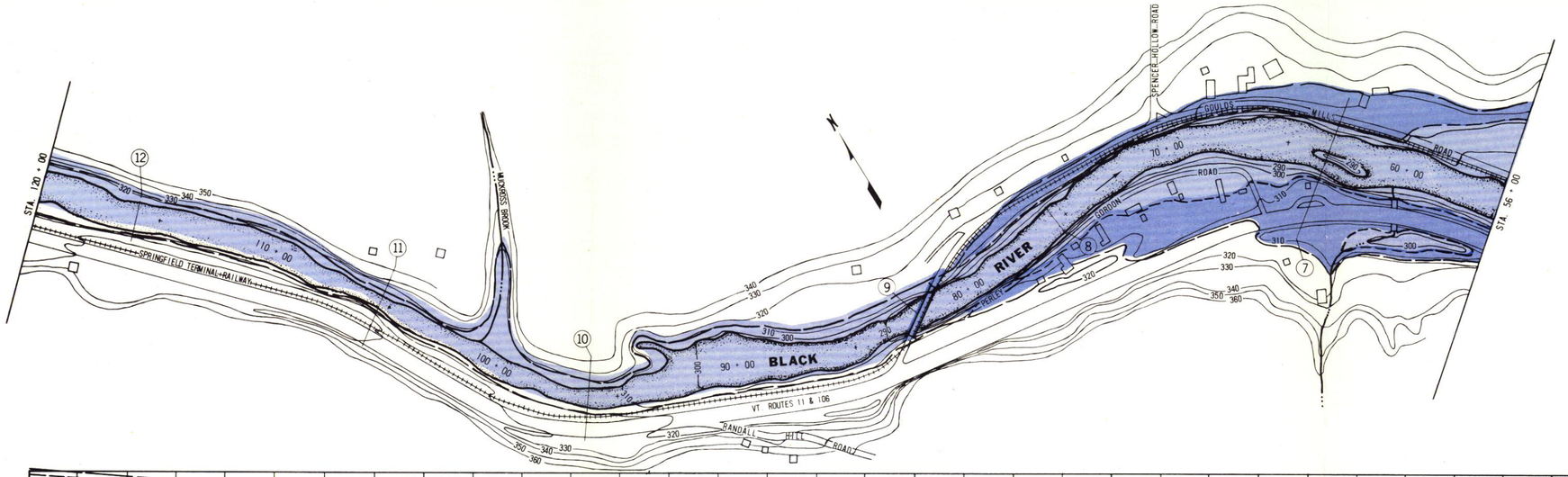
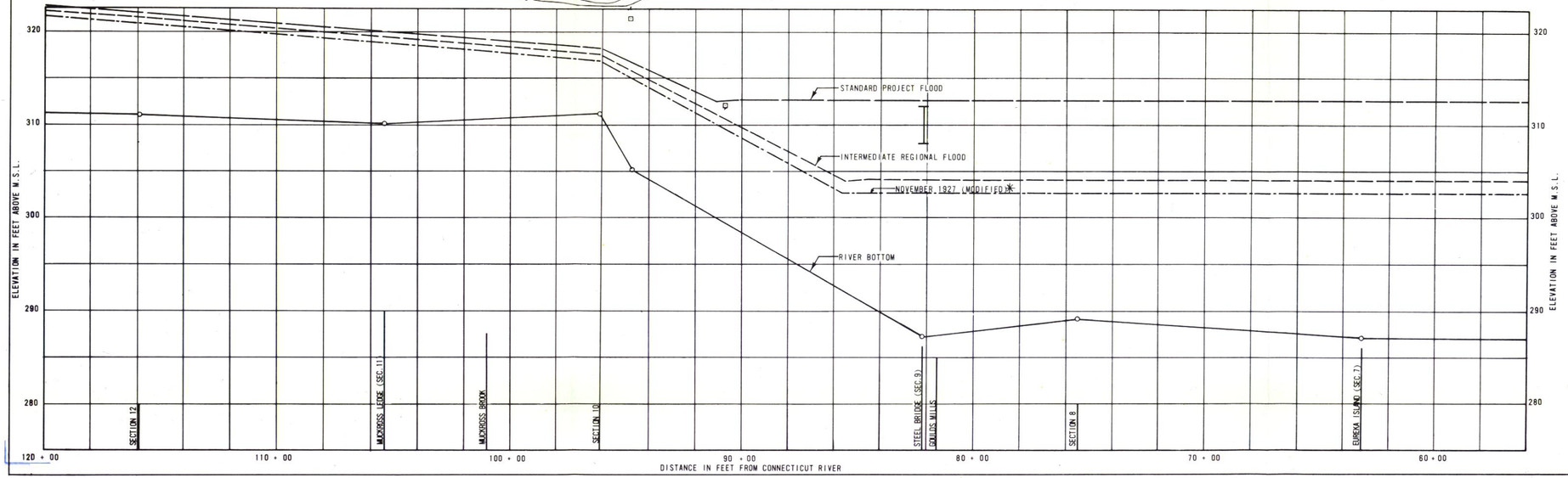
PLATE NO. 4

CORPS OF ENGINEERS

U.S. ARMY





LEGEND

NORMAL FLOW — INTERMEDIATE REGIONAL FLOOD — STANDARD PROJECT FLOOD

(2) RIVER CROSS-SECTION

BRIDGE

HIGH WATER EXPERIENCED
- ○ NOV. 1927
- □ MAR. 1936
- △ SEPT. 1938

SCALE IN FEET

200 0 200 400

NOTES:

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ELEVATIONS REFER TO MEAN SEA LEVEL DATUM.

CONTOUR INTERVAL EQUALS 10 FEET.

TOPOGRAPHY IS BASED ON PHOTOGRAMMETRY, HIGHWAY PLANS AND FIELD SURVEYS.

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FLOOD PLAIN INFORMATION

BLACK RIVER

SPRINGFIELD, VERMONT

PLAN AND PROFILE

MARCH, 1969 STA. 56+00 - 120+00

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NEW ENGLAND DIVISION, CORPS OF ENGINEERS
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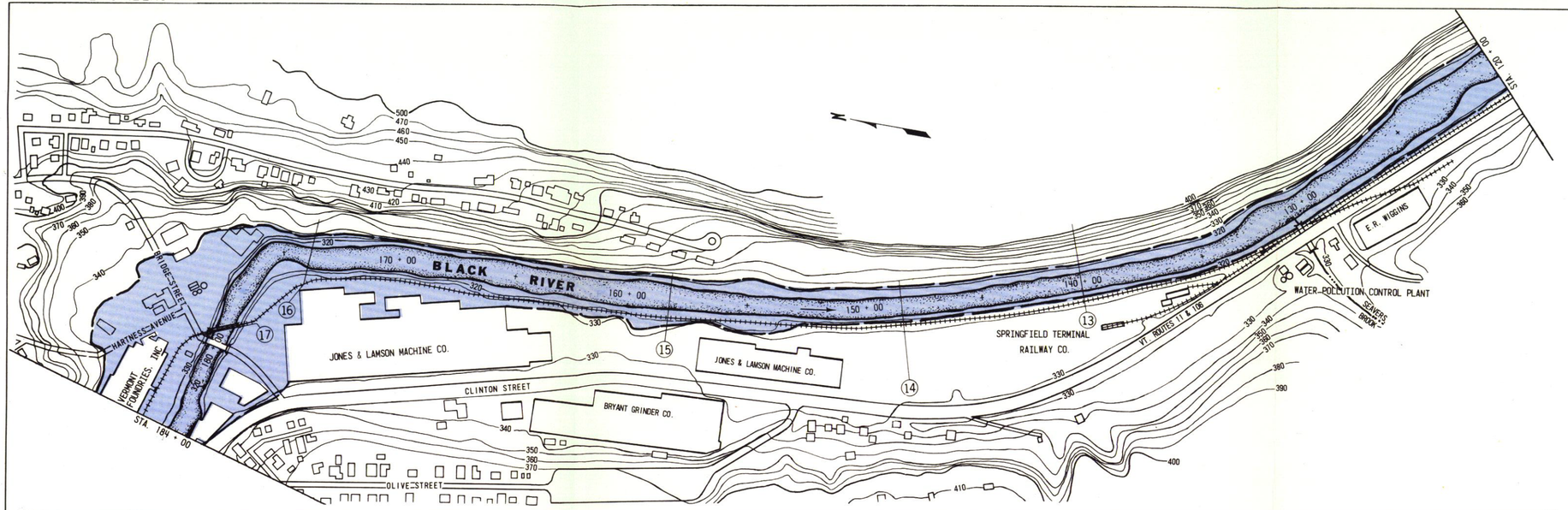
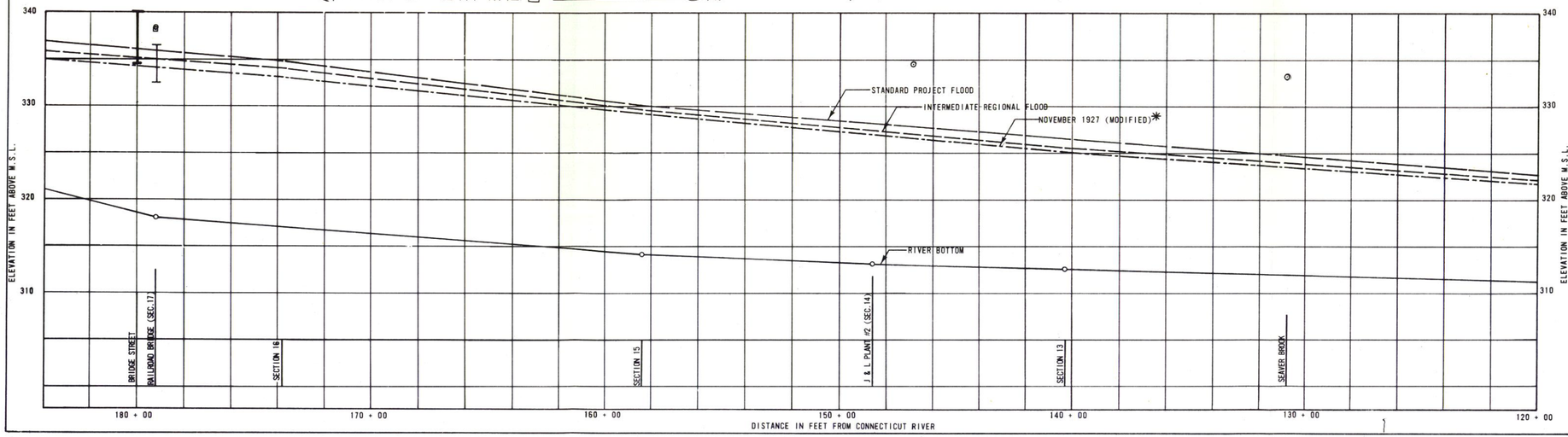
PLATE NO. 5

CORPS OF ENGINEERS

U.S. ARMY





LEGEND

NORMAL FLOW

INTERMEDIATE REGIONAL FLOOD (STANDARD PROJECT FLOOD WILL COVER APPROX. THE SAME AREA)

(2) RIVER CROSS-SECTION

BRIDGE

HIGH WATER EXPERIENCED

- ○ NOV. 1927
- □ MAR. 1936
- △ SEPT. 1938

SCALE IN FEET

200 0 200 400

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* MODIFIED BY NORTH SPRINGFIELD FLOOD CONTROL RESERVOIR

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FLOOD PLAIN INFORMATION

BLACK RIVER

SPRINGFIELD, VERMONT

PLAN AND PROFILE

MARCH, 1969 STA. 120+00 - 184+00

DEPARTMENT OF THE ARMY
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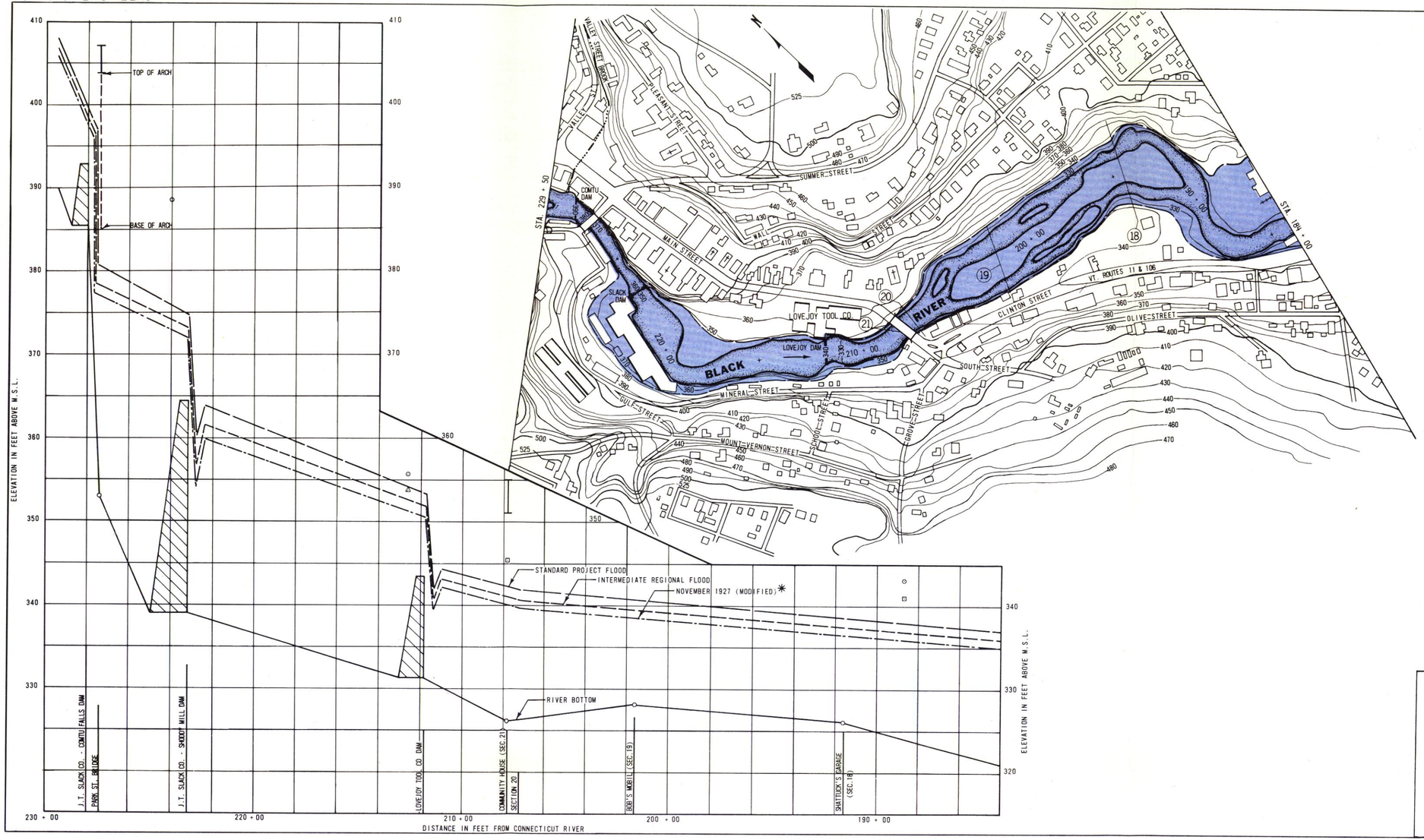
PLATE NO. 6

CORPS OF ENGINEERS

U.S. ARMY



LEGEND

NORMAL FLOW

INTERMEDIATE REGIONAL FLOOD (STANDARD PROJECT FLOOD WILL COVER APPROX. THE SAME AREA)

(2) RIVER CROSS-SECTION

BRIDGE

DAM

HIGH WATER EXPERIENCED

- NOV. 1927
- MAR. 1936
- SEPT. 1938

SCALE IN FEET

200 0 200 400

NOTES:

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ELEVATIONS REFER TO MEAN SEA LEVEL DATUM.

CONTOUR INTERVAL EQUALS 10 FEET.

TOPOGRAPHY IS BASED ON PHOTOGRAMMETRY, HIGHWAY PLANS AND FIELD SURVEYS.

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FLOOD PLAIN INFORMATION

BLACK RIVER

SPRINGFIELD, VERMONT

PLAN AND PROFILE

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NEW ENGLAND DIVISION, CORPS OF ENGINEERS
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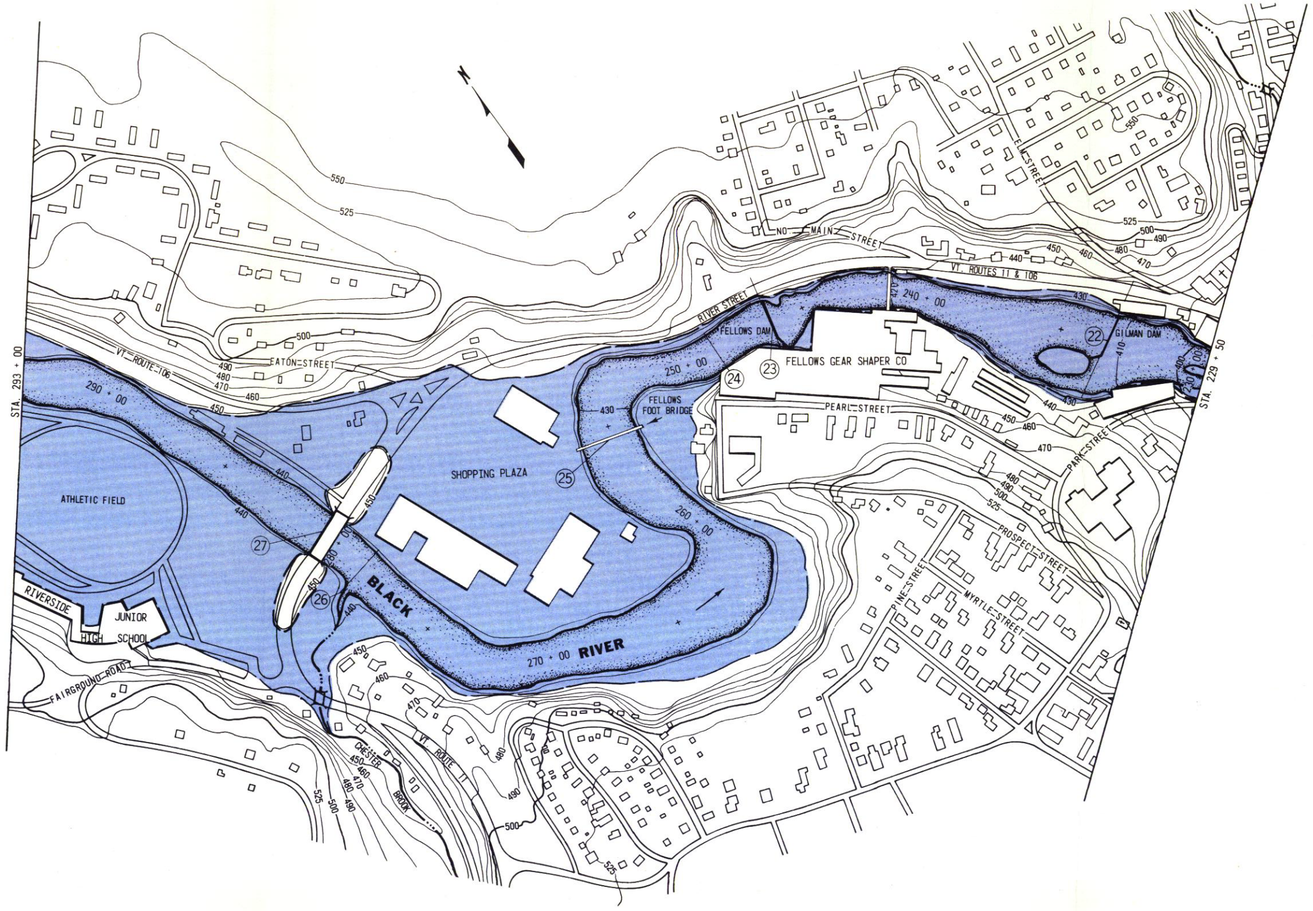
PLATE NO. 7

CORPS OF ENGINEERS

U.S. ARMY



LEGEND

NORMAL FLOW

INTERMEDIATE REGIONAL FLOOD (STANDARD PROJECT FLOOD WILL COVER APPROX. THE SAME AREA)

(2) RIVER CROSS-SECTION

SCALE IN FEET

200 0 200 400

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CONTOUR INTERVAL EQUALS 10 FEET.

TOPOGRAPHY IS BASED ON PHOTOGRAMMETRY, HIGHWAY PLANS AND FIELD SURVEYS.

FOR PROFILE, SEE PLATE 9.

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FLOOD PLAIN INFORMATION

BLACK RIVER

SPRINGFIELD, VERMONT

PLAN

MARCH, 1969 STA. 229+50-293+00

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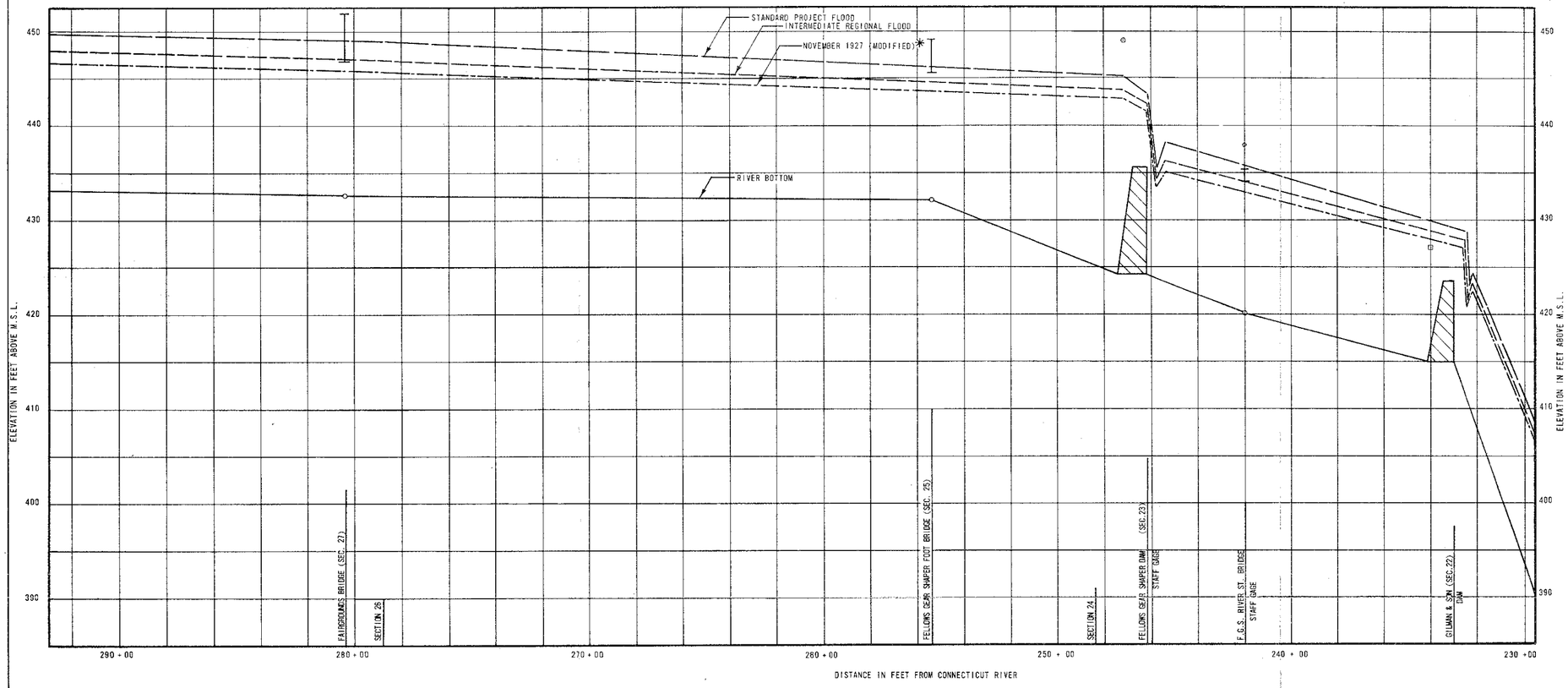
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

PLATE NO. 8

CORPS OF ENGINEERS

U.S. ARMY



LEGEND

I BRIDGE

DAM

HIGH WATER EXPERIENCED

- o NOV. 1927
- □ MAR. 1936
- △ SEPT. 1938

*MODIFIED BY NORTH SPRINGFIELD FLOOD CONTROL RESERVOIR

NOTES:

FOR PLAN, SEE PLATE 8

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FLOOD PLAIN INFORMATION

BLACK RIVER

SPRINGFIELD, VERMONT

PROFILE

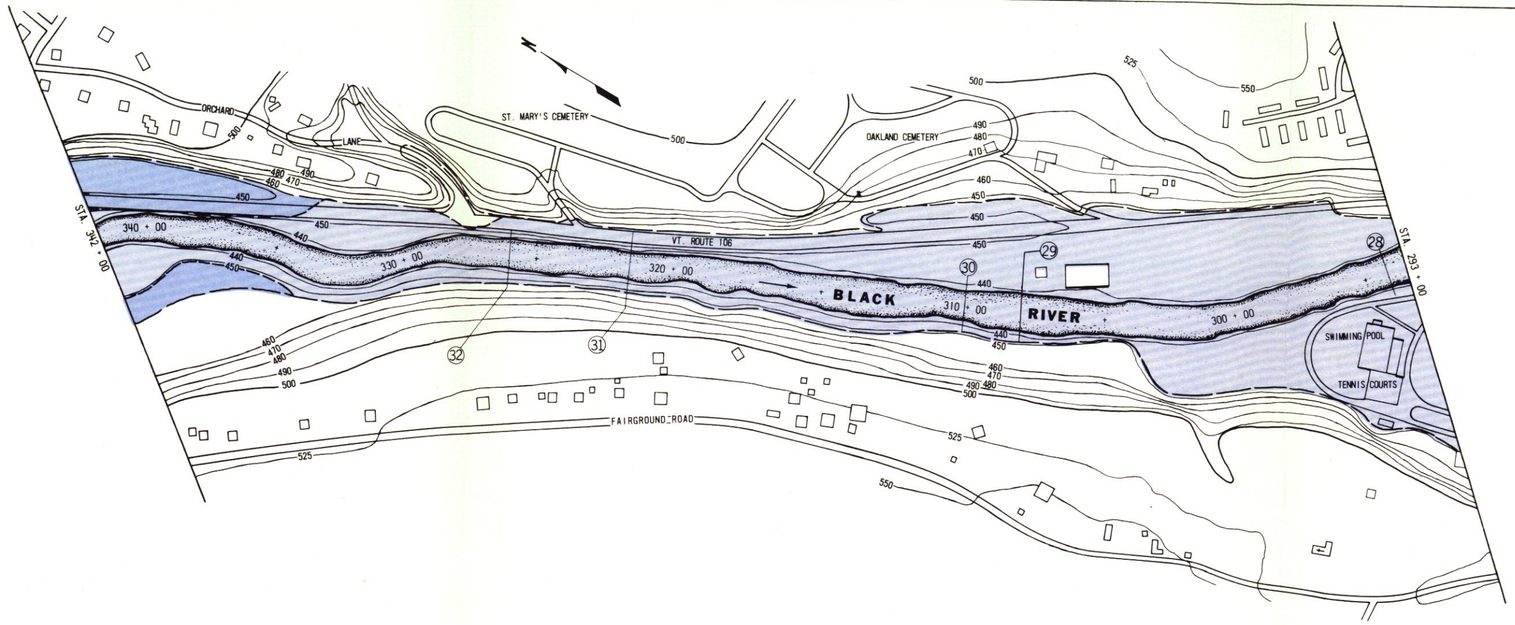
MARCH, 1969 STA. 229+50-293+00

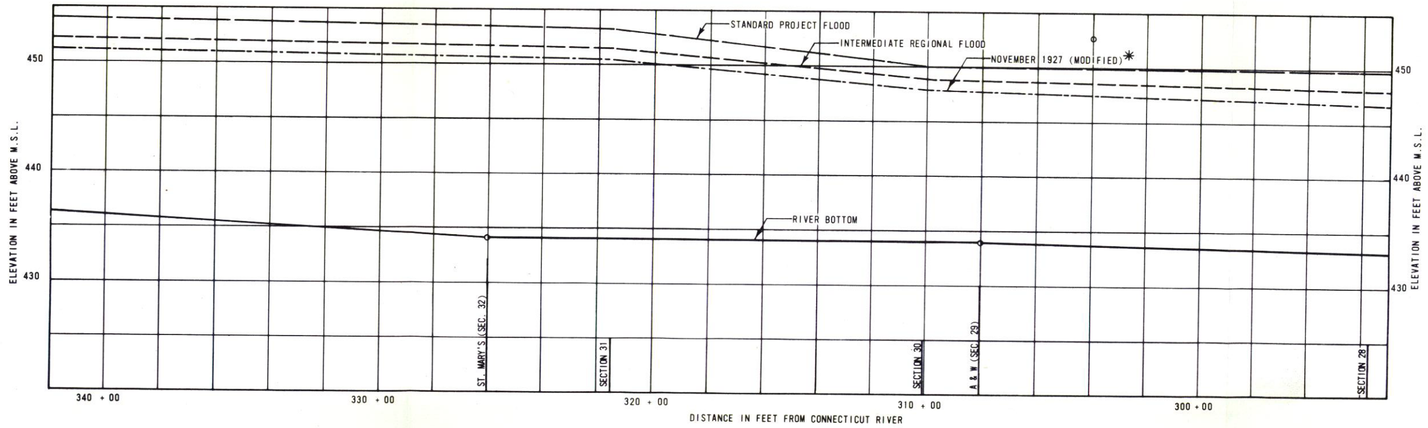
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

PLATE NO. 9

CORPS OF ENGINEERS

U.S. ARMY





LEGEND

NORMAL FLOW > INTERMEDIATE REGIONAL FLOOD > STANDARD PROJECT FLOOD

(2) RIVER CROSS-SECTION

HIGH WATER EXPERIENCED
- ○ NOV. 1927
- □ MAR. 1936
- △ SEPT. 1938

SCALE IN FEET

200 0 200 400

NOTES:

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ELEVATIONS REFER TO MEAN SEA LEVEL DATUM.

CONTOUR INTERVAL EQUALS 10 FEET.

TOPOGRAPHY IS BASED ON PHOTOGRAMMETRY, HIGHWAY PLANS AND FIELD SURVEYS.

* MODIFIED BY NORTH SPRINGFIELD FLOOD CONTROL RESERVOIR

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FLOOD PLAIN INFORMATION

BLACK RIVER

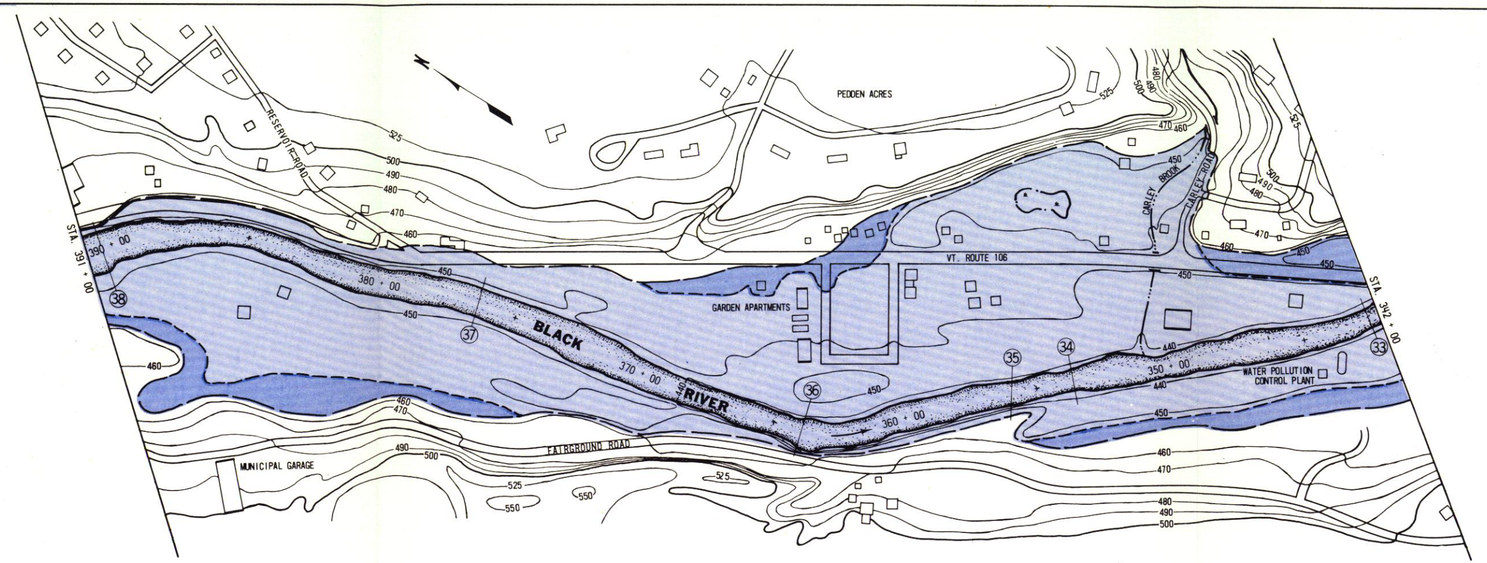
SPRINGFIELD, VERMONT

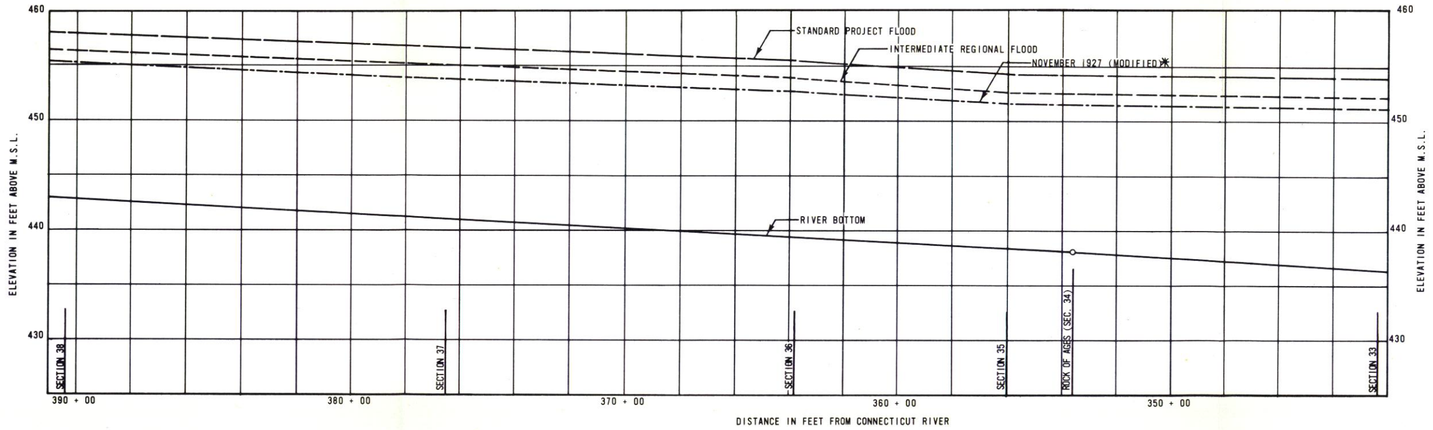
PLAN AND PROFILE

MARCH, 1969 STA. 293+00-342+00

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

PLATE NO.10





LEGEND

NORMAL FLOW → INTERMEDIATE REGIONAL FLOOD → STANDARD PROJECT FLOOD

② RIVER CROSS-SECTION

HIGH WATER EXPERIENCED
- ○ NOV. 1927
- □ MAR. 1936
- △ SEPT. 1938

SCALE IN FEET

200 0 200 400

NOTES:

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ELEVATIONS REFER TO MEAN SEA LEVEL DATUM.

CONTOUR INTERVAL EQUALS 10 FEET.

TOPOGRAPHY IS BASED ON PHOTOGRAMMETRY, HIGHWAY PLANS AND FIELD SURVEYS.

* MODIFIED BY NORTH SPRINGFIELD FLOOD CONTROL RESERVOIR

DUFRESNE-HENRY
ENGINEERING CORPORATION
NORTH SPRINGFIELD, VERMONT

FLOOD PLAIN INFORMATION

BLACK RIVER

SPRINGFIELD, VERMONT

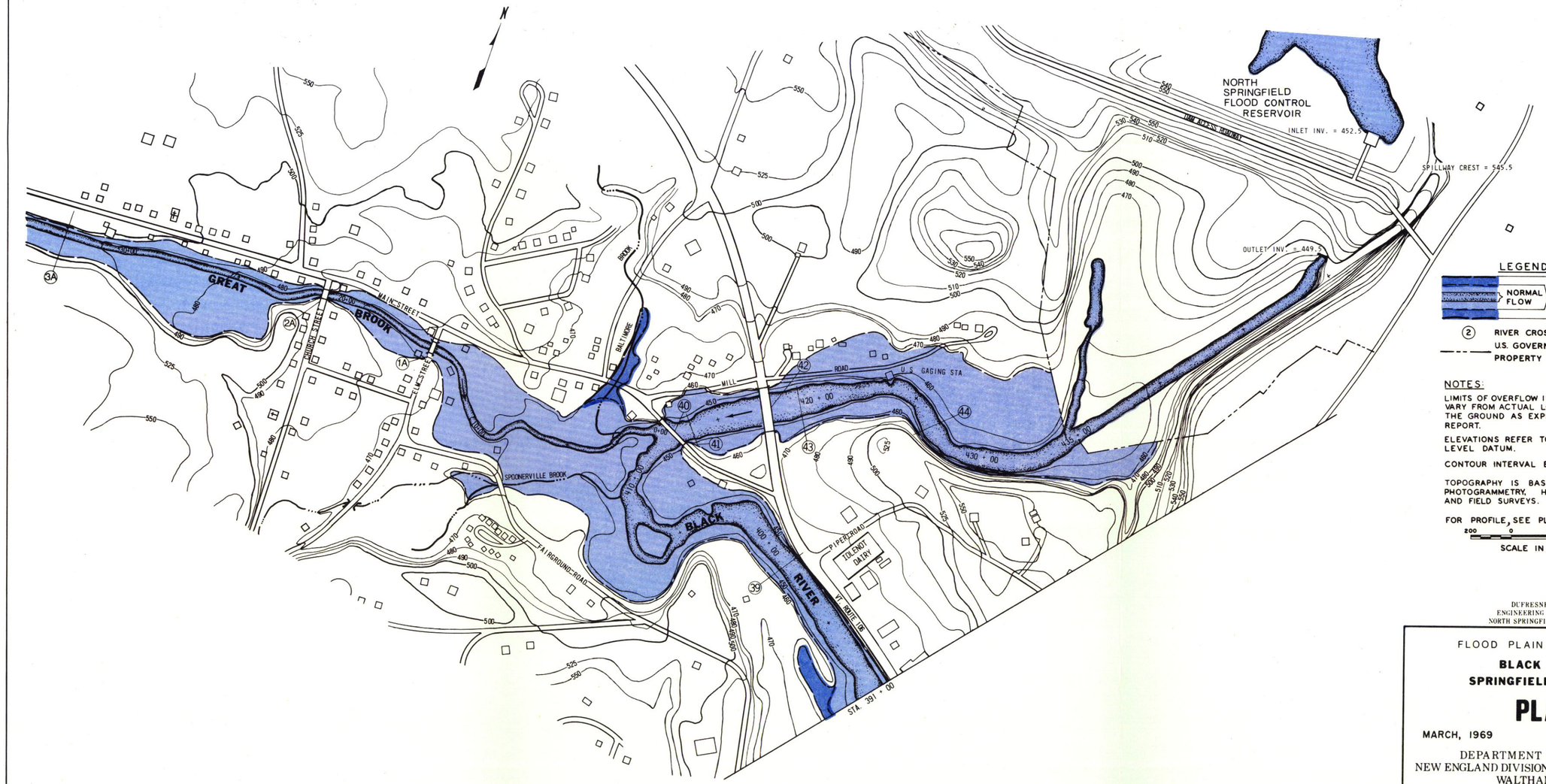
PLAN AND PROFILE

MARCH, 1969 STA. 342+00 - 391+00

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

CORPS OF ENGINEERS

U.S. ARMY



DUFRESNE-HENRY ENGINEERING CORPORATION
NORTH SPRINGFIELD, VERMONT

FLOOD PLAIN INFORMATION

BLACK RIVER
SPRINGFIELD, VERMONT

PLAN

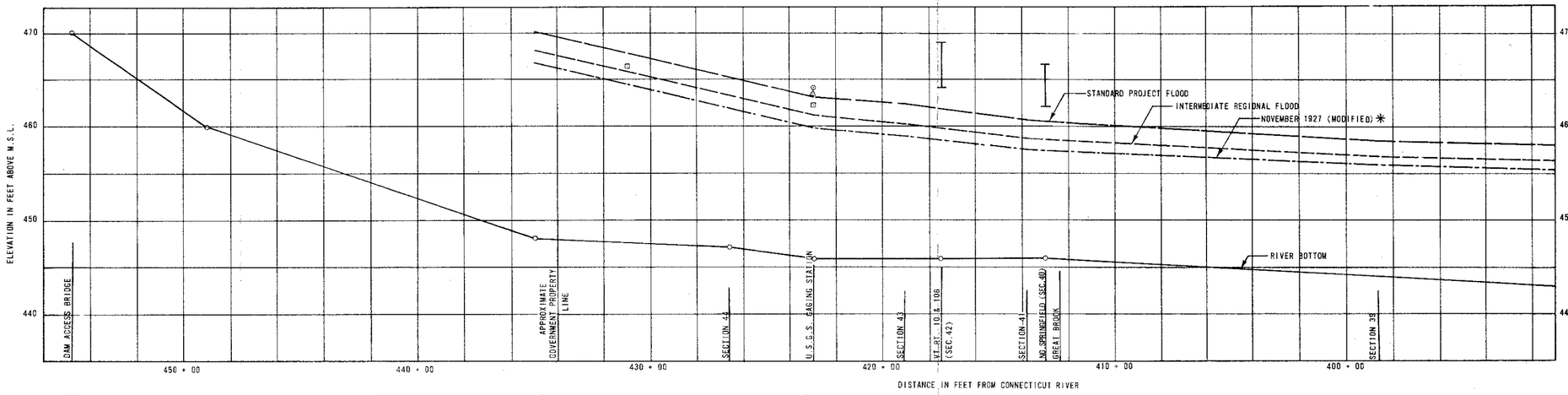
MARCH, 1969 STA. 391+00-435+00

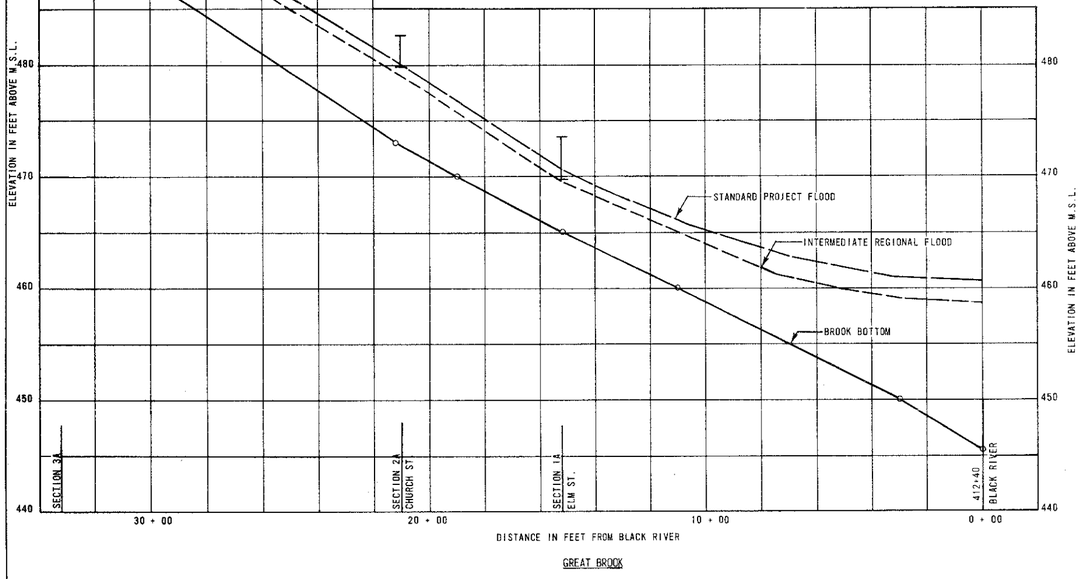
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

PLATE NO.12

CORPS OF ENGINEERS

U.S. ARMY





GREAT BROOK

LEGEND

I BRIDGE HIGH WATER EXPERIENCED
- o NOV. 1927
- □ MAR. 1936
- △ SEPT. 1938

* MODIFIED BY NORTH SPRINGFIELD FLOOD CONTROL RESERVOIR

NOTES:

FOR PLAN, SEE PLATE 12.

DUFRESNE-HENRY ENGINEERING CORPORATION
NORTH SPRINGFIELD, VERMONT

FLOOD PLAIN INFORMATION

BLACK RIVER

SPRINGFIELD, VERMONT

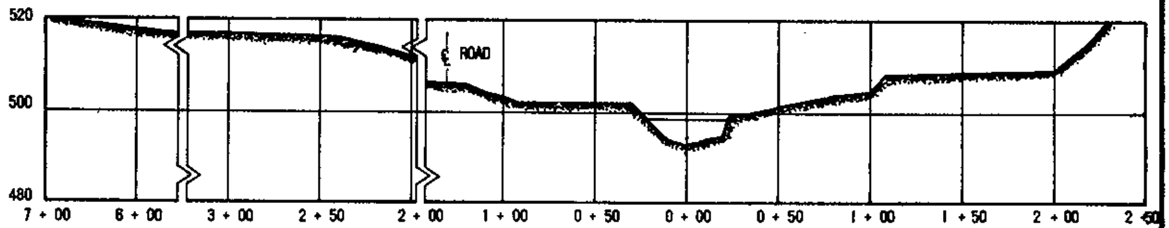
PROFILE

MARCH, 1969

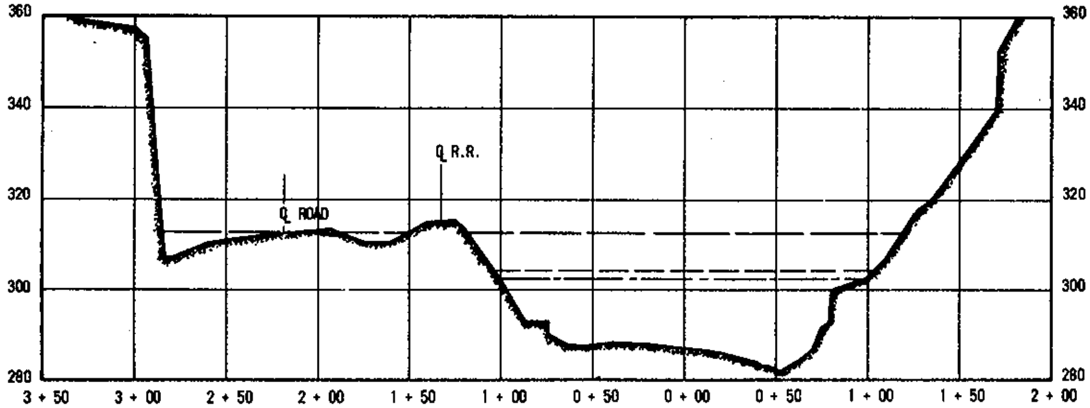
STA. 391+00 - 435+00
GREAT BROOK 0+00 - 33+20

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

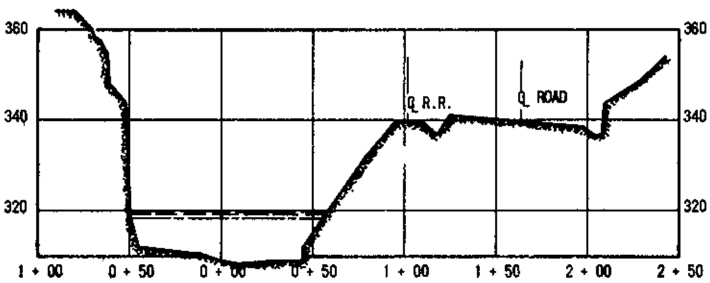
PLATE NO.13



CROSS SECTION NO. 3A STATION 33 + 20 **GREAT BROOK**



CROSS SECTION NO. 4 STATION 40 + 60



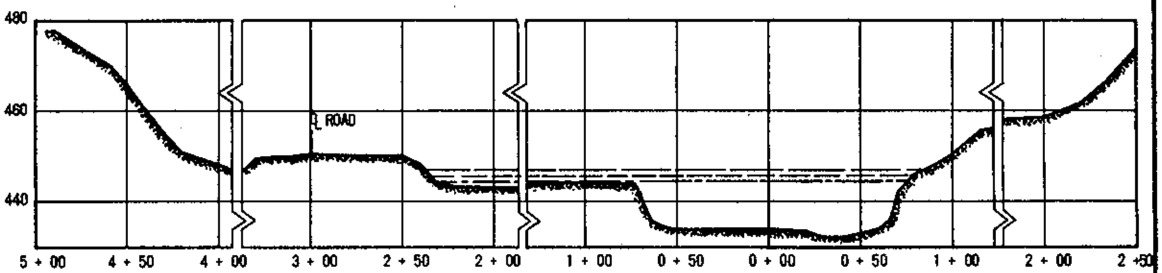
CROSS SECTION NO. 11 STATION 105 + 40

LEGEND

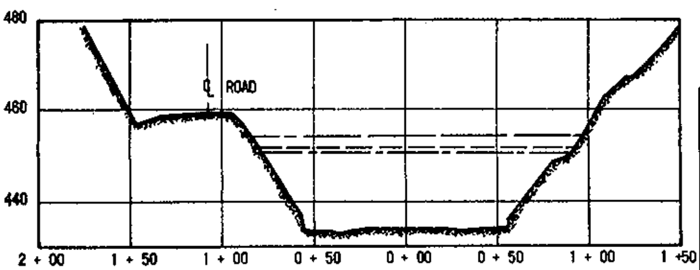
- STANDARD PROJECT FLOOD
- INTERMEDIATE REGIONAL FLOOD
- NOV. 1927 FLOOD AS MODIFIED BY NORTH SPRINGFIELD FLOOD RESERVOIR

NOTES

1. SECTIONS TAKEN LOOKING DOWNSTREAM.
2. HORIZONTAL DISTANCES IN FEET.
3. ELEVATIONS IN FEET (MEAN SEA LEVEL DATUM)



CROSS SECTION NO. 29 STATION 308 + 00



CROSS SECTION NO. 32 STATION 326 + 00

DUFRESNE–HENRY
ENGINEERING CORPORATION
NORTH SPRINGFIELD VERMONT

FLOOD PLAIN INFORMATION

BLACK RIVER
SPRINGFIELD, VERMONT

TYPICAL CROSS SECTIONS

MARCH 1969

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