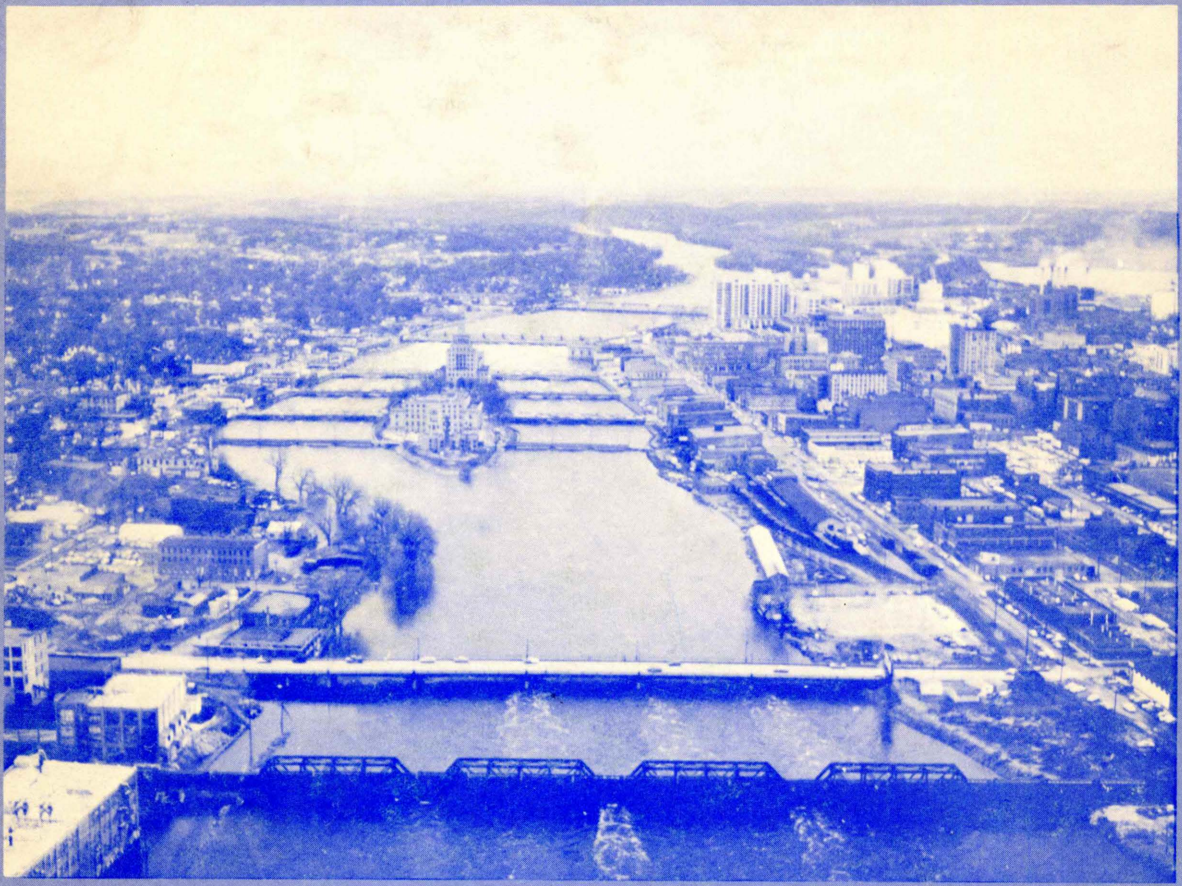
FLOOD PLAIN INFORMATION

CEDAR RIVER

LINN COUNTY

IOWA



PREPARED FOR STATE OF IOWA
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BY
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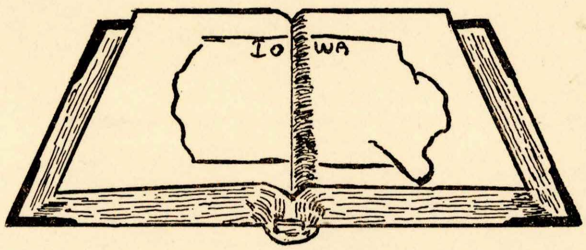
ROCK ISLAND DISTRICT

OCTOBER 1967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INTRODUCTION

This report evaluates the flood hazards along the Cedar River within Linn County, Iowa, including the city of Cedar Rapids, Iowa. The report was prepared at the request of the State of Iowa, through the Iowa Natural Resources Council to aid in the solution of local flood problems and in the best utilization of land subject to overflow. The report is based upon information on rainfall, runoff, historical and current flood heights, and other technical data defining the occurrence and size of floods in the Cedar Rapids area.

The report covers two significant phases of the Cedar Rapids and Linn County flood problem. It first brings together a record of the largest known floods of the past on the Cedar River. Secondly, it treats of probable future floods: namely, Intermediate Regional Floods and Standard Project Floods. Intermediate Regional Floods are floods that have an average frequency of occurrence in the order of once in 100 years. The Intermediate Regional Flood flow was determined from an analysis of known floods on the Cedar River and other streams which have similar physical characteristics and are in the same general geographical region. Standard Project Floods are floods of rare occurrence and, on most streams, are considerably larger than any floods that have occurred in the past. However, Standard Project Floods should be considered in planning for use of the flood plains.

In problems concerned with the controlled development of the Cedar River flood plain and with decisions on the size of floods to consider for this purpose, appropriate evaluation should be made of the possible recurrence of historic floods, and the occurrence of the Intermediate Regional Flood and the Standard Project Flood.

The report contains maps, profiles, and cross sections which indicate the extent of experienced flooding and probable future flooding on the Cedar River in Linn County and the vicinity of Cedar Rapids under existing conditions. The data will be helpful in planning the best use of the flood plain. From the maps, profiles, and cross sections, the depth of flooding either by recurrence of the largest known floods or by occurrence of the Intermediate Regional or Standard Project Floods at any location may be determined. Based on this information, floor levels for buildings may be planned to avoid flood damage. Flood proofing, as an alternate solution, may be applied to special cases or to existing structures presently located in the flood plain with recognition of inconveniences and hazards of flooding.

While the report evaluates the flood hazards along the Cedar River, it does not include plans for the solution of flood problems. Rather, it provides the basis for further study and planning by Linn County and the City of Cedar Rapids to minimize vulnerability to flood damages. Local planning programs may guide developments by controlling flood plain use through zoning and subdivision regulations, the construction of flood protection works, or a combination of the two approaches.

Upon request, the Rock Island District of the Corps of Engineers will provide technical assistance to Federal, State, and local agencies in the interpretation and use of the information contained herein.

SUMMARY OF FLOOD SITUATION

The Cedar River flows southeasterly through Linn County, Iowa, and the City of Cedar Rapids. Prairie Creek joins the Cedar River in the southeast part of the city. Indian Creek flows into the Cedar River about 2 miles downstream from the city. Flood Plain Information reports are available for both Prairie and Indian Creeks. This report covers the Cedar River from the south Linn County boundary to the west Linn County boundary, a distance of approximately 48 miles. Included in this study reach are portions of Franklin, Putnam, Bertrum, Rapids, College, Clinton, Fayette, Monroe, and Washington civil townships and the eight mile reach through the minicipality of Cedar Rapids.

The principal residential developments of Cedar Rapids are on high ground east and west of the river. Major industrial and commercial developments and as well as some residential developments occupy the flood plains throughout the Cedar Rapids area. Portions of this land have been inundated by floods of the past, and substantially greater areas are within reach of the potentially greater floods of the future.

The U. S. Geological Survey has maintained a stream gaging station on the Cedar River at Cedar Rapids since October 1902. Residents along the river have been interviewed and newspaper files and historical documents searched for information concerning past floods. From these investigations and from studies of possible future floods on the Cedar River, the local flood situation, both past and future, has been developed. The following paragraphs summarize the significant findings. All water surface elevations and depths refer to those at the U.S. Geological Survey gage at Cedar Rapids unless otherwise stated.

THE GREATEST FLOOD FLOW known on the Cedar River at Cedar Rapids during the past 100 years or more occurred in March 1961. Newspapers and other reports pointed out the disastrous proportions of the flood at Cedar Rapids and in the Linn County area, and leave no doubt that is was greater than any known to the oldest residents of the community.

ANOTHER GREAT FLOOD, in April 1965, was the second highest known flood flow on the Cedar River. The flood stage was about 1 foot lower than the March 1961 flood at the U. S. Geological Survey gage.

OTHER LARGE FLOODS on the Cedar River at Cedar Rapids occurred in June 1851 and March 1929. The peak flows for these floods were less than the March 1961 and April 1965 floods; however, the stage was lower for the 1961 and 1965 floods because of recent channel excavation near the gage. Floods on tributaries, within the area, usually occur at the same time as floods on the river.

INTERMEDIATE REGIONAL FLOOD by definition is a flood that has an average frequency of occurrence in the order of once in 100 years. In the study, the Intermediate Regional Flood was determined from an analysis of floods on the Cedar River. The analysis shows that the Intermediate Regional flood for the Cedar River is about 8 feet, and 9 feet higher than the March 1961 and April 1965 floods, respectively.

STANDARD PROJECT FLOOD is a flood produced by the most severe combination of meteorological and hydrological conditions that are considered reasonably characteristic of the drainage basin under study. Hydrologic determinations indicate that a flood of this magnitude could occur on the Cedar River, in the vicinity of Cedar Rapids, about 12 feet higher than the March 1961 flood and about 13 feet higher than the April 1965 flood crest. The Standard Project

Flood on the Cedar River would be about 4 feet higher than the Intermediate Regional Flood on the river.

FLOOD DAMAGES that would result from recurrence of major known floods would be substantial. Extensive damage would be caused by the Intermediate Regional Flood and the Standard Project Flood because of their wider extent, greater depths, and higher velocities.

MAIN FLOOD SEASON for the Cedar River is in winter and spring. Most of the higher floods have resulted from heavy general rains during those times. However, floods due to intense local thunderstorms occur in the summer, and large floods may occur any time, particularly on smaller streams within the study area. Snow melt runoff combined with heavy general rainfall produced the March 1961 flood flow.

VELOCITIES OF WATER during major floods range up to 8 feet per second (about 5 to 6 miles per hour) in the Cedar River channel. Velocities on the flood plain vary widely, depending on location, but generally are less than 3 feet per second. During a Standard Project Flood, velocities would be extremely dangerous to life and property. In the channel, velocities would range up to 10 feet per second and about 4 feet per second in some flood plain area. Velocities of 2 feet per second combined with depths of 2 feet produce undesirable conditions. Furthermore, velocities greater than 3 feet per second combined with depths of 3 feet or greater are considered hazardous.

DURATION OF FLOODING is relatively long on the Cedar River in the vicinity of Cedar Rapids. Stages can rise from normal river flows to extreme flood peaks in 3 days following intense rainfall over the critical portion of the watershed. During the flood of March 1961, the Cedar River had a maximum rate of rise of about 0.5 feet per hour and remained out of banks for 5 days. During a Standard Project

Flood on the Cedar River, the stream would rise 29 feet in 5 days with a maximum rate of rise of about 1 foot per hour and would remain out of banks for about 8 days.

HAZARDOUS CONDITIONS The larger floods have caused hazards to local residents in many ways. Flood waters which overtop roads can cause hazardous driving conditions for anyone attempting to drive through the inundated areas. Due to the long duration of flooding, health problems often develop when septic tanks, and wells used for water supply systems become affected. The danger from underestimating the velocity and depth of flood waters by unsuspecting children is an age old problem confronting residents within the flooded areas.

FLOOD DAMAGE PREVENTION MEASURES. There are no existing or authorized flood control or related measures in the study area. Survey studies of flood control and related purposes within the Iowa and Cedar River basins are continuing. Flood control at Cedar Rapids will be the subject of one of the studies connected therewith.

The zoning ordinance adopted by Linn County in 1959 regulates construction on the flood plain in unincorporated areas of the county. The flood plain, with reference to the zoning ordinance, is defined as land areas known to have been flooded previously or that are reasonably expected to be flooded by a 50-year frequency flood, as determined by the county engineer. Buildings intended for permanent occupancy may not be moved onto or constructed on flood plain areas and the lowest floor of summer cottages must be at least one foot above flood crest elevation. The ordinance exempts from its operation all farmland and structures, in terms very similar to those used in the enabling statute, Section 358A.2, Iowa Code 1962, prior to 1965 amendments. Chapter 374, Laws of the Sixty-First General Assembly of Iowa, 1965, amended Section 358A.2 to provide that county ordinances relating to any structure, building, dam, obstruction, deposit or excavation in or on the flood plains shall apply thereto.

The City of Cedar Rapids has prepared comprehensive plans and enacted zoning ordinances; however, it appears that there are no subdivision regulations, building codes, or zoning ordinances adopted with provisions which affect or regulate the use of land with respect to flood risk. The authority of local governing bodies to zone for protection from floods is included in the standard objectives listed in the state enabling statutes, Chapter 358A and Chapter 414 of the Iowa Code 1966, as amended. (See also Chapter 374, Laws of the Sixty-First General Assembly of Iowa, 1965.)

State regulation of the flood plains of Iowa rivers and streams is provided primarily through administration of Chapter 455A of the Iowa Code by the Iowa Natural Resources Council. This statute assigns to the Resources Council the duty and authority to establish and enforce an appropriate comprehensive state-wide program for the control, utilization, and protection of the surface and ground-water resources of the state. Prior approval of the Resources Council is required for any structure, dam, obstruction, deposit, or excavation to be erected, made, used, or maintained in or on the floodway or flood plains of any river or stream. Similarly, works of any nature for flood control may not be constructed or installed unless and until the proposed works are approved by the Resources Council. Chapter 374, Laws of the Sixty-First General Assembly of Iowa, 1965, amended this statute to authorize the Resources Council to establish and enforce regulations for the orderly development and wise use of the flood plains of any river or stream within the state. The Resources Council is directed to determine the characteristics of floods which reasonably may be expected to occur. In addition, the Resources Council is directed to establish encroachment limits, protection methods and minimum protection levels appropriate to flood characteristics of the stream and reasonable use of the flood plains. Policies and procedures for administration of this Act presently are being formulated by the Resources Council.

FUTURE FLOOD HEIGHTS that would be reached if the Intermediate Regional and Standard Project Floods occurred in the vicinity of Cedar Rapids are shown in Table 1. The table gives the comparison of these flood crests and also shows the comparison with the March 1961 flood for the Cedar River. The peak discharges for the March 1961, Intermediate Regional, and Standard Project Floods are 73,000, 126,000, and 169,000 cubic feet per second, respectively.

TABLE 1

RELATIVE FLOOD HEIGHTS 1/

Mile	March 1961 2/ Flood Elevation feet	Intermediate 3/ Regional Flood Elevation feet	Standard 4/ Project Flood Elevation feet
97.55	691.65	694.10	697.60
98.00	692.15	694.95	698.36
98.44	692.72	695.94	699.26
98.73	692.93	696.25	699.56
99.00	693.17	696.62	699.91
99.25	693.58	697.17	700.43
99.39	693.93	697.62	700.79
99.70	694.44	698.22	701.34
100.00	694.95	698.85	701.92
100.39	695.65	699.76	702.84
100.69	696.17	700.41	703.51
101.00	696.41	700.69	703.81
101.40 DS 5/ (Hwy No. 1)	696.61	700.90	704.00
101.40 US 6/	696.64	701.00	704.48
101.76	697.21	701.84	705.34
102.04	697.67	702.46	705.99
102.38	698.19	703.09	706.63
102.71	698.80	703.98	707.63
103.03	699.35	704.74	708.48
103.40	699.95	705.65	209.59
103.68	700.50	706.39	710.43
104.00	701.00	707.08	711.22
104.21 DS (Palisades Dam)	701.31	707.52	711.74
104.21 US	702.09	708.31	712.56
104.50	702.55	708.90	713.20
104.74	703.06	709.54	713.90
105.00	703.29	709.85	714.26
105.27	703.72	710.48	715.05
105.60	704.14	711.09	715.81
105.87	704.52	711.57	716.35
106.24	705.09	712.16	716.94
106.59	705.65	712.65	717.40
106.90	706.17	713.11	717.84
107.29	706.66	713.57	718.28
107.58	702.00	713.86	718.54
108.00	707.58	714.52	719.24
108.29 DS (Hwy No. 30)	707.92	714.87	719.60
108.29 US	708.08	715.26	720.43
108.47	708.31	715.48	720.62
108.82	708.64	715.81	720.93
109.21	709.12	716.15	721.21
109.59	709.40	716.52	721.52
109.97	709.80	716.79	721.75
110.35	710.35	717.10	721.98
110.73	710.80	717.39	722.19
111.11	711.24	717.71	722.42
111.27	711.44	717.90	722.59
111.65	711.94	718.28	722.91
112.03	712.45	718.64	723.20
112.41	712.95	719.06	723.55
112.68	713.25	719.33	723.76
113.08	713.79	719.93	724.37
113.49	714.39	720.68	725.14
113.75	714.69	721.01	725.49
114.10	715.19	721.48	725.87
114.48	715.63	721.84	726.12
114.86	716.25	722.38	726.78
115.05 DS (C&NW RR)	716.44	722.74	727.07
115.05 US	716.93	723.47	727.98
115.40	717.14	723.64	728.13
115.76	717.49	723.94	728.38
116.31	718.54	725.36	729.85
116.71	719.01	726.08	730.64
117.23 DS (CRI&P RR)	719.10	726.14	730.67
117.23 US	719.13	726.89	731.44
117.69	719.73	727.36	731.89
117.82 DS (16th Ave SW)	719.77	727.36	731.89
117.82 US	720.07	727.98	732.30
117.98	720.43	728.28	732.58
118.20 DS (CMSTP&P RR)	720.48	728.32	732.60
118.20 US	720.49	728.60	732.70
118.27 DS (8th Ave)	720.66	728.71	732.77
118.27 US	720.79	728.92	733.06
118.35 U.S.G.S. Gage	720.82	728.95	733.15
118.57	722.62	730.38	734.28
118.64 DS (3rd Ave)	722.97	730.59	734.44
118.64 US	723.26	731.31	734.96
118.68	723.28	731.33	734.98
118.72 DS (2nd Ave)	723.35	731.35	735.00
118.22 US	723.53	731.84	735.40
118.74	723.53	731.88	735.48
118.80 DS (1st Ave)	723.78	732.18	735.79
118.80 US	723.89	732.66	736.24
118.89	724.33	732.84	736.40
118.97 DS ("B" Ave)	724.57	733.06	736.65
118.97 US	725.01	733.42	736.84
119.00 DS (Dam)	725.13	733.50	736.93
119.00 US	726.80	734.22	737.53
119.07	726.88	734.31	737.65
119.22 DS (C&NW RR)	727.04	734.44	737.82
119.22 US	727.12	734.71	738.12
119.44	727.40	734.95	738.39
119.59	727.58	735.08	738.53
119.89	727.86	735.26	738.71
120.24	728.14	735.32	738.78
120.78	728.84	735.90	739.33
121.16	729.41	736.36	739.83
121.64	729.80	736.82	740.41
122.02	730.04	737.07	740.70
122.40	730.71	737.63	741.31
122.83	731.43	738.23	741.93
123.34	732.16	738.89	742.65
123.90	732.87	739.52	743.33
124.22	733.36	739.92	743.71
124.62	733.95	740.42	744.23
125.24 DS (Abandonded Rd)	734.89	741.20	745.00
125.24 US	735.23	741.52	745.29
125.65	735.62	741.87	745.64
126.44 DS (CMSTP&P RR)	736.62	742.76	746.55
126.44 US	737.10	743.55	747.52
126.56 DS (CRI&P RR)	737.14	743.60	747.62
126.56 US	737.87	745.64	750.08
127.28	738.43	746.15	750.64
127.70	738.71	746.40	750.91
128.08	739.09	746.66	751.16
128.40	739.33	746.83	751.31
128.74	739.61	747.01	751.49
129.19	739.68	747.05	751.53
129.74 DS (Palo Br)	739.83	747.11	751.57
129.74 US	740.06	747.23	751.63
130.10	740.26	747.32	751.70
130.56	740.83	747.59	751.90
131.12	741.57	747.95	752.18
131.50	742.14	748.23	752.38
131.95	742.87	748.59	752.63
132.29	743.67	748.93	752.85
132.61	744.40	749.48	753.24
132.93	745.35	750.23	753.81
133.36	746.48	751.08	754.48
133.60	747.02	751.59	754.91
134.19	747.97	752.70	755.99
134.40	748.47	753.26	756.57
134.64	748.69	753.48	756.79
134.87	749.05	753.78	757.10
135.13	749.12	754.22	757.58
135.42	749.57	754.71	758.10
135.88	750.46	755.66	759.11
136.33	751.08	756.14	759.55
136.78	751.60	756.49	759.84
137.20	752.31	757.07	760.36
137.70	753.21	757.73	760.91
138.27	753.84	758.20	761.31
138.59	753.30	758.56	761.62
138.90 DS (County Rd Z)	754.86	759.00	762.02
138.90 US	755.09	759.38	762.68
139.20	755.34	759.58	762.85
139.50	755.87	760.07	763.26
139.75	756.37	760.45	763.56
140.00	756.90	760.80	764.00
140.25	757.3	761.20	764.40
140.62	757.8	761.50	764.80

1/ Discharges at U.S.G.S. gage at Cedar Rapids
2/ 1961 Flood flow - 73,000 cfs
3/ Intermediate Regional Flood flow - 126,000 cfs
4/ Standard Project Flood flow - 169,000 cfs
5/ Downstream
6/ Upstream

PAST FLOODS

GENERAL

This section of the report is a history of floods on the Cedar River within Linn County, Iowa, including the eight mile reach in Cedar Rapids, Iowa. Linn County is located in the east central portion of the State of Iowa. The study area of the Cedar River extends from the south boundary to the west boundary of Linn County, a distance of approximately 48 miles. The drainage area of the Cedar River above the lower limit of this study is 6,997 square miles. The Cedar River watershed extends upstream through northeastern Iowa and includes a very small portion of southern Minnesota. The watershed has a maximum width of 60 miles and a maximum length of 190 miles. Indian Creek and Prairie Creek enter the Cedar River approximately 14 and 18 miles, respectively, upstream from the lower limit of the study area. Indian Creek and Prairie Creek flood plain information reports are available at the offices of the Linn County Engineer and City Engineer, Cedar Rapids. The Indian Creek watershed drains 93 square miles and has a maximum width of 8 miles and a maximum length of 17 miles. Prairie Creek drains 216 square miles with a maximum watershed width of 12 miles and a maximum length of 38 miles. Shellrock River has a drainage area of 1783 square miles and is the largest of the tributaries which form the watershed of the Cedar River above the study area. Other major tributaries include West Fork Cedar River, Beaver Creek, Blackhawk Creek, Wolf Creek, and Little Cedar River.

Channel depths within the study area average 5 to 10 feet. The banks vary from 5 to 60 feet in height, the highest being in the Palisades State Park near mile 105.0 where steep rock valley walls are present. In most of the remaining area the banks are about 10 feet high with a flat, wide flood plain. The banks have been lined with concrete, for short distances, in the densely developed commercial area within the City of Cedar Rapids. Flow in the flood plain through Cedar Rapids has been restricted by past development and filling. However, channel and bridge improvements have been accomplished to partially compensate for the restrictions. These improvements have not been sufficient to eliminate the adverse effects of encroachments and bridge restrictions. The width of the channel varies from 300 to 600 feet throughout the study area with an average slope of 1.7 feet per mile.

Three major dams, 10 to 12 feet high, and ponding areas are located within the study area. The lower dam is located at Palisades Kipler State Park, mile 104.2, and used primarily for recreational activities. A low head dam for condensor water has been recently constructed by the Iowa Electric Light and Power Company at mile 104.75. Iowa Electric Light and Power Company operates jointly with the City of Cedar Rapids the hydro-power dam at mile 119.0. Above the hydro-power dam is a low submerged dam that has little or no effect on water surface elevations. The Veterans' Memorial Coliseum, City Hall, County Courthouse, and Jail are located on an island in the river at mile 118.6. The island has been built up and protected for higher flows.

The records of river stage and discharge on the Cedar River date from October 1902. The U.S. Geological Survey installed a staff gage on the right bank 500 feet upstream from Eighth Avenue Bridge in Cedar Rapids. This location is 2.7 miles upstream from the mouth of Prairie Creek at mile 118.35. Since August 20, 1920, a recording gage has been located at the same site.

Cedar River flood history data were collected for the study. Reports had been made following the floods of March 1929, June 1947, March 1961, and April 1965. Local residents were interviewed. Field investigations and office computations were made to supplement the early data and to develop the flood profiles for the largest recent floods on the Cedar River, those of March 1961 and April 1965. A search was also made of newspaper files and historical documents and reports. From these sources and gage records a history of the known floods on the Cedar River has been developed covering the past 64 years.

Settlement

Man has been building on and occupying the flood plain of the Cedar River since the arrival of the early settlers. The river first provided transportation and water supply. Later, mill dams were built and early highways and railroads were constructed along the gentle valley grades. Today the continuing growth of Cedar Rapids and Linn County results in ever increasing encroachment on the flood plains and river channel.

The vast quantities of water carried by the Cedar River during flood periods caused little damage until the works of man invaded the flood plain. Man has observed through bitter experience that floods periodically inundate portions of the flood plain, damaging or sweeping away roads, buildings, and homes. In addition to property damages, floods often pose a severe threat to human life and health.

According to estimates of the Cedar Rapids City Planning Commission, considerable growth can be expected over the next 15 to 20-year period. In a report entitled "Background for Planning", it is estimated that Linn County's population will grow to approximately 185,600 by 1980. This represents an increase of almost 50,000 people over the 1960 population of 136,899. A large portion of this increase is expected to take place in the urban area of Cedar Rapids. History has shown that such growth in areas on a stream's flood plain will increase future flood damages if allowed to occur without positive flood plain management practices.

There are several constricted reaches along the Cedar River, and the channel banks are very low adjacent to the flood plain. In such reaches it is easy for people to unknowingly move into a development that is frequently flooded. Encroachment limits and minimum floor elevations need to be established by local and state agencies. Establishment of these controls will permit orderly flood plain development and will protect public and private interests consistent with the flood hazard.

At the time of publication in 1961, the Cedar Rapids Parks and Schools Report listed 33 city park areas totalling nearly 1,300 acres of land in Cedar Rapids. Since that time, Cedar Rapids has acquired 14 additional park areas totalling approximately 420 acres, which brings the existing total to 47 park areas containing more than 1,700 acres. The Open Space Plan prepared for the Linn County Board of Supervisors lists 18 existing county park areas containing nearly 1,500 acres of land, all acquired since 1959. Most of these park areas are located along the stream banks of the Cedar and Wapsipinicon Rivers and their tributaries.

Flood Damage Prevention Measures

There are no existing or authorized flood control or related measures in the study area. Survey studies for flood control and related purposes within the Iowa and Cedar River Basins are continuing. Flood control at Cedar Rapids will be the subject of one of the studies connected therewith.

Flood Warning and Forecasting Services

The Environmental Science Services Administration Weather Bureau provides a flood forecasting service for the major river basins in Iowa, including the Cedar River Basin. The Weather Bureau predicts anticipated stages at a particular gage or gages in the basin. These forecasts are based on observed precipitation and flows at upstream points adjusted for anticipated weather conditions. The flood forecast is transmitted to city officials, to newspapers and to radio and television stations in the basin. These media disseminate the information to residents of the flood plain in the form of a flood warning. This timely forewarning permits protective measures to be undertaken by industrial plants, public utilities, municipal officials, and individuals with property in the lowlands.

Flood Fighting and Emergency Evacuation Plans

Technical services, provided by the Weather Bureau, can be classified in three general types:

1. Flash Flood. The Des Moines Weather Bureau River District Office is equipped with WSR-57 radar. The contributing area of the Cedar River is within the range of effective application for flash floods developing in the Cedar Rapids, Iowa, area. Mass news media contacts and National Warning System telephone service direct to Cedar Rapids emergency organizations from Des Moines make possible the immediate broadcast of information on location of storms and possible flash flooding.

2. Major Flood Forecasts. This is an integral part of the National River Forecast Service. Forecasts are based on radar coverage, reports from 10 river gages, and about 40 rainfall reporting stations in the basin above Cedar Rapids. The River Forecast Center at Kansas City is staffed with professional hydrologists

responsible for the preparation of river forecasts based on water equivalent of snow cover, rainfall-runoff relations, streamflow routing, and a working knowledge of anticipated weather conditions. The lead time between distribution of this information and the flood crests may range from 24 hours to several days.

3. Hydroclimatic Data. Most of the data from the network is published. These records provide the basis for forecasts, as well as for the planning and design of protective works and their operation during floods.

The Stream and Its Valley

The channel bed of the Cedar River is essentially glacial drift. The soil within the Cedar River valley is a deep black loam (Carrington) considered as being a part of the most productive agricultural land in Iowa. Adjacent flood plains are generally agricultural land. Much of this land is covered with timber which resticts flood flows in the flood plain. Many of these timbered areas are planned for parks and recreational developments with the probability of much brush and timber cleanout.

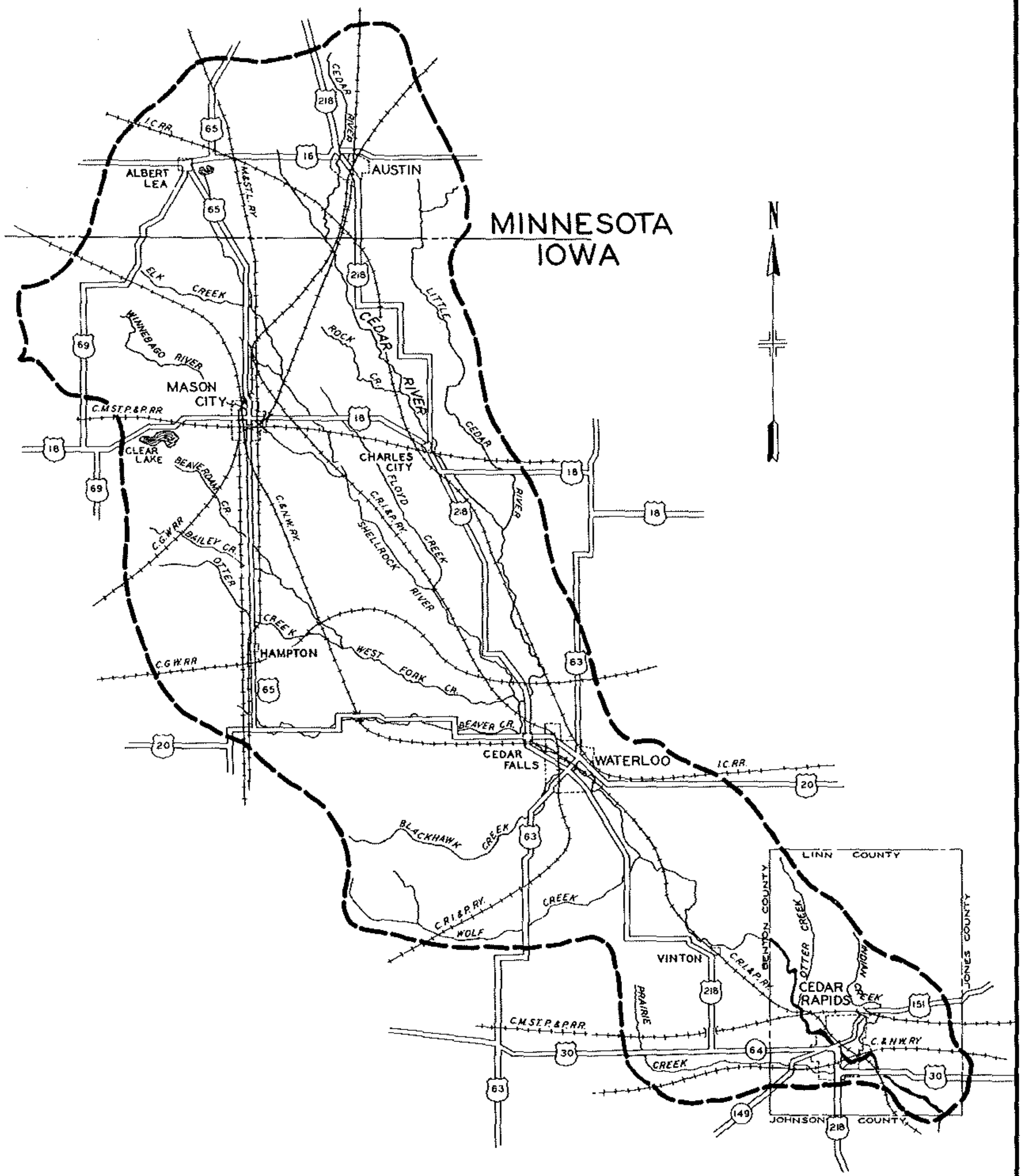
Several bridges play a significant role in determining flood stages within the study area. With the rapid urbanization of the rural areas and expansion of the urban area, some of these bridges are being removed and new bridges constructed. In general, the new bridges are designed to provide more waterway capacity. In some instances, existing bridges have been modified to provide additional flow area. Ice jams are frequent in certain reaches along the study area.

Since the Cedar River flood plain is relatively low and flat throughout many reaches, large areas are susceptible to flooding. At the present time the flood plain has not been extensively developed, except in the central part of the city. The rural flood plain area consists mainly of agricultural land with several scattered industrial developments. Since Cedar Rapids is experiencing rapid industrial expansion, considerable pressure is being exerted for more intensive utilization of the flood plain for commercial and industrial developments within the city limits. The several railroad lines and major highways serving the Cedar River valley will also stimulate the continued growth of industrial developments in the central part of the study area. Because the flood plain has been developed in the metropolitan area, heavy damage has occurred from past floods. Plate 1 shows the watershed and the stream drainage system of the Cedar River above mile 97.55.

The scenic reach of the Cedar River flood plain upstream from the south Linn County boundary to the east corporate limits of Cedar Rapids is oriented generally in a northwest-southeast direction. The Palisades Keplar State Park is located in the center of the reach. Good boating, fishing, camping, and picnic facilities attract a large number of recreationists to the area each year. South Cedar Access Park contains 154 acres and is located downstream from the Palisades Keplar State Park at mile 100.2. South Cedar is the county's newest park and has received minor development, including boat launching facilities. Three other areas of recreational interest in this reach are the Palisades Dows Preserve, Palisades Access, and Z.C.B.J. Park. With the exceptions of a few scattered cottages and farm buildings, the remainder of the reach is predominantly in undeveloped agricultural and timber land. On the north edge of the flood plain, Otis Road and the Chicago and Northwestern Railway parallel the flood plain limits. Indian Creek, with a drainage area of about 93 square miles, enters Cedar River from the north about midway in this reach.

Proceeding upstream from the east corporate limits of Cedar Rapids, the flood plain is oriented in a southeast-northwest direction through the heart of metropolitan Cedar Rapids. The Iowa Electric Light and Power Company has recently constructed (1967) a low head dam for condensor water at mile 114.75. Prairie Creek, with a drainage area of about 216 square miles, enters the Cedar River from the west, at a point just upstream from the Chicago and Northwestern Railway bridge. Cedar Rapids' main sewage treatment plant is located on the west side of the river at mile 117.0. Proceeding upstream through the highly developed commercial and industrial area along both sides of the river, six city streets and three railroads cross the Cedar River. The city and the Iowa Electric Light and Power Company jointly operate a hydro-power dam at mile 119.0. At mile 118.6, an island is located in the channel of the Cedar River between the east and west business districts. On this island, which is the hub of the city's civic plan, are the Veterans' Memorial Coliseum, housing the City Hall and the Chamber of Commerce, and the County Courthouse and jail. On both sides of the island normal and moderate flood flows are confined within the channels by concrete floodwalls. During the major floods of 1961, overtopping was prevented by extensive flood fighting operations. Continuing upstream to the city limits there is a transition from the highly developed metropolitan area of the city to open space uses of the flood plain. Within this area the city of Cedar Rapids obtains its municipal water supply from a system of alluvial wells and artificial recharge basins. In addition to the city well field, Ellis Park and Golf Course occupies a portion of the flood plain on the west side of the river. The facilities at Ellis Park include a boat harbor at mile 121.0. The boat harbor provides accommodations for houseboats and docks for small craft.

From the west city limits to the west Linn County boundary, the



—— REACH COVERED BY THIS REPORT

CORPS OF ENGINEERS, U.S. ARMY
ROCK ISLAND, ILLINOIS, DISTRICT

CEDAR RIVER WATERSHED
(ABOVE MILE 97.55)

10 0 10 20 30 40
SCALE IN MILES

MARCH 1967

PLATE I

Cedar River flood plain is generally undeveloped and wooded. The area of the Chain Lakes Access and Park, near mile 129.8, is 57 acres. This area has continually been expanded to keep pace with public useage. The area has boat launching facilities for the Cedar River and an attractive and well equipped picnic area. Other recreational areas in this reach are Polo Marsh Wildlife Refuge, Wickiup Hill Conservatory Area, Sokol Camp, and Lewis Bottom Access. The northwest to southeast orientation of the flood plain continues in this reach of the Cedar River. Near mile 126.5 two railroads (the Chicago, Milwaukee, St. Paul and Pacific and the Chicago, Rock Island and Pacific) cross the Cedar River. Near mile 128.7, Otter Creek, with a drainage area of about 71 square miles, enters the Cedar River. Pertinent drainage areas of the Cedar River are given in Table 2.

TABLE 2

DRAINAGE AREAS IN WATERSHED OF CEDAR RIVER

Stream	Location	Mile above Mouth	Drainage Area sq.mi.
Cedar River	South Linn County Line	97.55	6,997
	Above Big Creek	108.82	6,844
	Above Indian Creek	112.03	6,739
	Above Prairie Creek at U.S.G.S. Gage	118.35	6,510
	Above Otter Creek	129.19	6,381
	Above Opossum Creek	131.95	6,245
	Northwest Linn County Line	140.50	6,206
Big Creek			111
Indian Creek			93
Prairie Creek			216
Otter Creek			70.9
Opossum Creek			98.6

Developments in the Flood Plain

Plate 4 is an index map of the 16 sheets that show the flooded areas of the Cedar River within Linn County, Iowa. Except for developments within the City of Cedar Rapids and minor concentrations of developments throughout the county, most of the flood plain is devoted to agricultural or related purposes.

Main lines of the Chicago and North Western Railway, the Chicago, Rock Island and Pacific Railroad cross the Cedar River within the study area. The profiles in this report show that the other railroad bridges are subject to inundation by the Intermediate Regional and/or Standard Project floods.

U. S. Highway 30, one of the most important of four major highways crossing the Cedar River in the study reach, bridges the river downstream from the City of Cedar Rapids. This Federal highway is above past floods but is inundated by the Intermediate Regional and the Standard Project floods. The other highways are subject to inundation by these floods.

Many structures in the flood plain of the Cedar River have been damaged by past floods. Numerous structures are only slightly above past flood levels and the Intermediate Regional flood stage. Many additional buildings, including residences, commercial establishments and industrial plants, would be damaged by the Standard Project Flood. Upstream to the city limits there is a transition from the highly developed metropolitan area of the city to open space uses of the flood plains of the Cedar River. Adjacent to Ellis Park, the city obtains its municipal water supply from a system of alluvial wells and artificial recharge basins. Ellis Park and Golf Course occupies a portion of the flood plain on the west side of the river. This area is subject to periodic flooding, however, damages are relatively light since this type of occupancy has low damage potential in recognition of the flood hazard.

Bridges across the Stream

Several highway and railroad bridges cross the Cedar River in the study reach. Table 3 lists pertinent bridge elevations and relates them to the crest elevations of the flood of March 1961 and the Intermediate Regional Flood. Figures 1 through 11 show photographs of the bridges and dams across the Cedar River in Linn County.

Some of the bridges across the Cedar River are serious obstructions to stream flow. The seriousness of the obstructions is illustrated by the water surface profiles. Floods in the Cedar River basin are often the result of rainfall on frozen snow-covered soils. In addition, stages are often affected by ice jams at some bridges because of location and flow characteristics of the structures.

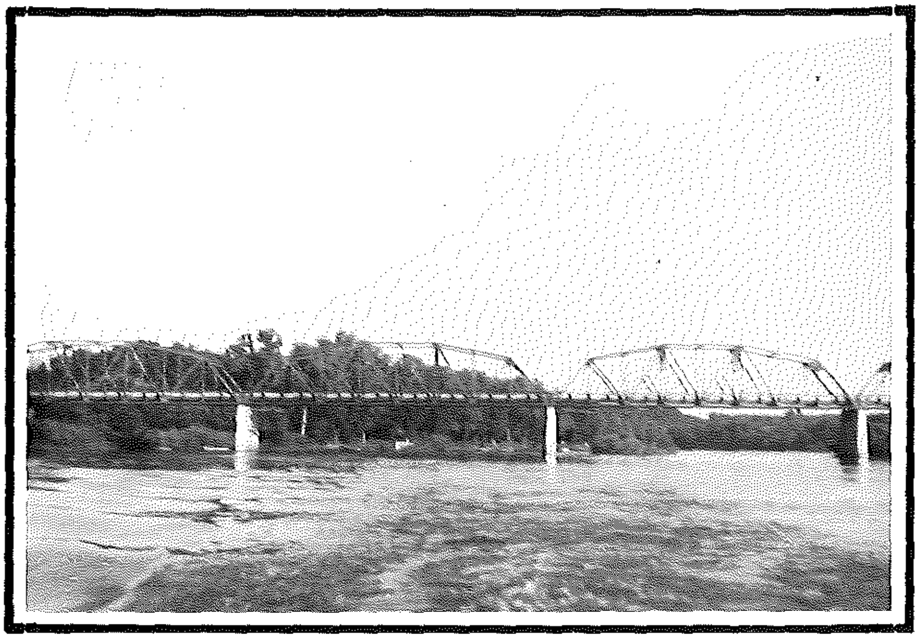
Several of the bridges over the Cedar River, within the study area, are multiple span concrete arches. These bridges are submerged by the Intermediate Regional Flood and are constrictive to high flows as shown by the profiles. At high stages debris lodges against the girders, floor and railings of the bridge and creates further impedence to flow. Within the confined central portion of Cedar Rapids, concrete arch bridges are being reconstructed as arch bridges with open spandrels. This improvement has been considered in the report. For detailed profile information, refer to Table 1 and the water surface profiles in this report.

TABLE 3

BRIDGES ACROSS CEDAR RIVER

Mile	Identification	Stream Bed Elev. feet	Floor Elev. feet	Intermediate Regional Flood Crest Elev. feet	Mar. 1961 Flood Crest Elev. feet	Underclearance Elev. feet	Underclearance Above 1961 Flood feet	Underclearance Below 1961 Flood feet
101.40	Highway #1	670.9	706.0	701.0	696.6	701.4	4.8	
108.29	Highway #30	682.2	720.6	715.3	708.1	711.6	3.5	
115.05	C&NW RR	691.5	719.4	723.5	716.9	712.5		4.4
117.23	C RI&P RR	681.0	728.8	726.9	719.1	717.8		1.3
117.82	16th Avenue SW	696.4	727.7	728.0	720.1	724.7	4.6	
118.20	CMStP&P RR	699.3	725.0	728.6	720.5	719.5		1.0
118.27	8th Avenue	697.9	734.5	728.9	720.8	729.0	8.2	
118.57	CR&IC RR*	699.5	723.9	730.5	722.8	721.8		1.0
118.64	3rd Avenue	699.9	726.7	731.3	723.3	724.3	1.0	
118.72	2nd Avenue	702.2	729.4	731.8	723.5	726.0	2.5	
118.80	1st Avenue	702.4	730.6	732.7	723.9	726.3	2.4	
118.97	"B" Avenue	702.0	728.4	733.4	725.0	725.4	0.4	
119.22	C&NW RR	701.6	730.3	734.7	727.1	727.7	0.6	
126.44	CMStP&P RR	712.0	783.0	743.6	737.1	748.1	1.0	
126.56	CRI&P RR	712.5	745.3	745.6	737.9	741.5	3.6	
129.74	Palo	718.1	747.0	747.2	740.1	742.3	2.2	
138.90	County Rd. Z	733.0	765.0	759.4	755.1	758.5	3.4	

* Superstructure removed in 1967.



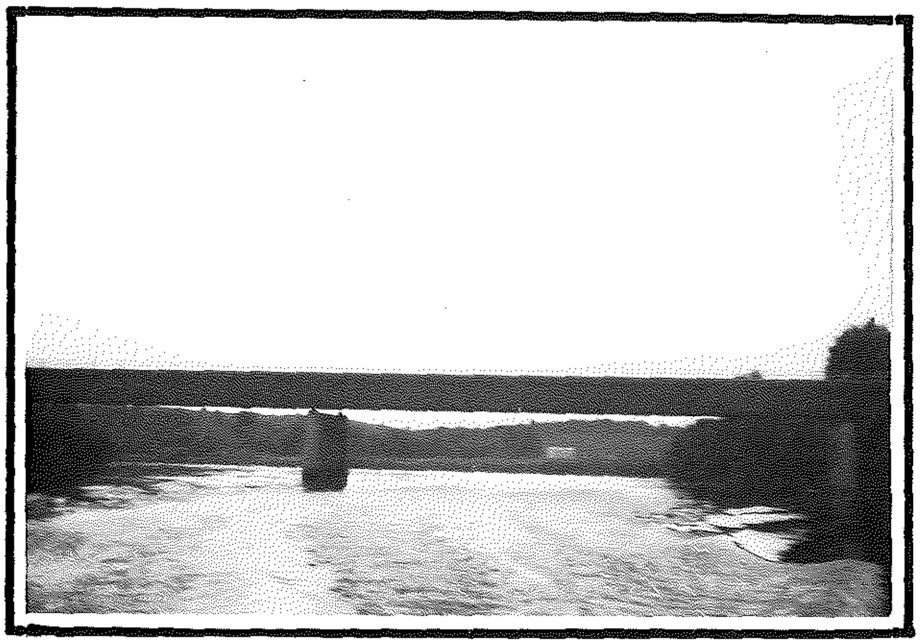
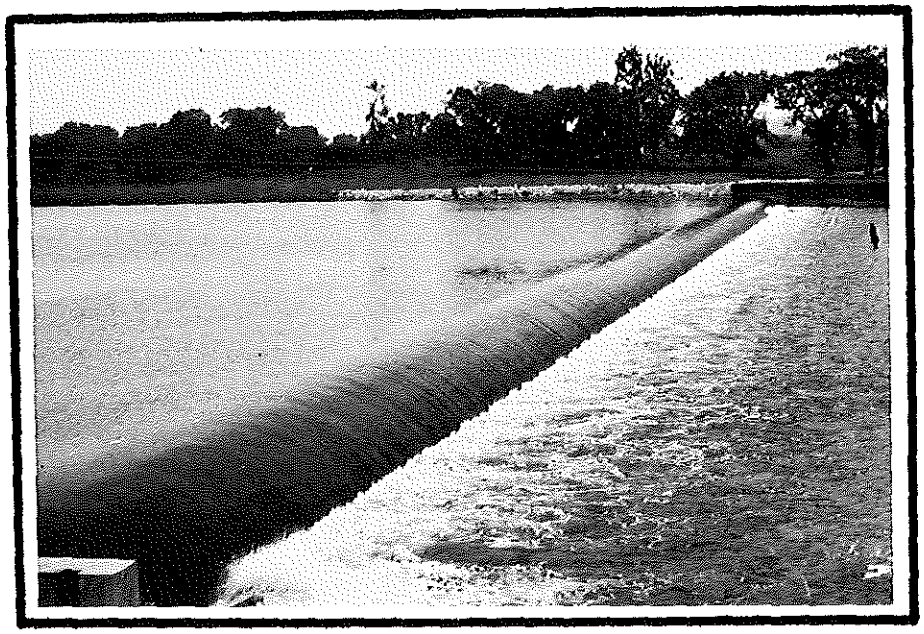


Figure 1. CEDAR RIVER BRIDGES AND DAMS
Top view is the State Highway No. 1 bridge at Mile 101.40, looking upstream.
Bottom view is the U.S. Highway 30 bridge at Mile 108.29, looking downstream.



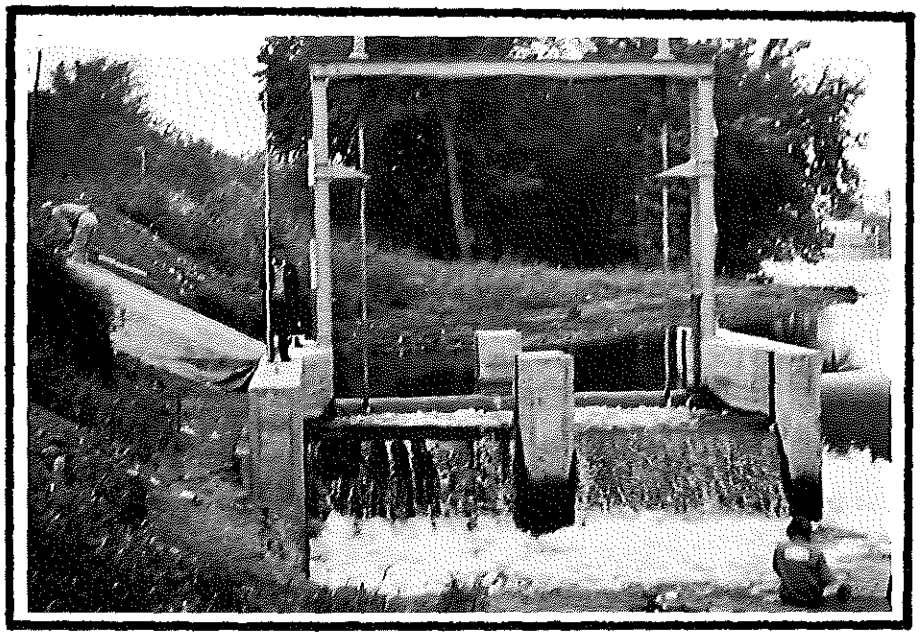
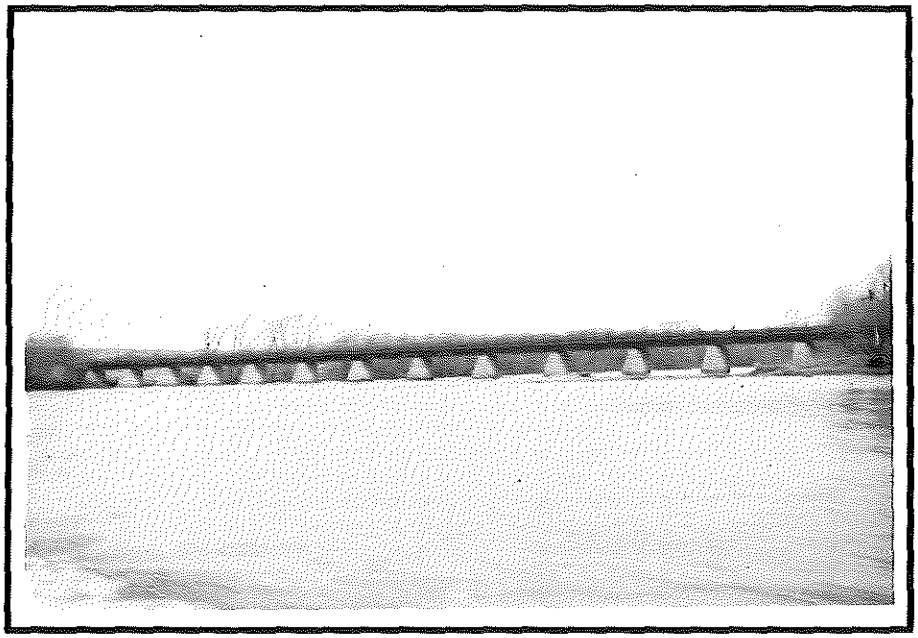


Figure 2. CEDAR RIVER BRIDGES AND DAMS
Both views show the Iowa Electric Light and Power Company dam at Mile 114.75. Bottom view shows the bypass structure on the right bank.



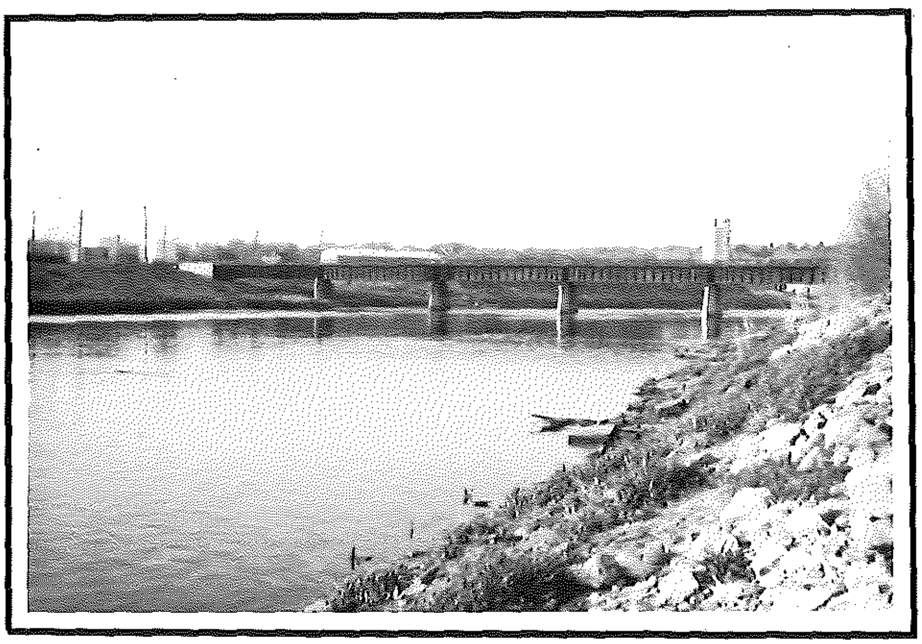
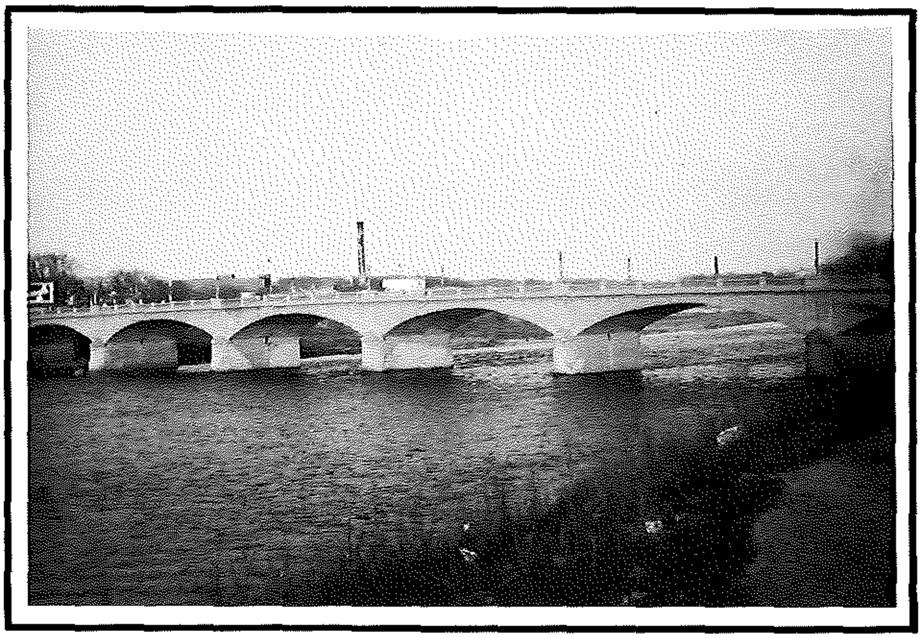


Figure 3. CEDAR RIVER BRIDGES AND DAMS
The top view shows the Chicago and North Western Railway bridge at Mile 115.05, looking upstream.
The bottom view shows the Chicago, Rock Island and Pacific Railroad bridge at Mile 117.23, looking downstream.



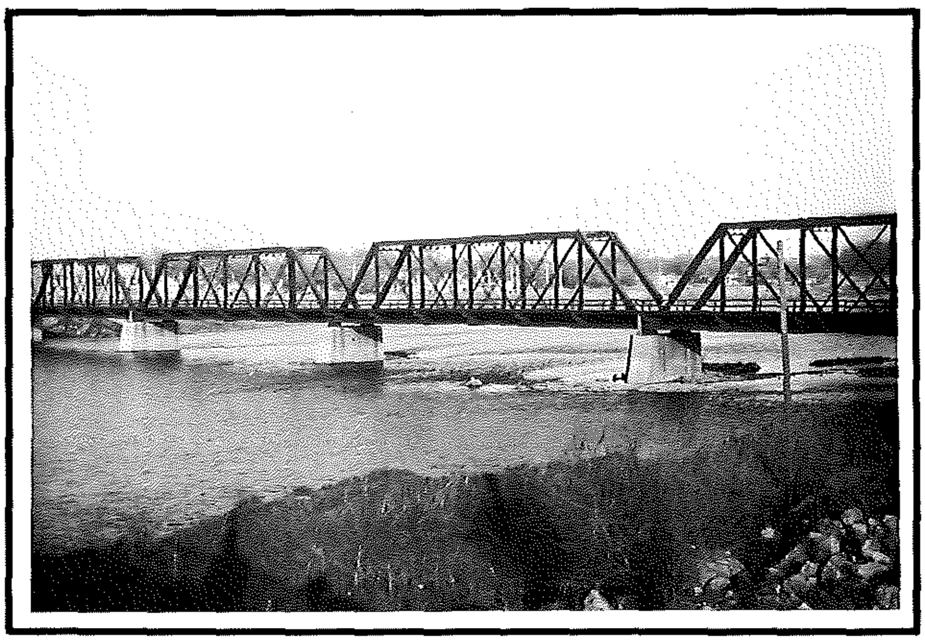
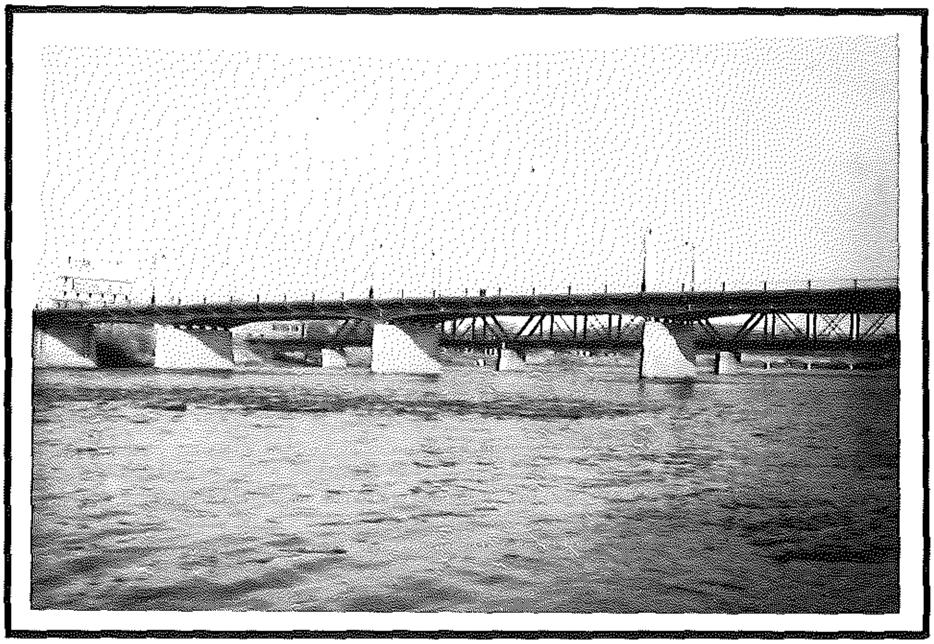


Figure 4. CEDAR RIVER BRIDGES AND DAMS
The top view is the 16th Avenue bridge in Cedar Rapids at Mile 117.82, looking downstream.
The bottom view is the Chicago, Milwaukee, St. Paul and Pacific Railroad bridge at Mile 118.20, looking downstream.



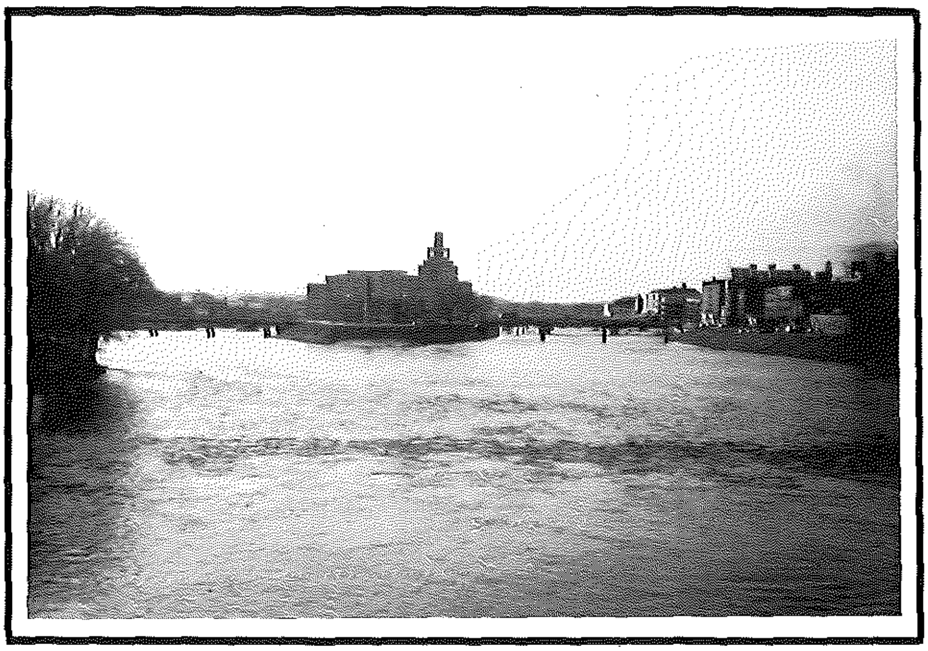


Figure 5. CEDAR RIVER BRIDGES AND DAMS
Top view shows the 8th Avenue bridge in Cedar Rapids at Mile 118.27. View is looking downstream with the C.M.St.P. and P. Railroad bridge in the background. Bottom view shows the maze of bridges crossing the river to the island at Mile 118.50. View is looking upstream.

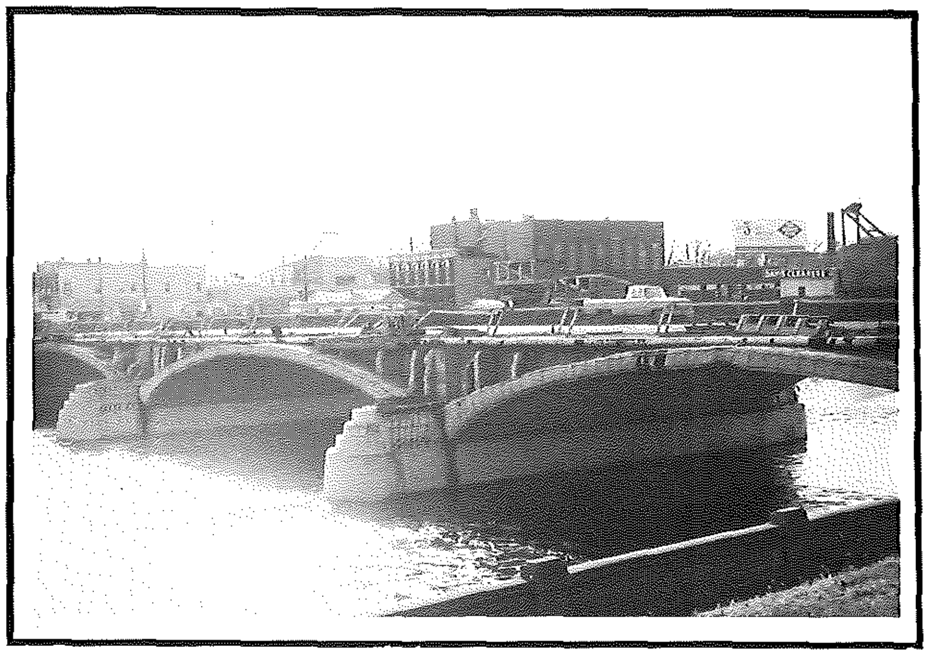


Figure 6. CEDAR RIVER BRIDGES AND DAMS
Top view is the abandoned Cedar Rapids and Iowa City Railroad bridge at Mile 118.57, looking downstream. Superstructure of this bridge was removed in 1967.
Bottom view shows the 3rd Avenue bridge in Cedar Rapids at Mile 118.64, looking upstream. Bridge to the island is being repaired and reconstructed with open spandrels.

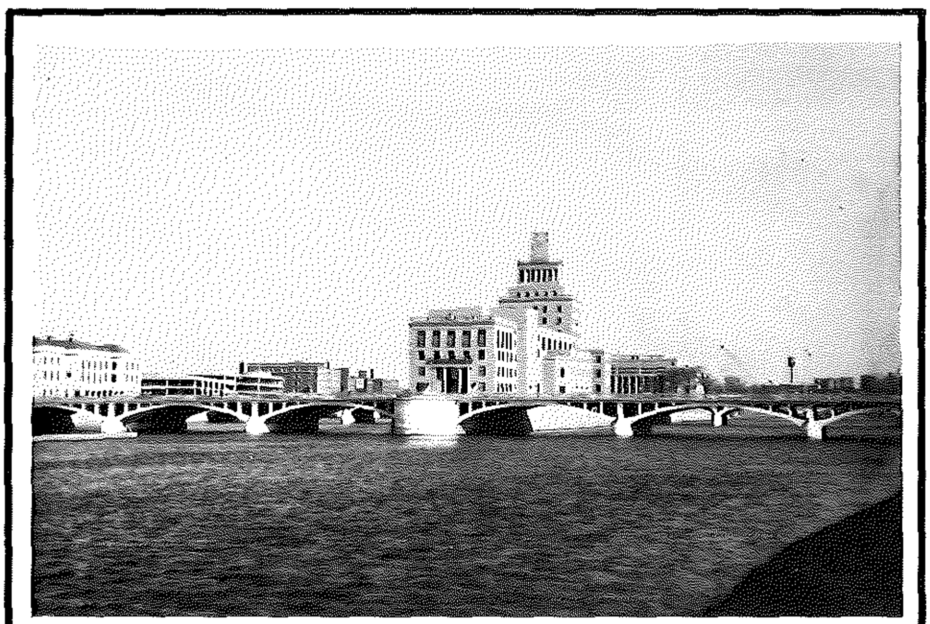
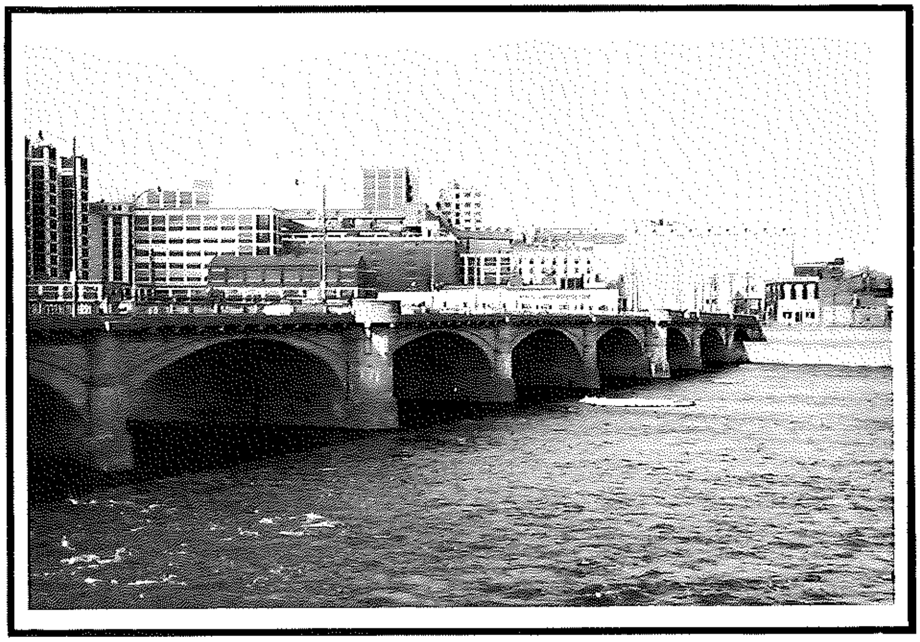


Figure 7. CEDAR RIVER BRIDGES AND DAMS
Top view shows the 2nd Avenue bridge on the west side of the island at Mile 118.72, looking upstream. Bridge on the east side is similar.
Bottom view shows the reconstructed 1st Avenue bridge at Mile 118.80, looking downstream at the Cedar Rapids City Hall. Note the open spandrels on both bridges.



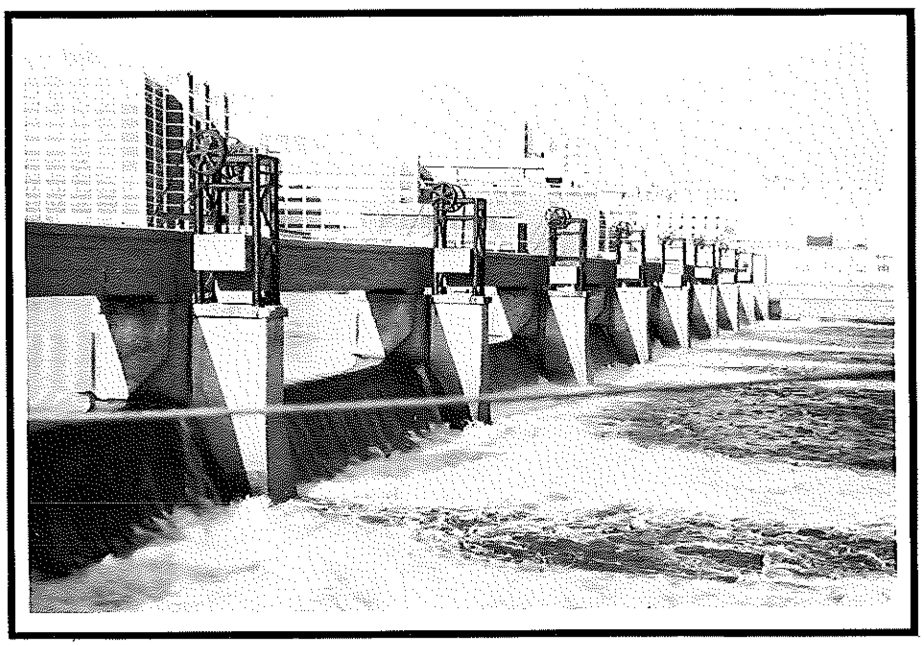


Figure 8. CEDAR RIVER BRIDGES AND DAMS
Top view is the B Avenue bridge in Cedar Rapids at Mile 118.97, looking upstream.
Bottom view is Iowa Electric Light and Power Company dam at Mile 119.00, looking upstream. Quaker Oats building is in the background.

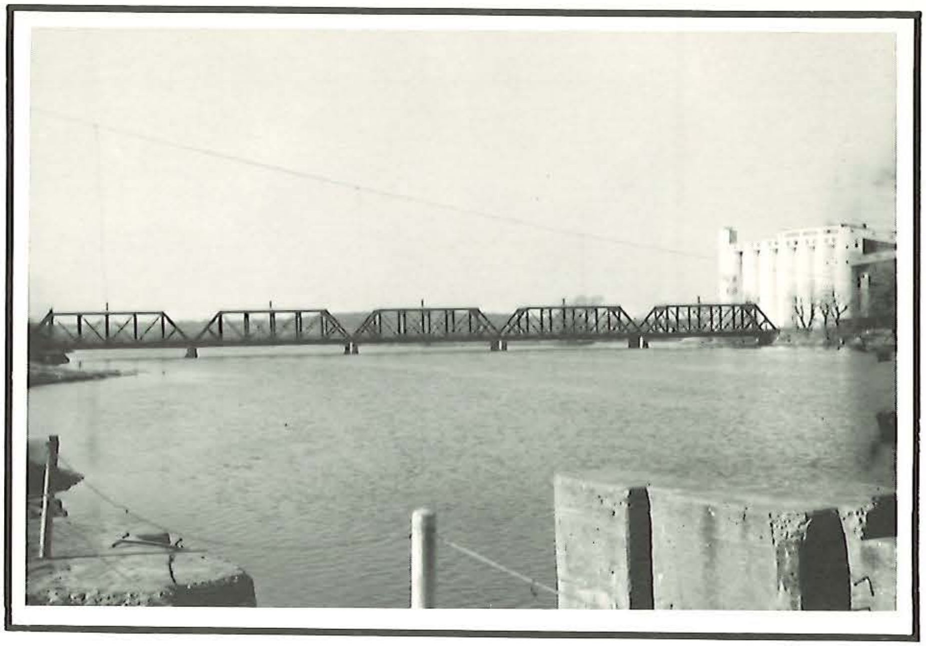


Figure 9. CEDAR RIVER BRIDGES AND DAMS
Top view is the Chicago and North Western Railroad bridge at Mile 119.22, looking upstream.
Bottom view is looking upstream at the piers remaining from the abandoned County Road bridge at Mile 125.24.

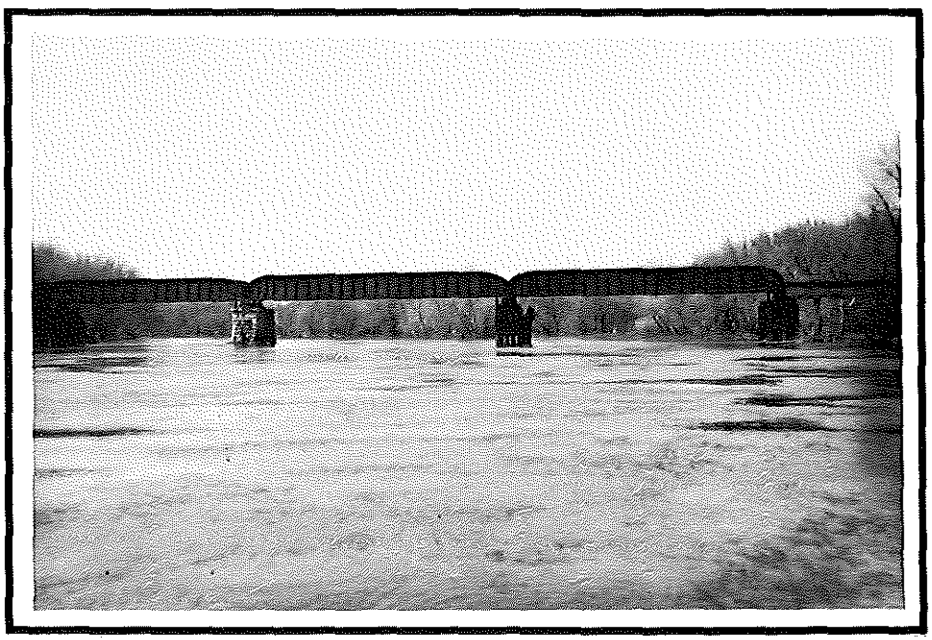


Figure 10. CEDAR RIVER BRIDGES AND DAMS
Top view is looking upstream toward the Chicago, Milwaukee, St. Paul and Pacific Railroad bridge at Mile 126.44.
Bottom view is looking upstream toward the Chicago, Rock Island and Pacific Railroad bridge at Mile 126.56.

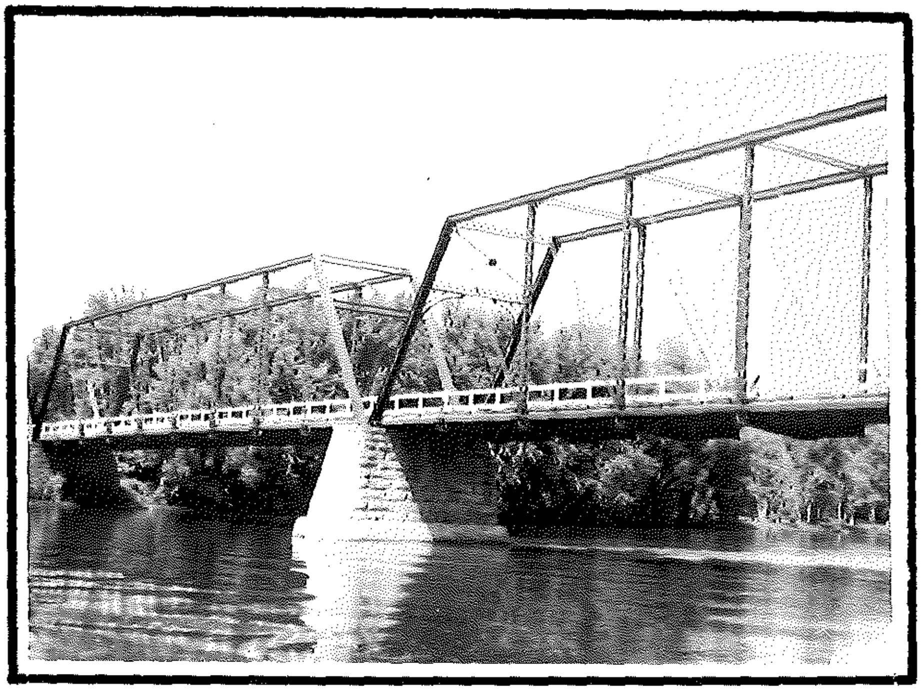


Figure 11. CEDAR RIVER BRIDGES AND DAMS
Top view is looking upstream toward the County Road bridge near Palo at Mile 129.74.
Bottom view is the County Road Z bridge at Mile 138.90, looking upstream.

Obstructions to Flood Flow

The effect of obstruction due to bridges and their approach fills has been described in the previous paragraphs. With the exception of the bridges, the hydro-power dam (mile 119.00) and the Island, (mile 118.6), there are no significant obstructions to flood flows in the Cedar River reach included in this study. The water surface profiles as presented in this report are responsive to the accumulated adverse effects resulting from flood plain encroachments. Further increases in the profile elevations can be expected if additional encroachments are permitted.

FLOOD SITUATION

Flood Records

Records of river stages and discharges on the Cedar River have been maintained since October 1902, when the U. S. Geological Survey began observations on a staff gage near mile 118.35. In August 1920, a recording gage was installed at the sáme site, and continuous records are available to date.

To supplement the record obtained at this gaging station, local residents were interviewed for information regarding dates and heights of floods. Newspaper files were searched, as were historical documents and records. Valuable data were obtained from reports of field investigations made after floods. From these records and investigations, a knowledge of floods on the Cedar River covering the past 65 years has been accumulated.

Flood Stages and Discharges

Table 4 lists crest stages and discharges for the known floods exceeding bankfull stage of 8 feet at the U.S.G.S. gaging station on the Cedar River at Cedar Rapids, Iowa. Table 5 lists the highest ten floods in order of magnitude. For floods since October 1902, the crest stages are those observed at the gage. The stage for the June 1851 flood is from a high water mark.

Flood Occurrences

Plate 2 shows known crest stages and years of occurrence of known floods since 1902 which have exceeded the bankfull stage of 8 feet at the U.S.G.S. gage on the Cedar River at Cedar Rapids, Iowa.

Duration and Rate of Rise

Plate 3 shows the stage hydrographs on the Cedar River at the

U.S.G.S. stream gaging station for the floods of March 1929 and March 1961. During the 1961 flood, the river rose to its crest stage in two days at an average rate of 0.2 foot per hour with a maximum rate of 0.5 foot per hour, and remained above bankfull stage for 5 days. During the 1929 flood the river rose to its crest stage in 5 days at an average rate of 0.1 foot per hour with a maximum rate of 0.4 foot per hour, and remained above bankfull stage for 11 days.

TABLE 4

FLOOD CREST ELEVATIONS ABOVE BANKFULL STAGE

CEDAR RIVER AT CEDAR RAPIDS

1851 - 1966

The table includes all known floods above bankfull stage of 8 feet at the U. S. Geological Survey gaging Station 500 feet upstream from Eighth Avenue Bridge (mile 118.35) in Cedar Rapids, Iowa. Drainage area = 6,510 square miles. Zero of gage = 700.33 (up to 1961). Zero of gage = 700.47 (from 1962 to the present), USC & GS General Adjustment of 1929.

Date of Crest	Gage Heights Stage feet	Gage Heights Elevation feet	Discharge cfs
June 1851	*20.00	720.33	*65,000
May 31, 1903	16.85	717.18	53,600
March 23, 1905	9.05	709.38	23,000
May 20, 1905	8.10	708.43	19,000
February 28, 1906	8.40	708.73	19,400
March 30, 1906	17.60	717.93	55,700
July 20, 1907	8.50	708.83	19,800
August 17, 1907	8.20	708.53	18,600
May 30, 1908	8.80	709.13	21,000
June 26, 1908	8.00	708.33	17,800
March 30, 1909	9.10	709.43	22,100
December 11, 1909	8.40	708.73	19,400
March 14, 1910	9.60	709.93	24,100
April 1, 1912	17.20	717.53	54,000
March 18, 1913	9.20	709.53	22,500
February 25, 1915	10.30	710.63	26,800

TABLE 4 (continued)

Date of Crest	Gage Heights Stage feet	Elevation feet	Discharge cfs
March 28, 1915	12.00	712.33	33,600
June 2, 1915	11.50	711.83	31,600
September 28, 1915	9.40	709.73	23,300
March 30, 1916	10.00	710.33	25,700
June 6, 1916	8.10	708.43	18,200
March 26, 1917	17.40	717.73	54,900
June 13, 1917	8.30	708.63	19.000
June 7, 1918	11.00	711.33	28,200
March 20, 1919	11.40	711.73	29,700
April 15, 1919	9.40	709.73	21,800
June 1, 1921	8.40	708.73	17,900
February 27, 1922	9.10	709.43	21,000
August 22, 1924	10.54	710.87	26,300
February 12, 1928	9.50	709.83	22,200
August 29, 1928	11.05	711.38	29,200
March 18, 1929	20.00	720.33	64,000
April 20, 1929	9.30	709.63	21,400
November 28, 1931	8.40	708.73	17.900
April 2, 1932	8.73	709.06	19,100
June 23, 1932	8.40	708.73	17,900
April 4, 1933	18.60	718.93	58,400
March 8, 1935	10.38	710.71	26,900
March 15, 1936	9.45	709.78	22,700
March 27, 1936	8.90	709.23	20,600
February 21, 1937	9.30	709.63	22,300
March 9, 1937	13.61	713.94	40,700
June 17, 1937	9.60	709.93	23,500

TABLE 4 (continued)

Date of Crest	Gage Heights Stage feet	Elevation feet	Discharge cfs
March 18, 1939	8.67	709.00	19,700
June 7, 1942	8.90	709.23	19,100
August 3, 1942	12.60	712.93	33,900
Mary 25, 1944	8.50	708.83	17,900
June 18, 1944	11.43	711.76	29,100
June 23, 1944	9.20	709.53	20,300
March 19, 1945	17.09	717.42	52,300
May 31, 1945	8.80	709.13	19,700
June 5, 1945	9.20	709.53	21,200
January 9, 1946	10.80	711.13	27,100
March 11, 1946	9.20	709.53	21,200
March 17, 1946	9.90	710.23	23,700
April 16, 1947	8.30	708.63	18,000
June 6, 1947	13.50	713.83	37,000
June 16, 1947	18.23	718.56	56,200
July 6, 1947	8.60	708.93	19,100
March 3, 1948	12.82	713.15	34,500
March 20, 1948	12.60	712.93	33,900
March 7, 1949	11.75	712.08	30,800
March 31, 1949	8.30	708.63	18,000
March 11, 1950	12.45	712.78	33,000
April 1, 1950	9.80	710.13	23,400
February 27, 1951	*12.51	712.84	*30,000
March 31, 1951	13.54	713.87	39,300
April 11, 1951	17.22	717.55	54,100
May 2, 1951	13.45	713.78	38,900
June 3, 1951	8.42	708.75	19,400

TABLE 4 (continued)

Date of Crest	Gage Heights Stage feet	 Elevation feet	Discharge cfs
June 30, 1951	12.00	712.33	33,300
July 10, 1951	8.35	708.68	19,400
April 5, 1952	10.40	710.73	27,000
June 26, 1954	14.02	714.35	41,400
March 21, 1959	8.75	709.08	21,000
March 30, 1959	9.77	710.10	25,800
January 13, 1960	8.60	708.93	20,400
April 2, 1960	16.75	717.08	55,100
May 7, 1960	11.59	711.92	32,400
March 31, 1961	19.66	719.99	73,000
April 2, 1962	15.15	715.62	50,000
September 7, 1962	8.11	708.58	18,900
March 6, 1965	11.19	711.66	32,100
April 10, 1965	18.51	718.98	66,800
September 26, 1965	10.04	710.51	27,200
October 5, 1966	10.51	710.98	29,200

Note:

Gage Zero is at elevation 700.33 up to 1961

Gage Zero is at elevation 700.47 from 1962 up to the present.

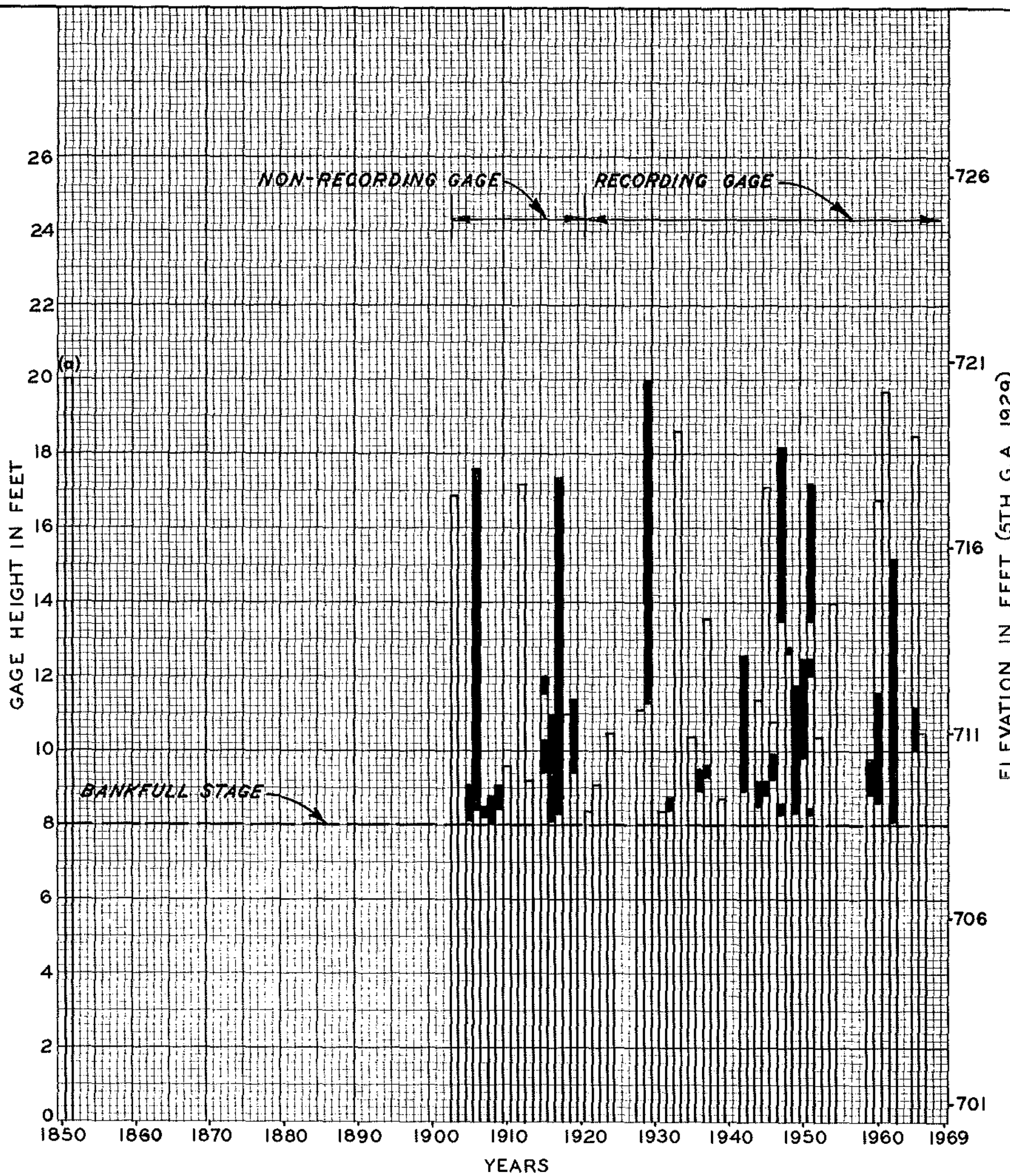
* Approximate measurements

TABLE 5

HIGHEST TEN KNOWN FLOODS IN ORDER OF MAGNITUDE

CEDAR RIVER AT CEDAR RAPIDS, IOWA

Order No.	Date of Crest	Gage Height Stage feet	Gage Height Elevation feet	Estimated Peak Discharge cfs
1	March 31, 1961	19.7	720.03	73,000
2	April 10, 1965	18.5	718.97	66,800
3	June, 1851	20.0	720.33	65,000
4	March 18, 1929	20.0	720.33	64,000
5	April 4, 1933	18.6	718.93	58,400
6	June 16, 1947	18.2	718.53	56,200
7	March 30, 1906	17.6	717.93	55,700
8	March 26, 1917	17.4	717.73	54,900
9	April 11, 1951	17.2	717.52	54,100
10	April 1, 1912	17.2	717.52	54,000



(a) Stage from flood mark.

River Gage at Mile 118.35

Variation in shading on bar graph indicates more than one flood during the year. For example, in 1915 there were 4 floods; gage heights were 9.40, 10.30, 11.50 and 12.00 feet.

Zero of Gage-Elevation 700.47.

CORPS OF ENGINEERS, U.S. ARMY
ROCK ISLAND, ILLINOIS, DISTRICT

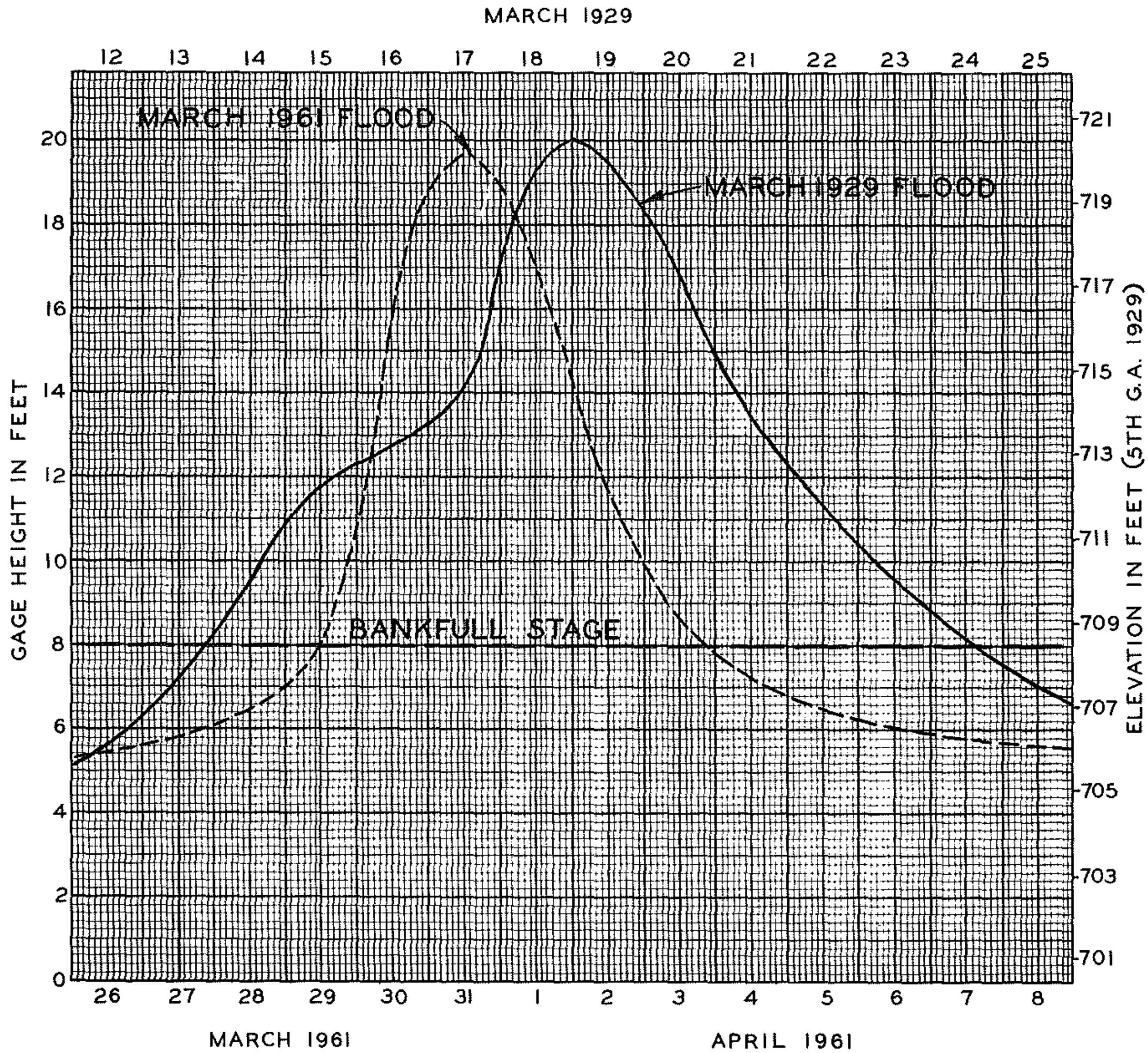
FLOODS ABOVE BANKFULL STAGE

CEDAR RIVER

LINN COUNTY, IOWA

SEPTEMBER 1967

PLATE 2



RIVER GAGE AT
MILE 118.35

CORPS OF ENGINEERS, U.S. ARMY
ROCK ISLAND, ILLINOIS, DISTRICT

STAGE HYDROGRAPHS

CEDAR RIVER

LINN COUNTY, IOWA

MARCH 1967

Velocities

During the March 1961 flood, it is estimated that velocities in the channel of the Cedar River in the vicinity of Cedar Rapids ranged up to 8 feet per second. Overbank velocities ranged up to 3 feet per second. During larger floods, velocities would be greater.

Flooded Areas, Flood Profiles and Cross Sections

Plates 7 through 17 show the approximate areas along the Cedar River in Linn County, Iowa, which would be inundated by the Intermediate Regional Flood and by the Standard Project Flood. The actual limits of these overflow areas on the ground may vary some from those shown on the map. The 5-foot contour interval and the scale of the topographic maps preclude precise plotting of the flooded area boundaries.

Plates 18, 19, 19A and 20 show the high water profile for the flood of March 1961. Also shown are the profiles for the Intermediate Regional Flood and the Standard Project Flood discussed in Section III of this report. It is suggested that elevations from the water surface profiles be used to determine flooded area boundaries for specific locations.

Plates 21 and 22 show cross sections that are typical of the 133 sections obtained for the Cedar River in the reach investigated. The locations of all sections are shown on Plates 7 through 17. The elevation and extent of overflow of the Intermediate Regional Flood and the Standard Project Flood are indicated on these typical cross sections.

FLOOD DESCRIPTIONS

Descriptions of known large floods that have occurred on the Cedar River near Cedar Rapids, Iowa are based on field investigations, newspaper accounts and historical records.

Flood of 31 March 1961

The flood of March 1961 was produced by the rapid melting of very heavy snow cover supplemented by rain showers. One of the heaviest snowfalls of record occurred on 7 and 8 March. Typical amounts of snowfall and water content observed for this 24-hour storm were: Charles City, 14 inches of snow with 1.47 inches water content; Marble Rock, 8 inches snow with 1.25 inches water content. Temperatures up to 24 March were low enough to prevent appreciable runoff from the earlier snow storm. On 24 March the temperature rose to the 60's and remained for 3 days causing a rapid rate of runoff to the Cedar River. The resulting runoff produced the maximum recorded flood flow along the main stem of the Cedar River and on several of the major tributaries. The flood crested at Cedar Rapids on 31 March with a peak discharge of 73,000 cubic feet per second at a stage of 19.66 feet.

Flood of April and May, 1965

The winter of 1964-1965 was unusually cold through northern Iowa. An early and severe cold period followed by continued subnormal temperatures froze the ground to a considerably greater depth than usual. A deep snow cover accumulated during the winter because of the sustained cold weather and above normal precipitation. At St. Paul, the Weather Bureau recorded a total winter snowfall of

73 inches compared to a normal of 45 to 50 inches. Heavy rains during the last part of March were absorbed by the existing snow cover with little runoff. In early April, rising temperatures began a rapid snow-melt. Most of the melting snow ran off because the ground was frozen. The resulting flood at Cedar Rapids was the second largest recorded flow. Peak discharge was 66,800 cubic feet per second at a stage of 18.5 feet at the gage in Cedar Rapids.

Flood of March 1929

This flood was caused by conversion of heavy ice and snow cover to runoff by a sudden rise in temperature in combination with rainfall. The total volume of flood discharge represented 3.2 inches from the entire basin above the gage at Cedar Rapids. The peak discharge was 64,000 cubic feet per second at a stage of 20.0 feet at the gaging station at Cedar Rapids. This flood was similar both in cause and effect to the 1961 flood and is the fourth largest flood flow of record.

Additional large floods are tabulated in Table 5. Figures 12 through 15 show typical flood scenes for selected floods of Table 5 in the reach of the Cedar River covered by this report.

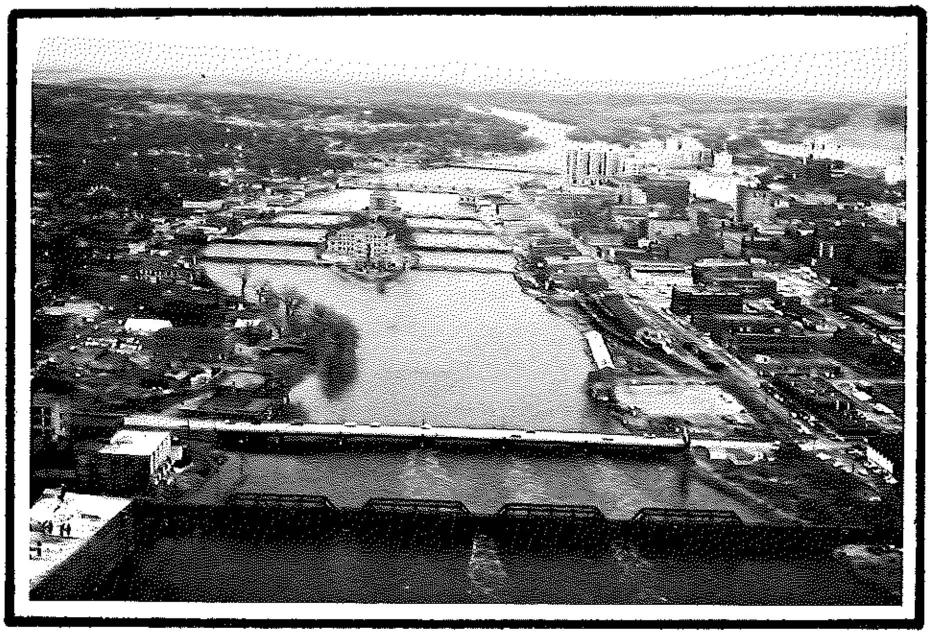
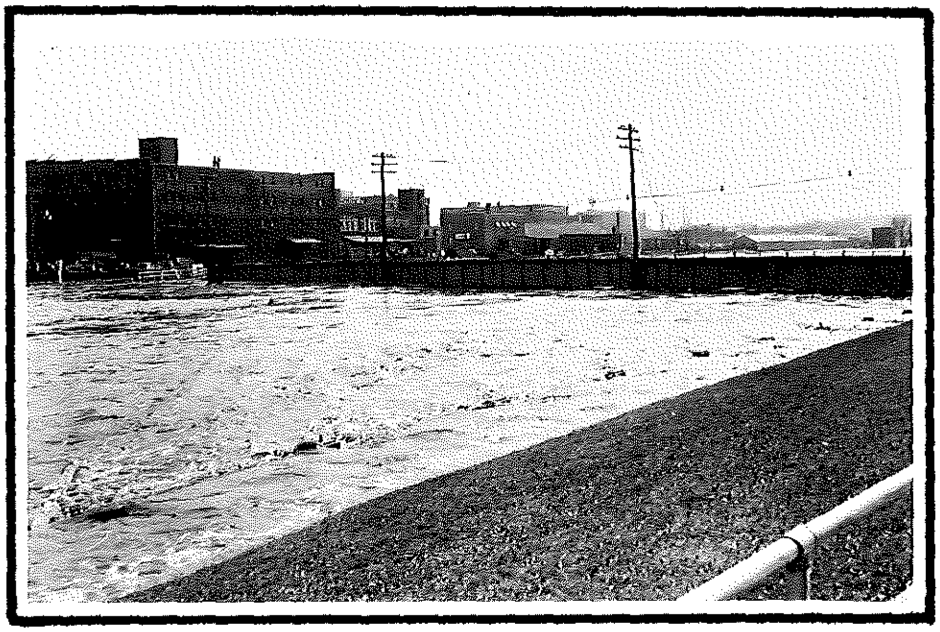


Figure 12. FLOOD SCENES - 31 March 1961.
Bottom view is looking upstream with 16th Avenue bridge in the foreground.
Top view is looking upstream with the C.M.St.P. and P. R.R. bridge and 8th Avenue bridge in the foreground and city government buildings on the island in the center of the photo.



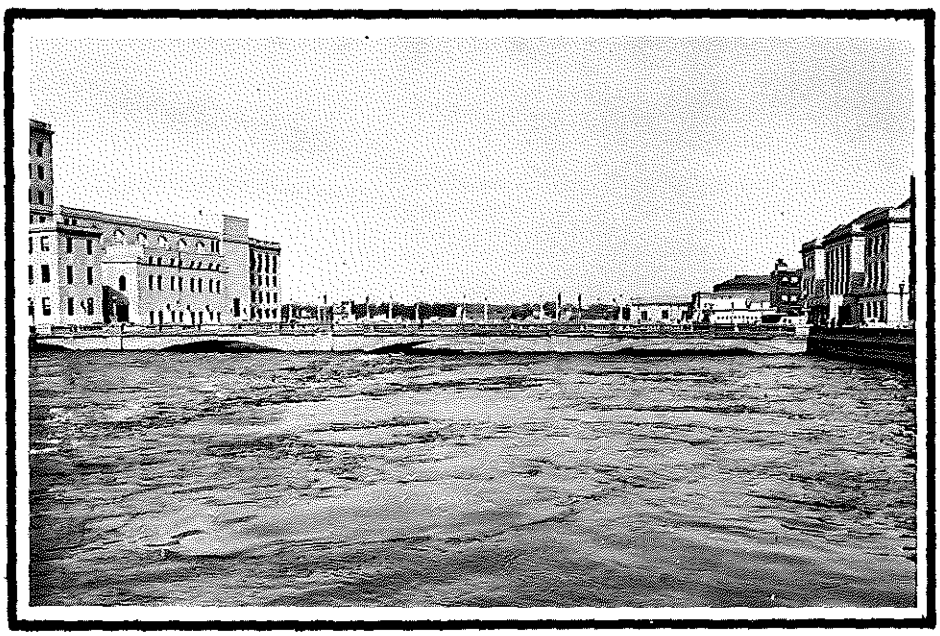
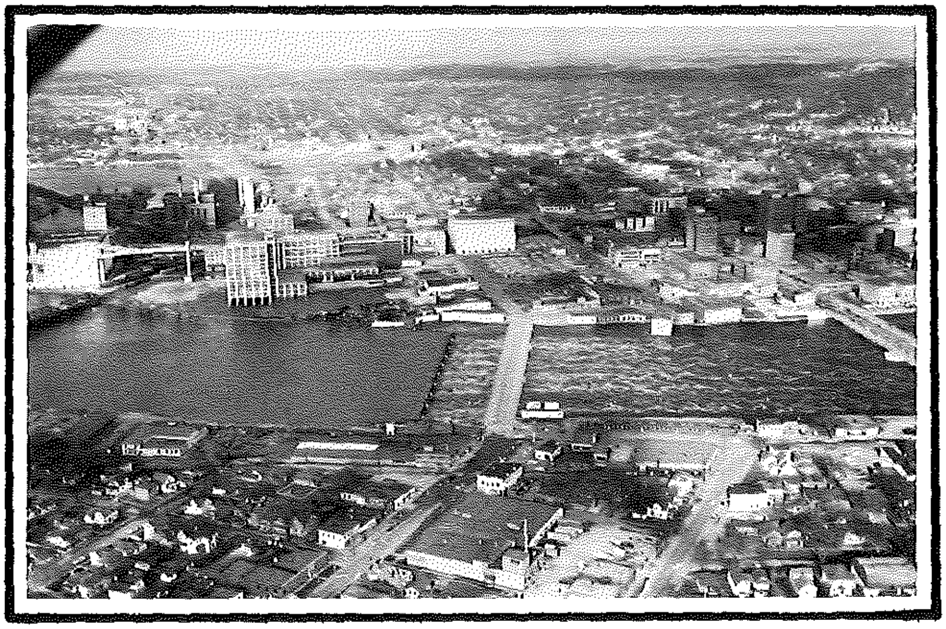


Figure 13. FLOOD SCENES - 31 March 1961.
Top view is looking downstream toward the C.R. and I.C. R.R. bridge. Superstructure of this bridge was removed in 1967.
Bottom view is looking upstream toward the 2nd Avenue bridge on the east side of the island.



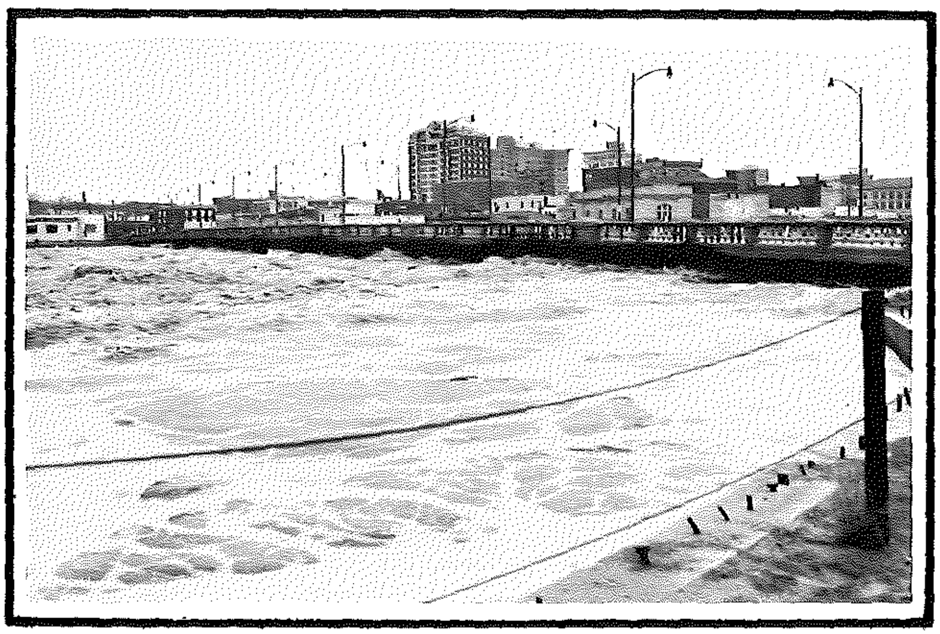


Figure 14. FLOOD SCENES - 31 March 1961.
Top view shows 1st Avenue bridge in the extreme right of the photo and B Avenue bridge and the Iowa Electric Power and Light Company dam in the center.
Bottom view shows the upstream side of the B Avenue bridge.

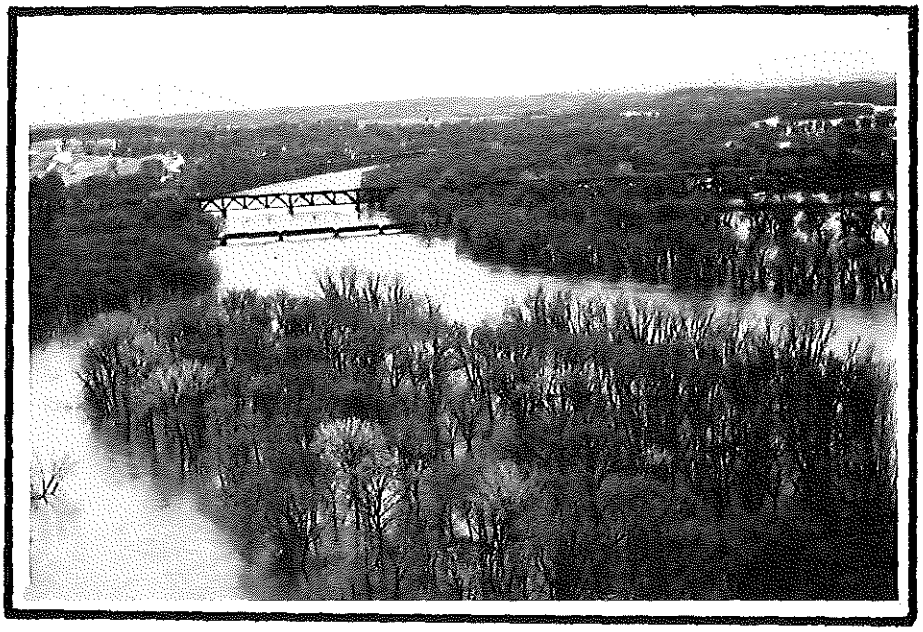


Figure 15. FLOOD SCENES - 31 March 1961.
Top view is looking downstream at the C.R.I. and P. R.R. bridge at Mile 126.56 and the C.M.St.P. and P. R.R. bridge at Mile 126.44.
Bottom view is the County Road bridge near Palo at Mile 129.74. Note the submerged approaches to the bridges and flooded overbank areas.

FUTURE FLOODS

This section of the report discusses the Standard Project Flood and the Intermediate Regional Flood on the study reach of the Cedar River and some of the hazards of great floods.

A Standard Project Flood is a severe flood of infrequent occurrence. The Standard Project Flood concept was developed by the U. S. Army Corps of Engineers. A flood of greater magnitude can possibly occur. However, the Standard Project Flood provides an estimate of the upper limit of flooding for any particular area and is used by the Corps of Engineers to compare floods at different locations throughout the United States.

The Intermediate Regional Flood represents floods that may be expected to occur more frequently than the Standard Project Flood. Either flood could occur during any year.

Large floods from heavy storms have occurred on other streams in the general geographical region of this study. Similar heavy storms could occur over the Cedar River watershed and could cause floods comparable to those experienced on neighboring streams. To determine future floods which may occur on the Cedar River, it is desirable to consider storms and floods that have occurred in the same geographic region. Table 6 lists the maximum known floods and corresponding peak flows which have occurred at U.S.G.S. gaging stations in the region of this study area.

Unfortunately, when Standard Project and Intermediate Regional Flood data are presented, some people believe that these floods will probably not happen during their lifetime and tend to ignore the potential problems. Although the Intermediate Regional Flood has an average frequency of occurrence on the order of once in 100 years and the Standard Project Flood occurs less frequently, either flood can happen in any given year.

DETERMINATION OF INTERMEDIATE REGIONAL FLOODS

The Intermediate Regional Flood is defined as a flood having an average frequency of occurrence on the order of once in 100 years, at a designated location. Some probability estimates are based on statistical analyses of streamflow records available for the watershed under study. Limitations in the streamflow records usually require analyses of rainfall and runoff characteristics in the general region of the study area. The Intermediate Regional Flood represents a major flood, although it is much less severe than the Standard Project Flood.

Statistical studies were made to determine the Intermediate Regional Flood for the Cedar River study area using the 46-year record of known flood data for the Cedar River at Cedar Rapids, Iowa. Table 6 lists the maximum known floods which have occurred on the Cedar River and on similar basins in the same geographical region. The study results show that the Intermediate Regional Flood peak discharge is 126,000 cubic feet per second at the gaging station at Cedar Rapids.

Intermediate Regional Floods may occur on the Cedar River in the reach investigated that would be from 3 to 8 feet higher than the March 1961 flood depending on location. The March 1961 flood flow was 73,000 cubic feet per second and is the maximum flood of record at the gaging station at Cedar Rapids.

TABLE 6

MAXIMUM KNOWN FLOOD DISCHARGES ON

STREAMS IN THE REGION OF CEDAR RAPIDS, IOWA

Stream	Location	Drainage Area sq. mi.	Date	Peak Discharge Amount cfs	Peak Discharge Per Sq Mi cfs
Cedar River	Little Cedar River near Ionia	306	March 27, 1961	10,800	35
	At Waterloo	5,146	March 29, 1961	76,700	15
	At Cedar Rapids	6,510	March 31, 1961	73,000	11
	At Conesville	7,785	April 2, 1961	70,800	9
Wapsipinicon River	Near Elma	95.2	March 29, 1962	5,700	60
	At Independence	1,048	June 14, 1947	21,500	21
	Near DeWitt	2,330	June 27, 1944	26,000	11
Iowa River	Near Rowen	429	June 21, 1954	8,460	20
	At Belle Plains	2,455	June 5, 1918	43,000	18
	At Iowa City	3,271	June 1851	70,000	21
	At Lone Tree	4,293	September 22, 1965	31,200	7
Des Moines River	Near Boone	5,511	June 22, 1954	57,400	10
	At Des Moines below Racoon River	9,879	June 26, 1947	77,000	8
	At Ottumwa	13,374	May 31, 1903	140,000	10
Turkey River	Crane Creek Near Lourdes	75.8	August 31, 1962	11,900	157
	At Elkader	891	June 1, 1916	30,000	34
	At Garber	1,545	February 23, 1922	32,300	21

TABLE 6 (continued)

Stream	Location	Drainage Area sq. mi.	Date	Peak Discharge Amount cfs	Peak Discharge Per Sq Mi cfs
Upper Iowa River	At Decorah	511	March 27, 1961	20,200	40
	Near Decorah	568	May 29, 1941	28,500	50
Maquoketa River	Near Manchester	305	June 15, 1925	25,400	83
	Near Maquoketa	1,553	June 27, 1941	48,000	31

DETERMINATION OF STANDARD PROJECT FLOODS

Only in rare instances has a specific stream experienced the largest flood that is likely to occur. Severe as the maximum known flood may have been on any stream, it is commonly accepted that a larger flood can and probably will occur. The Corps of Engineers, in cooperation with the Weather Bureau, has made comprehensive studies and investigations based on records of experienced storms and floods. Generalized procedures have been developed to estimate the flood potential of streams. These procedures have been used to determine the Standard Project Flood. It is defined as the largest flood that can be expected from the most severe combination of meteorologic and hydrologic conditions that are reasonably characteristic of the geographical region involved.

Standard Project Flood estimates made along the Cedar River indicate storm rainfall would be 7.2 inches occurring in a 96-hour period. Table 7 lists peak discharges at specific locations along the Cedar River for the Standard Project and the Intermediate Regional Floods.

TABLE 7

PEAK DISCHARGES

Location	Stream Mile	Drainage Area Sq. Mi.	Intermediate Regional Flood Disch cfs	Standard Project Flood Disch cfs
South Linn County Line	97.55	6,997	130,600	175,200
USGS Gage	118.35	6,510	126,000	169,000
North Linn County Line	140.62	6,143	122,400	164,200

Frequency

The occurrence of the Standard Project Flood would be a rare event; however, it could occur in any year. Since this flood is a rare event, the assignment of a frequency would require extrapolation of the frequency curve far beyond the range of observed data. This flood is a hypotetical event representing the critical flood volume and peak discharge that may be expected from the most severe combination of meteorologic and hydrologic conditions considered reasonably characteristic of the geographic region involved, excluding extremely rare combinations. Assignment of a frequency to this flood is therefore considered impractical.

Possible Larger Floods

Floods larger than the Standard Project Flood are possible; however the combination of conditions necessary to produce such floods would seldom occur. Consideration of the Standard Project Flood should not be overlooked in the study of any flood problem. The hazard and consequences of ignoring floods of the magnitude of the Standard Project Flood must be recognized.

HAZARDS OF GREAT FLOODS

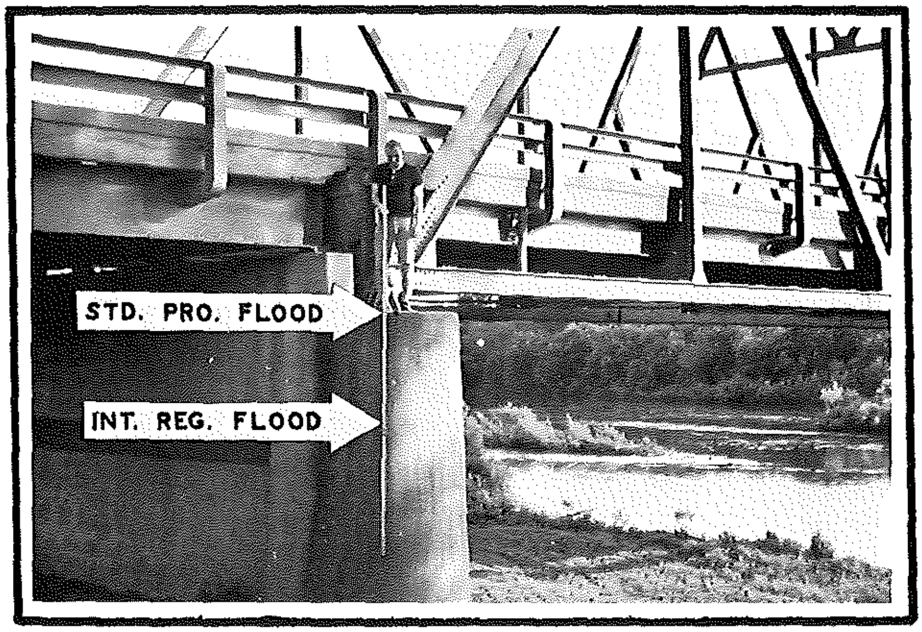
The amount and area extent of damage depends generally on the total area flooded, the height of flooding, the velocity of flow, the rate of rise and the duration of flooding.

Areas Flooded and Heights of Flooding

The areas flooded along the Cedar River in Linn County by the Intermediate Regional and Standard Project Floods are shown on plates 7 through 17. Depths of flow for the Standard Project Flood, the Intermediate Regionala Flood and the March 1961 flood can be estimated from the high water profiles shown on plates 18, 19, 19A and 20.

The high water profile for the March 1961 flood is based on observed high water marks. The high water profiles for the Intermediate Regional and Standard Project Floods were computed from stream characteristic information as determined from observed flood profiles, topographic maps and valley cross sections. The flooded areas shown on Plates 7 through 17 and the water surface elevations shown on Plates 18, 19, 19A and 20 have been determined with an accuracy consistent with the purpose of this study and the accuracy of the available basic data. The Standard Project Flood overflow in the urban area should be considered indicative only because of the effects of buildings, road and railroad fills, and other construction on the flood plain. The profiles of floods including the Intermediate Regional and Standard Project Floods depend in part on the degree of destruction or clogging of bridges. Because it is impossible to forecast these events, it was assumed that all bridge structures would stand and that no clogging would occur. Should clogging occur from debris or ice jams, the flood profiles could reach higher elevations than shown on Plates 18, 19, 19A and 20.

Figures 16 through 19 show the approximate heights which would be reached by the Standard Project and Intermediate Regional Floods on structures presently existing on the flood plain.



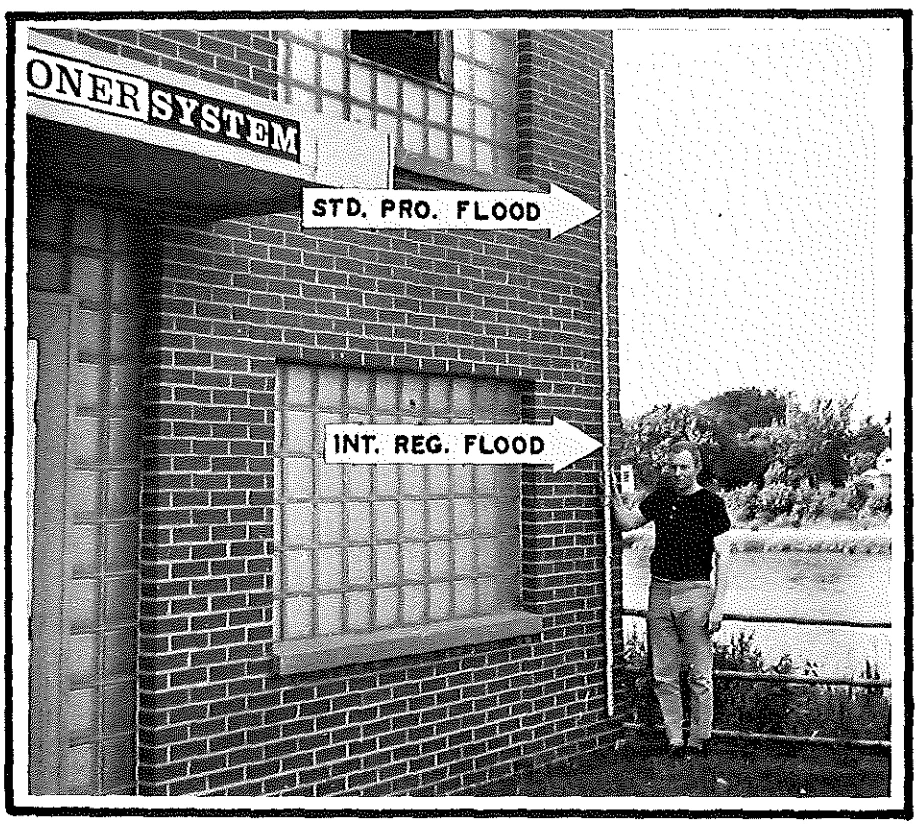
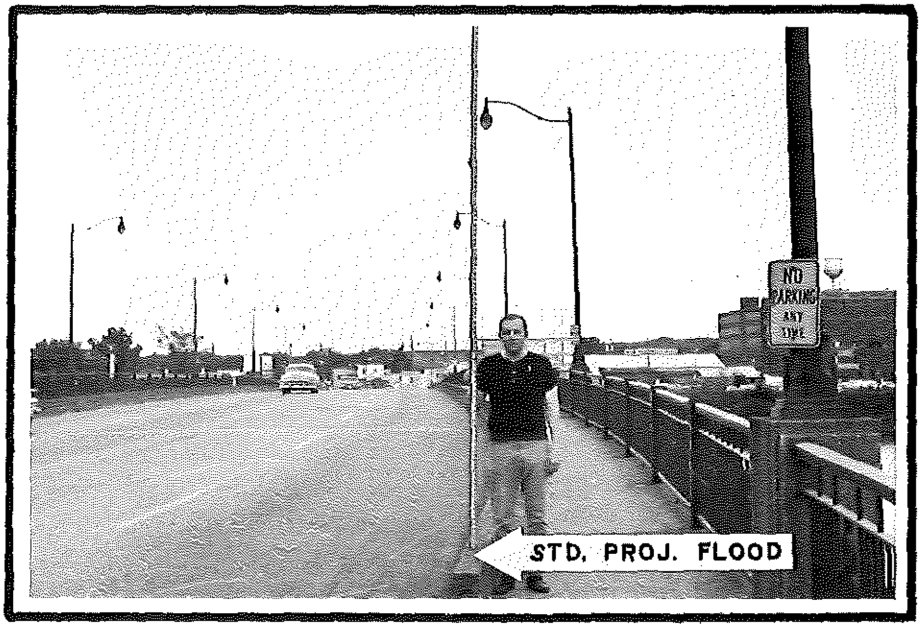


Figure 16. CEDAR RIVER FLOOD HEIGHTS
The upper view is Highway No. 1 bridge at Mile 101.40 looking downstream. The top arrow shows the Standard Project Flood height at the top of the pier.
The lower view is a building on the right bank just upstream from 16th Avenue S.W. bridge at Mile 117.82.



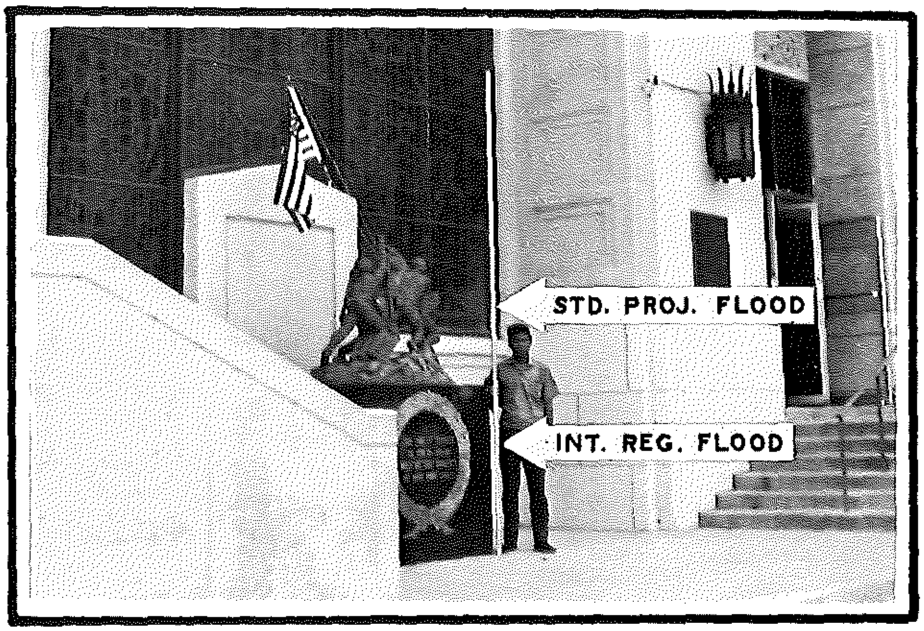
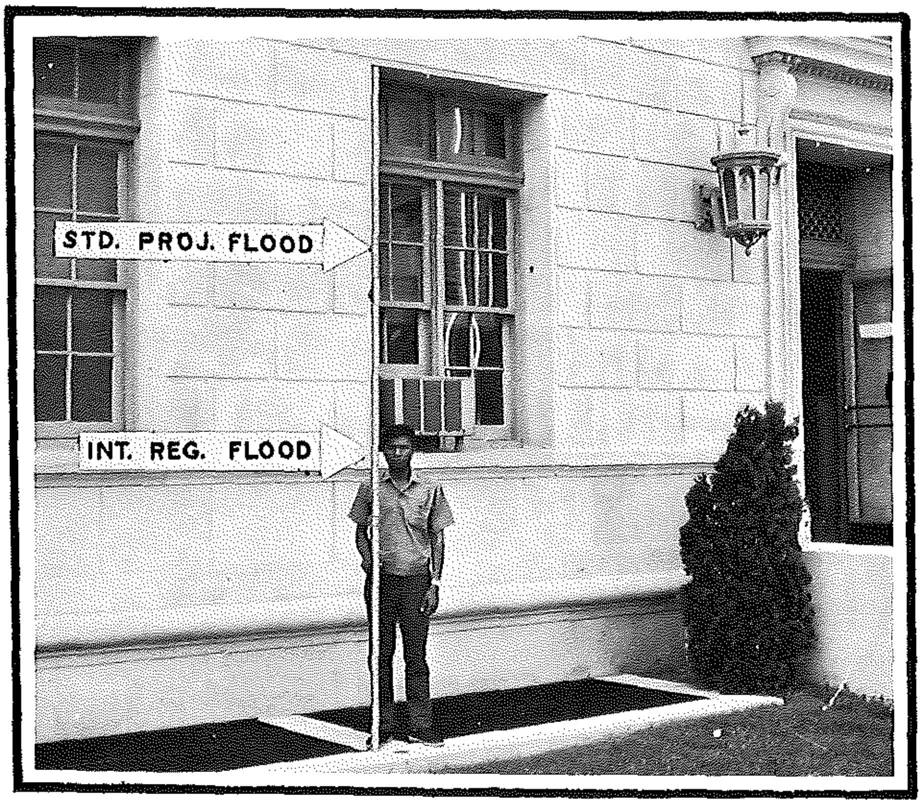


Figure 17. CEDAR RIVER FLOOD HEIGHTS
The upper view is 8th Avenue bridge at Mile 118.27. The Intermediate Regional Flood would be 4.2 feet below the base of the rod.
The lower view is the south entrance to the City Hall fronting on 2nd Avenue at Mile 118.72.



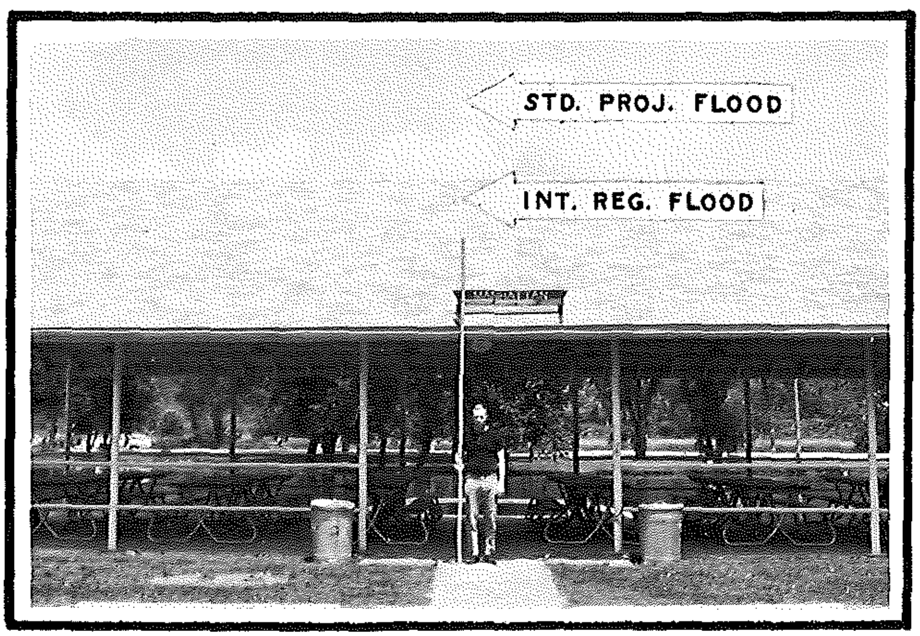
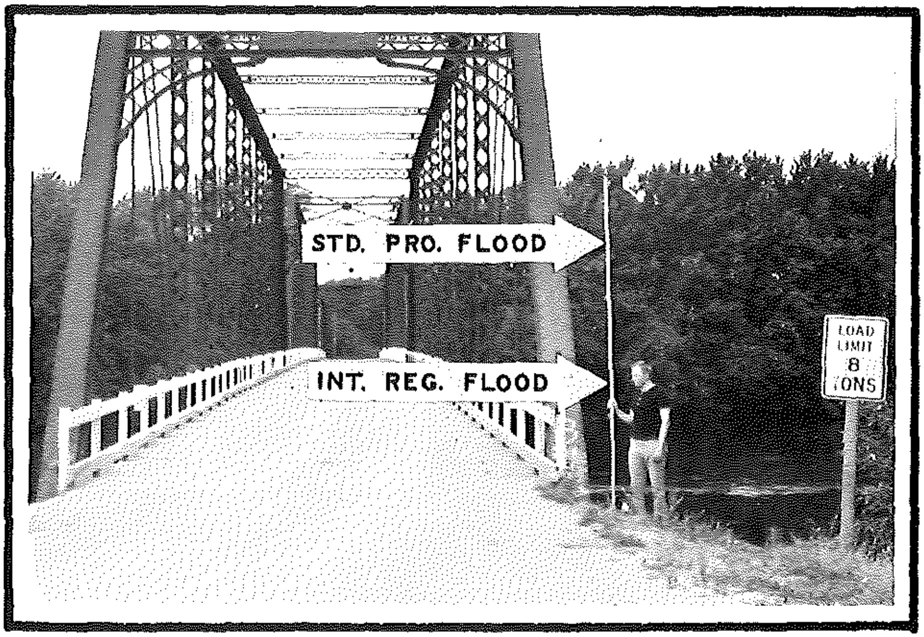


Figure 18. CEDAR RIVER FLOOD HEIGHTS
The upper view shows the southeast side of the post office fronting on 2nd Avenue at Mile 118.72.
The lower view is the Manhattan shelter in Ellis Park at Mile 121.25. The levels reached by the Intermediate Regional Flood and Standard Project Flood are shown.



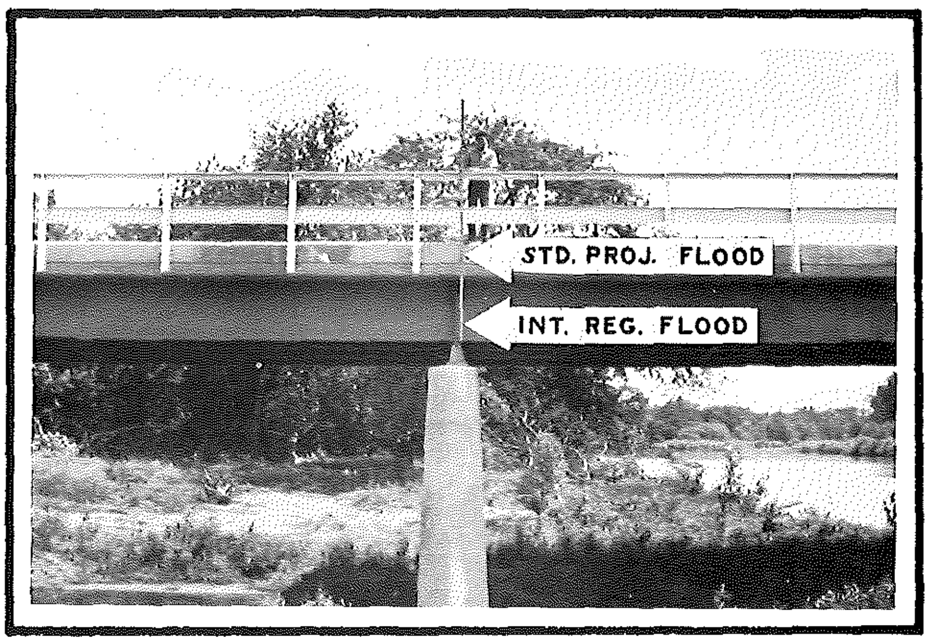


Figure 19. CEDAR RIVER FLOOD HEIGHTS
The upper view is the Palo bridge over the main channel at Mile 129.74, looking from the right bank.
The lower view is the upstream side of County Road Z bridge at Mile 138.90.

Velocities, Rates of Rise and Duration

Water velocities during floods depend largely on the size and shape of the cross section, the conditions of the stream and the bed slope, all of which vary on different streams and at different locations on the same stream. During a Standard Project Flood, channel velocities would range up to 10 feet per second. Overbank velocities would range up to 4 feet per second, depending on location. During an Intermediate Regional Flood, velocities would generally be lower than those of the Standard Project Flood.

Rates of rise and duration of flooding can assume varying degrees of importance depending on the basin characteristics and the flood plain development involved. In steep basins with well defined drainage-ways, storm runoff concentrates quickly and results in high rates of rise but relatively short flood duration. On flatter basins with considerable channel and overbank storage for flood waters, rates of rise may be considerably lower but duration of flooding may be for longer periods. During a Standard Project Flood on the Cedar River, the stream would rise 29 feet in 5 days. Maximum rate of rise would be one foot per hour and the stream would remain out of banks for 8 days.

These rates of rise and high stream velocities in combination with relatively long-duration flooding would create a hazardous situation in developed areas. Health problems and the danger from underestimating the velocity and depth of flood waters are obvious hazards. Velocities greater than 3 feet per second in combination with depths of 3 feet or greater are generally considered hazardous. Velocities of 2 feet per second combined with depths of 2 feet produce undesirable conditions.

GLOSSARY OF TERMS

Flood. An overflow of lands not normally covered by water and that are used or useable 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 later 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 rainfall and runoff characteristics in the "general region of the watershed."

Left Bank. The bank on the left side of a river, stream, or water course, looking downstream.

Low Steel (or Underclearance). See "Underclearance".

Right Bank. The bank on the right side of a river, stream, or water course, looking downstream.

Standard Project Flood. The flood that may be expected from the most severe combination of meteorological and hydrological conditions that is 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 water course 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 the Flood Control Act of 1960 (Public Law 86-645), as amended.

Assistance and cooperation of the U. S. Geological Survey, Weather Bureau (E.S.S.A.), Iowa Natural Resources Council, Linn County, City of Cedar Rapids and private citizens in supplying useful data are appreciated.

Special commendations are extended to Mr. William Harrington, Linn County Engineer and to Mr. William Behrens for their cooperation in acquiring adequate topographic mapping of the study area.

This report presents the flood situation caused by the Cedar River in Linn County, Iowa. The Rock Island District of the Corps of Engineers will provide interpretation and limited technical assistance in application of the data presented herein.

NOTES:
1. PLATE NUMBER CORRESPOND TO TOPOGRAPHIC MAPS OF FLOODED AREAS.
2. STATIONING IS MEASURED IN MILES FROM THE MOUTH OF CEDAR RIVER.
3. AERIAL MOSAIC OF JUNE 1947.

FLOOD PLAIN INFORMATION REPORT
LINN COUNTY, IOWA

INDEX SHEET
FOR
FLOODED AREA MAPS

CEDAR RIVER
MILE 97.5 TO MILE 110.4

1000 0 3000 6000 9000
APPROX. SCALE IN FEET

U. S. ARMY ENGINEER DISTRICT
ROCK ISLAND, ILLINOIS
MARCH 1967

NOTES:
1. PLATE NUMBER CORRESPOND TO TOPOGRAPHIC MAPS OF FLOODED AREAS.
2. STATIONING IS MEASURED IN MILES FROM THE MOUTH OF CEDAR RIVER.
3. AERIAL MOSAIC OF JUNE 1947.

FLOOD PLAIN INFORMATION REPORT
LINN COUNTY, IOWA

INDEX SHEET
FOR
FLOODED AREA MAPS

CEDAR RIVER
MILE 110.4 TO MILE 129.4

1000 0 3000 6000 9000
APPROX. SCALE IN FEET

U. S. ARMY ENGINEER DISTRICT
ROCK ISLAND, ILLINOIS
MARCH 1967

NOTES:
1. PLATE NUMBER CORRESPOND TO TOPOGRAPHIC MAPS OF FLOODED AREAS.
2. STATIONING IS MEASURED IN MILES FROM THE MOUTH OF CEDAR RIVER.
3. AERIAL MOSAIC OF JUNE 1947.

FLOOD PLAIN INFORMATION REPORT
LINN COUNTY, IOWA

INDEX SHEET
FOR
FLOODED AREA MAPS

CEDAR RIVER
MILE 129.4 TO MILE 140.6

1000 0 3000 6000 9000
APPROX. SCALE IN FEET

U. S. ARMY ENGINEER DISTRICT
ROCK ISLAND, ILLINOIS
MARCH 1967

LEGEND

INTERMEDIATE REGIONAL FLOOD

STANDARD PROJECT FLOOD

99.0 DISTANCE FROM MOUTH OF CEDAR RIVER IN MILES.

[5] LOCATION OF CROSS SECTION

NOTE:
1. ELEVATIONS BASED ON U.S.C. & G.S.
2. DATE OF PHOTOGRAPHY APRIL 1966.
3. CONTOUR INTERVAL 5 FEET.

FLOOD PLAIN INFORMATION REPORT
LINN COUNTY, IOWA

TOPOGRAPHIC MAP OF FLOODED AREA
CEDAR RIVER
MILE 97.5 TO MILE 100.1

1000 0 1000 2000
SCALE IN FEET

U. S. ARMY ENGINEER DISTRICT
ROCK ISLAND, ILLINOIS
APRIL 1967

CORPS OF ENGINEERS

U.S. ARMY

PLATE 8

LEGEND:

- INTERMEDIATE REGIONAL FLOOD
- STANDARD PROJECT FLOOD

109.0 DISTANCE FROM MOUTH OF CEDAR RIVER IN MILES.

35 LOCATION OF CROSS SECTION

NOTE:
1. ELEVATIONS BASED ON U.S.C.&G.S
2. DATE OF PHOTOGRAPHY APRIL 1966.
3. CONTOUR INTERVAL 5 FEET.

FLOOD PLAIN INFORMATION REPORT
LINN COUNTY, IOWA

TOPOGRAPHIC MAP OF FLOODED AREA
CEDAR RIVER

MILE 106.8 TO MILE 110.4

1000 0 1000 2000
SCALE IN FEET

U.S. ARMY ENGINEER DISTRICT
ROCK ISLAND, ILLINOIS
APRIL 1967

LEGEND:

- INTERMEDIATE REGIONAL FLOOD
- STANDARD PROJECT FLOOD

113.0 DISTANCE FROM MOUTH OF CEDAR RIVER IN MILES.

51 LOCATION OF CROSS SECTION

N

NOTE:
1. ELEVATIONS BASED ON U.S.C. & G.S.
2. ELEVATIONS ALSO INDICATED IN CITY DATUM. ZERO CITY DATUM 627.42 FEET (U.S.C. & G.S.)
3. DATE OF PHOTOGRAPHY APRIL 1956
4. CONTOUR INTERVAL 5 FEET.

FLOOD PLAIN INFORMATION REPORT
LINN COUNTY, IOWA

TOPOGRAPHIC MAP OF FLOODED AREA

CEDAR RIVER
MILE 110.4 TO MILE 116.0

400 0 800 1600
SCALE IN FEET

U.S. ARMY ENGINEER DISTRICT
ROCK ISLAND, ILLINOIS
JUNE 1966

CORPS OF ENGINEERS

U. S. ARMY

PLATE 11

LEGEND:

- INTERMEDIATE REGIONAL FLOOD
- STANDARD PROJECT FLOOD

121.0 DISTANCE FROM MOUTH OF CEDAR RIVER IN MILES.

82 LOCATION OF CROSS SECTION

NOTE:
1. ELEVATIONS BASED ON U.S.C. & G.S.
2. ELEVATIONS ALSO INDICATED IN CITY DATUM. ZERO CITY DATUM 627.42 FEET (U.S.C. & G.S.)
3. DATE OF PHOTOGRAPHY APRIL 1956
4. CONTOUR INTERVAL 5 FEET.

FLOOD PLAIN INFORMATION REPORT
LINN COUNTY, IOWA

TOPOGRAPHIC MAP OF FLOODED AREA
CEDAR RIVER
MILE 119.3 TO MILE 123.5

400 0 800 1600
SCALE IN FEET

U.S. ARMY ENGINEER DISTRICT
ROCK ISLAND, ILLINOIS
JUNE 1966

LEGEND:

INTERMEDIATE REGIONAL FLOOD

STANDARD PROJECT FLOOD

126.5 DISTANCE FROM MOUTH OF CEDAR RIVER IN MILES.

93 LOCATION OF CROSS SECTION

NOTE:
1. ELEVATIONS BASED ON U.S.C. & G.S.
2. DATE OF PHOTOGRAPHY APRIL 1966.
3. CONTOUR INTERVAL 5 FEET.

FLOOD PLAIN INFORMATION REPORT
LINN COUNTY, IOWA

TOPOGRAPHIC MAP OF FLOODED AREA

CEDAR RIVER
MILE 123.5 TO MILE 129.3

400 0 800 1600
SCALE IN FEET

U.S. ARMY ENGINEER DISTRICT
ROCK ISLAND, ILLINOIS
JUNE 1966

CORPS OF ENGINEERS U. S. AR

PLATE 14

LEGEND:

INTERMEDIATE REGIONAL FLOOD

STANDARD PROJECT FLOOD

105 LOCATION OF CROSS SECTION

N

NOTE:
1. ELEVATIONS BASED ON U.S.C.&G.S.
2. DATE OF PHOTOGRAPHY APRIL 1966.
3. CONTOUR INTERVAL 5 FEET.

FLOOD PLAIN INFORMATION REPORT
LINN COUNTY, IOWA
TOPOGRAPHIC MAP OF FLOODED AREA
CEDAR RIVER

400 0 800 1600
SCALE IN FEET

U.S. ARMY ENGINEER DISTRICT
ROCK ISLAND, ILLINOIS
MAY 1967


LEGEND:
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD
138.0 DISTANCE FROM MOUTH OF CEDAR RIVER IN MILES.
130 LOCATION OF CROSS SECTION
NOTE:
1. ELEVATIONS BASED ON U.S.C.&G.S.
2. DATE OF PHOTOGRAPHY APRIL 1966.
3. CONTOUR INTERVAL 5 FEET.
MATCH LINE PLATE 14
MATCH LINE PLATE 17
FLOOD PLAIN INFORMATION REPORT
LINN COUNTY, IOWA
TOPOGRAPHIC MAP OF FLOODED AREA
CEDAR RIVER
MILE 134.5 TO MILE 140.6
400 0 800 1600
SCALE IN FEET
U.S. ARMY ENGINEER DISTRICT
ROCK ISLAND, ILLINOIS
MAY 1967

LEGEND:

- INTERMEDIATE REGIONAL FLOOD
- STANDARD PROJECT FLOOD

NOTE:
1. ELEVATIONS BASED ON U.S.C.&G.S.
2. DATE OF PHOTOGRAPHY APRIL 1966.
3. CONTOUR INTERVAL 5 FEET.

FLOOD PLAIN INFORMATION REPORT
LINN COUNTY, IOWA

TOPOGRAPHIC MAP OF FLOODED AREA
CEDAR RIVER

400 0 800 1600
SCALE IN FEET

U.S. ARMY ENGINEER DISTRICT
ROCK ISLAND, ILLINOIS
MAY 1967

ELEVATION IN FEET (5TH G.A. 1929)
MILES ABOVE MOUTH
STANDARD PROJECT FLOOD
INTERMEDIATE REGIONAL FLOOD
MARCH 1961 FLOOD
STREAM BED
FLOOR
CLEARANCE
FLOOR
CLEARANCE
SECTION
HWY NO. 1
PALISADES STATE PARK DAM
HWY NO. 30
INDIAN CREEK
CORPS OF ENGINEERS, U.S. ARMY
ROCK ISLAND, ILLINOIS, DISTRICT
HIGH WATER PROFILES
CEDAR RIVER
LINN COUNTY, IOWA
APRIL 1967

PLATE 18

CORPS OF ENGINEERS, U.S. ARMY
ROCK ISLAND, ILLINOIS, DISTRICT

HIGH WATER PROFILES

CEDAR RIVER
LINN COUNTY, IOWA
APRIL 1967

PLATE 19

CORPS OF ENGINEERS, U.S. ARMY
ROCK ISLAND, ILLINOIS, DISTRICT

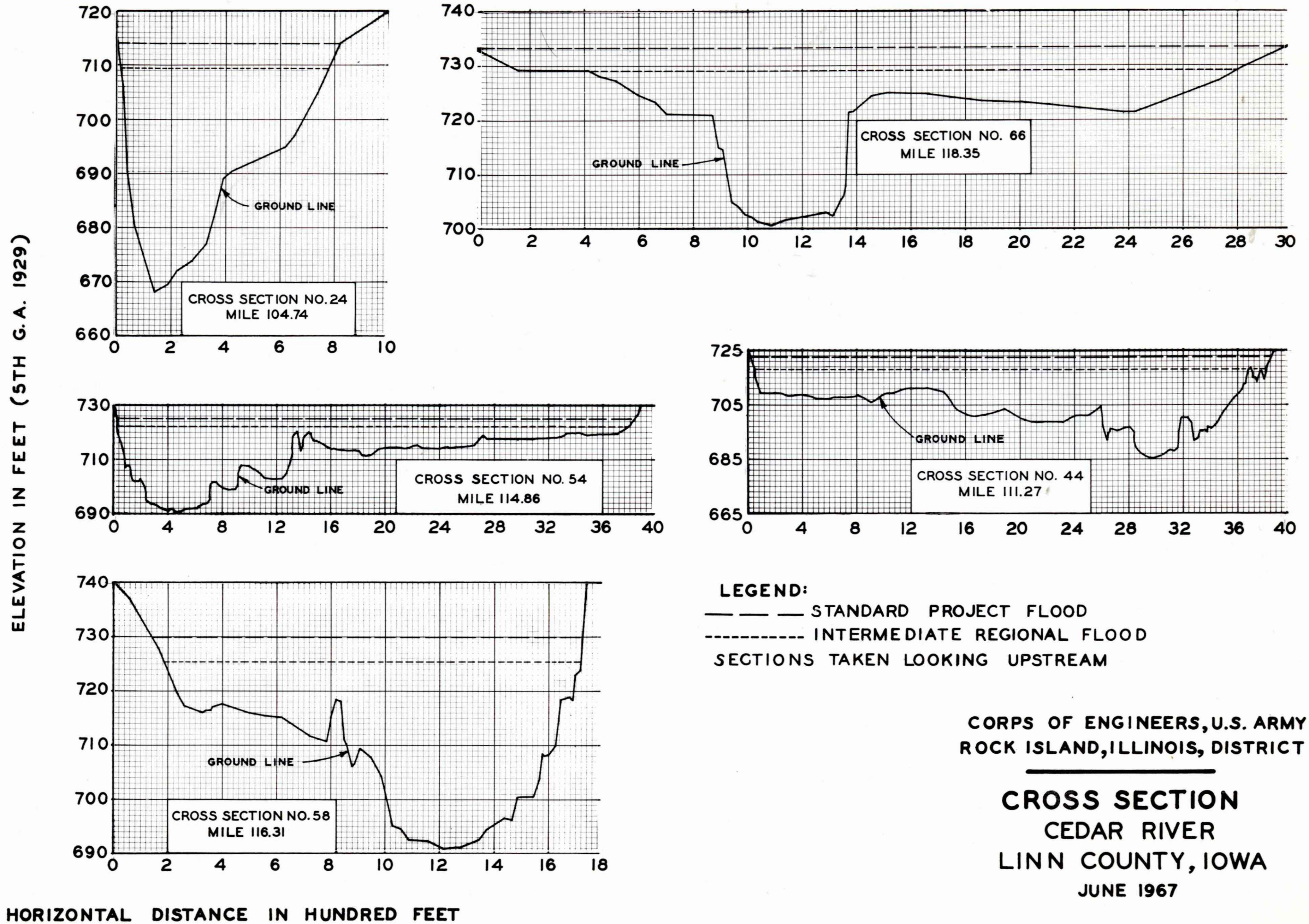
HIGH WATER PROFILES
CEDAR RIVER
LINN COUNTY, IOWA
APRIL 1967

PLATE 19A

CORPS OF ENGINEERS, U.S. ARMY
ROCK ISLAND, ILLINOIS, DISTRICT

HIGH WATER PROFILES
CEDAR RIVER
LINN COUNTY, IOWA
APRIL 1967

PLATE 20



LEGEND:

— — — STANDARD PROJECT FLOOD

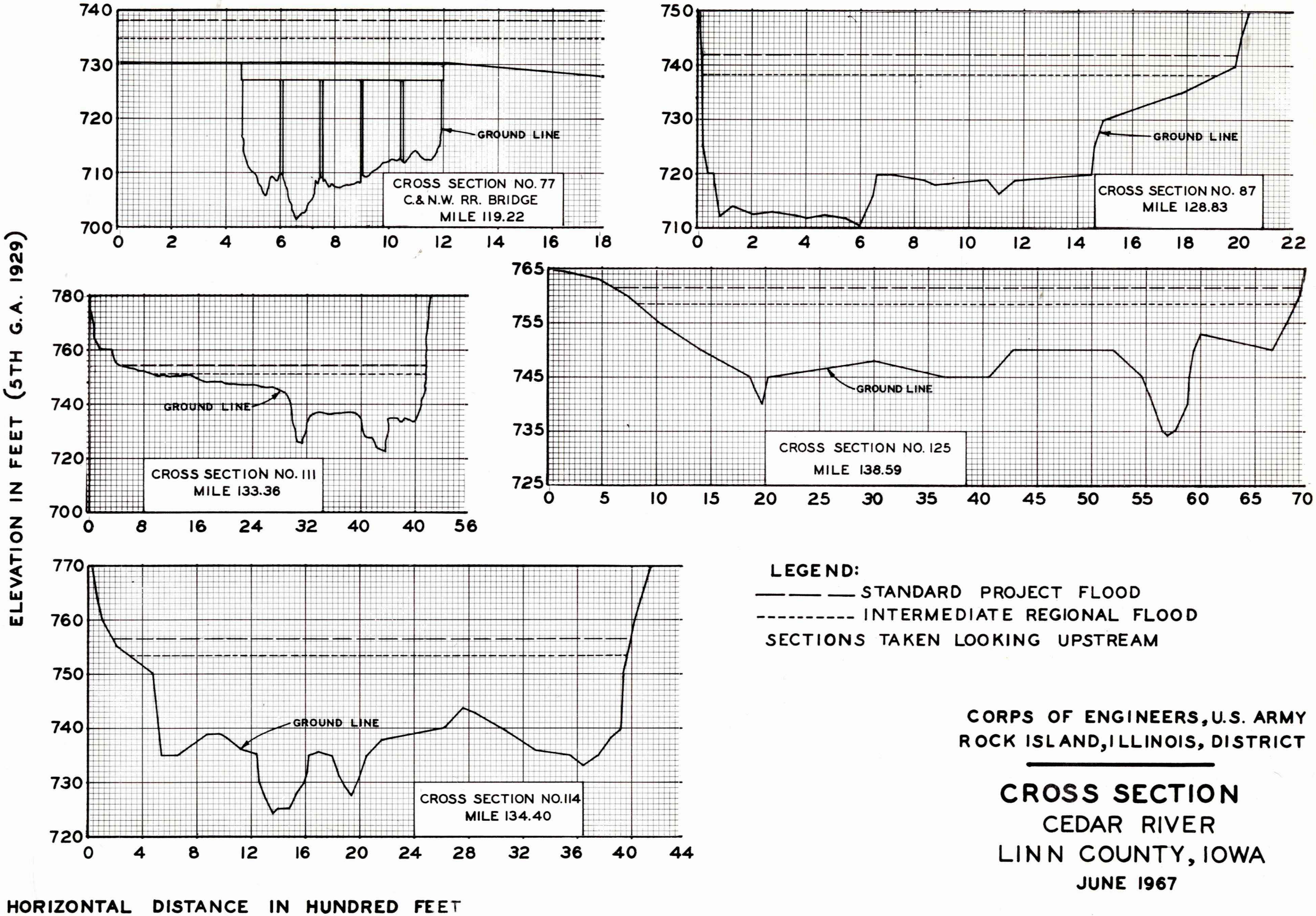
----------- INTERMEDIATE REGIONAL FLOOD

SECTIONS TAKEN LOOKING UPSTREAM

CORPS OF ENGINEERS, U.S. ARMY
ROCK ISLAND, ILLINOIS, DISTRICT

CROSS SECTION
CEDAR RIVER
LINN COUNTY, IOWA
JUNE 1967

PLATE 21



LEGEND:

——— ——— STANDARD PROJECT FLOOD

---------- INTERMEDIATE REGIONAL FLOOD

SECTIONS TAKEN LOOKING UPSTREAM

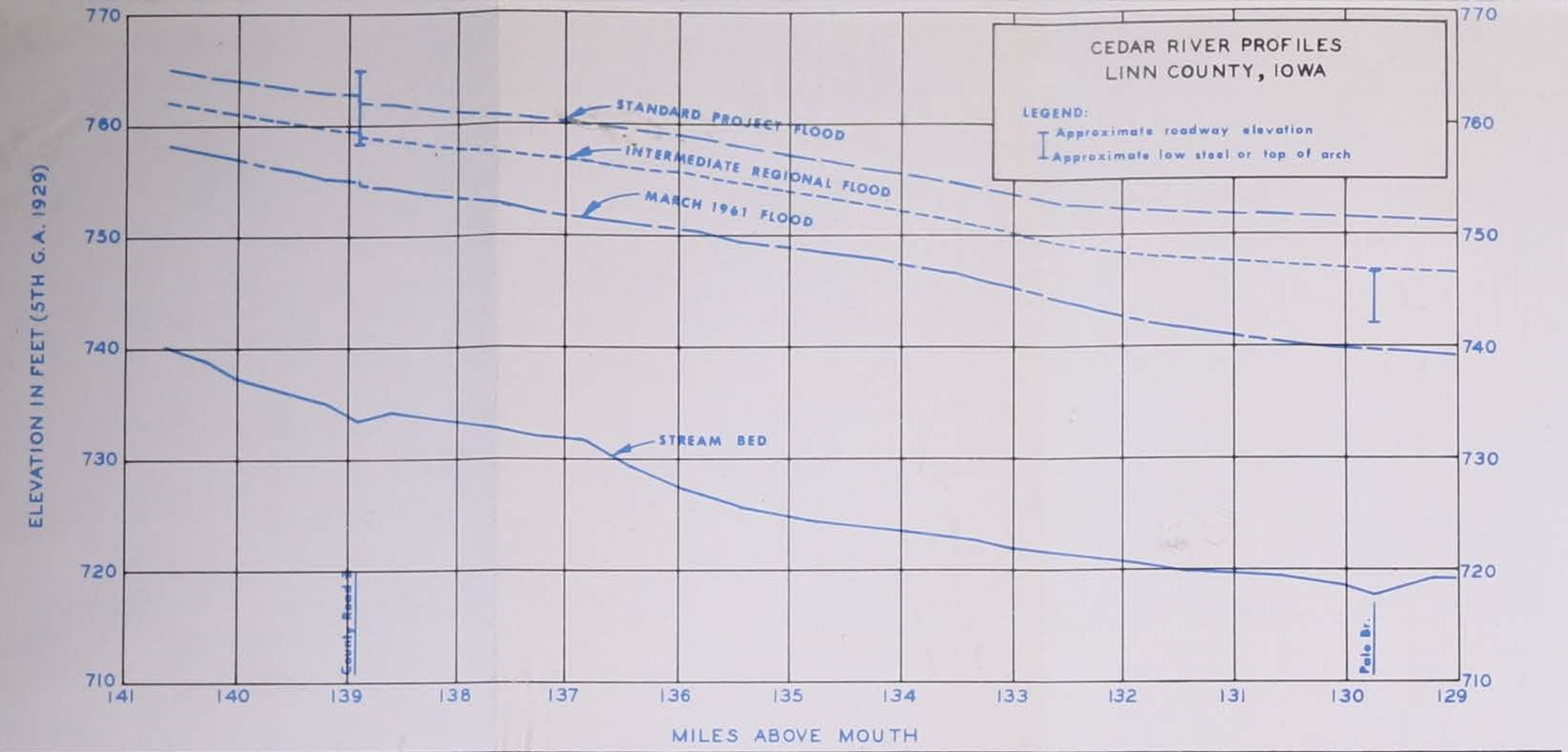
CORPS OF ENGINEERS, U.S. ARMY
ROCK ISLAND, ILLINOIS, DISTRICT

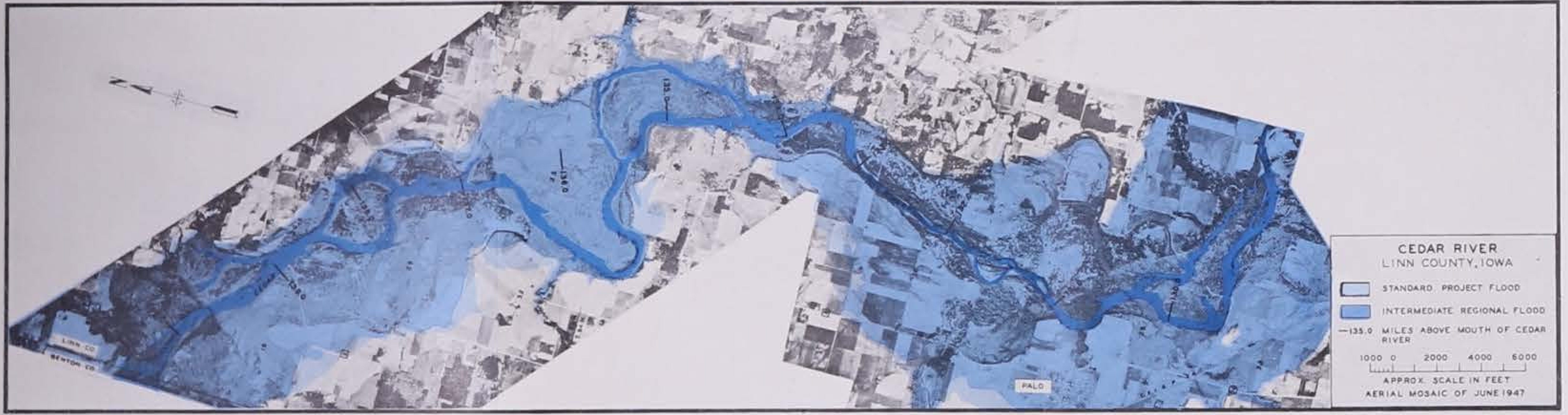
CROSS SECTION

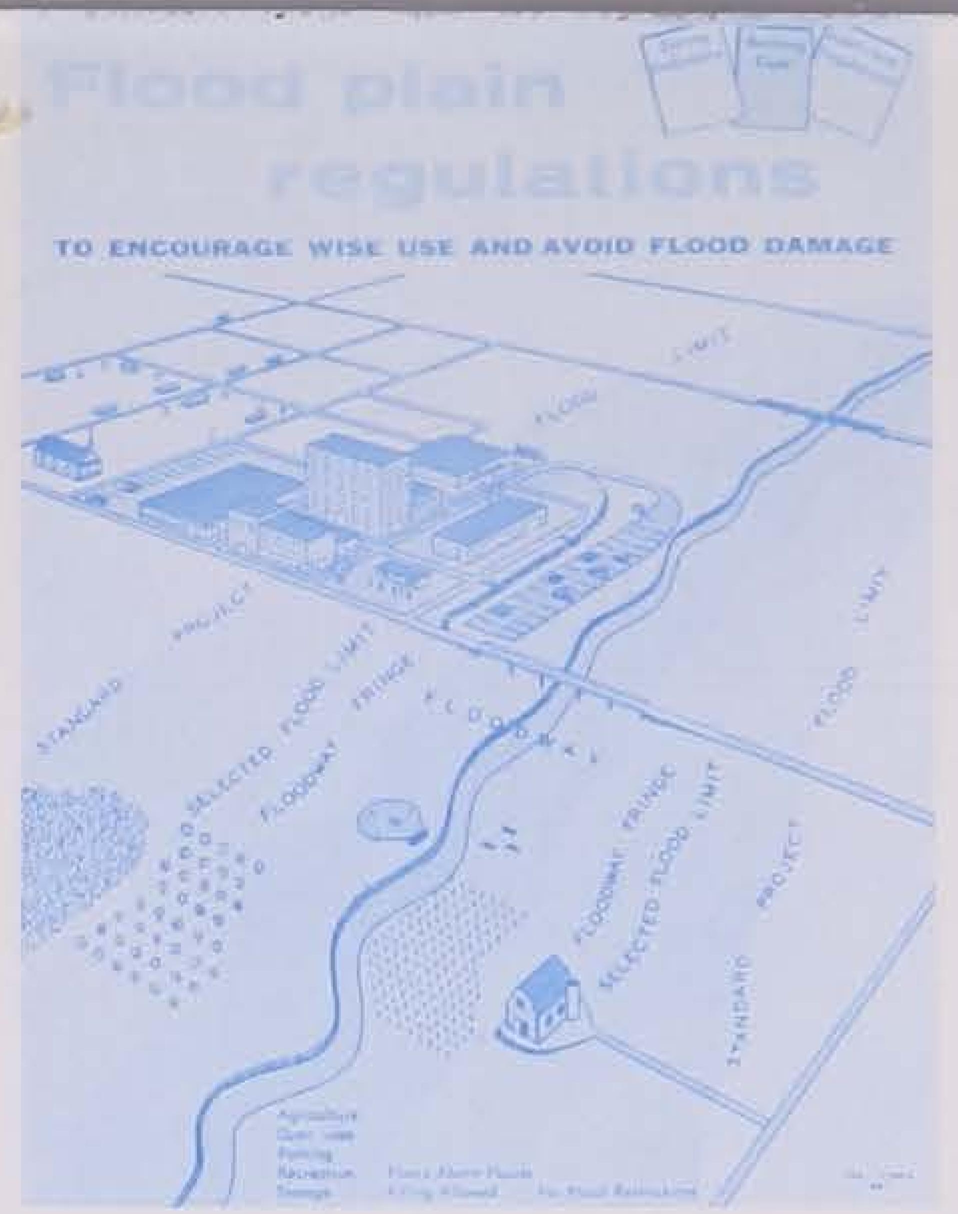
CEDAR RIVER
LINN COUNTY, IOWA

JUNE 1967

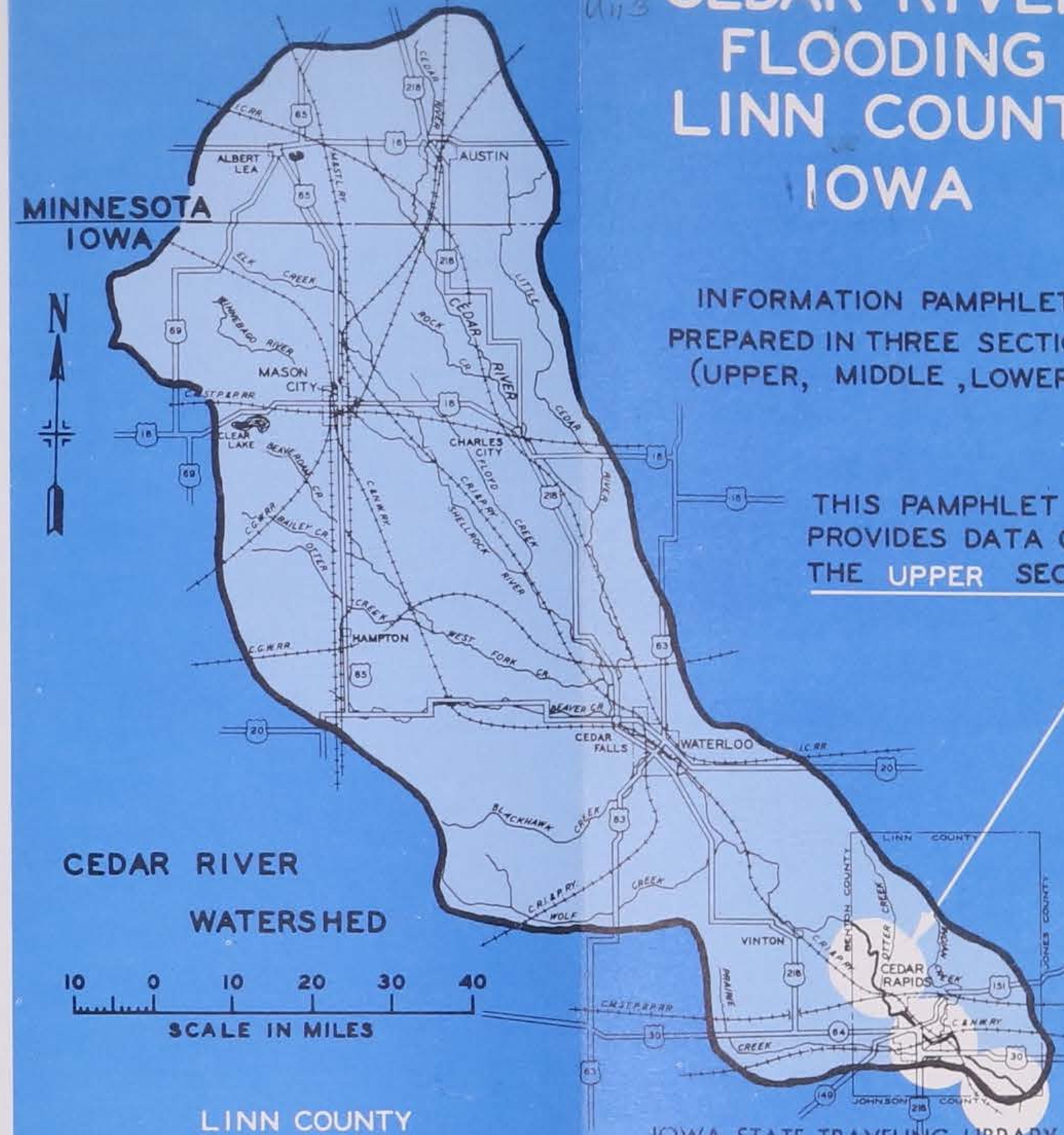
PLATE 22







An example showing the effect of channel encroachment on flood stage



CEDAR RIVER FLOODING LINN COUNTY IOWA

INFORMATION PAMPHLET
PREPARED IN THREE SECTIONS
(UPPER, MIDDLE, LOWER)

THIS PAMPHLET PROVIDES DATA ON THE UPPER SECTION

LINN COUNTY
CITY OF CEDAR RAPIDS
IOWA NATURAL RESOURCES COUNCIL
DECEMBER 1967

How to Avoid Damage

FLOOD OF MARCH 1961 ON CEDAR RIVER

Chain of Lakes Bridges near Palo

Abandoned Railroad Bridge

INTRODUCTION

This pamphlet is a summary of the Cedar River Flood Plain Information Report for Linn County, Iowa, which was prepared to enable State and local governments to disseminate the information and to utilize the report for regulation in the flood plain area.

The report does not include plans for the solution of flood problems. Rather, it provides a basis for further study and planning by all interests to minimize vulnerability to flood damages.

As shown on the reverse side hereof, the reach covered by the report was divided into three sections, namely, the lower section which covers the southern part of Cedar Rapids to the south county line, the middle section covering Cedar Rapids and suburbs, and the upper section covering the Cedar River flood plain northwest of Cedar Rapids to the west county line. A similar pamphlet was prepared for each section.

Except for the middle section, the flood plain area is not fully developed within the limits of the study area. The purpose of the flood plain report is to identify the flood plain and potential flood stages so that future developments may be regulated to make the most effective use of the area without increasing flood damages. Pictures in this pamphlet show the type of development which should be avoided in the flood plains. Also shown are the relative crest elevations of the Intermediate Regional and the Standard Project Floods.

For flood plain management to receive the necessary public support, it is important that residents of the area know the past history of flooding, the purposes and benefits of flood plain management and the ways that regulations can be coordinated with an overall plan of development for the area. Often, by ignoring the flood problem or by disregarding the flood potential, expensive development is allowed to occur in areas subject to flooding.

PAST FLOODS

The greatest flood of record on Cedar River occurred on 31 March 1961. Other major floods occurred in April 1965, June 1851, March 1929, April 1933, June 1947, March 1906, March 1917, April 1951, and April 1912, arranged in the order of their magnitude. Without major emergency flood fighting efforts, a recurrence of any of these floods in the study area would cause thousands of dollars in damages. The photographs show crest heights of the March 1961 flood and typical flood scenes on the flood plains of the reach covered by the report. The March 1961 flood is an example of an infrequent flood which has occurred in the Cedar River basin. However, floods of greater magnitude than the March 1961 flood are possible and should be taken into consideration when developing the flood plain.

FUTURE FLOODS

Floods higher than those of the past can occur. A study of floods and storms in the area surrounding Cedar Rapids and Linn County indicates that future floods could be significantly higher than past floods.

An Intermediate Regional Flood was determined from an analysis of known floods that have occurred on Cedar River. Stages for a flood of this magnitude would be 4 to 8 feet higher than those of March 1961 flood.

The Standard Project Flood represents the reasonable upper limit of expected flooding. This flood, based on storms and floods which have already occurred on the Cedar River and adjacent basins, would be significantly higher than experienced floods. Stages for a flood of this magnitude would be 6 to 12 feet higher than those of March 1961 flood.

Although a rare event, the conditions producing a Standard Project Flood could occur at any time. Therefore, the Standard Project Flood is a reasonable flood event to use in defining the flood plain area which has been or may be hereafter covered by flood water.

REDUCTION OF FUTURE FLOOD DAMAGE

The Flood Plain Information Report will be a valuable tool in minimizing future flood damages through present and future planning for the wise use and orderly development of the Cedar River flood plains. The overall plans of the community for industrial, commercial, and residential areas, for streets and utilities, and for parks and schools, can be coordinated with the need for flood plain areas to convey floodwaters. Thus a reasonable plan can be developed for the wise use of the flood plains. Proposals can be considered ranging from maintenance of reaches to be retained in a natural state (green belts in the midst of the city), through moderate development plans for park, residential and light commercial uses, to intensive development for heavy commercial and industrial areas. The present agricultural use of much of the flood plain land should not be overlooked in planning. A final plan incorporating any one or more of the above described uses may be selected by the city to conform to minimum flood protection levels and the optimum development pattern for the community.

The report contains maps, profiles, and cross sections relative to the above described floods. All water surface profile calculations are based on information which reflects current flood plain conditions.

GOOD FLOOD PLAIN USE

The flood plains of Cedar River may be attractive for some residential and commercial developments. Some method of control will be necessary to prevent a large increase in flood damages as future development increases. Flood control or protective works on a river are generally costly and are only feasible where floods are frequent and damages to existing developments are heavy. Damages to future development can be prevented by flood plain management. The objective of flood plain management is to provide for land use consistent with the flood hazard and the community land use needs. It is important that all future construction in the flood plain be regulated and regulations enforced through effective zoning, building codes, and subdivision regulations.

FLOOD PLAIN REGULATIONS

The State of Iowa and local governments have responsibility and authority for regulating developments on the flood plains. The Iowa Natural Resources Council administers Iowa Code Chapter 455A relating specifically to activities in or on the flood plains. Specific authority to zone for protection against floods is granted to counties by Code Chapter 358A and to cities and towns by Code Chapter 414 as those chapters were amended by the Sixth-First General Assembly of Iowa (1965). Flood plain regulations adopted by any city or county must be approved by the Iowa Natural Resources Council.

Cooperation of the State through the Iowa Natural Resources Council and the local communities through their governing bodies in the determination of flooding limits and the enactment and enforcement of appropriate zoning ordinances can provide effective control over use of flood plain lands. Cooperation on the part of the Resources Council includes participation in the planning functions described previously and the establishment of minimum levels of protection. Enactment of appropriate zoning ordinances consistent with the comprehensive plan and the minimum protection levels approved by the Resources Council is the responsibility of the local governments involved. Primary responsibility for enforcement of flood plain zoning ordinances will necessarily and logically remain with the local communities.

* * *

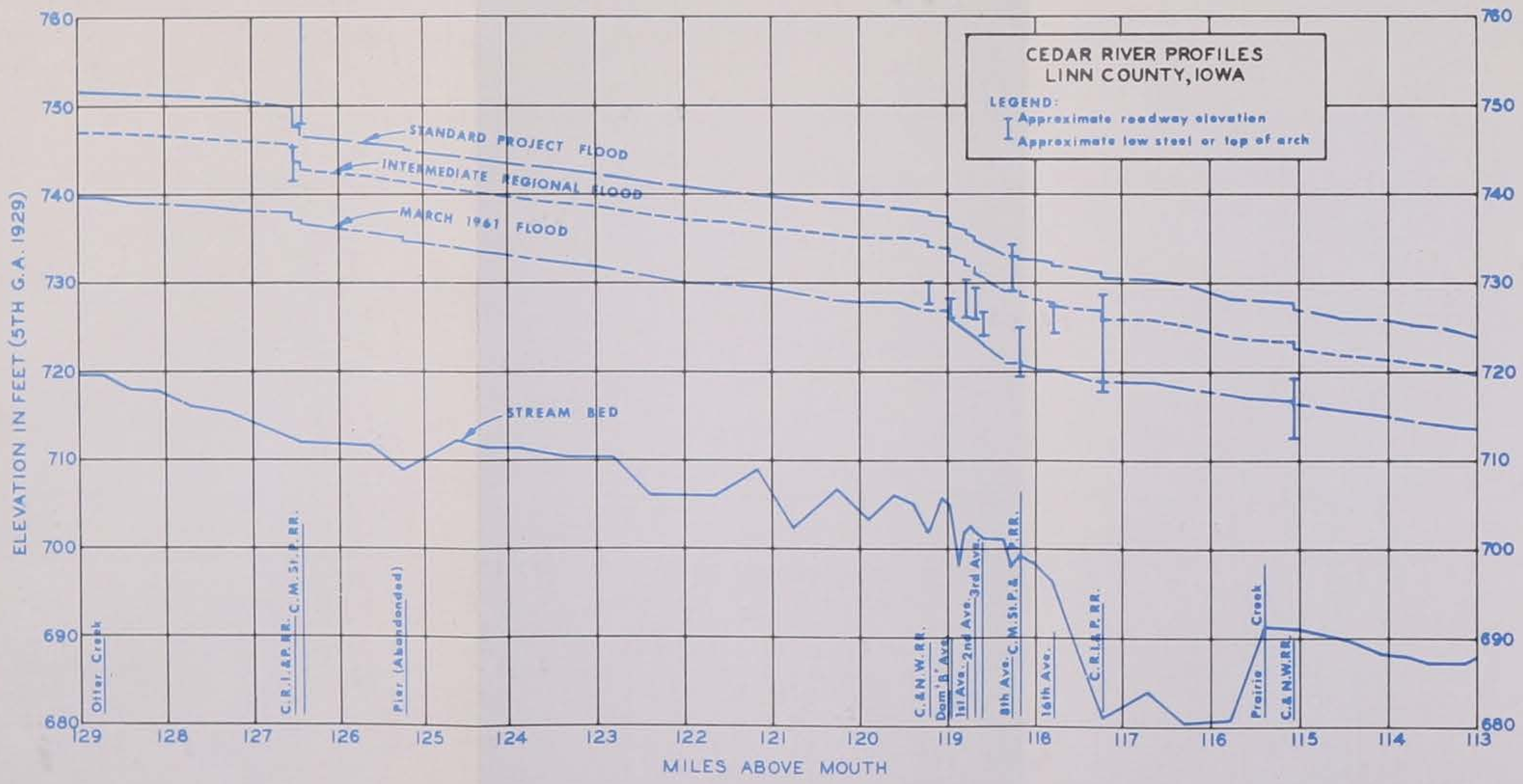
This brochure has been prepared from the data in the Corps of Engineers report, "Flood Plain Information, Cedar River, Linn County, Iowa."

The Rock Island District of the Corps of Engineers will provide upon request limited technical assistance in interpreting the information contained herein.

RELATIVE HEIGHTS OF PAST AND FUTURE FLOODS

Upstream side of county Road "Z" Bridge

Right bank of Chain of Lakes Bridge near Palo



An example showing the effect of channel encroachment on flood stage

CEDAR RIVER FLOODING LINN COUNTY IOWA

INFORMATION PAMPHLET
PREPARED IN THREE SECTIONS
(UPPER, MIDDLE, LOWER)

THIS PAMPHLET PROVIDES DATA ON THE MIDDLE SECTION

LINN COUNTY
CITY OF CEDAR RAPIDS
IOWA NATURAL RESOURCES COUNCIL

DECEMBER 1967

RELATIVE HEIGHTS OF
PAST AND FUTURE FLOODS

Base of rod on top of right concrete wingwall of dam at mile 119.00

City Hall fronting 2nd Avenue at mile 118.72

Post Office Building fronting 2nd Avenue at mile 118.72

INTRODUCTION

This pamphlet is a summary of the Cedar River Flood Plain Information Report for Linn County, Iowa, which was prepared to enable State and local governments to disseminate the information and to utilize the report for regulation in the flood plain area.

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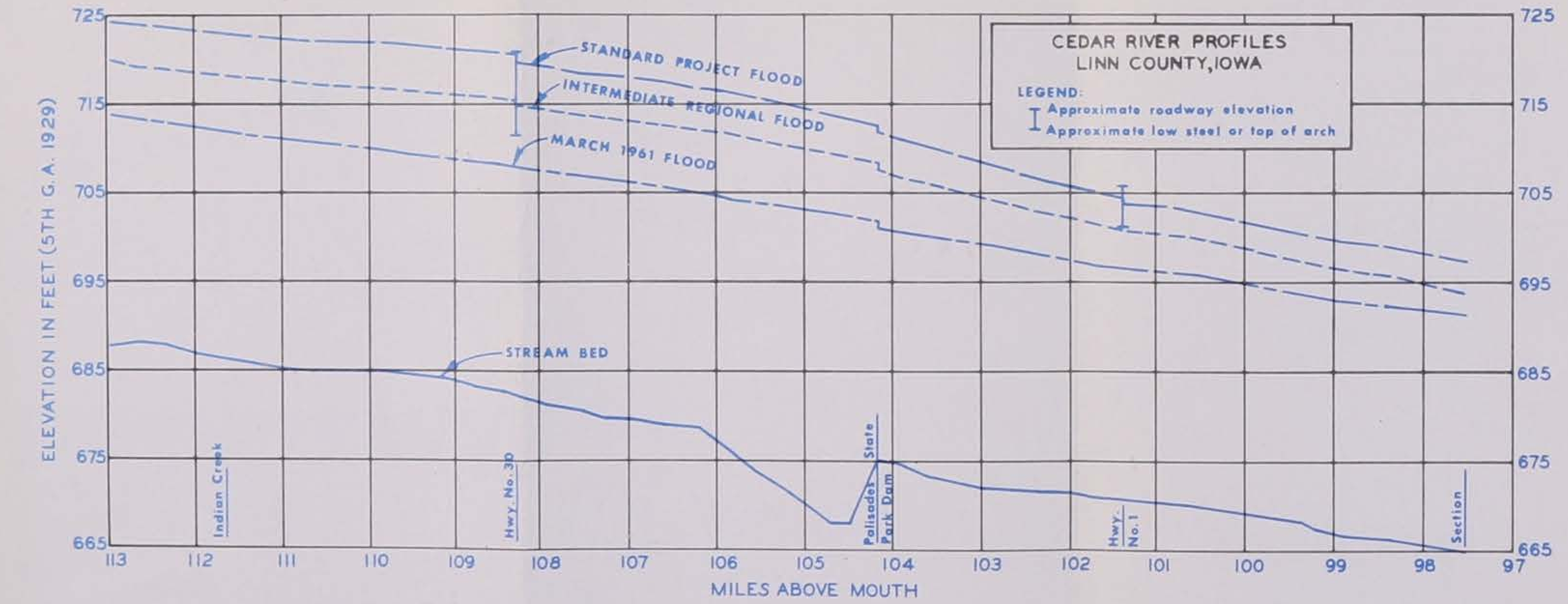
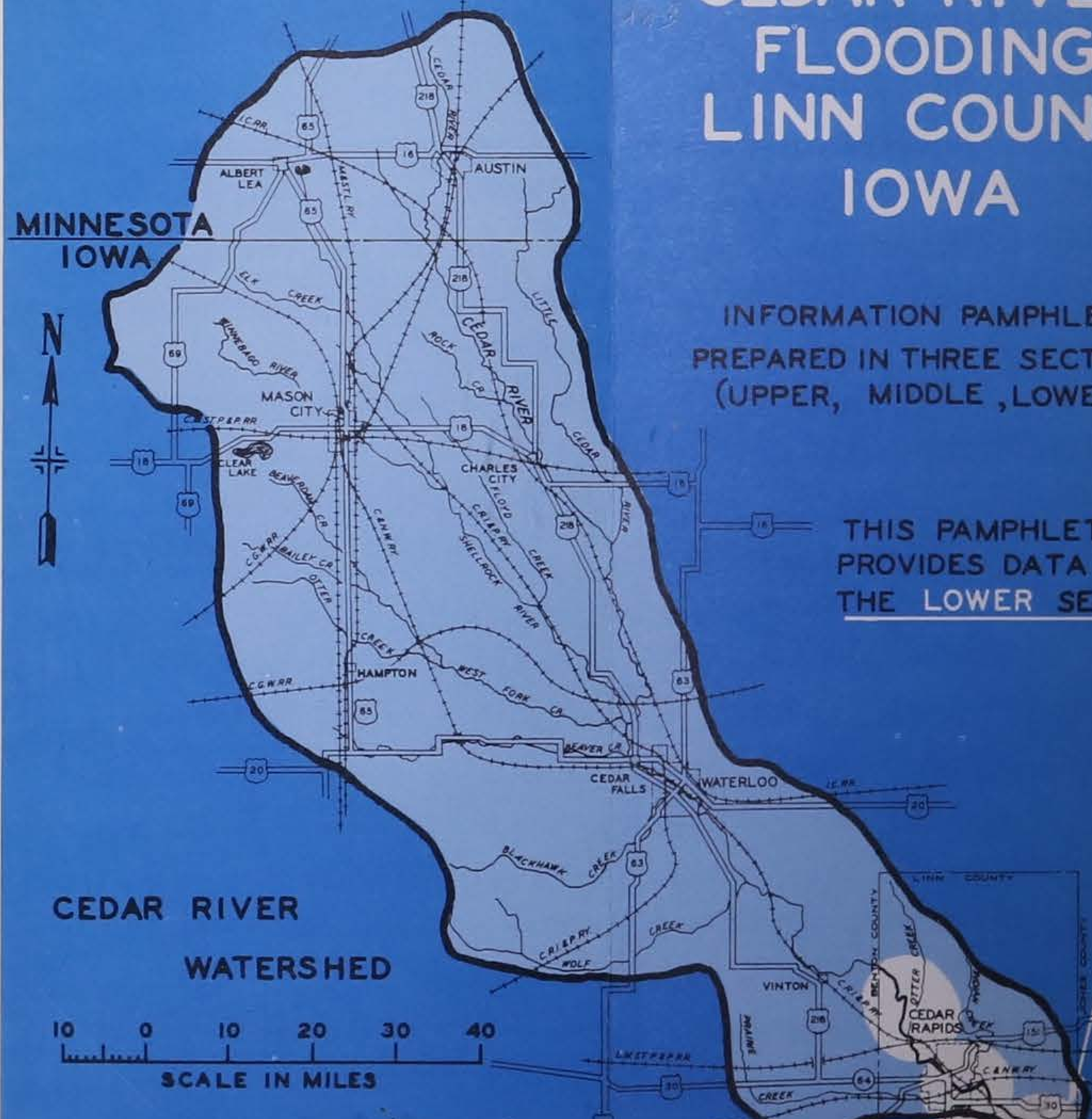
FLOOD OF MARCH 1961 ON CEDAR RIVER

March 1961 Flood Heights at the Dam and B Avenue bridge in Cedar Rapids




An example showing the effect of channel encroachment on flood stage



LINN COUNTY
CITY OF CEDAR RAPIDS
IOWA NATURAL RESOURCES COUNCIL

CEDAR RIVER FLOODING LINN COUNTY IOWA

INFORMATION PAMPHLET
PREPARED IN THREE SECTIONS
(UPPER, MIDDLE, LOWER)

THIS PAMPHLET PROVIDES DATA ON THE LOWER SECTION

How to Avoid Damage

RELATIVE HEIGHTS OF
PAST AND FUTURE FLOODS

Left bank of the Palisades Dam

Highway No. 1 Bridge

INTRODUCTION

This pamphlet is a summary of the Cedar River Flood Plain Information Report for Linn County, Iowa, which was prepared to enable State and local governments to disseminate the information and to utilize the report for regulation in the flood plain area.

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The Rock Island District of the Corps of Engineers will provide upon request limited technical assistance in interpreting the information contained herein.

FLOOD OF MARCH 1961 ON CEDAR RIVER

Please paste
this envelope on
inside of back
cover

Type plate

CHAMPION CLASP NO. K-50
5½ X 8¼