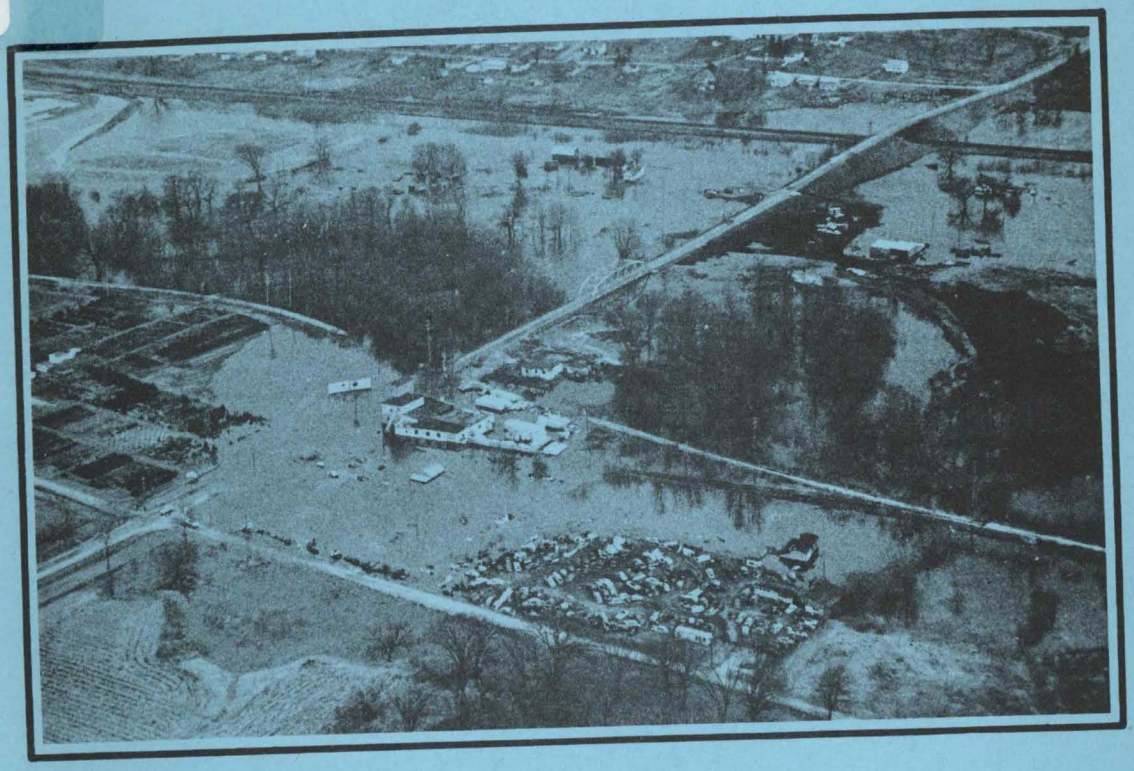
FLOOD PLAIN INFORMATION REPORT

PRAIRIE CREEK

LINN COUNTY, IOWA



PREPARED FOR

STATE OF IOWA

IOWA NATURAL RESOURCES COUNCIL

BY

U. S. ARMY ENGINEER DISTRICT, ROCK ISLAND

CORPS OF ENGINEERS

ROCK ISLAND, ILLINOIS

FEBRUARY 1966

Flood Plain Information Report
on
Prairie Creek
Linn County, Iowa

An early stage in the development of a flood plain problem. Arrows on photograph indicate water levels for the standard project, 100 year, and 50 year floods.

FLOOD PLAIN INFORMATION REPORT
on
PRAIRIE CREEK
LINN COUNTY, IOWA

TEXT

COVER PHOTO - BOWLING STREET
CEDAR RAPIDS, IOWA
MARCH 31, 1961

TABLES

PLATES

PHOTOGRAPHS

PHOTOGRAPHS (Cont'd)

FLOOD PLAIN INFORMATION REPORT

on

PRAIRIE CREEK

LINN COUNTY, IOWA

I - INTRODUCTION

The most notable floods in the Prairie Creek basin occurred during the years 1884, 1912, 1929, 1937, 1944, 1946, 1959, 1961 and 1965. To date the flood plain has not been extensively developed and consists mainly of agricultural land with several scattered industrial developments in the lower portion of the study area; and consequently damages from these floods have been relatively light. However, the population of Linn County and the City of Cedar Rapids is increasing at a rapid rate; and because of the resulting growth, it is certain that the development of more flood plain land will be attempted in the near future. If such developments were allowed to take place without sufficient regard for the potential flood hazards, the improvements would be subject to increasing flood damages.

On 21 March 1963, the Iowa Natural Resources Council submitted a formal request to the District Engineer, U. S. Army Engineer District, Rock Island, to prepare a series of flood plain information studies for Cedar River, Indian, Prairie and Otter Creeks in Linn County, Iowa. The limits of the Prairie Creek study area, shown on Plate 1, extend from the mouth of Prairie Creek at the Cedar River to a county road 2.5 miles west of the town of Fairfax at the west boundary of Section 7, Township 82N, R8W, Linn County, Iowa. The complete study area, approximately 216 square miles, is shown on the aerial mosaic, Plate 2.

The purpose of the study is to provide the State and local agencies with specific information on past and present flood hazards, as well as to provide a guide to the expected frequency of occurrence of future floods of varying magnitudes. With this information, the local governments can plan the most efficient use of the flood plain in view of the potential flood hazards.

This report is a condensation of the information contained in the technical appendix of the flood plain information study, and is prepared to acquaint the general public with the existing flood problems and the need for immediate action in regulating the development of areas subject to flooding.

It covers briefly; the history of floods in the study area, a description of the flood problem, and general guidelines for the use of

flood plain land and the reduction of future flood damages. The general guidelines provide information that can be useful in establishing zoning ordinances and other regulatory action which will permit conditional usage of flood plain land.

The technical appendix contains additional detailed information on past floods, flood plain information, methods of flood damage reduction, and the more technical aspects which will be especially useful to planners, contractors and engineers. You may obtain this additional flood plain information by making your request to:

Iowa Natural Resources Council
State House
Des Moines, Iowa 50319

A limited number of copies for consultation will also be available at the following locations:

a. Linn County Engineer
Linn County Court House
Cedar Rapids, Iowa

b. City of Cedar Rapids
City Hall
Cedar Rapids, Iowa

II - FLOOD HISTORY

The most severe floods of record on Prairie Creek occurred in March 1929, February 1937, June 1944, January 1946, March 1959, March 1961, and June 1965. Total damages from past floods have been relatively light and there has been no record of loss of life. County records, newspaper accounts, and other sources of information about the most significant floods have been condensed and are presented in the following paragraphs.

Flood of March 1929

This was one of the earliest floods on record. The major flood damage occurred on the Cedar River flood plain within the City of Cedar Rapids. Most of the available historic records, news articles, and photographs covered that area. However, Prairie Creek suffered flooding in many reaches and much land was inundated by flood water. As in 1961 and 1965, the major flooding and associated damage occurred on the lower reaches of Prairie Creek. During this March flood, much of the damage along Prairie Creek was attributed to Cedar River backwater. Agricultural damage was relatively small because most of the spring field operations had not begun.

Flood of February 1937

Incessant rain fell within the Prairie Creek watershed for two days. The Prairie Creek flood plain inundation caused some families to make evacuation plans from their residences. Several basements were reported flooded. According to newspaper accounts blasting of ice on the creek, as a precautionary measure to save bridges, was an additional factor that increased the flood stage at many downstream reaches. Water inundated Highway 161 at the Prairie Creek bridge which resulted in considerable damage to the roadbed and grade.

Flood of June 1944

Runoff from heavy rains resulted in one of the largest recorded floods on the Prairie Creek flood plain. High Cedar River stages which forced backwater into the lower reaches of the creek added to the record high stages causing much damage. Residents on the east and west side of Highway 218 between the Northwestern Railroad viaduct and the Prairie Creek bridge vacated their homes. Several Northwestern trains were held up in Cedar Rapids as waters from the flooding creek covered the tracks near Edgewood Road. The agricultural losses experienced in the existing flood plain were large and are indicative of the larger damages that would occur today with the expansion of industrial development. There was considerable damage to the county road system, railroads and utilities.

Flood of March 1959

Heavy rains caused Prairie Creek to go over its banks in Southwest Cedar Rapids. Basement flooding was reported and in some locations sewers backed up causing minor flooding. A drowning occurred in a drainage ditch within the City of Cedar Rapids which gave renewed attention to the storm sewer problems which was also evident within the Prairie Creek flood plain.

Flood of March 1961

As in many previous years, the major flood damage occurred on the Cedar River flood plain within the City of Cedar Rapids. Most of the available historic records, news articles, and photographs covered that area. However, Prairie Creek suffered flooding in many reaches and relatively large damages occurred. The major flooding and associated damage occurred on the lower reaches of Prairie Creek. Much of the damage along Prairie Creek was attributed to Cedar River backwater. The aerial mosaic shown on Exhibit 1, shows backwater flooding from the Cedar River during the 1961 flood. The Prairie Creek flood plain in the vicinity of Bowling Street is shown on Photo No. 1, Exhibit 2. Photo No. 2, Exhibit 2, shows the mouth of Prairie Creek during the flood. The need for flood plain management is apparent. Bowling Street is also shown on Photo No. 3, Exhibit 3, and points out the industrial development

within the area that was damaged by the flood waters. The total damage from this flood is unknown but the problems incurred are evident.

Flood of June 1965

Heavy rains totaling 5.0 inches at some locations cause relatively high flows on both the Cedar River and Prairie Creek. Hail and high winds caused considerable damage within the Prairie Creek watershed. Losses to agriculture crops were high and occurred in much of the study area. Photo No. 4, Exhibit 3, shows the flooding of a recreational park area and golf course near mile 0.70. The aerial mosaic shown on Exhibit 4 shows the flooded outline on Prairie Creek during the 1965 flood. An inspection of the mosaic reveals many undersirable practices and deposition areas along the flood plain. Photo No. 5, Exhibit 5, shows "C" Street under water near the R.E.A. Power Plant. Photo No. 6, Exhibit 5, shows a typical highwater bridge problem that exists in the area. This photo was taken east of the R.E.A. Power Plant and shows the C. & N.W. Railroad bridge loaded with railroad cars so as to improve loading and stress conditions. Total damage from this flood was considered small, however, it pointed out many locations where a serious flood potential exists.

III - FLOOD CONTROL IMPROVEMENTS

Flood damages on the Prairie Creek flood plain in the past have not been of sufficient magnitude to justify flood control measures. Direct flood control measures to alleviate possible future damages would include any one or a combination of the following: Improvement of the existing channel and overbank areas, bridge improvement, levee protection, and flood retention reservoirs. If adequate flood plain regulations are instituted and enforced now, these flood control measures may be kept at a minimum in the future.

IV - EXISTING FLOOD PLAIN MANAGEMENT CONTROL

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 farm land and structures, in terms very similar to those used in the enabling statute, Section 358A.2, Iowa Code 1962 as amended.

Although the City of Cedar Rapids has prepared a comprehensive plan and enacted a zoning ordinance, it appears that there are no


N
PRAIRIE CREEK
CEDAR RIVER

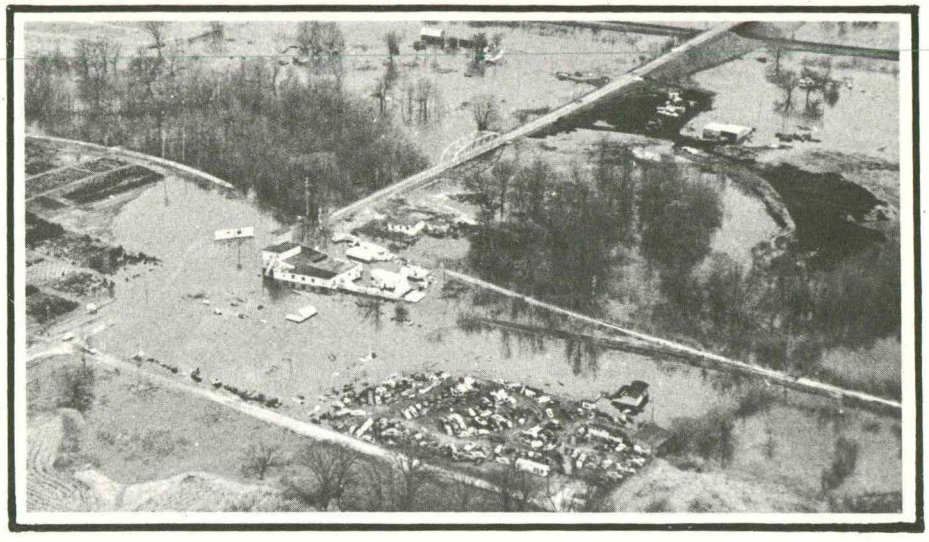


Photo 1 - Looking Northwest toward Bowling Street Bridge during 1961 flood at Mile 1.64.

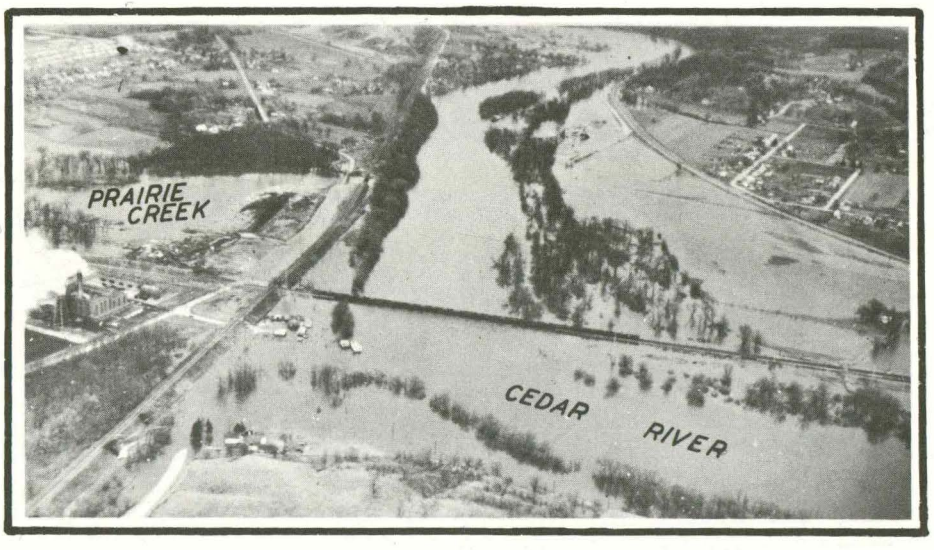


Photo 2 - Aerial view looking Northwest at the R.E.A. Power Plant and the mouth of Prairie Creek near center of photo at Mile 0.00.

Photo 3 - Aerial view looking west toward Bowling Street during 1961 flood. Note: Railroad submergence and industrial flooding near Mile 1.64.

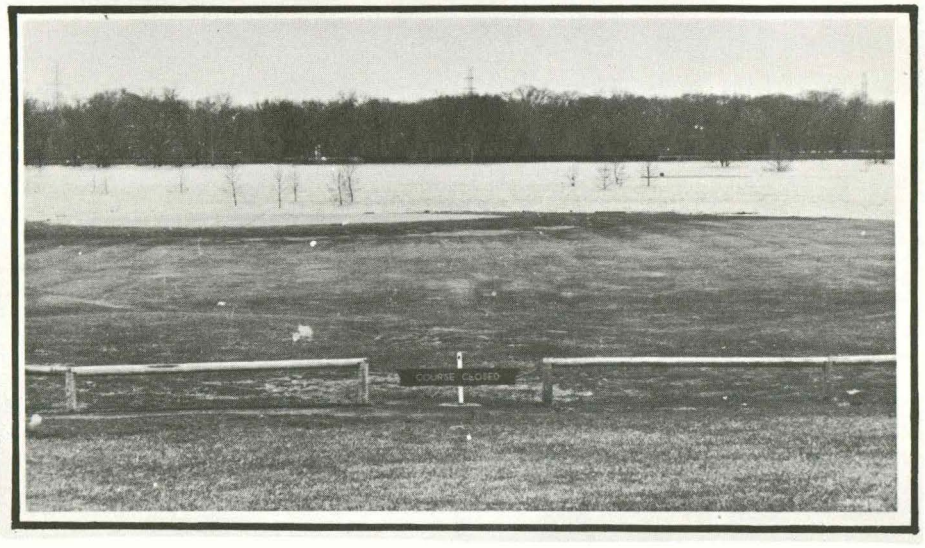
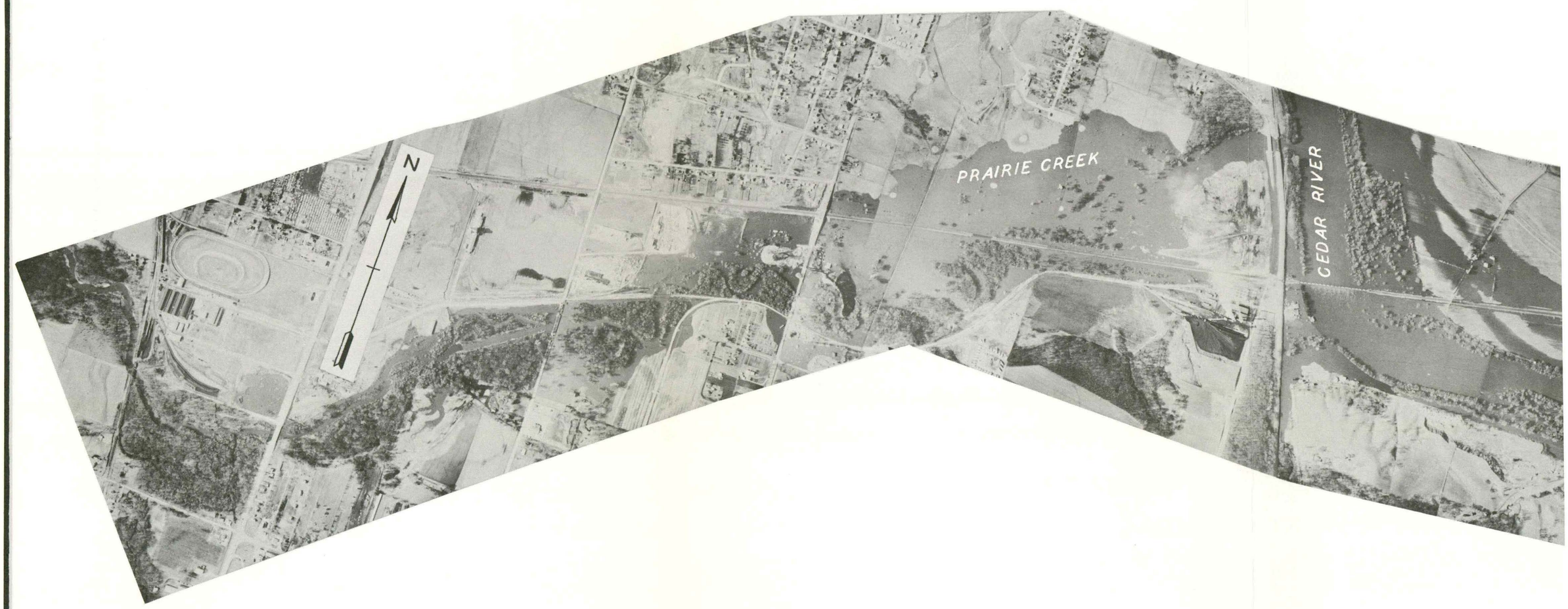


Photo 4 - Flooding of recreational park area and golf course during 1965 flood near Mile 0.70.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CEDAR RIVER

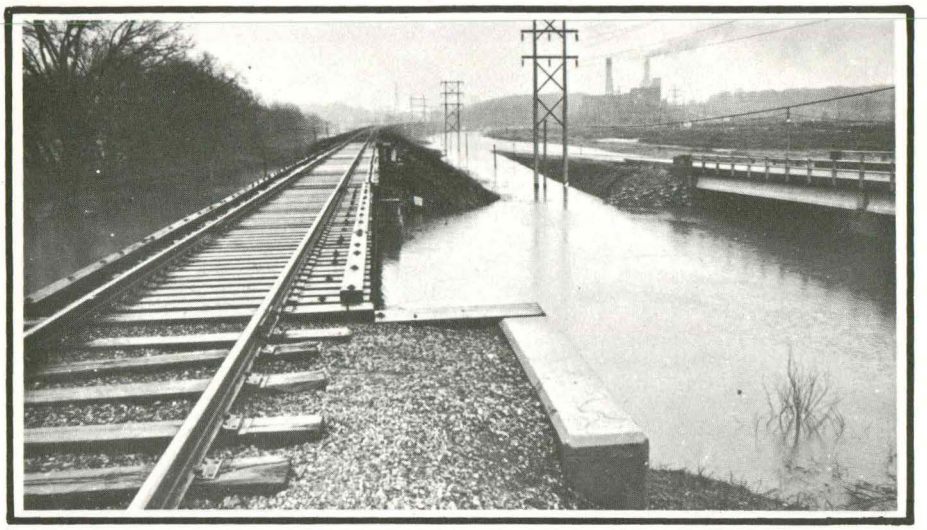


Photo 5 - C.R.I& P. Railroad Bridge on left and "C" Street Bridge on right, looking at the right bank of Prairie Creek with the R.E.A. Power Plant in background near Mile 0.03.

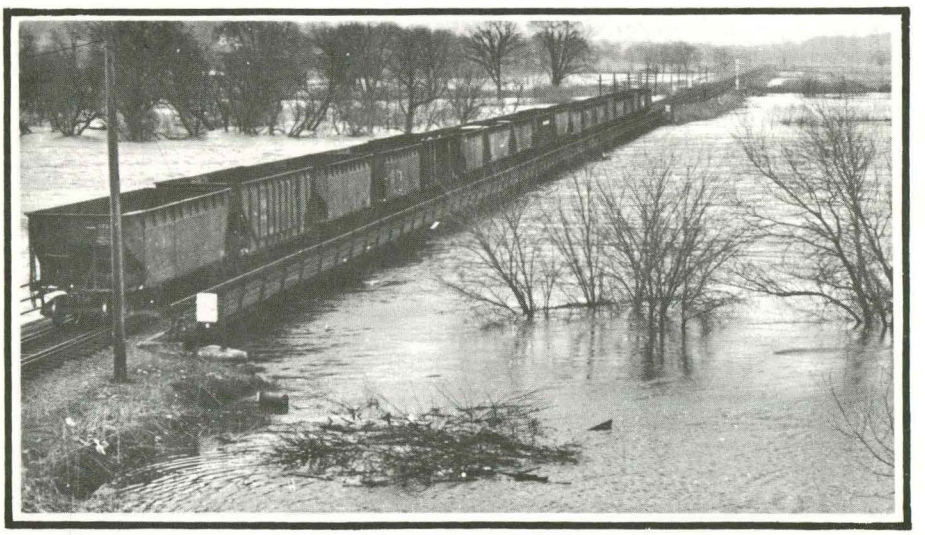


Photo 6 - C. & N.W. Railroad Bridge east of the R.E.A. Power Plant and Mile 0.00.

Exhibit 5

subdivision regulations, building codes or zoning ordinances adopted by the city 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 1962, as amended. (See also, Senate File 523, Acts 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 any floodway. 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.

V - FLOOD PROBLEM

Since floods are random occurrences, there is no method for accurately predicting the time of occurrence or size of any future flood event. However, an analysis of past floods can give an indication of the frequency of occurrence of a given stage or discharge.

In connection with flood damages and flood control planning, it is customary to estimate the frequency (or probability) with which specific flood stages or discharges may be equaled or exceeded rather than the frequency of an exact value of stage or discharge. When expressed correctly, frequency can be stated in two ways, that is, once in a specified number of years, or as a percent--the percentage being numerically equal to the estimated number of occurrences in 100 years. Another term, recurrence interval, is defined as the average interval of time in years over a long period which can be expected to elapse between floods equaling or exceeding the specified flood. Therefore, a flood having a frequency of once in 20 years can also be expressed as having a five percent frequency (five occurrences in 100 years) or as having a recurrence interval of 20 years. The longer the period of record, the more reliable the estimates of future flood frequencies. Therefore, as additional years of record are added to a frequency study, the frequencies of floods, as previously determined, may change.

As stated previously, floods of varying magnitude occurred on Prairie Creek in the years 1884, 1912, 1929, 1937, 1944, 1946, 1959, 1961 and 1965. High water marks recovered at certain locations for the floods of 1937, 1944, 1946, 1959, 1961 and 1965 have been plotted on the profiles shown on Plate 4. Because of the scarcity of high water information, profiles for the historic floods have not been plotted. The historic floods on Prairie Creek have produced damage in the developed reaches, however, there is no record of loss of life due to past floods.

In Tables 1 and 2, computed floods are shown which indicate discharge and corresponding elevation for flood estimates of various frequencies. Table 2 indicates the estimated frequency of elevations produced under free flow conditions only, that is, no ice or debris jams. Therefore, a given elevation will, in actuality, probably occur somewhat more frequently than is indicated in the table. The areas which would be inundated by such floods are shown on Plate 3. Since there are very few available flood discharge records for Prairie Creek at the present time, such information gathered in the future will substantially improve the reliability of the frequency estimates used in this report.

a. General. Man has been building on and occupying the flood plains of Iowa rivers and streams since the advent of the pioneer settlers. The streams 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 Iowa's cities results in ever increasing encroachment on the flood plains.

Streams in flood may carry thousands of times more flow than during low flow periods. These vast quantities of water caused little damage until the works of man invaded the flood plain. Man has learned through bitter experience that floods periodically inundate portions of the flood plain, damaging or sweeping away roads, buildings and homes. In addition to these property damages, floods often pose a severe threat to human life and health. Over the years, reservoirs, channel improvements, levees and other flood protection works have been constructed to protect the works of man against the force of nature's floods. Unfortunately, the construction of these protection works is extremely expensive. In addition, encroachment on the flood plains has taken place faster than flood protection works have been constructed with the result that flood hazard areas and flood damages have been steadily increasing in Iowa and across the nation.

Historically, man has tried to reduce flood damages through the exercise of control over the river in time of flood. Many different types of control works can be constructed for this purpose. Dams and reservoirs can be constructed to store water for gradual release after the threat of flooding has passed. Channel improvements are used to remove constrictions and improve flow characteristics so that future flood stages are reduced. Watershed treatment involves the regulation of the rate of runoff to the main stem and tributaries. Levees, dikes, and flood walls can be constructed to confine the river to a definite course at stages which may be well above the adjacent flood plain. These methods are generally very costly and therefore are more often used in areas where development has already heavily encroached on the flood plain, or where future plans call for extensive use of the flood plain. There should be a history of, or an existing potential for heavy flood damage to justify the cost of these measures.

The increase in flood hazards and flood damages, despite the expenditure of billions of dollars of tax funds for the construction of flood control works, has led to a new approach to the reduction of these hazards and damages, the exercise of control over the land lying adjacent to the river through the planned management and development of flood hazard areas. The flood plain plan, if fully integrated into the

comprehensive land use and development plan of an area and enforced by means of appropriate zoning, subdivision and building regulations, can prevent the creation of new flood hazard areas. While flood plain areas probably never can be considered flood free, planning will allow selection of a flood risk commensurate with the type of development desired and allow a reasonable level of protection to be built into a project during initial construction.

Regulation of the flood plain can be carried out by a variety of means--encroachment lines, zoning ordinances, subdivision regulations, and modifications or additions to building codes. These methods will be described subsequently in some detail. However, it is not within the purpose of this report to recommend the specific technique to be used. Flood plain regulations are the responsibility of State and local governments, and these report data are provided to furnish a basis for appropriate regulatory action. It is hoped that the basic data in this report will be used in conjunction with comprehensive plans to develop a reasonable and desirable plan for use of the Prairie Creek flood plain.

Fortunately, the need for flood plain planning on Prairie Creek has been recognized by local interests before extensive flood plain development has taken place. This means that future damages in the study area can be reduced now, at little or no cost to the taxpayer, by the enactment and enforcement of flood plain regulations. The Linn County Zoning Commission and the Cedar Rapids Planning Commission have done extensive research on the present and projected growth in the areas of land use, population, economy, recreation and transportation and have published comprehensive planning reports. The flood data in this report, together with the planning program for future land use, will enable State and local interests to minimize flood damage risks.

Flood plain management may also include other methods which are helpful, particularly in special localized areas. These include park and open space developments, evacuation, urban redevelopment, flood proofing, tax reductions, and warning signs. Discussion of these methods is given in the Technical Appendix.

b. Encroachment lines. A designated floodway is the area of channel and those portions of the flood plains adjoining the channel which are reasonably required to carry and discharge the flood water or flood flow of a flood of a specific size without unduly raising upstream water surface elevations. Encroachment lines or limits are the lateral boundaries of this floodway. They are two definitely established lines, one on each side of the river, and between these lines no construction or filling such as that shown on Photo Nos. 7 and 8, Exhibit 6, and Photo No. 9, Exhibit 7, should be permitted which will cause an impedance to flow. Flood plain shaping and filling, as shown by Photo No. 10, Exhibit 7, is an example of improvement that may be advantageous to the existing flood plain. This area is being developed and converted into a

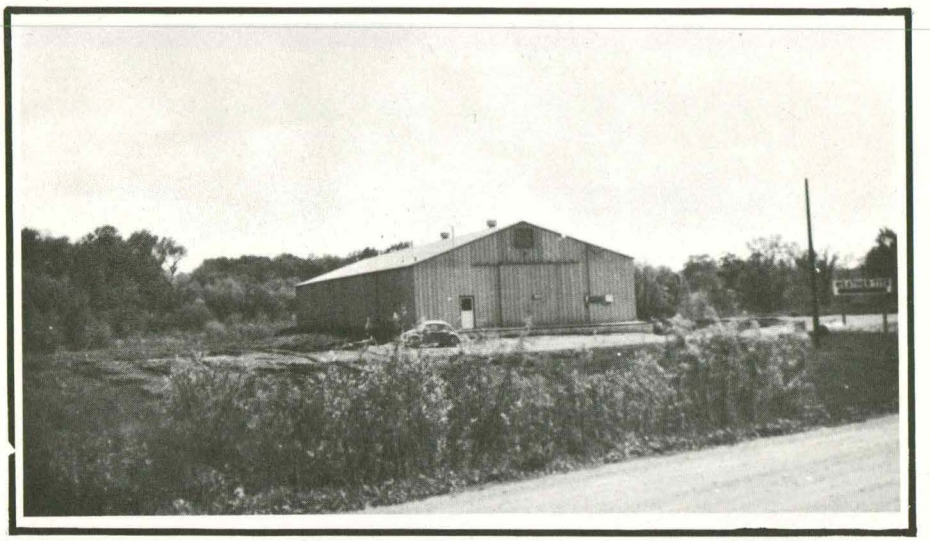


Photo 7 - Look downstream at filling and construction on Prairie Creek flood plain downstream from 6th Street Bridge along left bank near Mile 3.00.

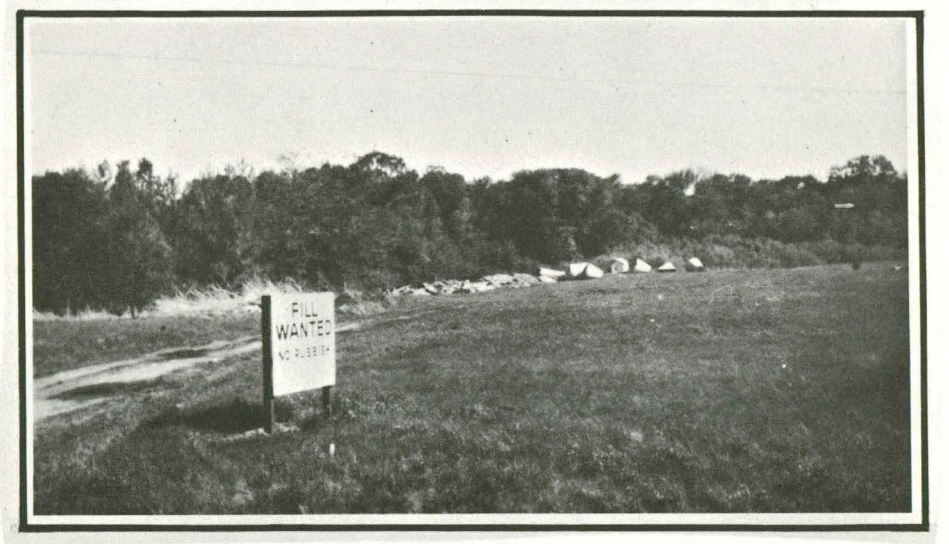


Photo 8 - Looking downstream at filling on Prairie Creek flood plain downstream from 6th Street Bridge along left bank near Mile 2.95.

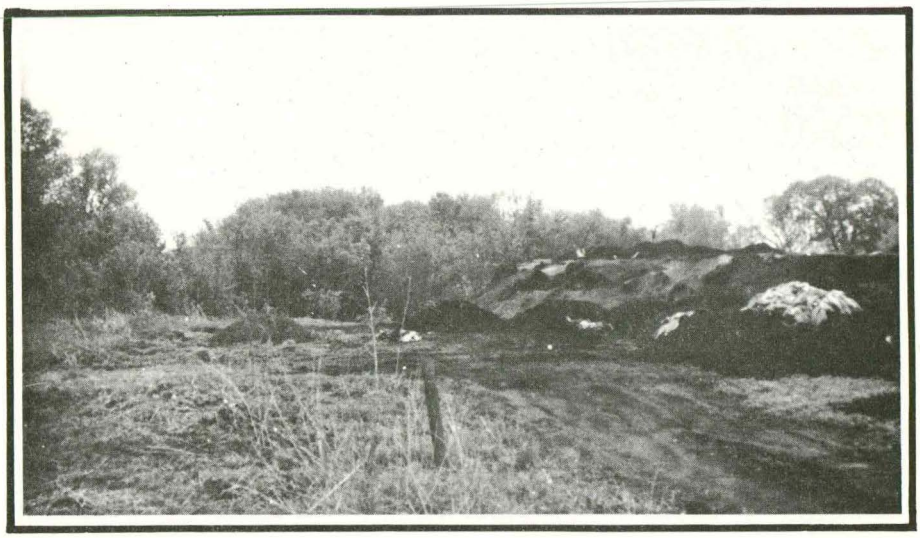


Photo 9 - Looking upstream at filling on the Prairie Creek Flood Plain upstream from 6th Street Bridge along left bank near Mile 3.25.

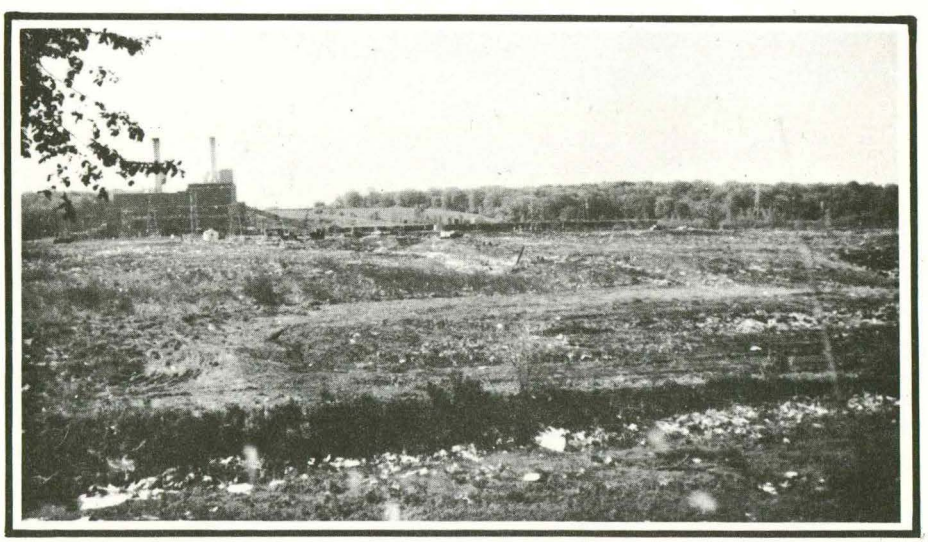


Photo 10 - Looking upstream at filling on the Prairie Creek Flood Plain upstream from "C" Street Bridge along right bank near Mile 0.50. Fill area about to be closed and shaped into a city park.

city park area which is expected to improve the flow characteristics of the reach. If possible, encroachment limits should be established before extensive development has taken place in order that costly clearance of existing structures may be avoided. Final choice of the magnitude of the flood, which will determine the size of the floodway, is a matter for State and local decision because in the final analysis, it is determined by consideration of local land use plans and comprehensive State-wide flood control plans.

The data contained in this report are being used by State and local interests to determine the size of the regulatory flood, and to establish floodway encroachment lines or limits and land use districts. For the present time, problems or situations regarding encroachment at specific points in the study area should be referred to the Iowa Natural Resources Council at Des Moines.

c. Zoning. Zoning is a legal tool used by cities, towns, and counties to control and direct the use and development of land and property within their jurisdiction. Division of a municipality or county into various zones should be the result of a comprehensive planning program for the entire area, with the purpose of guiding its growth. The planning program as such has no legal status. Zoning, as described above, is a legal tool that is used to implement and enforce the details of the planning program. Its objectives are the conservation of property value and the achievement of the most appropriate and beneficial use of available land. Flood plain zoning is not a special type of ordinance, but merely another set of provisions which can be incorporated into a comprehensive zoning ordinance so that flood damage can be minimized. Zoning regulations may be used in lieu of encroachment laws as well as a supplement to them. Thus, designated floodways may be zoned for the purpose of passing flood waters and for other limited uses that do not conflict with that primary purpose. The ordinance may also establish regulations for the flood plain areas outside the floodway. These include designating elevations above which certain types of development must be constructed. The enabling statutes which authorize municipalities and counties in Iowa to adopt zoning regulations are Chapters 414 and 358A, respectively, of the Iowa Code 1962 as amended. Amendments enacted in 1965 specifically added protection from floods as an authorized objective of zoning (Senate File 523, Acts of the Sixty First General Assembly of Iowa, 1965).

d. Subdivision regulations. A subdivision can be defined in a broad sense as a tract or parcel of land divided into two or more lots or other units for the purpose of sale or building development. Subdivision regulations are used by local governments to specify the manner in which land may be subdivided within the entire area under their jurisdiction. Regulations may state the required width of streets, requirements for curbs and gutters, size of lots, elevation of land, freedom from flooding, size of floodways and other points pertinent to the welfare of the community. It has been found that responsible subdividers favor

such regulations because the regulations discourage land speculation and prevent unscrupulous competition from other subdividers who might develop flood hazard land with less than minimum desirable standards. Experience has also shown that various municipal costs are reduced during flood periods and that the annual maintenance required for streets and utilities is minimized. Subdivision regulations provide an efficient means of controlling development in areas which are presently undeveloped. By introducing such regulations early in these areas, planned flood plain development can take place without being hampered by nonconforming uses.

e. Building codes. The primary purpose of building codes is to set up minimum standards for controlling the design, construction and quality of materials used in buildings and structures within a given area, so that life, health, property and public welfare are safeguarded. Since it may not be practical to prevent the location of any building in all areas subject to flooding, building codes can be used to minimize structural and consequential damages resulting from flood velocities and inundation. Some of the methods adaptable to building codes are:

(1) Prevent flotation of buildings from their foundations by specifying anchorage.

(2) Establish basement elevations and minimum first floor elevations consistent with potential flood occurrences.

(3) Prohibit basements in those areas subject to very shallow, infrequent flooding where filling and slab construction would prevent virtually all damage.

(4) Require reinforcement to withstand water pressure or high velocity flow and restrict the use of materials which deteriorate rapidly in the presence of water.

(5) Prohibit equipment that might be hazardous to life when submerged. This includes chemical storage, boilers or electrical equipment.

f. Flood plain regulations. Flood plain regulation involves the establishment of legal tools with which to control the extent and type of future development which will be allowed to take place within the flood plain. The regulations must be definite enough so that there is general public understanding of the problem and the choices of action which the regulations provide. Regulations must be specific enough so that criteria, such as minimum first floor elevations, type of construction or encroachment limits, are known for the area in question. There are basically two main objectives of regulation. The first is to assure and guarantee the retention of an adequate floodway for the river--floodway as previously being defined as the channel and those portions of the flood plains adjoining the channel, which are reasonably required to

carry and discharge the flood water or flood flow of a flood of a specific size without unduly raising upstream water surface elevations. Its size is based on sound economic and hydraulic criteria. Development and use of the area lying on either side of the floodway, and which may become inundated by the regulatory flood, should be planned and controlled. The second objective of regulation is to encourage sound land use consistent with the flood hazard and the community land use needs.

The profiles shown on Plate 4, combined with the detailed information contained in the Technical Appendix, will provide a basis which will allow formulation of flood plain regulations. Such regulations will be consistent with both minimum State requirements and the overall comprehensive plan of local authorities.

CONCLUSION

Linn County and the City of Cedar Rapids have active planning programs carried out through their various governing bodies. These planning agencies have made comprehensive studies of present growth trends, forecasts of future economic and population growth, and the resulting needs for housing, recreation facilities, schools, parks and major streets. The following estimates are particularly relevant to the urgent need for flood plain regulation in the Prairie Creek basin. According to the Cedar Rapids City Planning Commission, considerable growth can be expected in the vicinity of Prairie Creek over the next 15 to 20-year period. In a report prepared for Linn County entitled, "Background for Planning," it is estimated that the population of Linn County 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 bordering on a stream's flood plain will produce a considerable increase in future flood damages if allowed to occur without sufficient flood plain management practices.

The process of developing effective flood plain regulations should be coordinated with a comprehensive planning program for future land use. The City of Cedar Rapids and Linn County have made extensive studies of existing recreational facilities and needs for the future based upon population projections and general plan objectives. At the time of publication in 1961, the Cedar Rapids Parks and Schools Report indicated that there were 33 city park areas totaling nearly 1,300 acres of land in Cedar Rapids. Since that time, Cedar Rapids has acquired 14 additional park areas totaling approximately 420 acres, bringing 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 indicates that there are 18 existing county park areas containing nearly 1,500 acres of land, all acquired since 1959. Most of these park areas are located along stream frontages of the Cedar and Wapsipinicon Rivers and their tributaries.

The two reports suggest the need for the conservation of stream frontages for public and private recreational uses and for flood plain management purposes. The reports outline a program of stream frontage acquisition for public recreational needs where demand justifies this approach.

In view of the projected growth trend for Linn County, it is vital that action be taken now to implement the flood plain regulations mentioned herein in an effort to achieve the most efficient development of the flood plain that is possible in view of the potential flood hazards.

GLOSSARY OF SELECTED TERMS

A. HYDROLOGIC TERMS

1. Channel. A natural or artificial watercourse of perceptible extent with definite bed and banks to confine and conduct continuously or periodically flowing water. Channel flow thus is that water which is flowing within the limits of the defined channel.

2. Flood. A temporary rise in stream flow or stage that results in significant adverse effects in the areas adjacent to the stream.

3. Flood stage. A term commonly used by the U. S. Weather Bureau and others to designate that stage, on a particular river gage, at which overflow of the natural banks of the stream results in significant damage in any portion of the reach for which the gage is a representative index.

4. Flood frequency. A means of expressing the probability of flood occurrences as determined from a statistical analysis or representative stream flow records. It is customary to estimate the frequency with which specific flood stages or discharges may be equaled or exceeded, rather than the frequency of an exact stage or discharge. Such estimates by strict definition are designated "exceedence frequency" but in practice the term "frequency" is used. The frequency of a particular stage or discharge is usually expressed as occurring once in a specified number of years. Also see: Recurrence interval.

5. Flood peak. The highest value of stage or discharge attained during a flood event; thus peak stage or peak discharge.

6. Flood record. Records of flood events for which there is reasonable reliable data useful in technical analysis. The highest recorded stage or discharge is often referred to as "maximum flood of record" as differentiated from "historic high water marks" which may not be well defined.

7. Flood plain. The relatively flat lowlands adjoining a watercourse or other body of water subject to overflow therefrom during flood periods.

8. Flood profile. The longitudinal profile traced by the crest of a flood event expressed in elevation.

9. Historical flood. A known flood which occurred before systematic record keeping was begun for the stream or area under consideration.

10. Floodway. The channel of the stream or body of water and that portion of the flood plain that is inundated by a flood and used to carry the flow of the flood.

11. Recurrence interval. The average interval of time, based on a statistical analysis of actual or representative stream flow records, which can be expected to elapse between floods equal to or greater than a specified stage or discharge. Recurrence interval is generally expressed in years. Also see: Flood frequency.

12. Standard project flood. A hypothetical flood, estimated by the Corps of Engineers, representing the critical flood runoff volume and peak discharge that may be expected from the most severe combination of meteorological and hydrologic conditions that are considered reasonably characteristic of the geographical region involved, excluding extremely rare combinations.

13. Channel bottom. The elevation of the deepest part of a stream channel at a particular section. Such elevations, when determined for many sections along the length of a stream, provide a profile of the bottom from mouth to source.

B. REGULATORY TERMS

1. Building code. A collection of regulations adopted by a local governing body setting forth standards for the construction of buildings and other structures for the purpose of protecting the health, safety and general welfare of the public.

2. Designated floodway. The channel of a stream and that portion of the adjoining flood plain designated by a regulatory agency (Iowa Natural Resources Council) to provide for reasonable passage of flood flows.

3. Encroachment lines. Lateral limits or lines along streams or other bodies of water, within which no structure or fill may be added. Their purposes are to preserve the flood carrying capacity of the stream or other body of water and its flood plain, and to assure attainment of the basic objective of improvement plans that may be considered or proposed. Their location, if along a stream, should be such that the floodway between them including the channel, will handle a designated flood flow or condition. These lines are set by regulatory agencies and may be changed by them.

4. Flood plain regulations. A general term applied to the full range of codes, ordinances, and other regulations relating to the use of land and construction within flood plain limits. The term encompasses zoning ordinance, subdivision regulation, building and housing codes, encroachment laws and open area regulations.

5. Flood proofing. A combination of structural provisions, changes, or adjustments to properties subject to flooding primarily for the reduction or elimination of flood damages.

6. Green belt. A term related to the development and retention of stream frontages and flood plains as "green belts." Permissive use of these public or private lands for pasture or grazing, parks, golf courses

and similar uses would materially reduce or regulate the damage potential in the high-hazard flood plain area. The "green belt" is an integral part of overall planning and open space plans of Linn County and the City of Cedar Rapids.

7. Subdivision regulations. Regulations and standards established by a local public authority, generally the local planning agency, with authority from a State enabling law, for the subdivision of land in order to secure coordinated land development, including adequate building sites and land for vital community services and facilities such as streets, utilities, schools and parks.

8. Zoning ordinance. An ordinance adopted by a local governing body, with authority from a State zoning enabling law, which under the police power divides an entire local governmental area into districts and, within each district, regulates the use of land, the height, bulk, and use of buildings or other structures, and the density of population.

C. OTHER TERMS

Urban redevelopment. The overall program of public and private action, growing out of the National Housing Act of 1954 as amended, designed to prevent the spread of blight, to rehabilitate and conserve urban areas that can be economically restored, and to clear and redevelop areas that cannot be saved.

TABLE 1

DISCHARGES FOR FLOODS OF VARIOUS RECURRENCE INTERVALS

Mile	Drainage Area Square Miles	Discharge of Computed Floods 50-year flood	100-year flood	standard project flood
0.00	216.0	27,000	33,400	46,800
0.79	215.0	26,900	33,300	46,700
0.89	214.0	26,900	33,200	46,600
1.29	213.1	26,800	33,200	46,500
1.92	211.7	26,700	33,100	46,300
2.42	208.7	26,700	33,000	46,200
3.19	208.0	26,500	32,800	45,900
3.55	203.8	26,200	32,400	45,500
4.90	199.1	25,900	32,100	44,900
5.67	198.3	25,900	32,000	44,800
6.37	197.1	25,800	31,900	44,700
6.98	196.0	25,700	31,800	44,600
7.88	190.5	25,400	31,400	44,000
8.38	187.7	25,200	31,100	43,600
8.83	184.6	25,000	30,900	43,300
9.06	181.9	24,800	30,600	42,900
9.63	181.0	24,700	30,600	42,800
10.20	177.5	24,500	30,300	42,400
11.44	175.4	24,300	30,100	42,200
12.48	173.5	24,200	29,900	41,900
13.49	171.0	24,000	29,700	41,500

TABLE 2

FLOOD PROFILE INFORMATION

Mile	Location	Elevation of flood profile - feet 50-year flood	100-year flood	standard project flood
CRI & P RR Br.	Downstream	713.0	714.8	717.8
0.00	Upstream	716.6	719.4	724.2
"C" Street SW Br.	Downstream	716.9	719.7	724.4
0.02	Upstream	717.3	720.3	726.1
0.21		719.1	721.7	726.5
0.69		719.3	721.8	726.5
C & NW RR Br.	Downstream	719.5	722.0	726.6
0.89	Upstream	721.3	724.1	726.9
1.29		721.4	724.1	727.0
Bowling St. Br.	Downstream	721.8	724.4	727.2
1.64	Upstream	722.5	724.7	727.5
1.92		722.9	725.0	727.7
CR & IC RR Br.	Downstream	723.1	725.2	727.9
2.06	Upstream	723.9	725.9	728.4
2.22		724.1	726.0	728.5
"J" Street Br.	Downstream	724.6	726.3	728.7
2.42	Upstream	724.7	726.4	728.8
2.75		725.1	726.7	729.1
2.99		725.8	727.3	729.6
6th Street Br.	Downstream	726.6	727.9	730.1
3.19	Upstream	728.3	728.8	730.3
3.41		728.7	729.2	730.8
CR & IC RR Br.	Downstream	729.2	729.8	731.6
3.55	Upstream	731.7	733.6	738.5

TABLE 2 (Cont'd)

FLOOD PROFILE INFORMATION

Mile	Location	Elevation of flood profile - feet 50-year flood	100-year flood	standard project flood
3.86		731.8	733.7	738.7
4.08		732.0	733.9	738.9
C & NW RR Br.	Downstream	732.3	734.1	738.9
4.42	Upstream	733.7	736.4	740.4
4.90		734.3	736.8	740.7
C & NW RR Br.	Downstream	734.9	737.2	741.0
5.05	Upstream	737.1	740.4	742.0
5.20		737.3	740.6	742.1
21st Street Br.	Downstream	737.9	741.1	742.9
5.36	Upstream	738.3	741.3	743.1
CMST P & P RR Br.	Downstream	738.5	741.4	743.3
5.52	Upstream	739.1	741.7	743.6
5.67		739.6	742.1	744.1
Edgewood Road Br.	Downstream	740.5	742.9	745.2
5.95	Upstream	741.7	743.6	745.7
6.12		741.9	743.8	745.8
6.37		742.1	744.0	746.1
6.72		742.5	744.3	746.4
6.98		742.8	744.5	746.7
County Road Br.	Downstream	743.1	744.8	746.9
7.13	Upstream	743.1	744.8	746.9
7.50		743.6	745.3	747.4
7.84		744.6	746.1	748.1
8.17		745.4	746.7	748.7
8.38		746.0	747.2	749.2

TABLE 2 (Cont'd)

FLOOD PROFILE INFORMATION

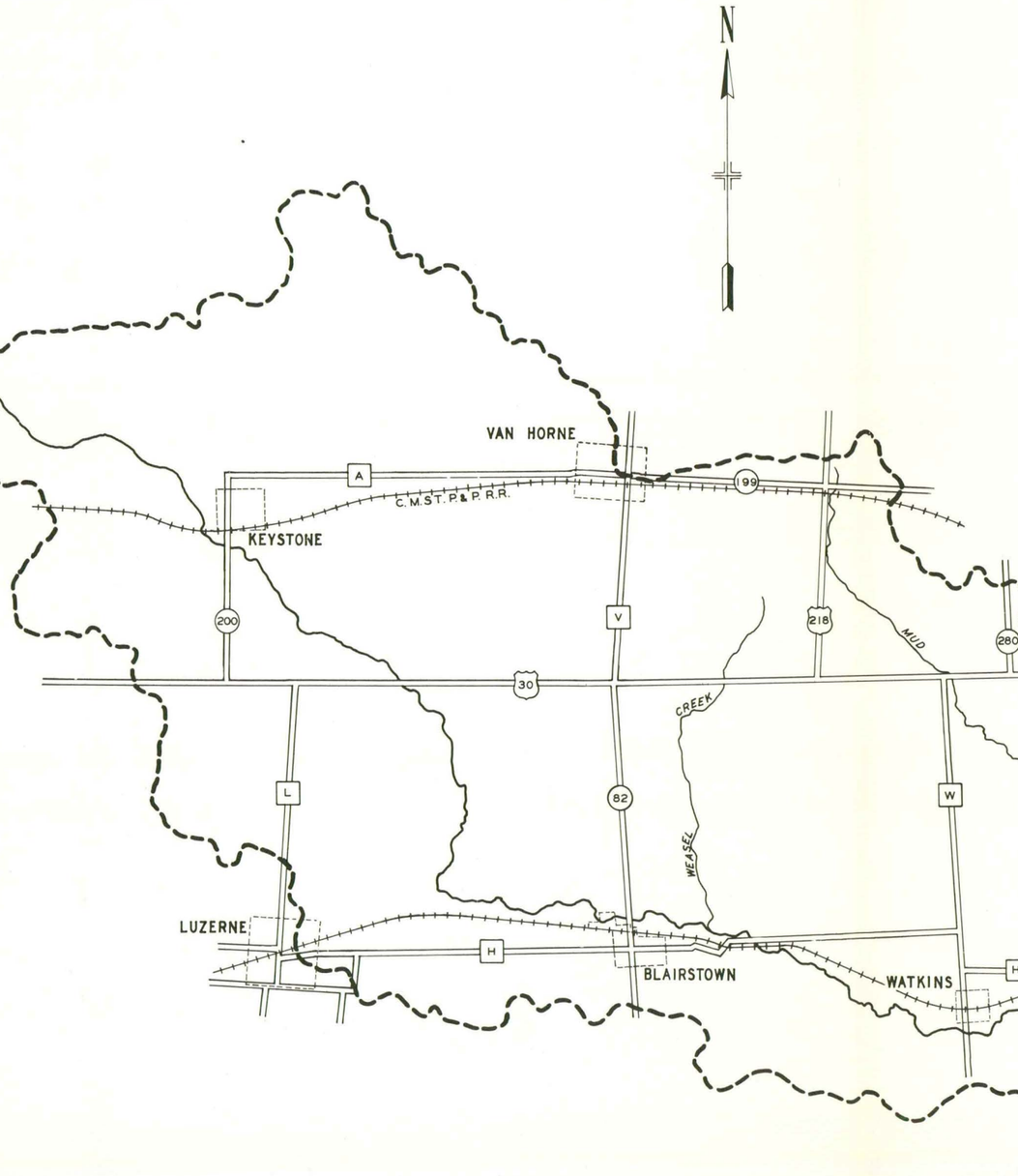
Mile	Location	Elevation of flood profile - feet 50-year flood	100-year flood	standard project flood
8.70		746.8	747.9	749.8
9.06		747.4	748.5	750.4
9.26		748.1	749.1	750.9
C & NW RR Br.	Downstream	748.9	749.9	751.6
9.46	Upstream	750.9	753.1	754.7
9.63		751.1	753.1	754.8
9.87		751.6	753.5	755.3
10.30		753.0	754.6	756.3
10.55		753.9	755.3	756.9
State Hwy Br.	Downstream	754.6	755.9	757.5
10.73	Upstream	757.3	759.3	761.3
10.97		757.6	759.7	761.7
11.44		758.1	760.0	762.1
11.69		758.5	760.3	762.3
12.01		759.5	760.9	762.9
12.20		760.2	761.4	763.3
12.50		760.9	762.0	763.7
12.80		761.5	762.5	764.2
13.04		761.9	762.9	764.5
13.25		762.3	763.2	764.8
13.49		762.8	763.6	765.2
13.71		763.7	764.5	765.9
13.97		764.8	765.6	766.9

TABLE 2 (Cont'd)

FLOOD PROFILE INFORMATION

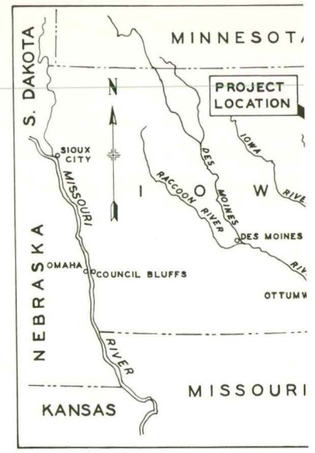
Mile	Location	Elevation of flood profile - feet 50-year flood	100-year flood	standard project flood
County Road Br.	Downstream	766.0	766.8	768.1
14.28	Upstream	767.7	768.7	769.8

CORPS OF ENGINEERS



LEGEND:

- COUNTY LINE
- WATERSHED
- CITY LIMITS
- 30 FEDERAL HIGHWAY
- 82 STATE HIGHWAY
- COUNTY ROAD

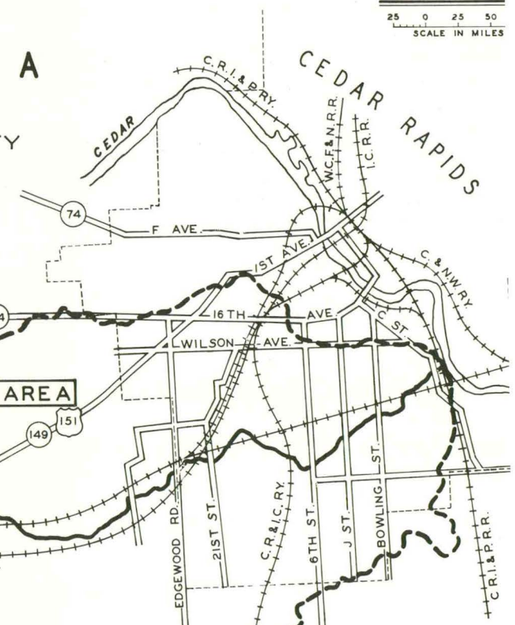


VICINITY M

25 0 25 50
SCALE IN MILES

I O W A

BENTON COUNTY | LINN COUNTY

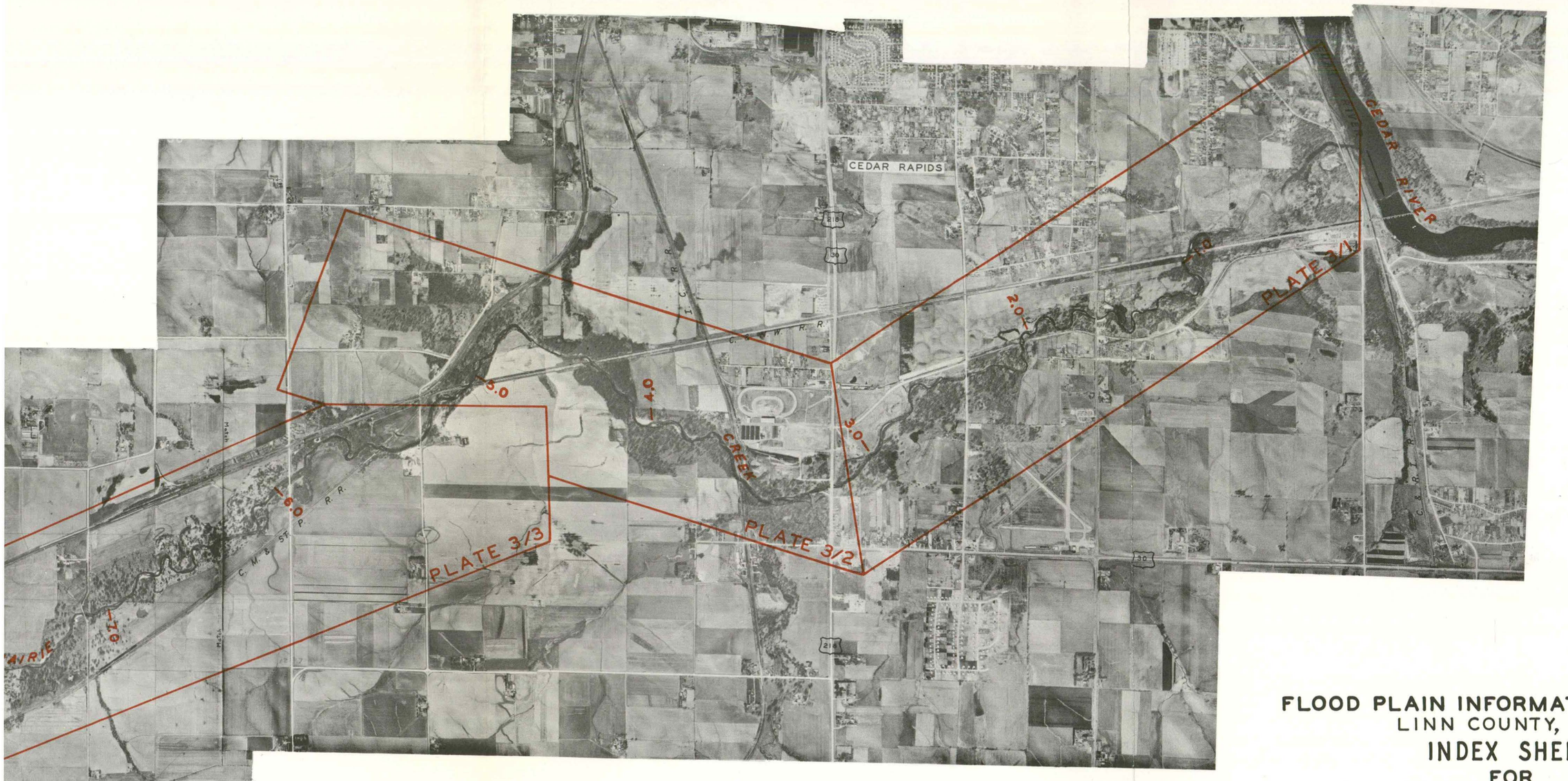


FLOOD PLAIN INFORMA
LINN COUNTY,
BASIN MA
PRAIRIE CR

0
SCALE IN MILE

U.S. ARMY ENGINEER
ROCK ISLAND, ILLI
JANUARY 1965

U.S. ARMY



NOTES:

1. PLATE NUMBERS CORRESPOND TO TOPOGRAPHIC MAPS OF FLOODED AREAS.
2. STATIONING IS MEASURED IN MILES FROM A POINT NEAR MOUTH OF PRAIRIE CREEK.

FLOOD PLAIN INFORMATION REPORT

LINN COUNTY, IOWA

INDEX SHEET

FOR

FLOODED AREA MAPS

PRAIRIE CREEK

MOUTH TO MILE 14.28

1000 0 2000 4000 6000

APPROX. SCALE IN FEET

U. S. ARMY ENGINEER DISTRICT
ROCK ISLAND, ILLINOIS
FEBRUARY 1965

PLATE 2

PLATE 5

FEBRUARY 1982

U.S. ARMY ENGINEER DISTRICT
ROCK ISLAND, ILLINOIS

APPROX. SCALE IN FEET

1000 0 2000 4000 8000

SCALE IN INCH = 2000 FEET

PRAIRIE CREEK

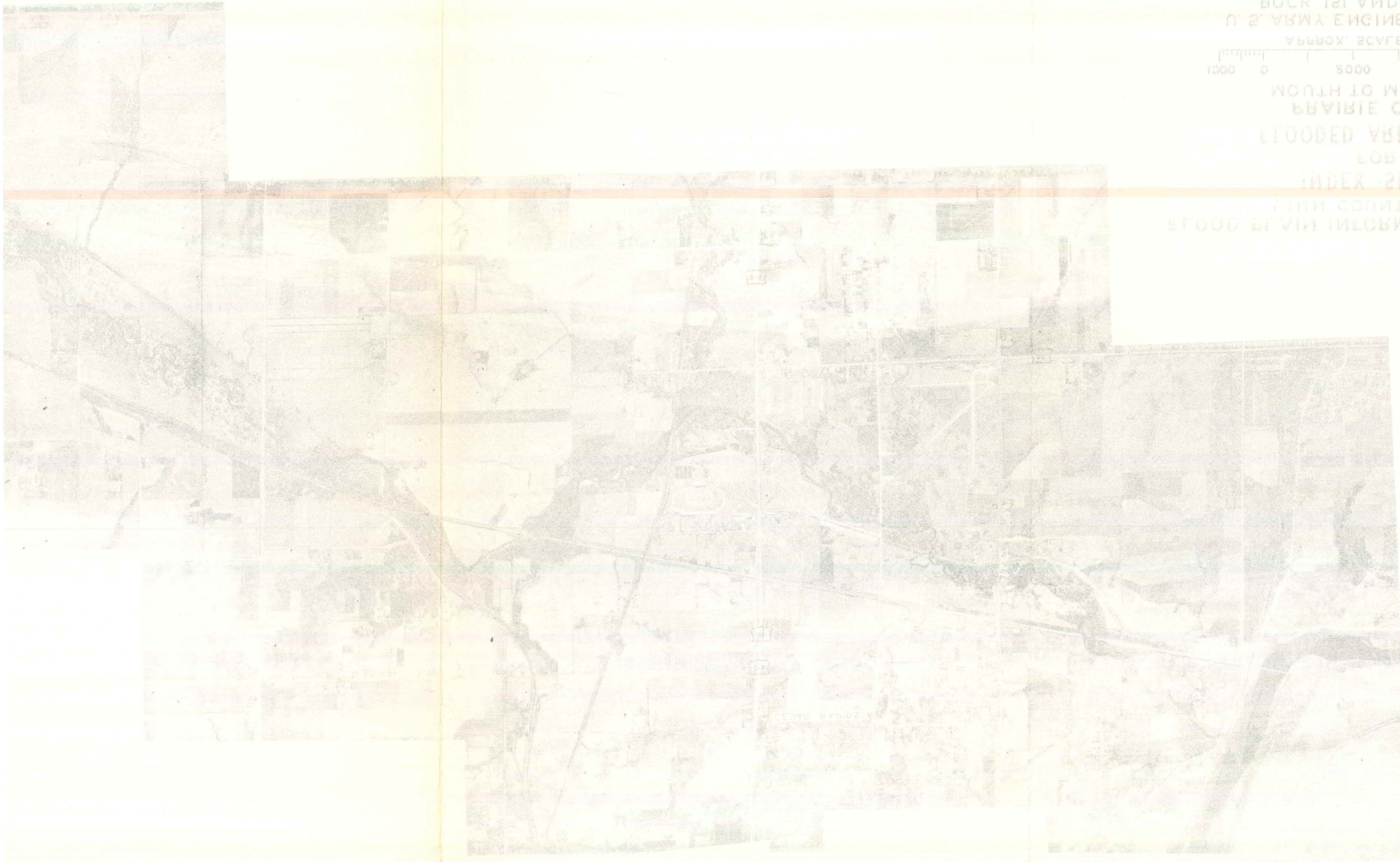
FLOODED AREA MAPS

FOR

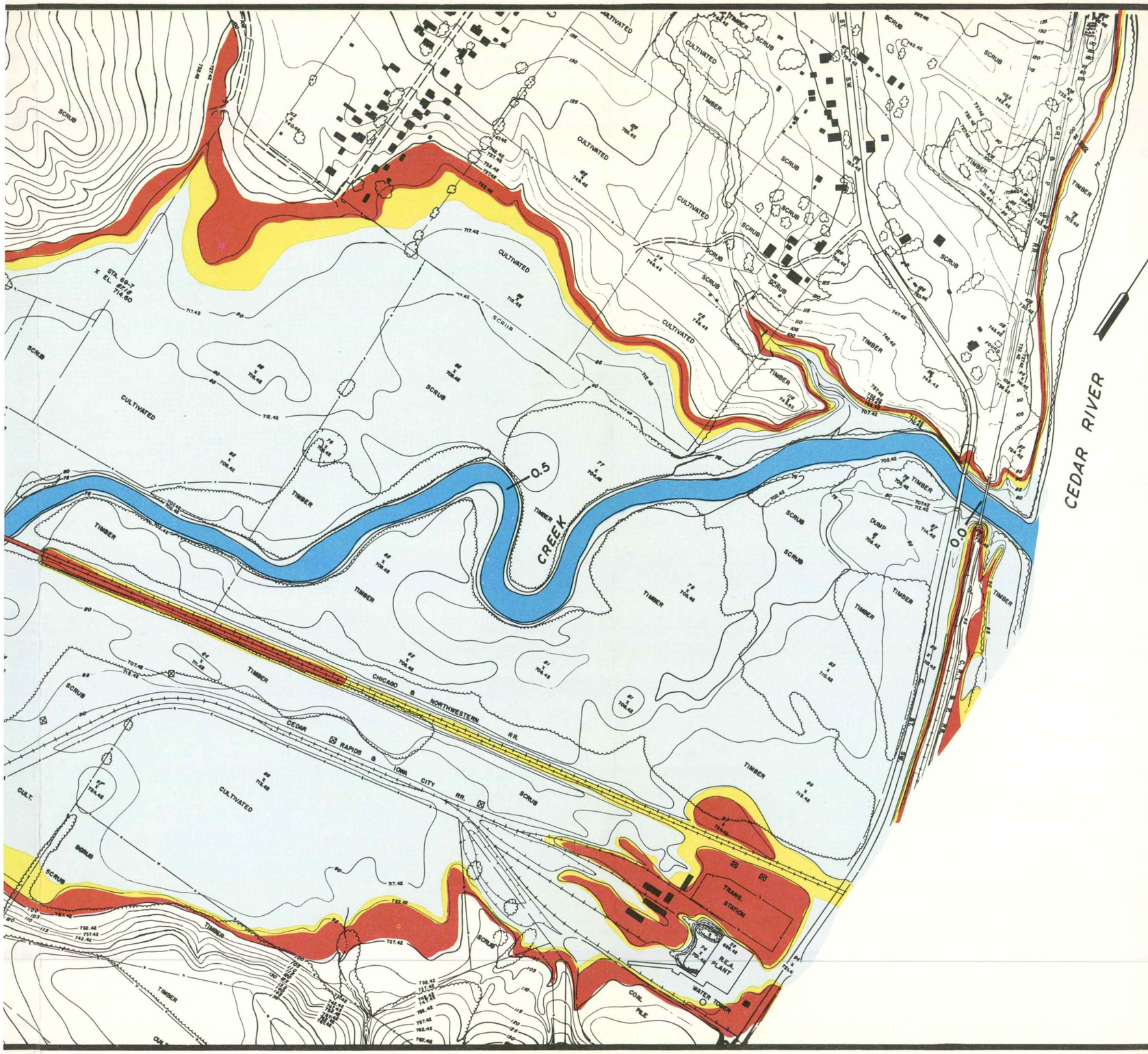
INDEX SHEET

FLOOD PLAIN INFORMATION REPORT

LEE COUNTY, IOWA



U. S. ARMY



N

LEGEND

- 50 YEAR FLOOD
- 100 YEAR FLOOD
- STANDARD PROJECT FLOOD
- 3.0 DISTANCE FROM MOUTH OF PRAIRIE CREEK IN MILES
- ⊗ U.S.G.S. REFERENCE POINT

NOTE:
ELEVATIONS BASED ON U.S.C.&G.S.
ELEVATIONS ALSO INDICATED IN CITY DATUM
ZERO CITY DATUM 627.42 FEET (U.S.C.&G.S.)

FLOOD PLAIN INFORMATION REPORT
LINN COUNTY, IOWA

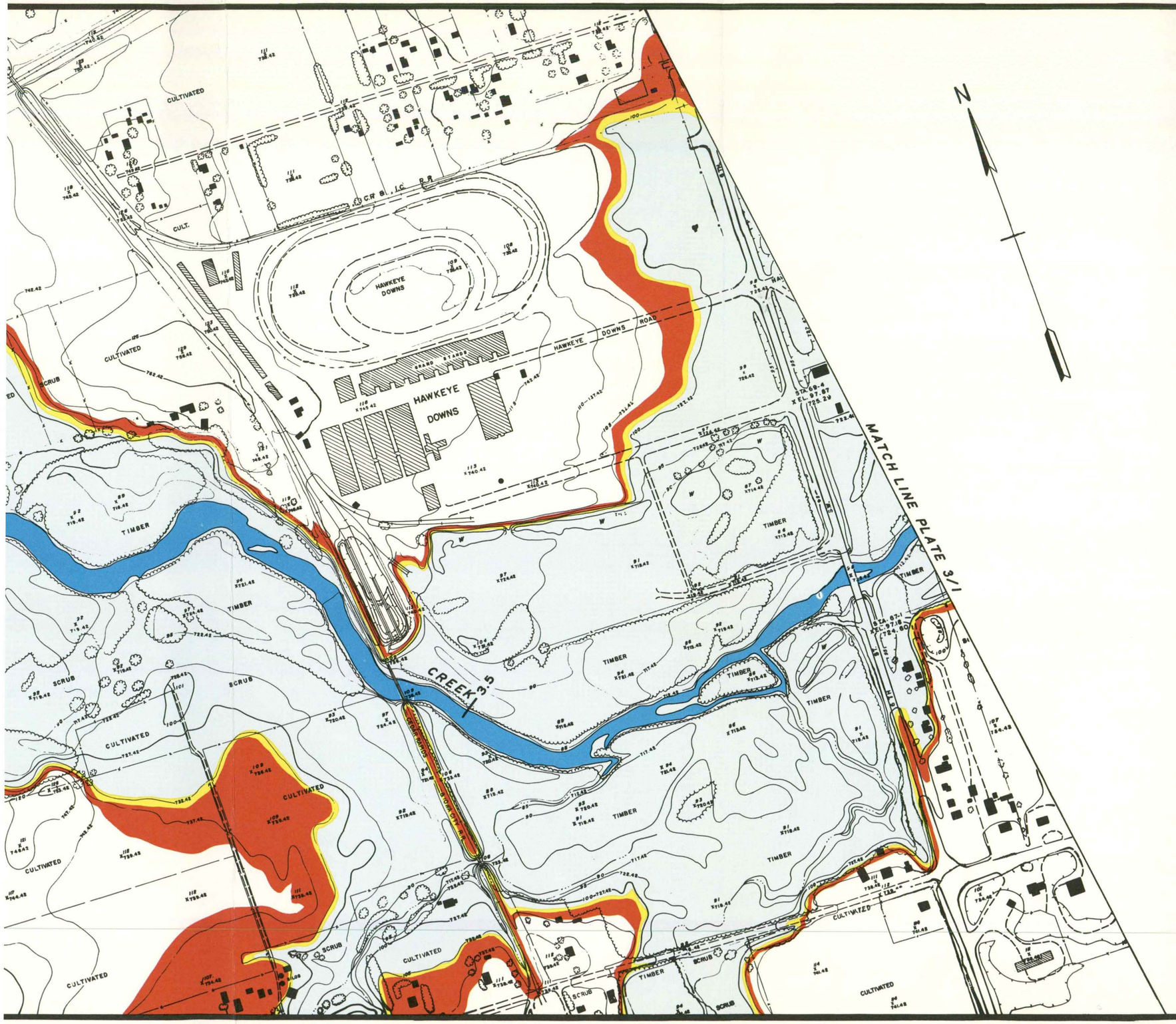
TOPOGRAPHIC MAP OF FLOODED AREA
PRAIRIE CREEK
MOUTH TO MILE 14.28

100 0 500 1000
SCALE IN FEET

U.S. ARMY ENGINEER DISTRICT
ROCK ISLAND, ILLINOIS
FEBRUARY 1965

PLATE 3/1

U. S. ARMY



N

LEGEND

- 50 YEAR FLOOD
- 100 YEAR FLOOD
- STANDARD PROJECT FLOOD
- 3.0 DISTANCE FROM MOUTH OF PRAIRIE CREEK IN MILES
- ⊗ U.S.G.S. REFERENCE POINT

NOTE:

ELEVATIONS BASED ON U. S. C. & G. S.
ELEVATIONS ALSO INDICATED IN CITY DATUM
ZERO CITY DATUM 627.42 FEET (U. S. C. & G. S.)

FLOOD PLAIN INFORMATION REPORT
LINN COUNTY, IOWA

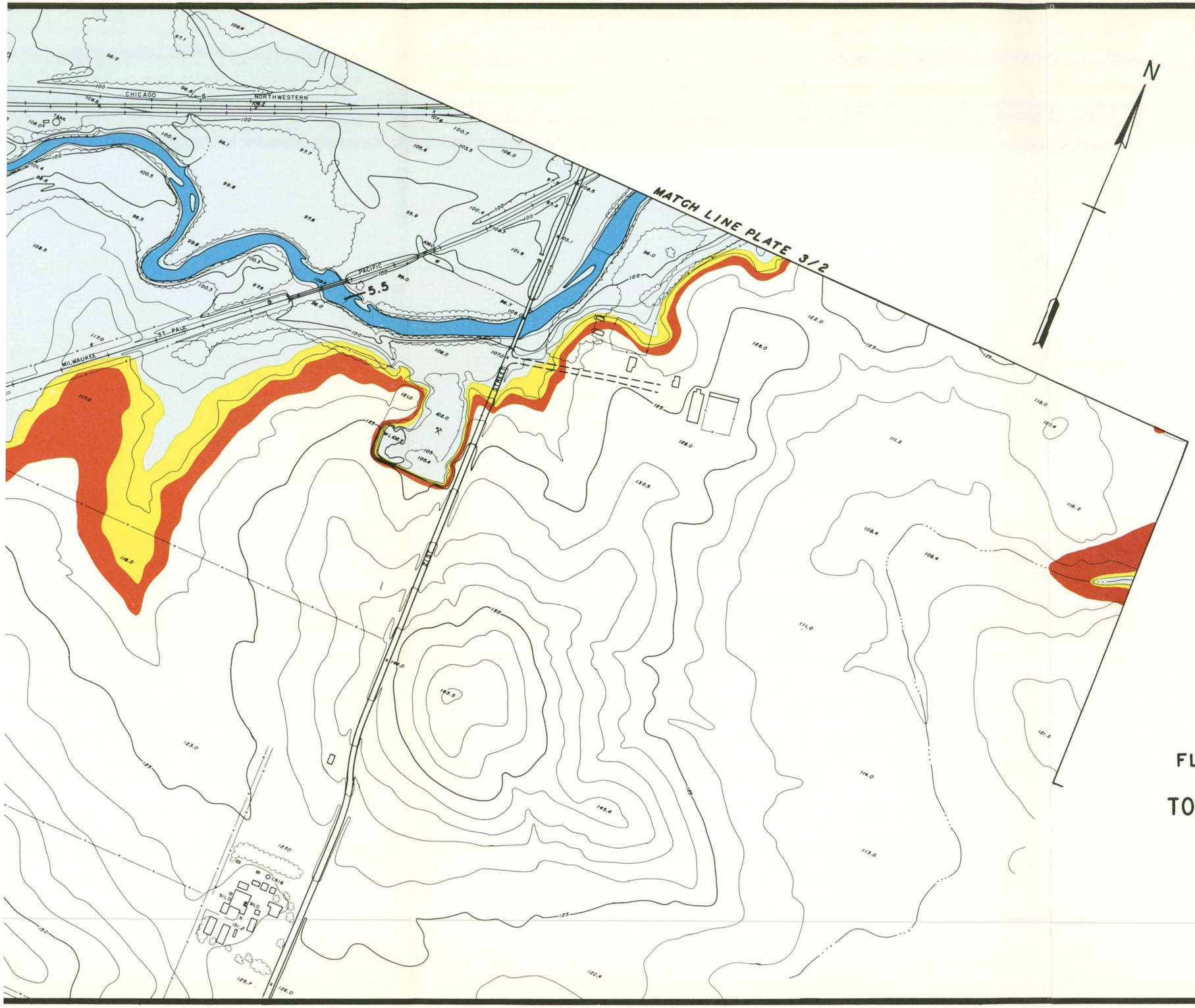
TOPOGRAPHIC MAP OF FLOODED AREA
PRAIRIE CREEK
MOUTH TO MILE 14.28

100 0 500 1000
SCALE IN FEET

U. S. ARMY ENGINEER DISTRICT
ROCK ISLAND, ILLINOIS
FEBRUARY 1965

PLATE 3/2

U.S. ARMY



LEGEND

- 50 YEAR FLOOD
- 100 YEAR FLOOD
- STANDARD PROJECT FLOOD
- 3.0 DISTANCE FROM MOUTH OF PRAIRIE CREEK IN MILES
- ⊗ U.S.G.S. REFERENCE POINT

NOTE:
ELEVATIONS BASED ON U.S.C.&G.S.

FLOOD PLAIN INFORMATION REPORT
LINN COUNTY, IOWA

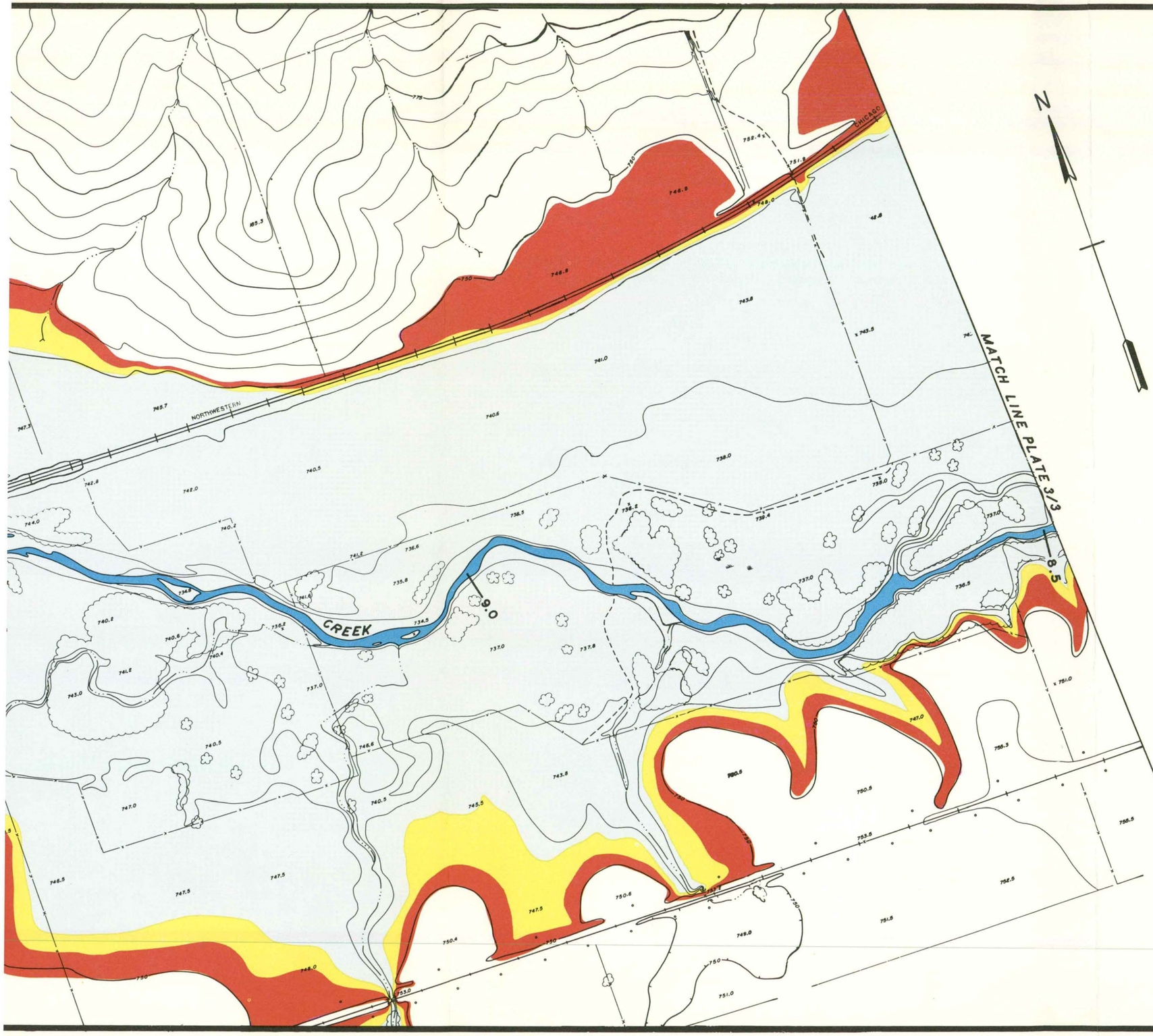
TOPOGRAPHIC MAP OF FLOODED AREA
PRAIRIE CREEK
MOUTH TO MILE 14.28

100 0 500 1000
SCALE IN FEET

U.S. ARMY ENGINEER DISTRICT
ROCK ISLAND, ILLINOIS
FEBRUARY 1965

PLATE 3/3

U. S. ARMY



LEGEND

- 50 YEAR FLOOD
- 100 YEAR FLOOD
- STANDARD PROJECT FLOOD
- 3.0 DISTANCE FROM MOUTH OF PRAIRIE CREEK IN MILES
- ⊗ U.S.G.S. REFERENCE POINT

NOTE:
ELEVATIONS BASED ON U.S.C.&G.S.

FLOOD PLAIN INFORMATION REPORT
LINN COUNTY, IOWA

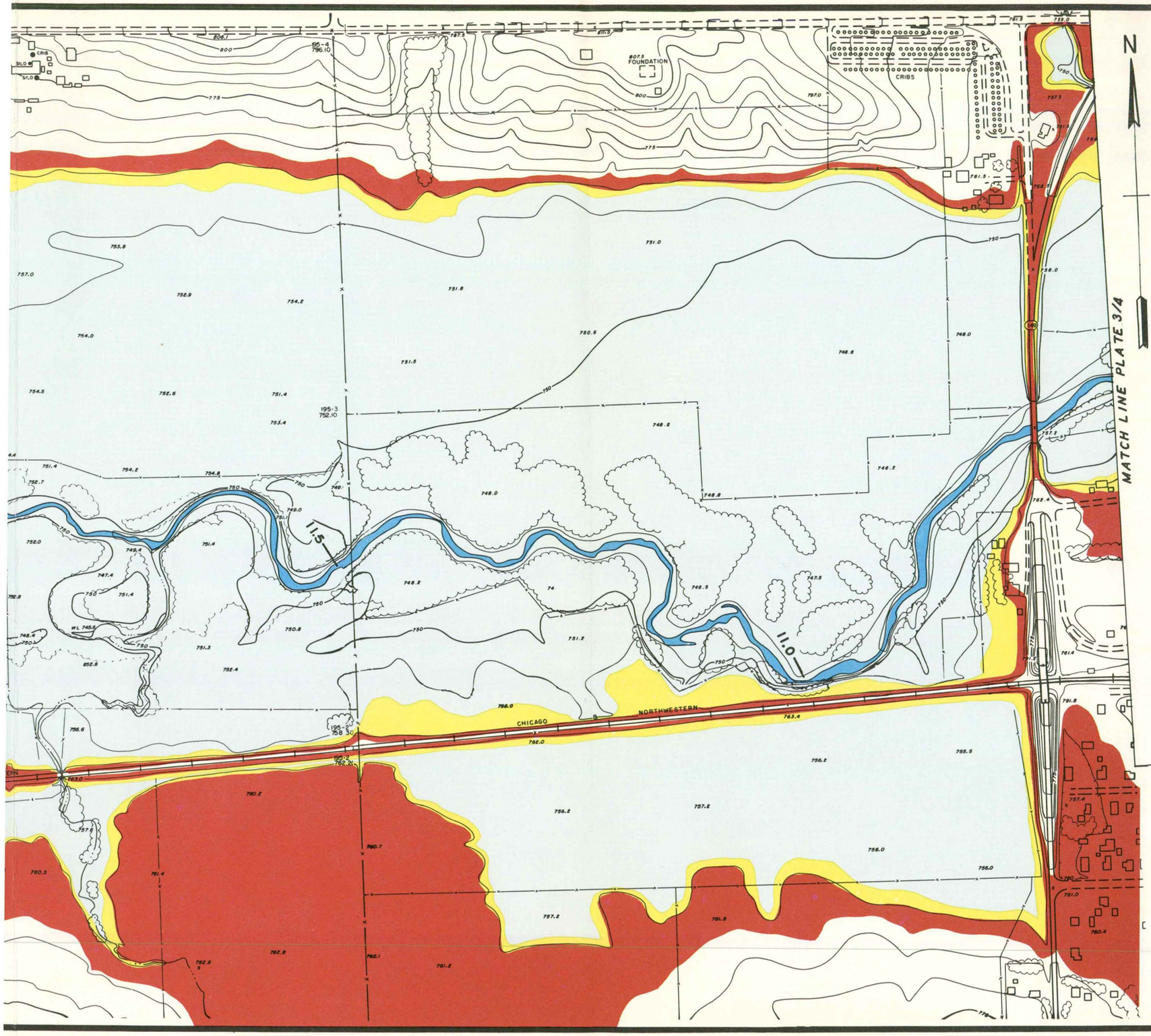
TOPOGRAPHIC MAP OF FLOODED AREA
PRAIRIE CREEK
MOUTH TO MILE 14.28

100 0 500 1000
SCALE IN FEET

U.S. ARMY ENGINEER DISTRICT
ROCK ISLAND, ILLINOIS
FEBRUARY 1965

PLATE 3/4

U. S. ARMY



LEGEND

- 50 YEAR FLOOD
- 100 YEAR FLOOD
- STANDARD PROJECT FLOOD
- 3.0 DISTANCE FROM MOUTH OF PRAIRIE CREEK IN MILES
- ⊗ U.S.G.S. REFERENCE POINT

NOTE:
ELEVATIONS BASED ON U.S.C.&G.S.

FLOOD PLAIN INFORMATION REPORT
LINN COUNTY, IOWA

TOPOGRAPHIC MAP OF FLOODED AREA
PRAIRIE CREEK
MOUTH TO MILE 14.28

100 0 500 1000
SCALE IN FEET

U.S. ARMY ENGINEER DISTRICT
ROCK ISLAND, ILLINOIS
FEBRUARY 1965

PLATE 3/5

JUNE 1944
JAN. 1946
FEB. 1937
MAR. 1959
JUNE 1961
JUNE 1965
JUNE 1965
JUNE 1965
JUNE 1961
965

C.M.ST.P.&P.R.R. BRIDGE MILE 5.52
MILE 5.67
EDGEWOOD ROAD BRIDGE, MILE 5.95

750
740
730
720
710
6.0
6.5
7.0

LEGEND:

– – – – – – – –	STANDARD PROJECT FLOOD	CEDAR RIVER
——·——	100 YEAR FREQUENCY	CEDAR RIVER
——– –——	50 YEAR FREQUENCY	CEDAR RIVER
◉	HIGH WATER MARK	
———	STANDARD PROJECT FLOOD	PRAIRIE CREEK
——— ———	100 YEAR FREQUENCY	PRAIRIE CREEK
– – – – – –	50 YEAR FREQUENCY	PRAIRIE CREEK
·····	LOW WATER PROFILE	
——·—·—·—	CHANNEL BOTTOM	
⌣	BRIDGE – LOW STEEL ELEVATION	

2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5

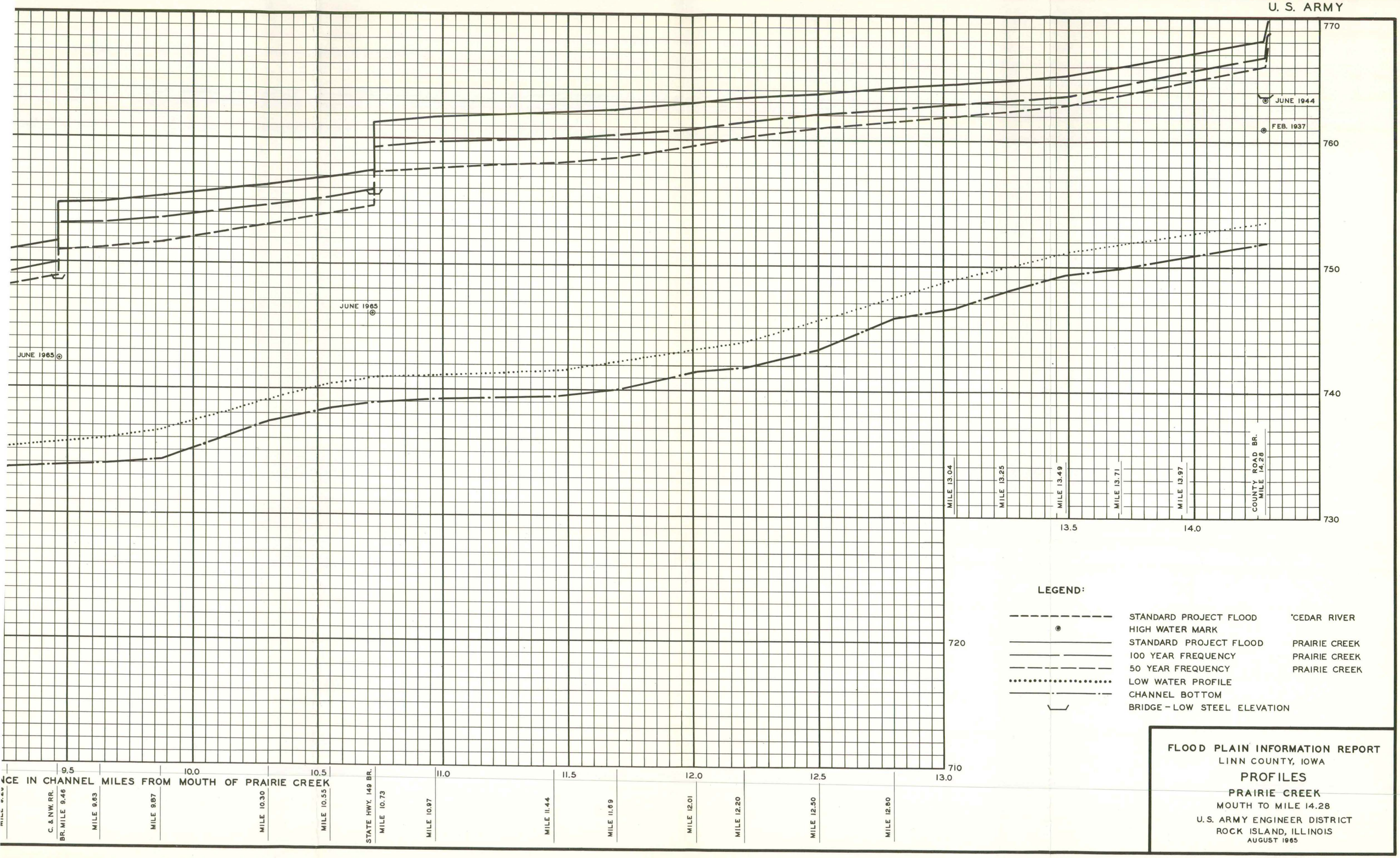
DISTANCE IN CHANNEL MILES FROM MOUTH OF PRAIRIE CREEK

MILE 1.92
C.R.&I.C.R.R. BRIDGE MILE 2.06
MILE 2.22
"J" STREET BRIDGE MILE 2.42
MILE 2.75
MILE 2.99
6TH STREET BR. MILE 3.19
MILE 3.41
C.R.&I.C.R.R. BR. MILE 3.55
MILE 3.86
MILE 4.08
C.&NW.R.R. BRIDGE MILE 4.42
MILE 4.90
C.&NW.R.R. BRIDGE MILE 5.05
MILE 5.20
21ST STREET BRIDGE MILE 5.36

FLOOD PLAIN INFORMATION REPORT
LINN COUNTY, IOWA
PROFILES
PRAIRIE CREEK
MOUTH TO MILE 14.28
U.S. ARMY ENGINEER DISTRICT
ROCK ISLAND, ILLINOIS
AUGUST 1965

PLATE 4/1

U. S. ARMY



LEGEND:

----------	STANDARD PROJECT FLOOD	'CEDAR RIVER
●	HIGH WATER MARK	
————	STANDARD PROJECT FLOOD	PRAIRIE CREEK
———— ————	100 YEAR FREQUENCY	PRAIRIE CREEK
— — — — — —	50 YEAR FREQUENCY	PRAIRIE CREEK
.....	LOW WATER PROFILE	
———·———·—	CHANNEL BOTTOM	
⌣	BRIDGE – LOW STEEL ELEVATION	

FLOOD PLAIN INFORMATION REPORT
LINN COUNTY, IOWA
PROFILES
PRAIRIE CREEK
MOUTH TO MILE 14.28
U.S. ARMY ENGINEER DISTRICT
ROCK ISLAND, ILLINOIS
AUGUST 1965

PLATE 4/2