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MINIMUM FLOODWAY AND FLOOD PROTECTION REQUIREMENTS

SKUNK RIVER - SQUAW CREEK

AMES, IOWA

IOWA NATURAL RESOURCES COUNCIL

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7/14/76, Natural Resources Council, Jett.

## I. Introduction

The Iowa Natural Resources Council was created in 1949 by the 53rd General Assembly of the State of Iowa. One of the primary overall objectives of the Council is to reduce future flood damages within the State.

Chapter 455A.2, Code of Iowa, reads in part,

"Declaration of policy. It is hereby recognized that the protection of life and property from floods, the prevention of damage to lands therefrom and the orderly development, wise use, protection and conservation of the water resources of the state by the considered and proper use thereof, is of paramount importance to the welfare and prosperity of the people of the state, . . ."

One means of protecting life and property from floods is a sound flood plain management program. The aim of such a program is planned, controlled flood plain development that recognizes the future flooding potential of flood plain lands. A flood plain management program can consist of flood control facilities, zoning ordinances, subdivision regulations, building and sanitary codes, open-space and public-land acquisition programs, and flood warning systems.

The principal objective of flood plain management is the allocation of land to its most appropriate use from the viewpoint of the community and the State as a whole. Several specific objectives relate to minimization and reduction of flood damages by:

- (1) Protecting adjacent, upstream, and downstream private and public landowners from direct and substantial increases in flood damages;

- (2) Minimizing unjustified cost to governmental units caused by development in flood hazard areas;
- (3) Preventing victimization and fraud;
- (4) Reducing risks to the individual or his family or guests from threats to health and safety or economic loss.

Flood plain management can, through careful planning and a range of management techniques, guide the use of flood plains so that it is consistent with overall community land use needs.

## II. Study Objectives

Chapter 455A.35, Code of Iowa, states in part,

"The Council may establish and enforce regulations for the orderly development and wise use of the flood plains of any river or stream within the state and alter, change, or revoke and terminate the same. The council shall determine the characteristics of floods which reasonably may be expected to occur and may by order establish encroachment limits, protection methods and minimum protection levels appropriate to the flooding characteristics of the stream and to reasonable use of the flood plains. The order shall fix the length of flood plains to be regulated at any practical distance; shall fix the width of the zone between the encroachment limits so as to include portions of the flood plains adjoining the channel, which with the channel, are required to carry and discharge the flood waters or flood flow of such river or stream; and shall fix the design discharge and water surface elevations for which protection shall be provided for projects outside the encroachment limits but within the limits of inundation."

It is the specific objective of this report to provide the following technical data on the Skunk River and Squaw Creek in the vicinity of Ames, Iowa, for use by both the Iowa Natural Resources Council and the City of Ames in establishing comprehensive flood plain regulations:

1. Delineation of the flood plain area;
2. Determination of a regulatory flood;
3. Delineation of the floodway;
4. Determination of minimum flood protection levels.

It is intended that this report be compatible with and established as part of the comprehensive state-wide plan for control, utilization, and protection of the water resources of the State.

### III. Discharge Determinations

#### A. Flood Plain Delineation Flood

Chapter 455A.1, Code of Iowa, defines flood plains as

"the area adjoining the river or stream which has been or may be hereafter covered by flood water".

In keeping with this definition, the flood plain area will be considered as the area that would be inundated by the Corps of Engineers Standard Project Flood as determined in their study entitled, "Flood Plain Information Report, Skunk River and Squaw Creek, Story County, Iowa", prepared for the Iowa Natural Resources Council by the Rock Island District of the Corps of Engineers and published in June 1966. The Corps of Engineers defines a Standard Project Flood as a hypothetical flood 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. Following is a tabulation of the Standard Project Flood discharges for the reaches of the Skunk River and Squaw Creek that are considered in this study:

	<u>Reach</u>	<u>Drainage Area (Sq. Mi. )</u>	<u>Standard Proj- ect Flood (cfs.)</u>
Skunk River	Below mouth of Squaw Creek	568	35,000
	Above mouth of Squaw Creek	329	26,500
Squaw Creek	Mouth to South 4th St.	227	22,000
	S. 4th St. to Stange Rd.	208	21,000
	Above Stange Rd.	193	20,500

B. Regulatory Flood

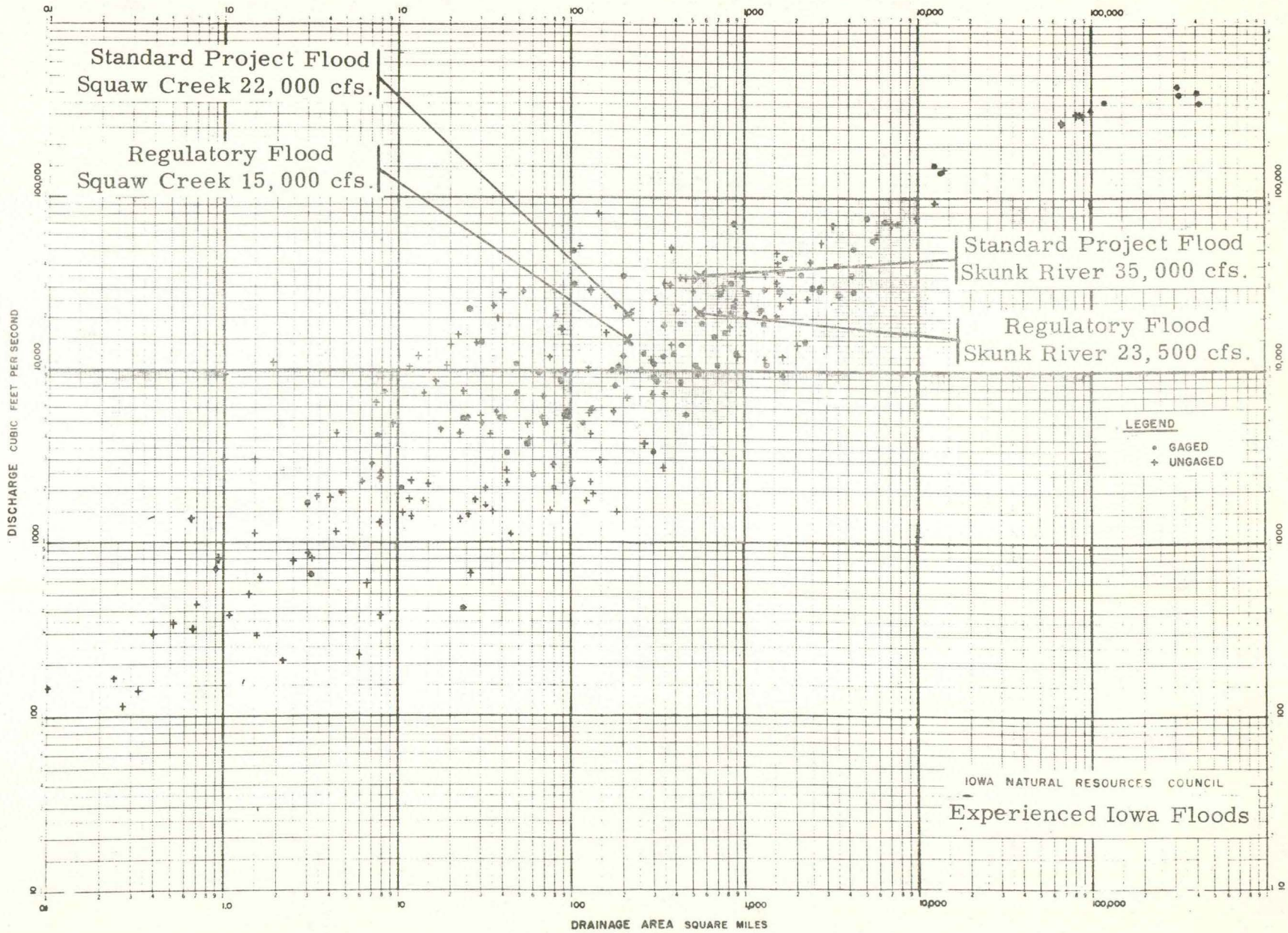
While it is reasonable to define the flood plain as the area inundated by an extremely large flood, it may not be feasible to require flood protection levels based on such an event. Recognizing that the Standard Project Flood is a rare event, the Iowa Natural Resources Council generally bases minimum flood protection levels on a flood which will have a one percent chance of occurring in any one year (100 year flood). The Corps of Engineers, in the study referenced in the previous section, developed 100 year flood discharges for the streams under consideration. For the purpose of this report, the Iowa Natural Resources Council Regulatory Flood discharge will be considered equal to the Corps of Engineers 100 year flood. It should be noted that floods larger than the Regulatory Flood discharge may occur at some time in the future.

Following is a tabulation of the Regulatory Flood discharges for the reaches of the Skunk River and Squaw Creek that are considered in this report:

	<u>Reach</u>	<u>Drainage Area (Sq. Mi. )</u>	<u>Regulatory Flood (cfs. )</u>
Skunk River	Below mouth of Squaw Creek	568	23,500
	Above mouth of Squaw Creek	329	18,000
Squaw Creek	Mouth to S. 4th St.	227	15,000
	S. 4th St. to Stange Rd.	208	14,500
	Above Stange Rd.	193	13,500

The figure on the following page indicates where the above referenced Standard Project and Regulatory Flood discharges would be located on a plot of Peak Discharge vs. Drainage Area for floods that have been experienced in Iowa.





#### IV. Floodway Delineation and Encroachment Limits

Chapter 455A, Code of Iowa, defines floodway as

"... the channel of a river or stream 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 any river or stream."

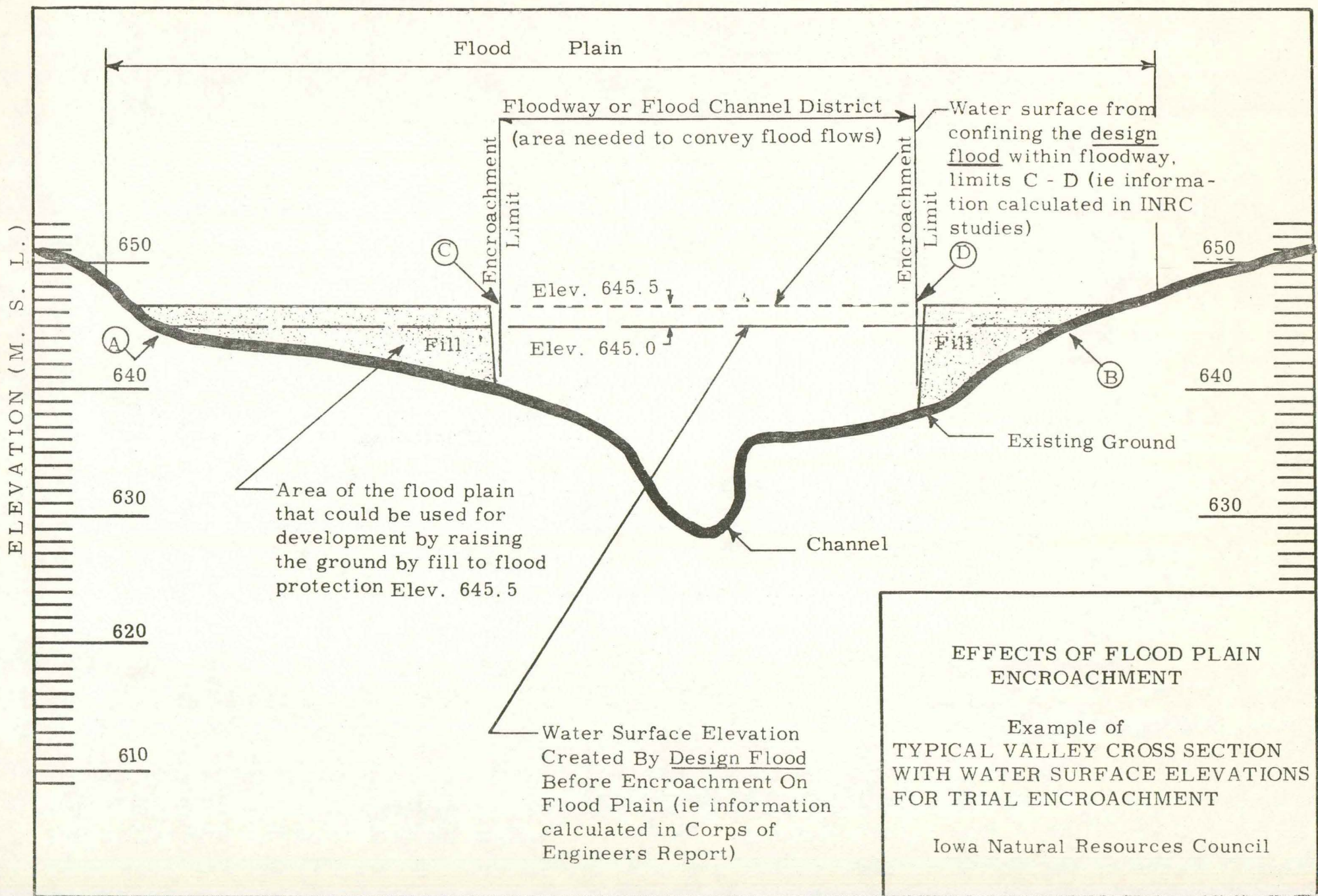
Encroachment limits may be thought of as lines which generally parallel a river or stream channel which delineate the area adjacent to the channel that is reasonably required to carry and discharge the flood water or flood flows. In other words, encroachment limits are used to distinguish the floodway within the flood plain.

The following considerations are usually given in locating encroachment limits:

1. In heavily developed flood plain areas having high damage potential or in areas where additional flood plain encroachment may reduce the level of protection of existing or proposed works for flood control, encroachment limits are located in a manner such that the increase in flood stage resulting by confining the Regulatory Flood discharge between said encroachment limits is minimized as much as possible, but in any event shall be less than 1.0 foot.
2. In other areas, the increase in flood stage resulting from confining the Regulatory Flood discharge between the encroachment limits shall generally not exceed 1.0 foot.
3. Existing buildings located in the flood plain shall be excluded from all areas lying between the encroachment limits, insofar as possible.

4. Encroachment limits or minimum offsets, subject to natural or other physical limitations, shall be established so as to provide comparable capacity for conveyance of flood flows on the overbank areas located on each side of the stream channel.

The figure on the following page shows the effects of flood plain encroachment on a typical valley cross section.



## V. Minimum Flood Protection Levels

The minimum flood protection level is the minimum elevation to which high damage potential types of flood plain development must be provided flood protection. The elevation of the minimum flood protection level corresponds to the elevation of the Regulatory Flood as confined to the floodway between the encroachment limits. The desired level of flood protection may be achieved by placing the lowest water entry level of high damage potential types of flood plain development at or above the minimum flood protection level. The lowest water entry level is defined as the level of a building or building complex, below which the structure is designed and constructed to withstand the seepage or passage of water into the structure and withstand flood conditions including the hydrostatic pressure of an elevated water table.

For high damage potential structures having basements or levels below the minimum flood protection level, the Iowa Natural Resources Council generally requires:

1. Walls and floors located below the minimum flood protection level be designed and constructed to withstand the hydrostatic pressure of an elevated water table.
2. Sanitary sewer systems outletting below the minimum flood protection level be provided with back-up valves.

One acceptable method of protecting walls and floors from the hydrostatic pressures of an elevated water table is to place compacted fill up to the minimum flood protection level extending for a distance of 15 feet out from and completely around the perimeter of the structure to be protected. Walls and

floors below the minimum flood protection level should be of poured concrete construction and waterproofed.

If protection is to be provided by a levee, the levee is to provide freeboard protection above the elevation of the regulatory discharge of an additional three feet or up to the level of the Standard Project Flood whichever is higher.

The following pages list the minimum protection levels upstream and downstream from certain structures such as street and railroad grades and bridges within the reaches under consideration. Some pertinent data on the road grade and low superstructure elevations is also included.

SKUNK RIVER

<u>Location</u>	<u>Minimum Flood Protection Level</u>		<u>Low Super-structure City Datum</u>	<u>Low Road Grade City Datum</u>
	<u>MSL Datum</u>	<u>City Datum</u>		
U. S. Highway #30	DS 880.5 US 881.7	DS 56.9 US 58.1	61.4	68.6
Lincoln Way	DS 885.8 US 888.4	DS 62.1 US 64.8	66.5	63.5
C. & N. W. R. R.	DS 889.5 US 891.0	DS 65.9 US 66.6	78.2	86.2
13th Street	DS 892.4 US 892.8	DS 68.7 US 69.3	69.6	70.4
Riverside	DS 907.3 US 908.7	DS 83.6 US 85.2	84.8	81.4

SQUAW CREEK

Duff Avenue	DS 885.8 US 886.8	DS 62.2 US 63.2	65.0	62.4
C. & N. W. R. R.	DS 890.0 US 892.1	DS 66.4 US 68.5	65.0	66.4
South 4th Street	DS 893.0 US 894.1	DS 69.4 US 69.9	71.0	70.5
Lincoln Way	DS 895.2 US 896.0	DS 71.1 US 72.1	75.0	72.0
Spur Line	DS 897.4	DS 73.6	74.7	77.0
C. & N. W. R. R.			86.0	91.0
6th Street	US 899.1	US 75.5	81.7	76.0

SQUAW CREEK (CONT.)

<u>Location</u>	Minimum Flood Protection Level		Low Super- structure <u>City Datum</u>	Low Road Grade <u>City Datum</u>
	<u>MSL Datum</u>	<u>City Datum</u>		
13th Street	DS 900.5 US 902.0	DS 76.9 US 78.4	83.0	84.2
Stange Road	DS 903.5 US 904.8	DS 79.9 US 81.2	84.4	82.2



## VI. Explanation of Maps and Profiles

### A. Flood Profiles

Plates #1 and #2 show the flood profiles for the Standard Project Flood and the Regulatory Flood on the Skunk River and Squaw Creek, respectively.

As related in the previous section entitled, "Discharge Determinations", the Standard Project Flood is used to define the limits of the flood plain, while the Regulatory Flood is used to establish minimum flood protection levels. Regulatory Flood profiles shown in this report reflect the anticipated elevations of flooding caused by confining the Regulatory Flood to the area within the encroachment limits. Elevations are based on Ames City Datum.

### B. Flood Plain and Floodway Delineation Maps

Plates #3 through #7 show the flood plain and floodway areas along the Skunk River and Squaw Creek. The floodway area, as identified by encroachment limits, and the flood plain area are delineated on topographic maps having a scale of 1 inch equals 100 feet with a 2 foot contour interval. Photography upon which the topographic mapping is based was taken in May, 1954, and November, 1961. Some recent street improvements have been noted.

Since the topographic maps reflect conditions at the time of the aerial photography, the flood plain limits as shown on the maps may vary in precision because of changed conditions. In the event a question arises as to the location of a parcel of property with respect to the flood plain, current

elevations of the property should be checked against the elevation of the Standard Project Flood profile adjacent to the property. That portion of the property below the elevation of the Standard Project Flood would be considered to be in the flood plain.

## VII. Use of Report

### A. Iowa Natural Resources Council

As referenced in the previous section entitled "Study Objectives" the Iowa Natural Resources Council has the authority to establish and enforce comprehensive regulations for the orderly development and wise use of the flood plains. It is intended that the information in this report be the basis for the establishment of comprehensive regulations on the flood plains of the Skunk River and Squaw Creek in the vicinity of Ames, Iowa.

In the absence of comprehensive regulations, the Iowa Natural Resources Council has jurisdiction over and must approve individual construction projects on the flood plains prior to construction thereof. Chapter 455A.33, Code of Iowa, reads in part,

"It shall be unlawful to suffer or permit any structure, dam, obstruction, deposit, or excavation to be erected, used, or maintained in or on any floodway or flood plains, which will adversely affect the efficiency of or unduly restrict the capacity of the floodway, adversely affect the control, development, protection, allocation, or utilization of the water resources of the state, or adversely affect or interfere with the state comprehensive plan for water resources, or an approved local water resources plan. . .

"In the event any person desires to erect or make, or to suffer or permit, a structure, dam, obstruction, deposit or excavation, . . . to be erected, made, used or maintained in or on any floodway or flood plains, such person shall file a verified written application with the council."

This report will assist the Resources Council in determining if a particular project by itself or relative to others will adversely affect the

efficiency of or unduly restrict the capacity of the floodway, adversely affect the control, development, protection, allocation, or utilization of water resources of the state, or adversely affect or interfere with the state comprehensive plan for water resources, or an approved local water resources plan.

B. Local Units of Government

Chapter 455A.35, Code of Iowa, as previously referenced in the section entitled "Study Objectives" continues, in part,

"The council may cooperate with and assist local units of government in the establishment of encroachment limits, flood plain regulations and zoning ordinances relating to flood plain areas within their jurisdiction. Encroachment limits, flood plain regulations, or flood plain zoning ordinances proposed by local units of government shall be submitted to the council for review and approval prior to adoption by such local units of government. Changes or variations from an approved regulation or ordinance as it relates to flood plain use shall be approved by the council prior to adoption. Individual applications, plans and specifications and individual council approval orders shall not be required for works on the flood plains constructed in conformity with encroachment limits, flood plain regulations, or zoning ordinances adopted by the local units of government and approved by the council."

The information contained in this report will serve as a technical basis for the development of local flood plain regulations or for implementation of flood plain provisions into zoning, subdivision, and/or building regulations. The encroachment limits and flood protection levels contained herein indicate the minimum state requirements. In some instances local units of government may elect to be more restrictive. The staff of the Iowa Natural Resources Council will make every effort to assist the local units of government in drafting local regulations when assistance is requested.

C. Other Uses:

This study may be further used as a possible guide toward implementation of:

1. Land use development policies such as green belt or open space programs.
2. Tax adjustments for floodway and flood plain lands.
3. Development of flood warning systems.
4. Flood insurance in accordance with the provisions of the National Flood Insurance Program.

## Bibliography

Code of Iowa, 1973, as amended, Chapter 455A, Relating to Water Resources.

Corps of Engineers, Rock Island District, 1966, Flood Plain Information Report, Skunk River and Squaw Creek, Story County, Iowa.

Kusler, Jon A. and Lee, Thomas M., 1972, Regulations for Flood Plains, American Society of Planning Officials, Planning Advisory Service, Report No. 277.

Shearman, J. O. and Dougal, M. D., 1964, A Computer Program for Computing Water Surface Profiles, Center for Industrial Research and Service.

United States Water Resources Council, 1970, Regulation of Flood Hazard Areas to Reduce Flood Losses, Volume I, Parts I-IV; Volume II, Parts V-VI.

## INDEX LISTING OF PLATES

### Flood Profile Plates

Plate #1  
Flood Profiles, Skunk River

Plate #2  
Flood Profiles, Squaw Creek

### Flood Plain Delineation and Encroachment Line Location Plates

Plate #3  
Skunk River, Mile -3.0 to 0.0

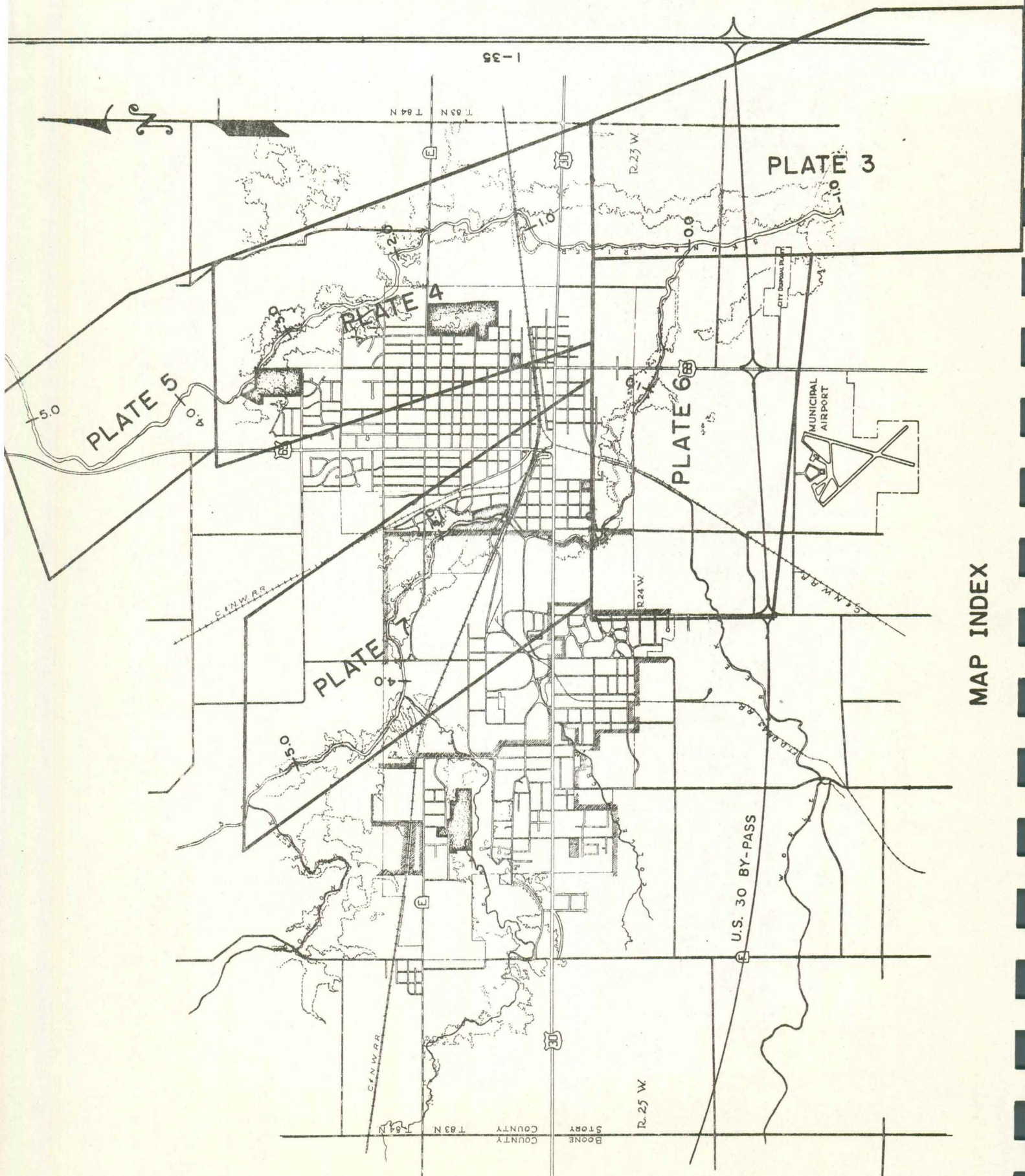
Plate #4  
Skunk River, Mile 0.0 to 3.8

Plate #5  
Skunk River, Mile 3.8 to 5.0

Plate #6  
Squaw Creek, Mile 0.0 to 2.0

Plate #7  
Squaw Creek, Mile 2.0 to 5.0

(See next sheet for map index of plates 3-7)



MAP INDEX

1-35

PLATE 3

PLATE 4

PLATE 5

PLATE 6

PLATE 7

U.S. 30 BY-PASS

MUNICIPAL AIRPORT

BOONE COUNTY MO. ST. 1-35

R. 25 W.

CIN. W. R.R.

T. 84 N.

T. 83 N.

T. 83 N.

T. 84 N.

R. 23 W.

R. 24 W.

CIN. W. R.R.

CIN. W. R.R.

CIN. W. R.R.

5.0

4.0

0.50

0.20

1.0

0.60

0.70

0.80

0.90

1.00

1.10



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