F L O O D P L A I N I N V E N T O R Y R E P O R T

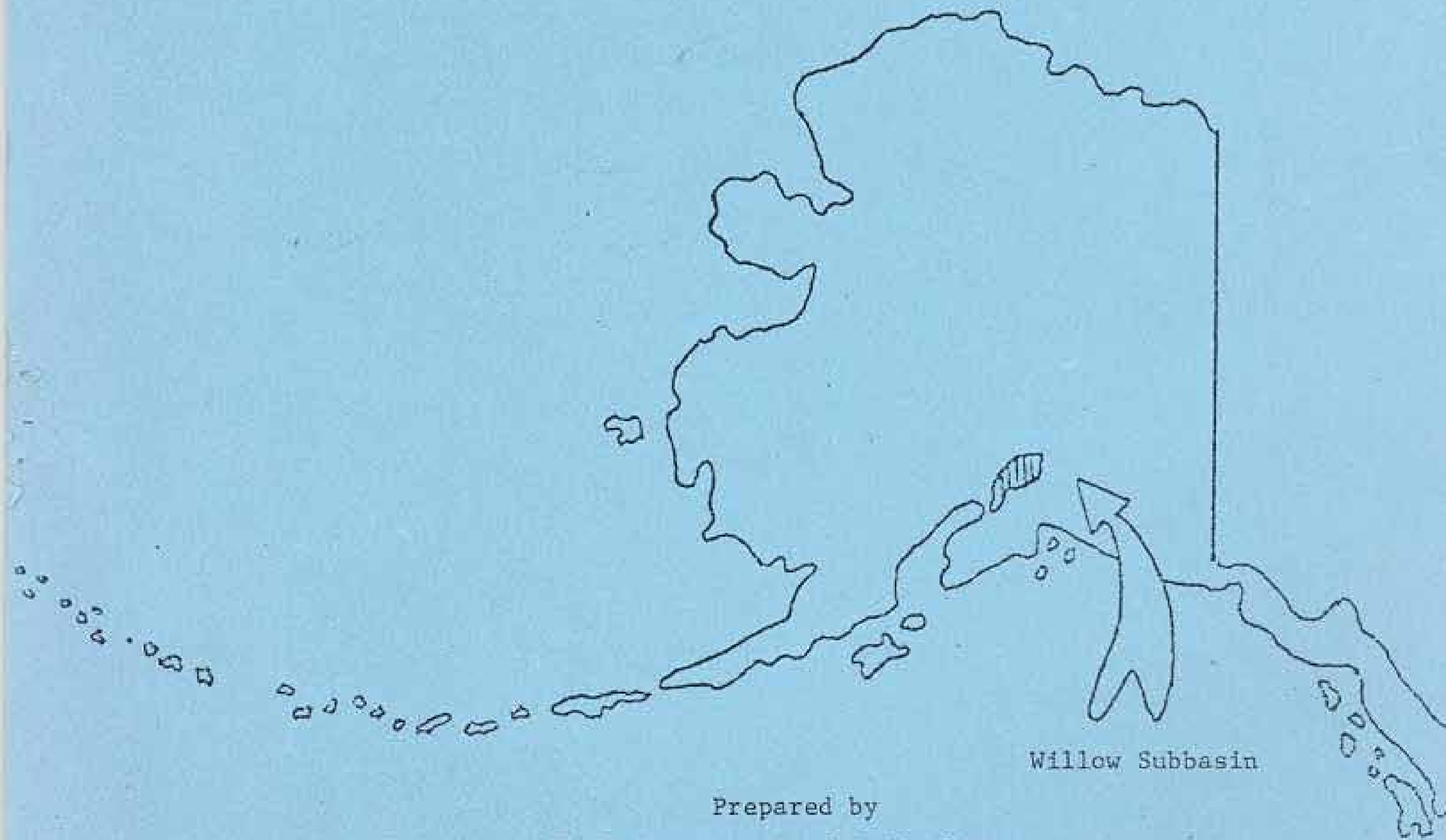
ALASKA RIVERS COOPERATIVE STUDY

Lower Little Susitna River and Little Willow Creek

Susitna River Basin, Willow Subbasin

Matanuska-Susitna Borough

Alaska



Prepared by

U.S. Department of Agriculture

Soil Conservation Service

Economics, Statistics, and Cooperatives Service

Forest Service

in cooperation with the State of Alaska

Department of Environmental Conservation

Department of Fish and Game

Department of Natural Resources

February 1980

FOREWARD

The United States Department of Agriculture, in cooperation with the State of Alaska, is participating in a study of the water and related land resources within the Susitna River Basin. This report presents the results of the flood plain inventory portion of that study in the Willow Subbasin.

Acknowledgement is made to the Palmer and Wasilla Soil Conservation Subdistricts, Matanuska-Susitna Borough, U.S. Army Corps of Engineers, and U.S. Geological Survey for assistance in the development of this report. Thanks is extended to the many persons who gave of their time to review drafts and provide suggestions.

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INTRODUCTION

Early in 1977, questionnaires concerning resource problems were distributed to local residents through newspapers and at public information meetings held throughout the basin. Several respondents indicated a desire for more flood plain information and better resource management. With the local borough population increasing nearly 140 percent from 1970 to 1977, local and state planners have made the prevention of increased flood damages associated with urban development a high priority objective.

With this objective in mind, local and state planners identified the flood plains of the Little Susitna River, Willow Creek, Wasilla Creek, Cottonwood Creek, Lucille Creek, and Little Willow Creek as being the most likely to be developed for urban uses under existing conditions. These conditions consist of two ingredients:

1. A growing trend to subdivide property with stream frontage, and

2. A lack of existing information with which to delineate and identify flood hazard areas.

Without proper information, enforcement of ordinances restricting development in flood hazard areas is difficult. On this basis the cooperating U.S.D.A. agencies involved in this study were requested by participating agencies of the State of Alaska to assist in determining flood hazard potentials of these streams.

The U.S. Army Corps of Engineers is presently authorized, through the U.S. Department of Housing and Urban Development (HUD) Flood Insurance Administration, to do Flood Insurance Studies on Willow Creek and the Upper Little Susitna River. These areas are excluded from this report.

U.S.D.A. inputs for analyzing flood hazard potentials concern only Little Willow Creek and the lower reaches of the Little Susitna River. The details of work items involved in this analysis and authorities for U.S.D.A. and State of Alaska agency participation are set forth in the Alaska Rivers Cooperative Study Plan of Work for the Willow and Talkeetna Subbasins dated February 1979.

DESCRIPTION OF THE STUDY AREA

The Willow Subbasin encompasses an area of approximately 1700 square miles and is bounded by the Kashwitna River-Little Willow Creek drainage divide to the north, Matanuska River Basin and Knik Arm to the east, Cook Inlet to the south, and the Susitna River to the west. The eastern limit is about 55 highway miles, but less than 10 air miles north and west of Anchorage. The entire subbasin lies within the central portion of the U.S. Geological Survey's hydrologic unit region number 19, subregion number 05. This number designates the Cook Inlet portion of the Southcentral region of Alaska. See Figure 1 for more detail.

Elevations range from sea level to 6336 feet above sea level at Montana Peak, the extreme northeastern limit. The area generally slopes from northeast toward the south and west. The streams in the subbasin drain into the Susitna

River to the west and into Cook Inlet and Knik Arm to the south. Topography to the northeast is predominately in the rugged Talkeetna mountains where elevations are primarily between 3000 and 5000 feet above sea level and vegetation is of the tundra types.

In the remainder of the area, relief is nearly level to undulating; low hills with irregular slopes are dominant and poorly drained bogs and other wetlands are common.

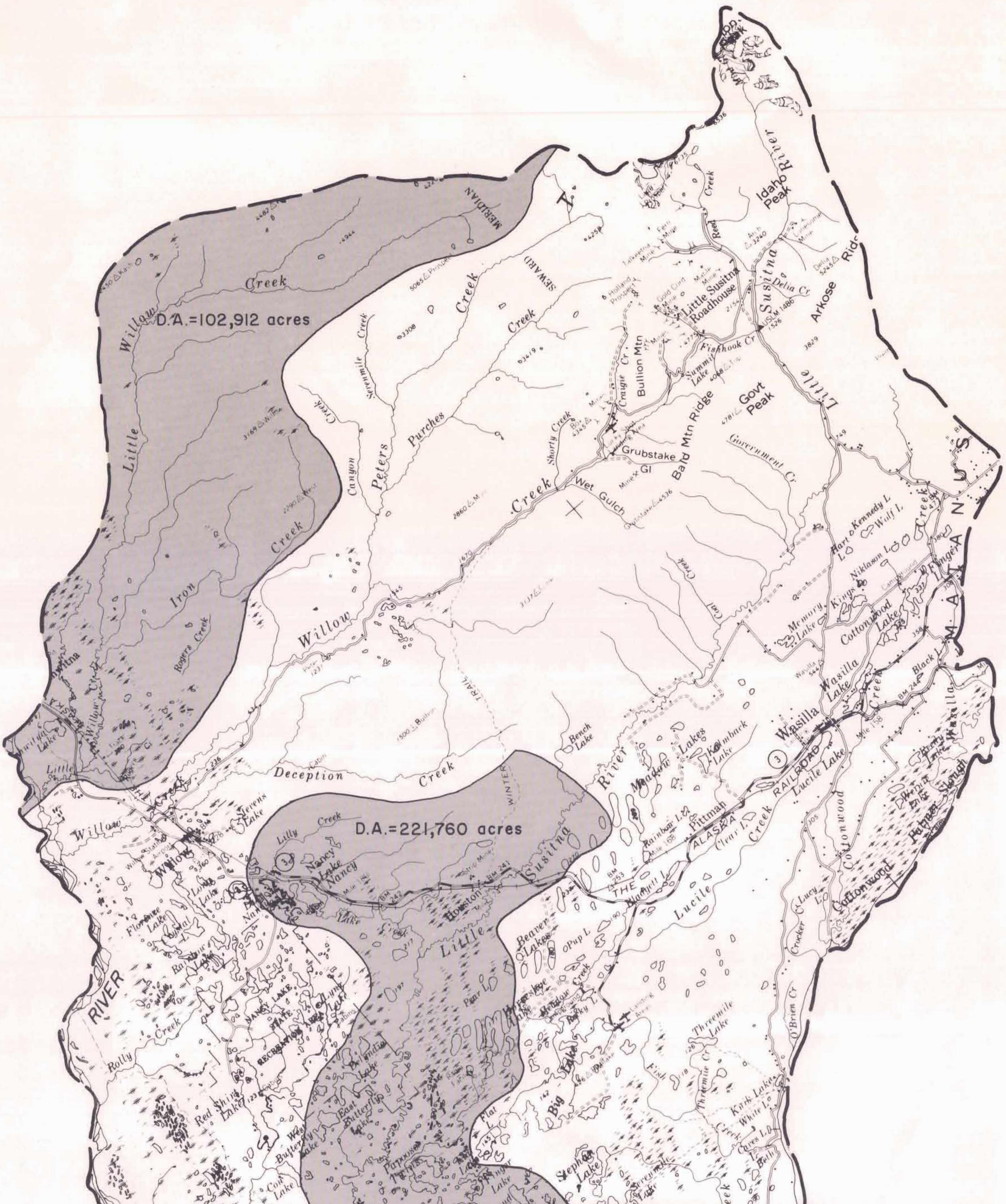
Willow and Little Willow Creeks are tributary streams to the Susitna River. The Susitna River drains a portion of the Alaska Range. It is braided and heavily laden with glacier fed silt. The Little Susitna River with headwaters in the Talkeetna Mountains is a semiglacier fed stream and carries a natural load of sediment which gives it a greenish-blue to white tint during the summer runoff. All other streams are clear.

The climate of the area is influenced by marine conditions in the south and continental conditions in the east. The temperature ranges from nearly 45°F below zero to 85°F above zero. The average daily maximum temperature in the summer is in the upper 60's with low 60's being common. Temperatures of 32°F or lower however have been recorded during every summer month. In winter average minimum temperatures range from about zero to the midteens. The freeze-free period averages about 80-95 days. The average annual precipitation generally exceeds 20 inches with over half occurring from June 1 through the end of September.

Below timberline, approximately 2000 feet above mean sea level elevation, on the better drained soils paper birch-white spruce stands are the predominate vegetation and on poorly drained soils associated with numerous sphagnum bogs the slower growing black spruce is found. Cottonwood is the predominant vegetative species found in the flood plains. Alder and willow thickets are also common to most subbasin flood plains.

The total drainage area of the streams studied is approximately 324,600 acres. Figure 1 delineates the drainages investigated for this report and provides the area of each. The channel slopes for Little Willow Creek are 23 feet per mile in the upper reaches and 6 feet per mile in the lower reaches near the Parks Highway. The Little Susitna River is similar with slopes ranging from 25 feet per mile in the upper reaches to 6 feet per mile near the Parks Highway.

Typical vegetative scene below the 2000 feet elevation. Predominantly paper birch-white spruce.



5 0 5 10 MILES
SCALE 1:250,000

LEGEND

Subbasin Boundary

Areas included in potential flood hazard study

FIGURE 1

SHEET 1 OF 1	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE WILLOW SUBBASIN FLOOD HAZARD ANALYSES ALASKA

VICINITY MAP

LITTLE WILLOW CREEK AND LITTLE SUSITNA RIVER

FLOOD HISTORY

Damaging floods have occurred within the subbasin in 1955, 1959, 1969, 1971, 1973, and 1975. Railroad officials generally recognize the August 1955 storm as the most damaging event, while others credit the August 1971 flood as most severe to highways and residences. There is little information available concerning historical floods within the area other than newspaper accounts and interviews with local residents. These sources indicate that areas most susceptible to past damages included the following:

1. The Hatcher Pass Road along Willow Creek literally became a river in 1971.

2. The Alaska Railroad at Houston where undermining of the roadbed by the Little Susitna River caused derailment of 13 cars in 1971.

3. The lower Hatcher Pass Road Bridge spanning the Little Susitna River which washed out in 1971 completely closing off large sections of the road.

4. At Houston and at the Little Susitna Inn where massive road washouts were reported in 1959.

Historically, however, flooding danger or flood plain development has not been considered a major concern by local residents. With a population of less than four persons per square mile, development pressures have not been as significant as in several other areas within Southcentral Alaska.

The most recent damaging flood occurred in 1971, prior to the population growth induced by the Trans-Alaska Oil Pipeline Project in the mid-1970's. This indicates that most residents have not experienced flood associated problems within the basin.

FLOOD POTENTIAL (Present Conditions)

Flood Hazards - Present damagable property in the areas studied consists of scattered homes and cabins, many of which are for seasonal use, and highway and railroad crossings. Damage to these properties from a 100 year event is estimated to be less than $150,000 with average annual damages totaling less than $9,000. A detailed damage analysis concerning the effect of flooding on stream fisheries is beyond the scope of this study, however, under certain conditions flooding could severely disrupt stream sports fisheries and have a long run negative impact on commercial fisheries.

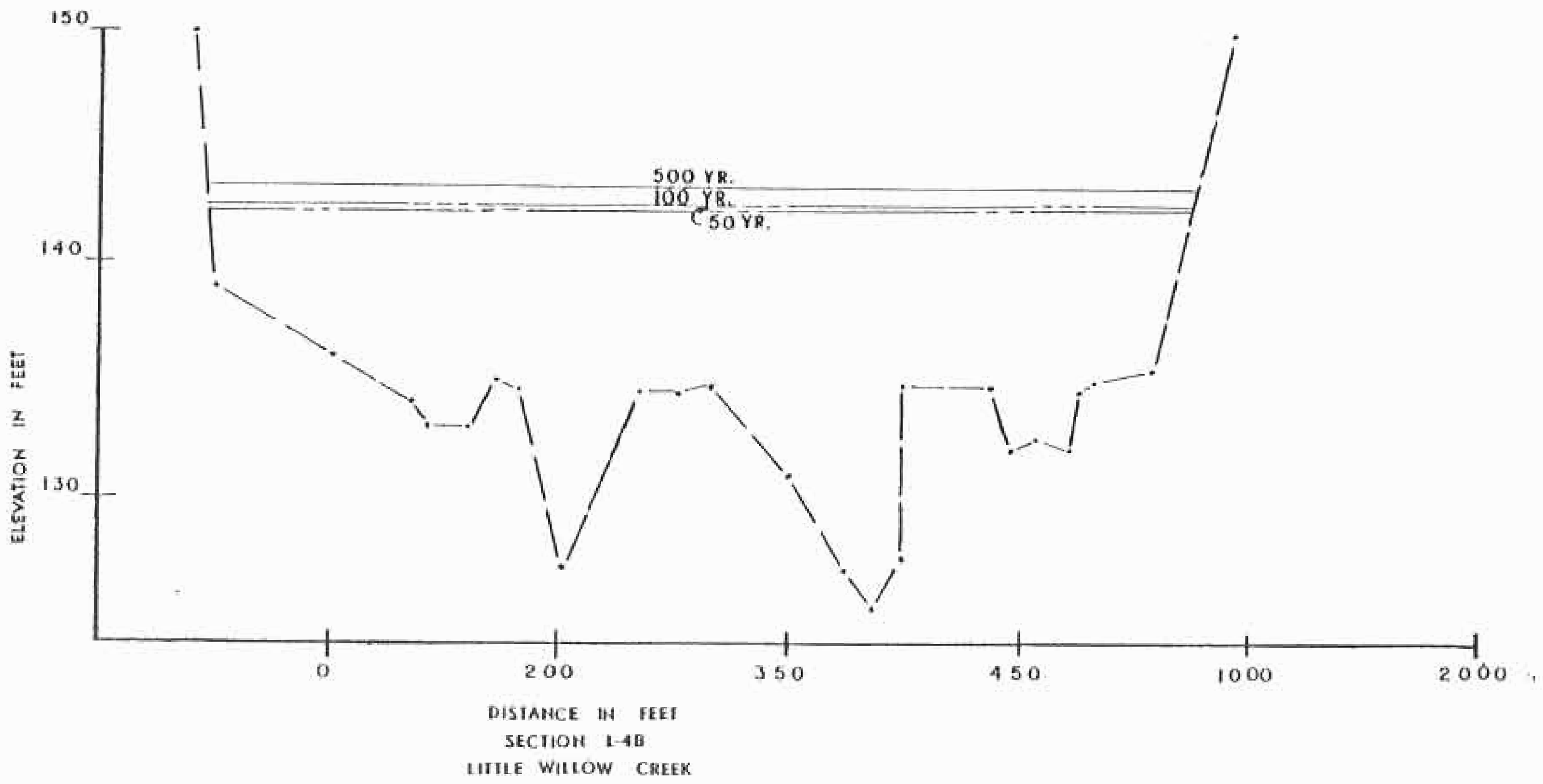
Figures 2, 3, 4, and 5 are drawings of selected valley cross sections showing the flood elevations of the 50-, 100-, and 500-year under present land use conditions.

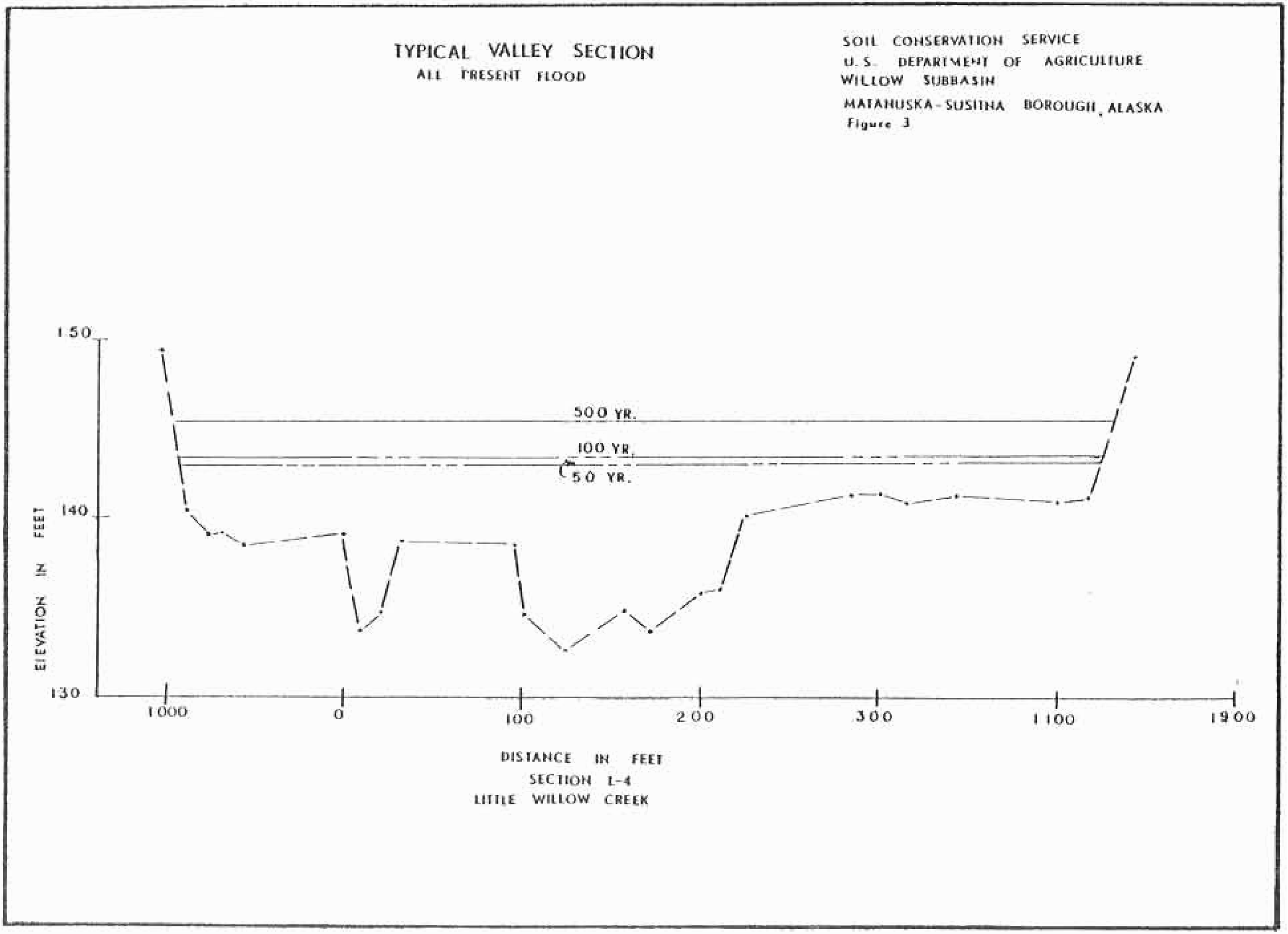
TYPICAL VALLEY SECTION

ALL PRESENT FLOOD

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
WILLOW SUBBASIN
MATANUSKA-SUSITNA BOROUGH, ALASKA

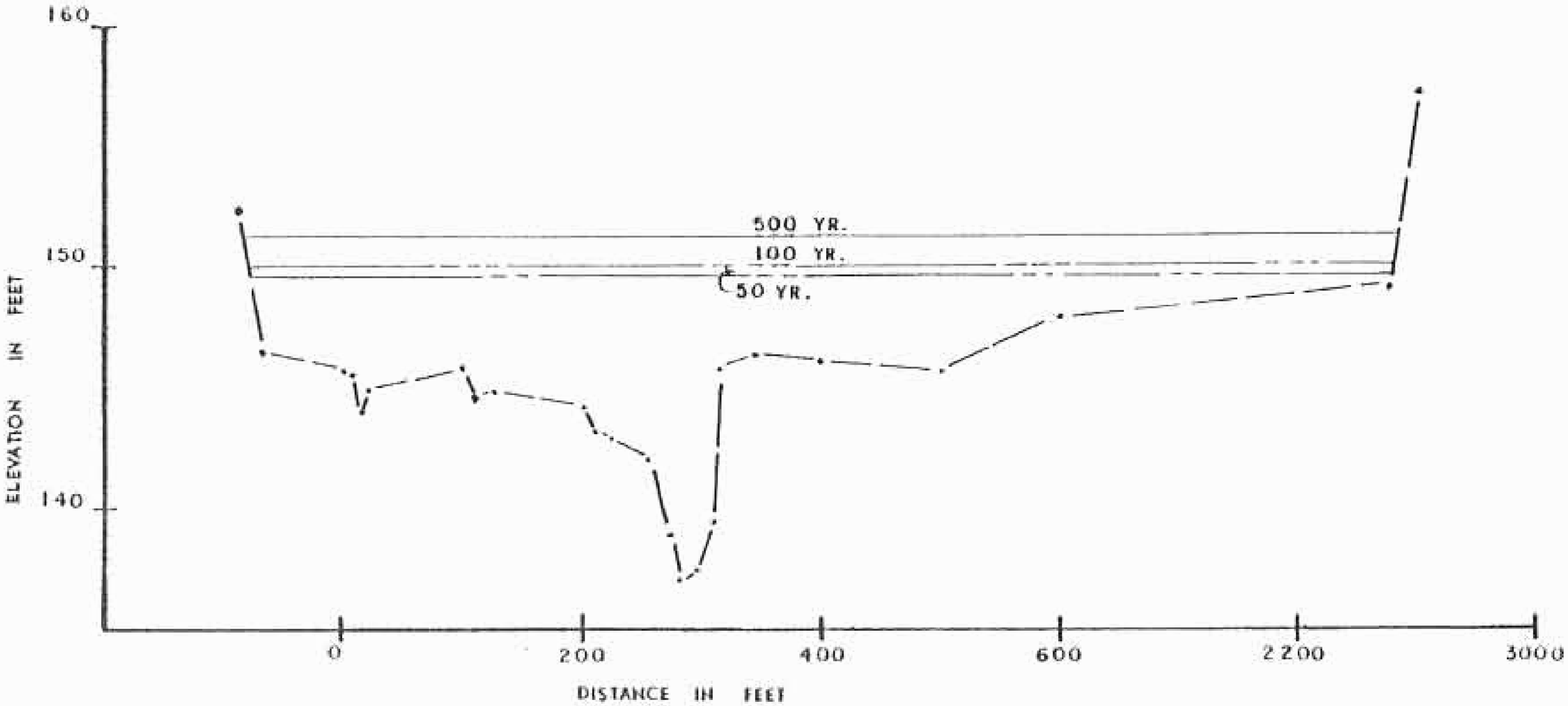
Figure 2




TYPICAL VALLEY SECTION
ALL PRESENT FLOOD
SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
WILLOW SUBBASIN
MATANUSKA-SUSITNA BOROUGH, ALASKA
Figure 3
500 YR.
100 YR.
50 YR.
150
140
130
ELEVATION IN FEET
1000
0
100
200
300
1100
1900
DISTANCE IN FEET
SECTION L-4
LITTLE WILLOW CREEK

TYPICAL VALLEY SECTION
ALL PRESENT FLOOD

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
WILLOW SUBBASIN
MATANUSKA-SUSITNA BOROUGH, ALASKA
Figure 4

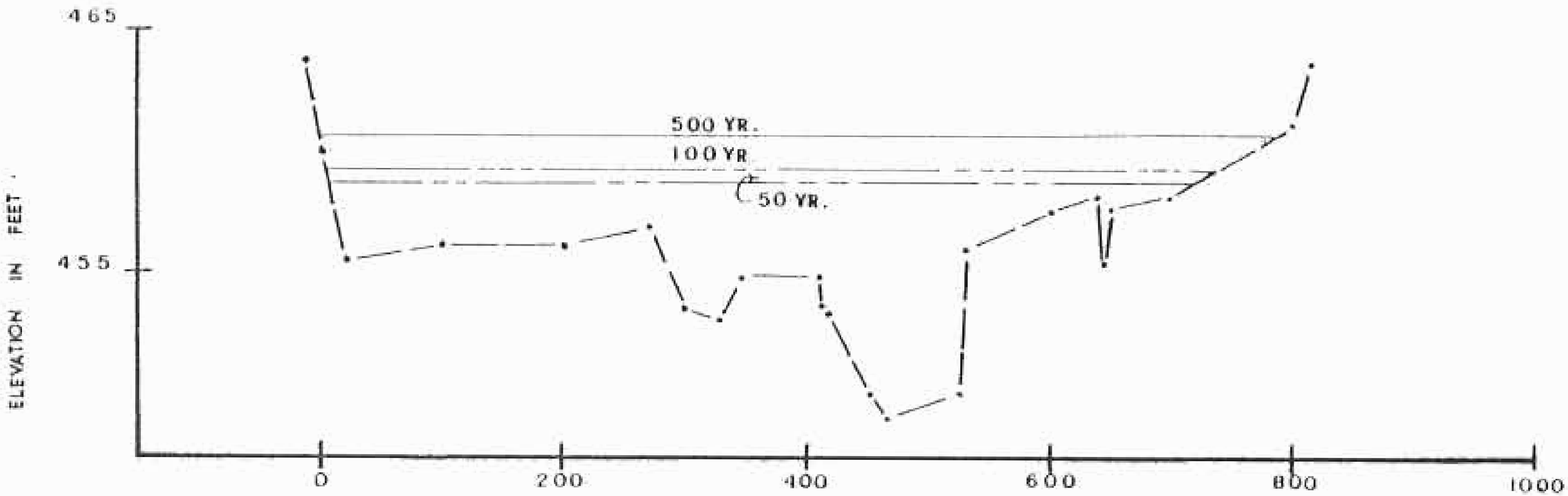


SECTION L-3A
LITTLE WILLOW CREEK

TYPICAL VALLEY SECTION

ALL PRESENT FLOOD

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
WILLOW SUBBASIN
MATANUSKA – SUSITNA BOROUGH, ALASKA
Figure 5



DISTANCE IN FEET
SECTION LS-38
LITTLE SUSITNA RIVER

The magnitude of the flood hazard depends on several variables including the depth and velocity of flow, frequency and duration of flooding, rate of rise, and area topography. It is generally accepted that if the product of depth times velocity (feet/second) is 7 or greater, severe structural damage can occur and the threat of loss of life is great. Table 1 displays the velocity and discharge of flooding for the 100 year storm at key locations on those streams surveyed.

Table 1--Flood Characteristics

Stream	Structure		100 Year Flood		
	Name	Elevation	Elevation	Velocity (FPS)	Discharge (CFS)
Little Susitna River	Parks Highway Bridge	252.2	249.5	7.07	15,200
	Alaska Railroad	245.5	245.1	7.60	15,200
Little Willow Creek	Parks Highway Bridge	145.3	143.3	8.04	12,300
	Alaska Railroad	164.8	162.3	19.52	12,180

Channel obstructions are another factor which is significant in assessing damage potential. Ice, logs, and other debris collecting on bridge and culvert openings can decrease their ability to pass flood flows, resulting in greater water depths upstream of these structures. Ice jams were reported within the study area in both 1938 and 1975. Since such occurrences, however, are divorced from probability analysis, only the physical characteristics of the structures were considered in the hydraulic and hydrologic analyses, and maps provided in Appendix A do not reflect water surface elevations caused by potential debris obstructing bridge and culvert openings.

Flood Hazard Areas - With the majority of the area studied being in private ownership and with these holdings being extremely small in contrast to total state, federal, and native lands within the subbasin, the impact of limiting development potential on any private land can be significant. Table 2 provides approximate drainage areas, peak discharge and depth of flow, from the 100-year flood at each cross section. Table 3 provides acreages inundated by the 100 year flood for each area surveyed.

Table 2--Depth of Flow

Cross Section ID	Sheet No.	Drainage Area (Sq. Miles)	Discharge (cfs)	Depth from Channel Bottom (ft.)
Little Susitna River				
LS-12	1	319.9	24,200	21.1
LS-11A	1	318.4	24,200	21.8
LS-11	1	287.5	22,460	18.8
LS-10	2	273.1	21,850	34.6
LS-9	2	233.9	19,650	12.8
LS-8	2	217.3	18,580	15.6
Railroad Bridge	2	175.3	15,200	21.1
LS-6C	2	175.0	15,200	14.4
Highway Bridge	2	174.5	15,200	14.5
Little Willow Creek				
L-5	3	157.7	12,300	11.1
L-4C	3	157.7	12,300	11.5
L-4B	3	156.5	12,300	17.3
L-4A	3	156.5	12,300	11.8
Highway Bridge	3	156.5	12,300	12.1
L-4	3	155.7	12,300	13.6
L-3A	3	154.2	12,180	12.9
L-3B	3	154.2	12,180	12.6
Railroad Bridge	3	154.2	12,180	10.8
L-3	3	154.2	12,180	16.8
L-1A	3	124.2	10,430	9.3

Table 3--Areas Inundated

Stream	Sheet Number (See Appendix A)	Area Inundated by 100 Year Flood (approximate) acres
Little Susitna River	1	9,840
	2	6,560
	Subtotal	16,400
Little Willow Creek	3	1,440
Survey Area	Grand Total	17,840

Flood Hazard Exhibits - To determine areas flooded from the 100 year flood at specific locations use Sheet Index, Appendix A and refer to the appropriate photomosaic map (Appendix A, 3 sheets) to determine the location of the nearest surveyed section and general area affected.

FLOOD POTENTIAL (Future Conditions)

The Matanuska-Susitna Borough is a participant in the HUD Flood Insurance Program administered by the Flood Insurance Administration. This participation guarantees that federally subsidized flood insurance coverage is available to owners and occupiers of all buildings and mobile homes (including contents) within the subbasin.

As required by the HUD Program the Borough has adopted land use management regulations which:

1. Insure that all new construction is designed to minimize flood loss and

2. Require that all new construction or substantial improvements to existing structures have the first floor (including basement) level at or above the 100-year flood elevation and that all utilities be flood proofed.

With these regulations in effect it is expected that future residential, commercial, and industrial flood plain development will be such that flood damages to these properties will not increase above present levels. This presupposes that flood plains will be identified and used as a tool and a means for enforcing local ordinances and that the ordinances themselves are enforced. Should this fail to occur, damage potential will increase drastically with population growth.

Although the damage threat to occupied buildings is expected to be arrested, it is doubtful that the same will be true of highways and railroads. Transportation networks are often found in and adjacent to flood plain lands as a result of construction costs. Even when flood damage costs are added to construction, operation, and maintenance costs, it often remains less expensive to build on flat lowland areas than on more rugged upland terrain.

FLOOD PLAIN MANAGEMENT

Regulatory measures presently adopted do not prevent flooding but, instead, reduce the threat of damage or loss of life from floods by discouraging development of homes and other buildings on flood plains. Without additional measures damage to existing property will continue and road and bridge related damages are likely to increase. As a means to minimize this situation the following alternatives are suggested.

1. For Existing Properties:

    a. Permanent measures built as an integral part of the structure, such as raising the elevation of the structure, water-proofing of basement and foundation walls, anchor and reinforce floors and walls, and use water-resistant materials.

b. Contingency measures which require action to be taken to make them effective, such as manually closed sewer valves and removable bulkheads.

c. Emergency measures carried out during floods according to prior emergency plans, such as sandbagging, pumping, and removal of contents to flood-free areas.

d. Reclamation of flood plains which includes the permanent evacuation of developed areas subject to inundation and the acquisition of these lands by purchase or land trades, the removal of structure, and the relocation of the population from such areas.

e. Use of flood watch or warning systems to provide advance notice of impending flood danger.

f. Buildings and mobile homes within or adjacent to the delineated flood hazard areas in Appendix A of this report should carry flood insurance on the structure and its contents. Although this will not reduce existing damage potential, it will have the positive effect of spreading the flood hazard risk.

2. For Future Road and Bridge Construction

a. When analyzing proposed alternative transportation routes, the costs of potential flood damage will continue to be investigated and included for use in the decision making process.

b. Construction designs will continue to reflect sound engineering judgement with regards to flood hazard potential. This includes the analysis of soils, geology, hydrology and hydraulics, as well as adequacy of construction materials.

LIMITATIONS OF THE STUDY

In the area adjacent to and between the Alaska Railroad and the Parks Highway the data is in sufficient detail to be used for most land use decisions and is accurate enough for the Regular Flood Insurance Program.

In the more remote areas the data should be considered approximate for use in the Regular Flood Insurance Program. The data is adequate for planning and zoning. Zoning regulations need to provide for free board and/or more detailed studies before any major development takes place.

Typical section stream channel. Stream channels meander depositing sediment on inside of curve and eroding on the outside bank. Fallen trees and dense vegetation on bank is typical throughout the length of the streams.

TECHNICAL STUDY PROCEDURES

The hydraulic and hydrologic investigations followed procedures in the SCS publications National Engineering Handbook, Section 4, Hydrology (NEH-4) and Section 5, Hydraulics (NEH-5), and other technical references. Computer programs were used for most of the analyses.

An inventory and collection of maps, photographs and other basic data was made. USGS quadrangle maps at a scale of 1:63,360 with 50' contour intervals were available. SCS high altitude aerial photography flown in 1976-1977 and enlarged to a scale of 1:63,360 was available. The photography is color infrared and available in stereo pairs.

Stream channel cross sections were located on the aerial photographs and USGS quad sheets on the average of 1 per 3 miles. These channel and valley cross sections were surveyed by SCS personnel during the summer of 1978. Cross section elevations near the Alaska Railroad and the Parks Highway were tied to mean sea level datum. Elevations for remote cross sections were estimated from the USGS quadrangle sheets.

There is one stream gaging station located within the study area on the Little Susitna River near Palmer. Records are available for the station from 1948 to present. The station has a 62 square mile watershed drainage area. The watershed has similar soils, land cover, topography and stream channels as the study area. Peak discharges were developed for Willow Creek and the Little Susitna River by the Corps of Engineers using a regionalized study prepared by USGS and standard Log Pearson Type III statistical procedures. The frequency curves for these two areas is the best data available. Therefore, the data on the Upper Little Susitna River was expanded to the Lower Little Susitna and the data on Willow Creek was expanded to Little Willow Creek.

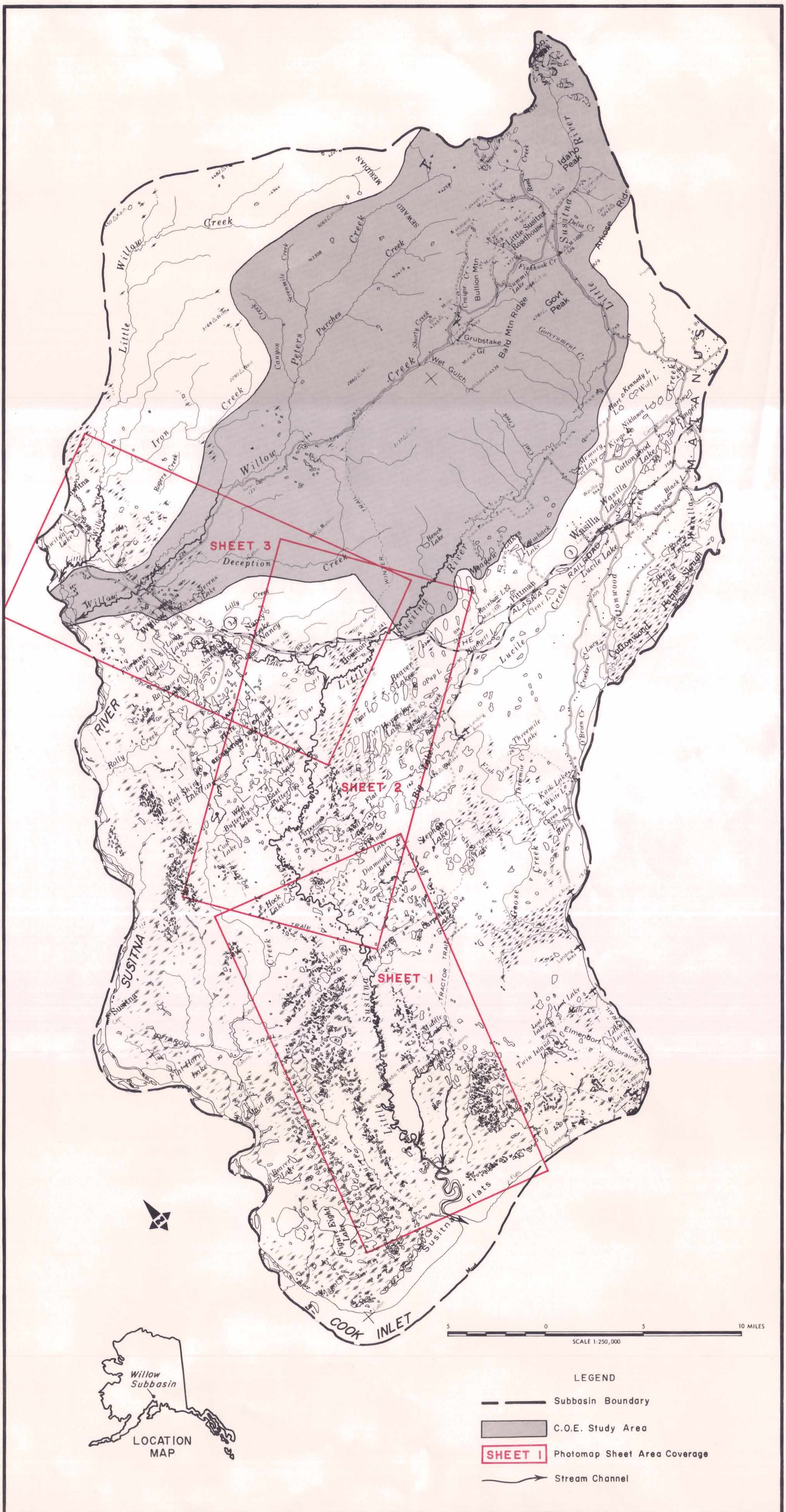
Hydraulics for the streams were computed utilizing standard normal depth computation procedures and Manning's Equation. Slopes were computed using channel bottom elevations and horizontal distances obtained from the quadrangle sheets. Surveyed cross section data was used for area and wetted perimeter calculations. The roughness coefficients were estimated from field observations and aerial photographs using standard SCS procedures.

Normal bridge and channel conditions were assumed in the hydraulic computations. No consideration was made for openings blocked by ice or debris. Channel and flood plain flow characteristics may change in time as changes in vegetation growth, sedimentation, scour, debris deposits, and filling or other encroachments occur. Computations for this study considered only those features in the flood plain at the time of the study.

High water elevations for the 10-year, 50-year, 100-year and 500-year frequency storms were computed. The 100-year storm was delineated on 1:63,360 aerial photographs. The flood boundaries were located utilizing the surveyed cross sections, USGS quadrangles and stereo photographs to interpolate flood boundaries from one cross section to the next.

APPENDIX A

Flood Hazard Delineation

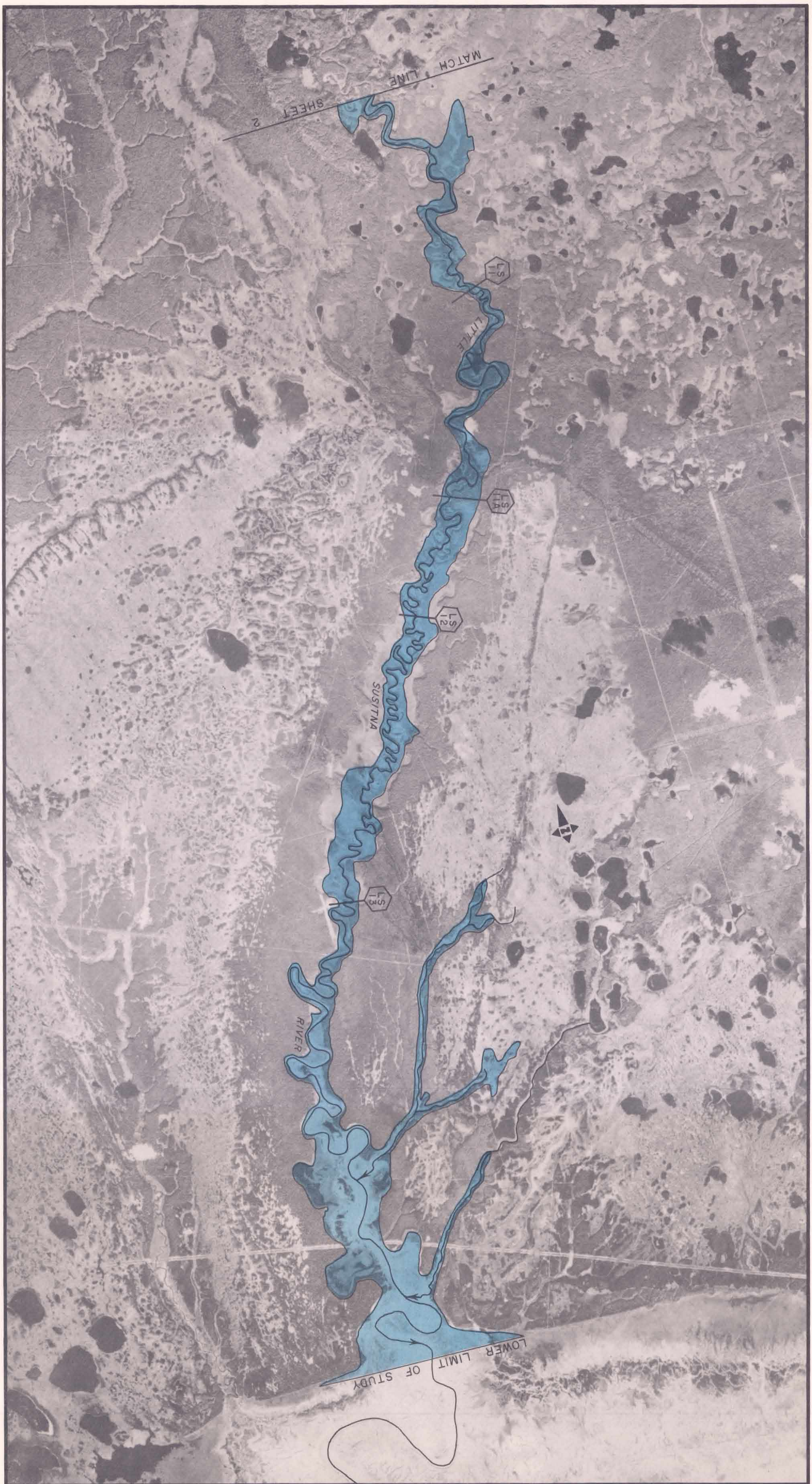


SHEET 1 OF 1

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
WILLOW SUBBASIN
FLOOD HAZARD ANALYSES
ALASKA

PHOTO MAP INDEX

LITTLE WILLOW CREEK AND LITTLE SUSITNA RIVER



LEGEND

Approximate 100 Year Flood Hazard Area

Stream Channel

LS 11A — Cross Section Location

Limits of flooding may vary from actual location on the ground.

1 0 1 2 3 MILES

SCALE 1:63,360

N.A.S.A. Photography-8-76

SHEET 1 OF 3

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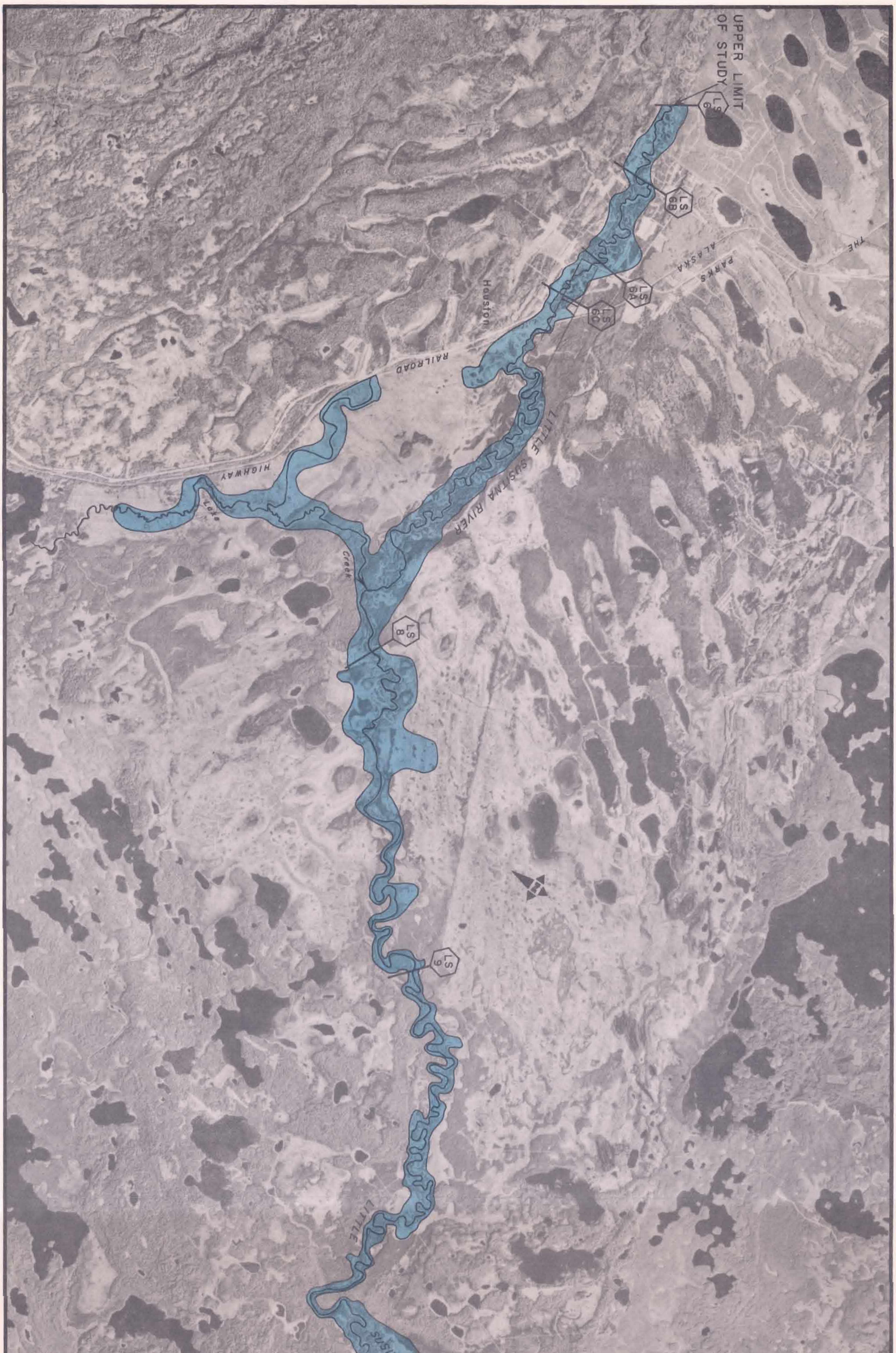
WILLOW SUBBASIN
FLOOD HAZARD ANALYSES
ALASKA

FLOOD HAZARD AREA

LITTLE WILLOW CREEK AND LITTLE SUSITNA RIVER



LEGEND

Approximate 100 Year Flood Hazard Area

Stream Channel

LS 11A Cross Section Location

Limits of flooding may vary from actual location on the ground.

1 0 1 2 3 MILES

SCALE 1:63,360

N.A.S.A. Photography–8–76

SHEET 2 OF 3

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WILLOW SUBBASIN
FLOOD HAZARD ANALYSES
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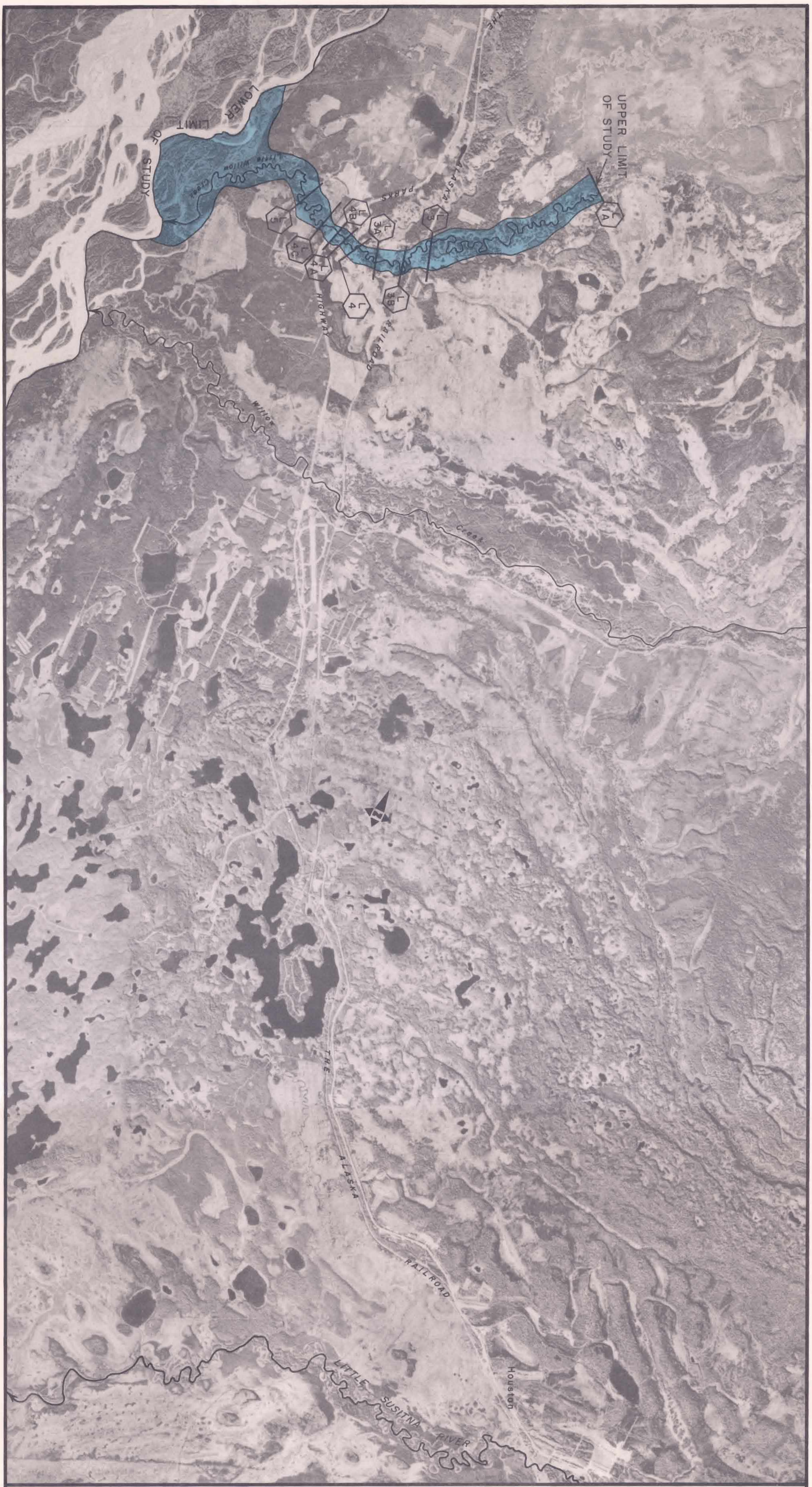
FLOOD HAZARD AREA

LITTLE WILLOW CREEK AND LITTLE SUSITNA RIVER



LEGEND

Approximate 100 Year Flood Hazard Area

Stream Channel

LS IIA — Cross Section Location

Limits of flooding may vary from actual location on the ground.

1 0 1 2 3 MILES

SCALE 1:63,360

N.A.S.A. Photography-8-76

SHEET 3 OF 3

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ALASKA

FLOOD HAZARD AREA

LITTLE WILLOW CREEK AND LITTLE SUSITNA RIVER

APPENDIX B

Glossary of Terms

GLOSSARY

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

Flood - Water from a river, stream, watercourse, lake or other body of standing water, that temporarily overflows the boundaries within which it is ordinarily confined.

Flood Peak - The highest stage or discharge attained during a flood event; also referred to as peak stage or peak discharge.

Flood Plain - The relatively flat or low land area adjoining a river, stream, watercourse, lake, or other body of standing water which has been or may be covered temporarily by flood water. For regulatory purposes, the federally accepted flood plain has been defined as the area that would be inundated by the 100-year flood.

Manning's "n" Value - A coefficient of roughness used in determining stream velocities.

100 Year Flood - A flood having an average frequency of occurence in the order of once in 100 years although the flood may occur in any year.

Stream - Any natural channel or depression through which water flows either continuously, intermittently, or periodically, including modification of the natural channel or depression.

Structure - Anything constructed or erected, the use of which requires a more or less permanent location on or in the ground. Includes but is not limited to bridges, buildings, canals, dams, ditches, diversions, irrigation systems, pumps, pipelines, railroads, roads, sewage disposal systems, underground conduits, water supply systems, and wells.

Watershed - A drainage basin or area which collects runoff and transmits it usually by means of streams and tributaries to the outlet of the basin.