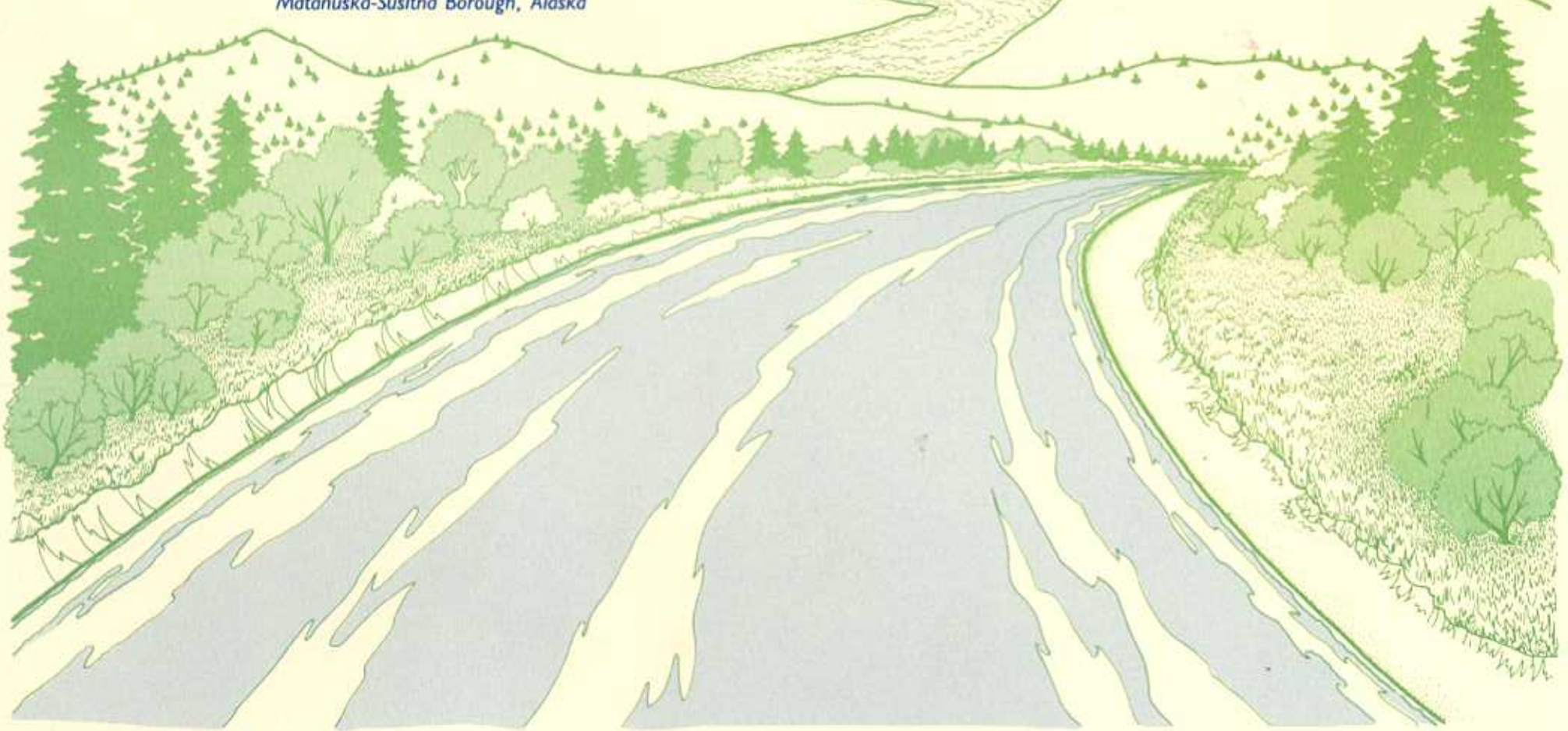
FLOOD HAZARD STUDY

Troublesome, Byers, Honolulu Creeks
East and Middle Forks of the Chulitna River.

ALASKA RIVERS COOPERATIVE STUDY

Susitna River Basin, Talkeetna Subbasin
Matanuska-Susitna Borough, Alaska



September, 1981

Prepared by the
U.S. Department of Agriculture
Soil Conservation Service
Economics Research Service
Forest Service

In cooperation with the
State of Alaska
Department of Natural Resources
Department of Fish and Game

```
      Leader        REC TYPE =  a  BIB LV = m  CNTL TYPE =   ENC LV = 1  RULES =
   Control # 001           |wln85190388
   Date/time 005           |19980129000000.0
System ctrl # 035    |a     |(OCoLC)8428522
System ctrl # 035    |a     |(WaOLN)3707633
  Cat source 040     |ac    |AkAAR|AkAAR
ME:pers name 100 1   |a     |Grey, Edward.
       Title 245 10  |abc   |Flood hazard study :|Troublesome, Byers and
                            Honolulu creeks, East and Middle forks of
                            Chulitna River, Matanuska-Susitna Borough,
                            Alaska /|prepared by the U.S. Department of
                            Agriculture, Soil Conservation Service, Economic
                            Research Service, Forest Service in cooperation
                            with the State of Alaska, Department of Natural
                            Resources, Department of Fish and Game ; Edward
                            Grey.
     Imprint 260 0   |abc   |[S.l. :|s.n.,|1981]
Phys descrpt 300     |abc   |i, 78 p., 8 folded leaves of plates :|ill.,
                            maps ;|28 cm.
General note 500     |a     |"Alaska rivers cooperative study"--Cover.
General note 500     |a     |"September, 1981."
Bibliography 504     |a     |Bibliography: p. 23.
Subj:topical 650   0 |azz   |Floods|Alaska|Chulitna River Region.
   Subj:geog 651   0 |a     |Chulitna River Region (Alaska)
AE:corp name 710 1   |ab    |United States.|Soil Conservation Service.
AE:corp name 710 1   |abb   |United States.|Dept. of Agriculture.|Economic
                            Research Service.
AE:corp name 710 1   |ab    |United States.|Forest Service.
    AE:title 740 0   |a     |Alaska rivers cooperative study.
  Fixed data 008     DATE KY = s       DATE 1 = 1981    DATE 2 =          PLACE =
                       ILLUS = ab        AUDI =           FORM =       CONTENTS =
                     GOV PUB =           CONF = 0         FEST = 0        INDEX =
                    LIT FORM = 0         BIOG =            LAN = eng    MOD REC =
                     CAT SRC = d
```

FLOOD HAZARD STUDY

TROUBLESOME, BYERS AND HONOLULU CREEKS, EAST AND MIDDLE FORKS OF CHULITNA RIVER

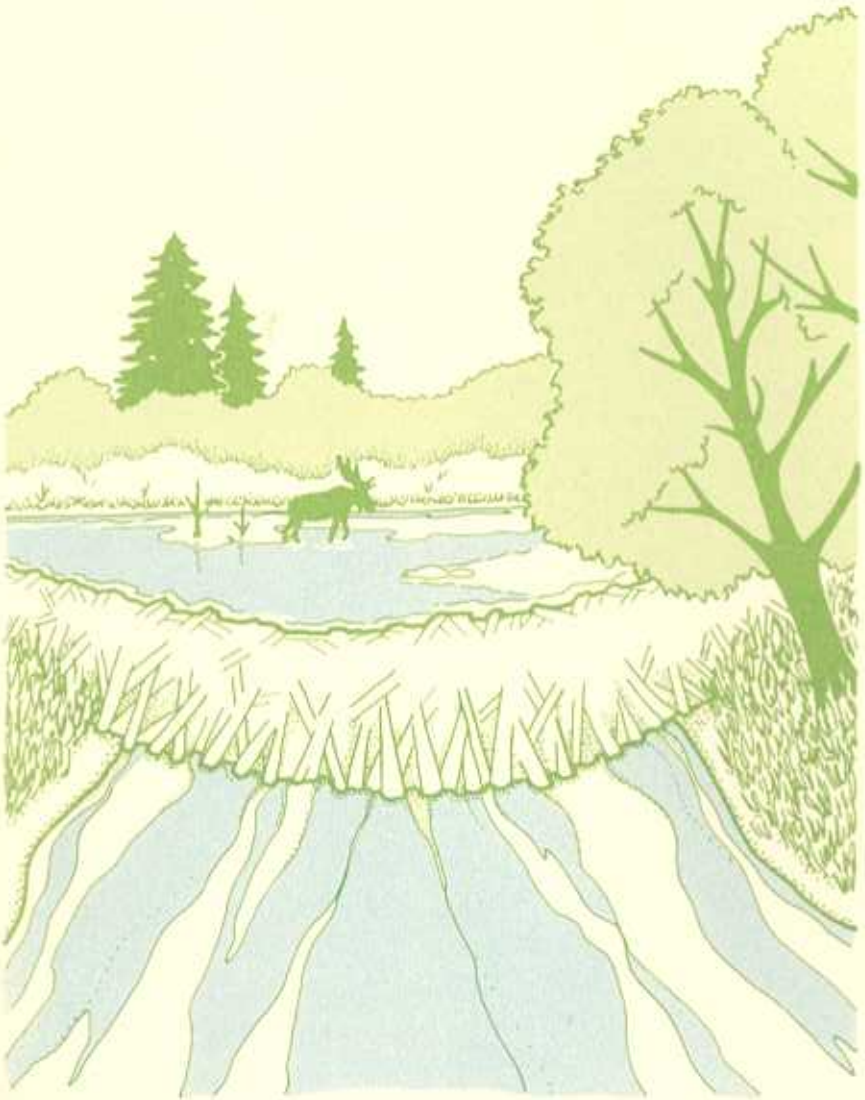
MATANUSKA-SUSITNA BOROUGH ALASKA

Prepared by the
U.S. Department of Agriculture
Soil Conservation Service
Economic Research Service
Forest Service

Edward Grey, Hydraulic Eng. S.C.S.

In cooperation with the
State of Alaska
Department of Natural Resources
Department of Fish and Game

Graphics by
Elaine Thomas DNR
Robin Hall, artist DNR



FOREWORD

The flood hazard information in this report will serve as a basis for local government and planning groups in formulating flood plain land use and management programs, adopting regulations, and providing the public with information concerning flood hazards along Troublesome, Byers and Honolulu Creeks, and East Fork and Middle Fork of Chulitna River.

The Soil Conservation Service implemented the technical phases of the study. The State of Alaska and Matanuska-Susitna Borough, Alaska Soil Conservation District and Palmer, Wasilla, and Montana Subdistricts assisted in providing land use data, obtaining permission for field surveys, and made available materials to be used for the study. They will distribute the report and make interpretations of the study data so it may be used effectively in local flood plain management programs. The State of Alaska, Matanuska-Susitna Borough and the SCS encourage the immediate use of the flood hazard information in implementing these programs and upon request will assist in the interpretation and use of the data presented in the report.

The cooperation and assistance given by other federal, state and local agencies and property owners in the collection of data for this report are greatly appreciated.

TABLE OF CONTENTS

TABLE OF CONTENTS

INTRODUCTION

Local Study Needs

The Matanuska-Susitna Borough requested the Soil Conservation Service, through the Alaska Soil Conservation District and Alaska Department of Natural Resources, to carry out flood studies of several streams which presently have development along the stream banks. The local government feels that rapid development will take place in the near future, along the Parks Highway, adjacent to these streams. Development will increase the potential flood damages to those properties in the flood plains. An immediate need exists to approximate the existing flood hazard areas along existing travel routes. This report defines the areas subject to flooding so that adequate flood plain management programs can be implemented that will regulate land use and development in flood prone areas. Such management programs will reduce potential flood damage, assure wise land use, and preserve and enhance the communities' physical environment.

Development of flood plain reports requires that peak discharge-frequency analysis be developed in sufficient detail that reliable peak discharges by frequency can be determined for each watershed area to be studied. The peak-frequency analysis included all of the streams that drain into the Cook Inlet north of the Anchorage bowl around to and including McArthur River.

This report will include Troublesome, Byers and Honolulu Creeks, and East Fork and Middle Fork of Chulitna River. The details of work items involved in this analysis and authorities for USDA 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.

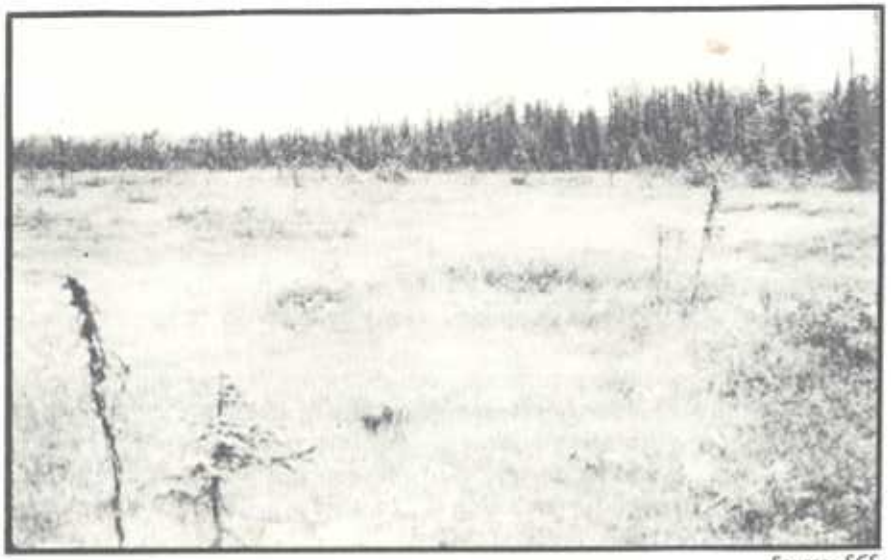
The U.S. Corps of Engineers has published a Flood Plain Information Report on a portion of the Talkeetna River which is within the Talkeetna Subbasin.

DESCRIPTION OF THE STUDY AREA

The flood hazard report concerns the area of the Talkeetna Subbasin bounded by the Susitna River drainage divide on the south and east, the Chulitna River on the west and the most southerly boundary of the Talkeetna River, and the Alaska Mountain Range on the north. The study area, for flood hazard concerns, encompasses about 483 square miles. The southern boundary of the area is about 140 miles by the road and 90 miles by air north of Anchorage. The area is within the USGS hydrologic unit number 19050002. This number designates the Cook Inlet subregion of the Southcentral Alaska Region. Figure 1 designates the location of the area and delinates watershed boundaries of the area covered by the flood hazard report.

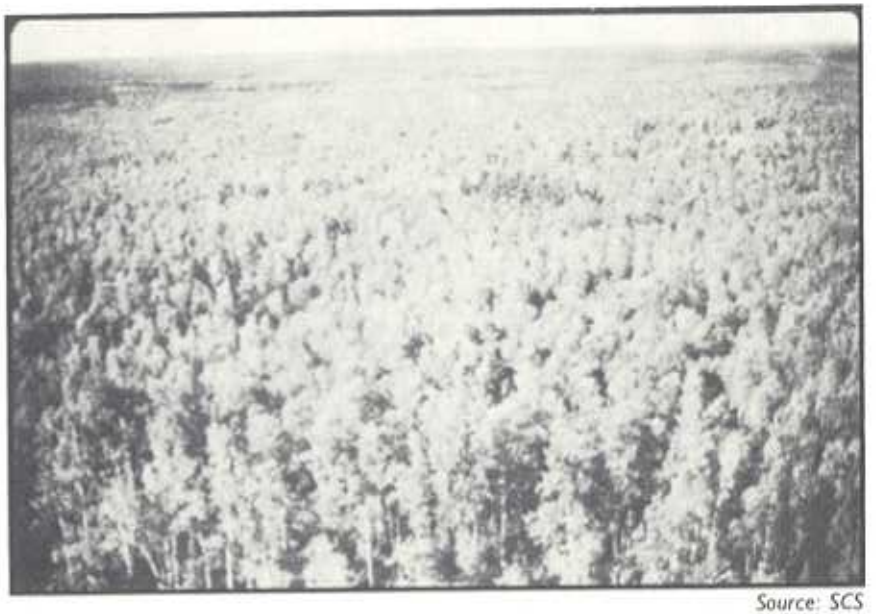
Source: SCS

Headwaters of the streams are in the rough mountainous areas.



Source: SCS

Wet grassy areas are common in the lower reaches of the study area.



Source: SCS

Thick stands of timber, paper birch and spruce, are common up to timberline elevations.

Elevations range from about 142 feet above sea level to about 6,300 feet above sea level. The area slopes to the west, and drains into the Chulitna River, a large tributary to the Susitna River. Troublesome, Byers and Honolulu Creeks, and East Fork and Middle Fork of the Chulitna River head in the Talkeetna Mountains which are steep and rough.

A small portion of the area is nearly level to undulating; low hills with irregular slopes are prominent; poorly drained bogs and other wetlands are common.

Below timberline, about 2,000 feet above mean sea level elevation, on the better drained soils paper birch-white spruce stands are the predominant vegetation. Black spruce is predominant on the poorly drained soils associated with numerous sphagnum bogs. Cottonwood, alder and willow are common in the flood plains adjacent to the streams. Vegetation above timberline, 2000 feet to 6300 feet elevation, is predominately of the tundra type.

Stream channel slopes range from about 6 feet per mile in the lower reaches to about 200 feet per mile in the mountains. Highway 3 (Parks Highway) running north and south, crosses all of the streams in the study area. The Alaska Railroad crosses all except Troublesome and Byers Creeks.

The climate is influenced by marine conditions in the south and continental conditions in the east. The temperature range is from a minus 45 degrees F to 85 degrees F. The average daily maximum temperature in the summer is in the upper 60's with low 60's being common. Temperatures of 32 degrees F or lower have been recorded during every month of the year. Average maximum winter temperatures range from about zero to the mid-teens. The freeze free period is less than 80 days. Average annual precipitation ranges from about 30 inches in the southwest to about 40 inches in the mountains. Over half of the precipitation occurs from October through the end of April in the form of snow. Snow melt in the spring and early summer produces most of the surface water supply.

Source: SCS

Tundra types of vegetative cover are on the slopes above timberline.

Source: SCS

Winter will find the area covered with snow.

Channel obstruction is a factor which is significant in assessing flood damage. Lack of historical data makes this assessment difficult. Fallen trees and other debris at times will block or partially block the stream channels throughout the Susitna River Basin. Ice jams and ice dams have been witnessed on Willow and Montana creeks and have probably occurred on other streams without being noticed. These obstructions in the stream channels eventually break releasing a large head of water which goes on a rampage for many miles down stream and causes damage to stream banks, flood plains, private property, structures at highway and railroad crossings, and are a risk to human life.

FLOOD HISTORY

Development in the area is sparse, however, some has taken place in recent years. Contact with local residents, State, Borough officials and other Federal agencies were made in an effort to obtain historical flood data in the study area.

High velocities cause erosion of flood plains, channel banks, and around highway and railroad structures across the streams. The high discharge in Troublesome Creek in the spring and early summer of 1980 caused stream bank erosion throughout the lower reaches of the stream channel. In several locations along the stream the channel has been changed from one location to another. As much as five to eight feet of the banks were washed away in other locations. It is estimated that the 1980 peak discharge was about equal to a 25-year frequency event. It is felt that this is an example of what can happen on any of the streams.

FLOOD POTENTIAL (PRESENT CONDITIONS)

Flood Hazards

Present damagable property in the area consists of scattered homes and

Example of stream bank erosion. *Source: SCS*

cabins, many of which are for seasonal use, and highway and railroad crossings. Damages to these properties from a 100-year event is estimated to be less than $150,000 with average annual damage totaling less than $8,000. 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 term negative impact on commercial fisheries. See Appendix D, Exhibit 2, for water surface elevations along the streams.

Area subject to flooding by the 100-Year frequency under present conditions.

Stream		Acres
Troublesome Creek		40
Byers Creek		20
Honolulu Creek		60
East Fork of Chulitna River		840
Middle Fork of Chulitna River		1700
	Total	2660

Troublesome Creek at Parks Highway bridge. *Source: SCS*

Troublesome Creek

The approaches to the bridge are built to overflow before the flow capacity of the bridge is exceeded, therefore the bridge will not receive major damages. Flow velocities are in excess of ten feet per second which accelerates the rate of erosion around the highway and railroad structures, along stream banks and the flood plains. High velocities and fast rising water are a risk to human life.

Byers Creek

At the Parks Highway crossing over the creek, stream velocities through the highway bridge structure are in excess of ten feet per second and are highly erosive to the stream banks and materials around the bridge structure and presently a risk to human life.

Honolulu Creek

The stream velocity at the railroad and highway structures across the creek

Looking upstream on Byers Creek at Parks Highway Bridge. *Source: SCS*

are greater than seven feet per second and cause erosion around the structures, in the flood plain along stream banks, and presently is a threat to human life.

East Fork of Chulitna River

Peak discharges produced by a storm equal to or greater than the 25-year frequency event at the railroad and highway bridges across the East Fork stream causes a rapid rise of the water surface and velocities in excess of seven feet per second. These two circumstances cause erosion at the structures in the flood plains, along stream banks, and are a risk to human life.

Middle Fork of Chulitna River

Flood flows caused by 25-year frequency storms or greater create velocities in excess of seven feet per second and overtops the stream channel banks along much of the stream length. These factors cause erosion at

Source: SCS

Honolulu Creek looking up stream from the Parks Highway crossing.

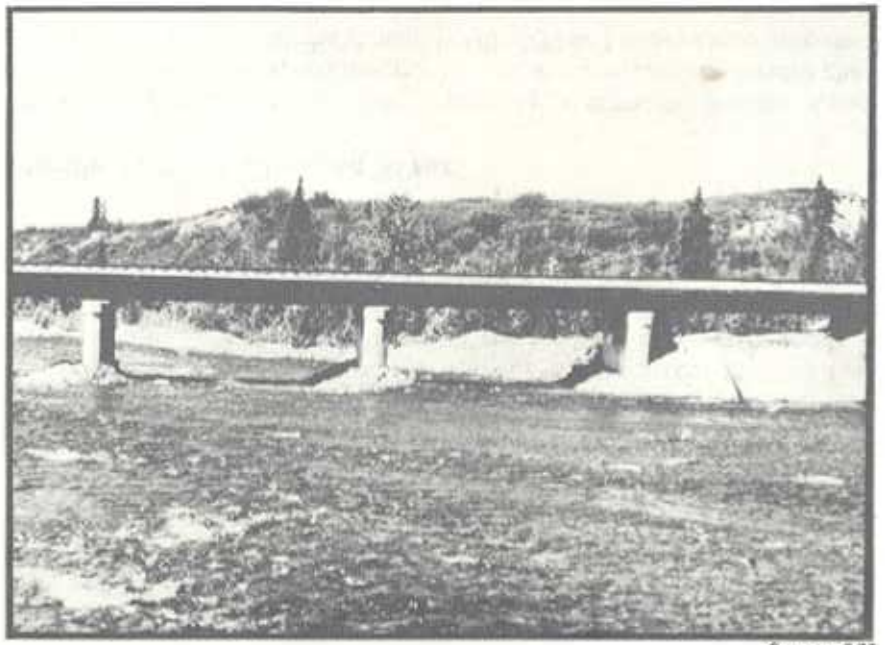
the bridge abutments where the railroad and Parks Highway cross the stream, and cause erosion to stream banks and flood plains adjacent to the streams. The high velocities coupled with the fast rise of water surface create a risk to human life.

Technical Data and Related Material

The technical data and related material needed for the intended uses of this study are provided as figures, exhibits and tables in this report.

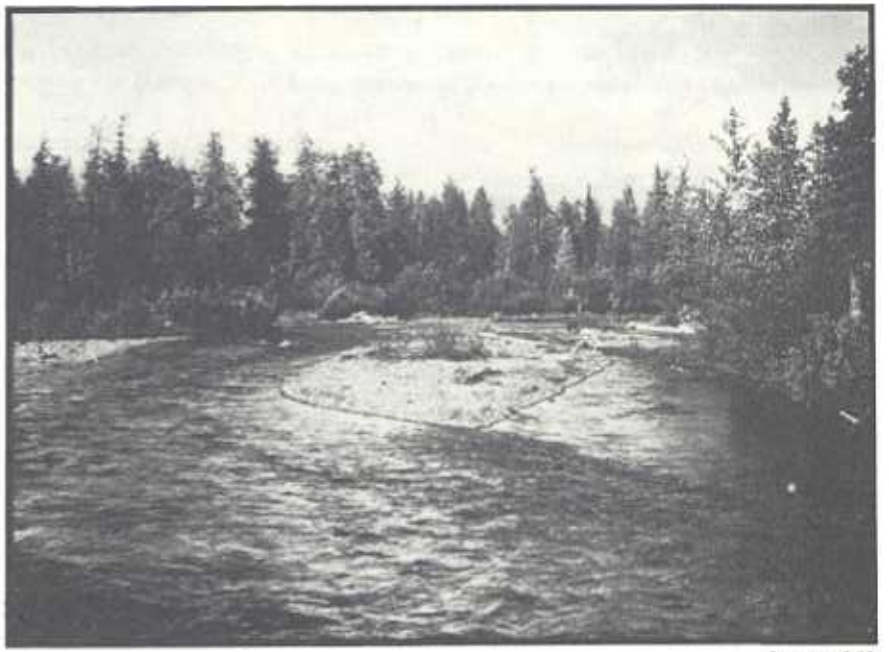
Figures 2 through 11 are drawings of selected valley cross sections showing the flood elevations for the 10-, 50-, 100-, and 500-year under present land use conditions.

Table 1 (Appendix A) is a tabulation of frequency-discharge-elevation data for present conditions at cross sections for the 10-, 50-, 100-, and



Source: SCS

Parks highway bridge across East Fork of the Chulitna River.



Source: SCS

View looking upstream from the foot bridge over Middle Fork of the Chulitna River.

500-year floods. This table may provide greater convenience and efficiency when information is needed at specific locations. Table 2 (Appendix B) is a listing of descriptions and elevations for selected elevation reference marks established in the study area. Their locations are shown on the appropriate photomap indicated in the table. All elevations are estimated by interpolations made from USGS topographic quadrangles with scale one inch equals one mile and 100 foot contour intervals. They may be used in establishing the relative locations of existing or planned buildings, roadways, etc., with the floodwater elevations. Table 3 (Appendix C) presents flood data such as width of flooding, stream channel stationing, and average stream velocities, for the 100-year event at each valley cross section. Width of flooding is shown to the right and left, looking downstream, of the stream channel. Stream channel width is not included in these dimensions.

Exhibit 1 of Appendix D provides the index for Exhibit 2, flood profile sheets. Exhibit 2 provides plottings of the routed water surface elevations for the 10-, 50-, 100-, and 500-year peak discharges along the streams. The zero station for each stream is at its confluence with the Chulitna River, a large tributary to the Susitna River. The stations increase in an upstream direction for each stream. Water surface profile for each stream were started at the average water surface elevation in the Chulitna River. A straight line interpolation was used between each cross section. These profiles may be used for those purposes which require flood elevations or flow depth between cross sections or which require the location of flood boundaries on the ground.

To locate a flood profile elevation on the ground, determine on the appropriate photomap the distance along the stream from the point in question to the nearest cross section. On the appropriate profile sheet, use the distance from the reference cross section to determine the stream distance on the profile of the point in question and read the elevation of the desired flood frequency line. Transfer this elevation to the ground from the nearest reference mark. Check the depth of flow from the profiles to be sure that your ground elevation allows for an adequate depth of flow. Adjust upward if needed to provide a safe elevation.

Exhibit 3 of Appendix E is a Photomap Index to determine the sheet number of the photomap desired.

The Flood Hazard Area Photomaps, Exhibit 4 of Appendix E, show the area inundated by the 100-year flood. The actual limits of the 100-year flood line on the ground may vary somewhat from that shown because of interpolation made from USGS quadrangles with 100 feet contour intervals and high altitude photography. These photomaps can be used to determine the location of points in question and their relationship to specific flood frequency as outlined above for Exhibit 2. They may also be used for flood plain management decisions or for purposes which require the approximate location of the 100-year flood plain.

FUTURE FLOOD POTENTIAL

The Matanuska-Susitna Borough is a participant in the HUD 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 flood plain management 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 existing development 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 floodplain 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 an more rugged upland terrain.

FLOOD PLAIN MANAGEMENT

Management Programs

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 floodplains. 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 flood gates 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.

Recommendations

It is not the intent of this report to provide solutions to flood problems in the study area; however, it does furnish an information base for the adoption of an overall flood plain management program. Other management programs dealing with environmental values of flood plains may also benefit from this information. Following are recommendations which should be emphasized during development and implementation of this program.

1. Adopt and/or enforce flood plain regulations in compliance with the National Flood Insurance Program as a minimum. The regulations should address such things as minimum floor elevations, floodways, greenbelt areas, adequate drainage facilities, building and housing codes, and sanitary codes with specific flood hazard provisions for all new construction.

2. Consider nonstructural measures for flood prevention such as flood plain acquisition, flood proofing, and flood forecasting and warning systems. Federal cost sharing for these measures may be available under Section 73(b) of Public Law 93-251. The realization of the need for a flood warning system is due to the projected rapid development of the flood plains that have occurred in the past decade and the high velocities in the streams. The National Weather Service of the National Oceanic and Atmospheric Administration issues frequent warnings of potential flood producing storms. Frequently the flood warnings are preceded by a "severe weather or flood watch."

3. Include in land development ordinance the provision for on-site runoff and sediment storage. A continuous maintenance program needs to be provided for these types of measures.

4. Owners of property subject to flood damage (including areas adjacent to the delineated flood hazard areas) should be encouraged to purchase flood insurance on their buildings, mobile homes, and their contents.

5. Develop a regular maintenance program to keep all hydraulic structure openings, approach channels, and outfall channels clear of sediment and debris.

INVESTIGATIONS AND ANALYSES

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 developed by the SCS were used for most of the analyses.

Field Surveys

Field surveys were completed in the summer of 1978 and 1979 for valley and road cross sections. Vertical control for surveys was referenced to contours from the USGS quadrangles, with a scale of one inch equal to one mile and contour intervals of 100 feet.

A few key cross sections were surveyed and others were made by use of the key cross sections, interpolations from USGS quadrangles and use of high altitude photography.

Hydraulics

Elevation-discharge relationships were developed for all bridges, culverts, and valley sections utilizing the water surface profile computer program WSP2 outlined in SCS Technical Release No. 61. The hydraulic parameters of the channel and flood plain for the conditions existing prior to 1979 were input data for the WSP2 program. High water marks, stream gage records, and other historical flood data were used in checking the accuracy of the computed water surface profiles. There are no stream gages located in the study area.

Hydrology

Peak-frequency (annual series) studies were made by the USGS for all of Alaska. The USGS published a regional analysis, "Flood Characteristics of Alaskan Streams," Water Resources Investigations 78-129, dated 1979, which presents regional equations for two areas in Alaska, Area I and Area II.

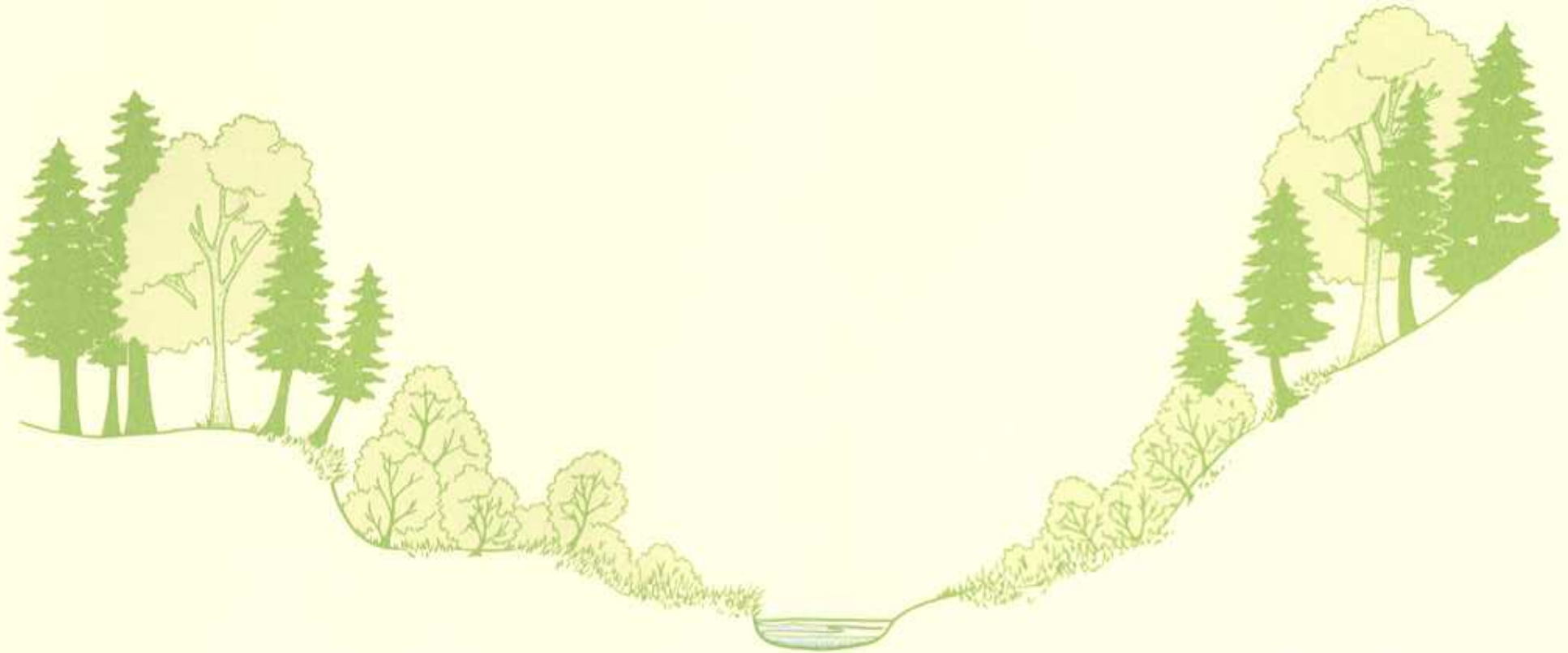
The study area is located in Area II. Peak-frequency curves were developed using the equation proposed by USGS and by use of the Log-Pearson Type III method. Peaks calculated by these two frequency methods for given storm frequencies were compared to one another to determine the adequacy of the regional equation for this study. From these comparisons it was determined that the regional equation lacked sufficient accuracy for this type of study.

Twenty-six stream gages within the Southcentral Region were then used to develop peak-frequency curves in an effort to obtain more reliable peaks for the study area.

Thirteen of these gage records were discarded because watershed characteristics and/or drainage areas were not representative of the study area and/or the time of stream gaging records was too short for adequate frequency analysis. Eleven of the gage records, on streams within the Cook Inlet drainage, were used to make a final determination of peak-frequency curves to be used in this study area.

An envelope for high, medium, and low peak discharge curves, for the 2-year, 10-year, 50-year, 100-year and 500-year events were developed. (See Appendix E, Exhibit 5, 6, 7, 8, and 9 of "Flood Hazard Study for 196 Mile, Caswell, Sheep, Montana, Answer and Birch Creeks" by SCS 1981.) These curves and watershed characteristics such as watershed slope, channel length and slope, mean elevation, land cover and average annual precipitation, were used to develop a peak-frequency curve for each watershed at each cross section.

The peak discharge for each area above each cross section for the 10-, 50-, 100-, and 500-year storm events were taken from these curves and used for channel flood routing on each stream to determine water surface elevations and area inundated.

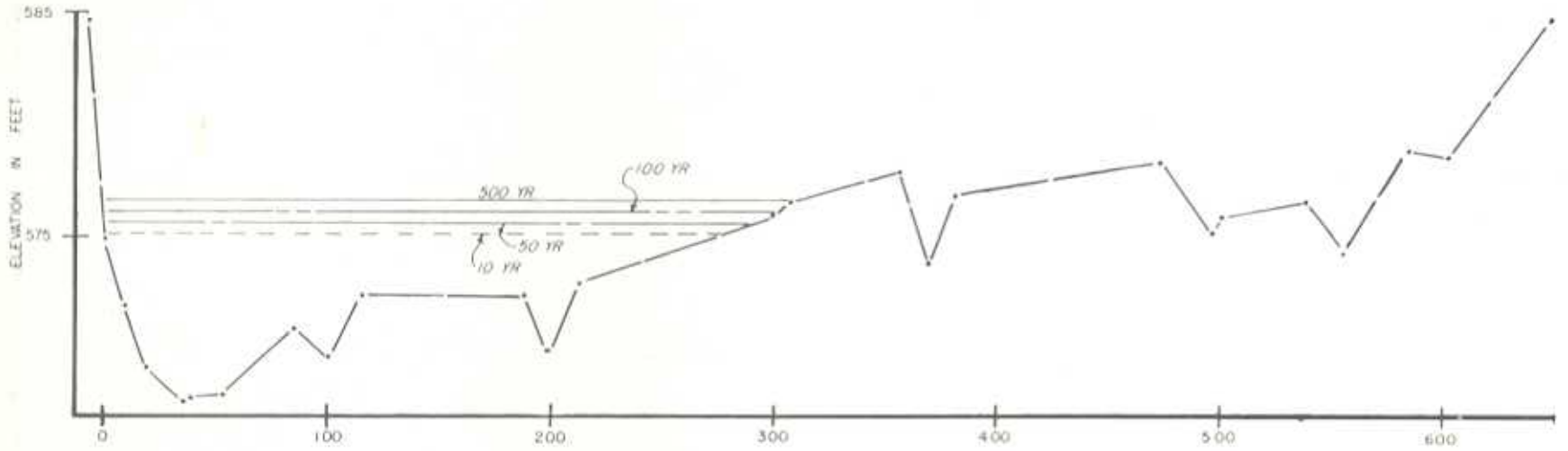


Typical Valley Sections

Figures 2 through 11

TYPICAL VALLEY SECTION

PRESENT CONDITIONS



DISTANCE IN FEET

SECTION TS-B

TROUBLESOME CREEK

SOIL CONSERVATION SERVICE

U.S. DEPARTMENT OF AGRICULTURE

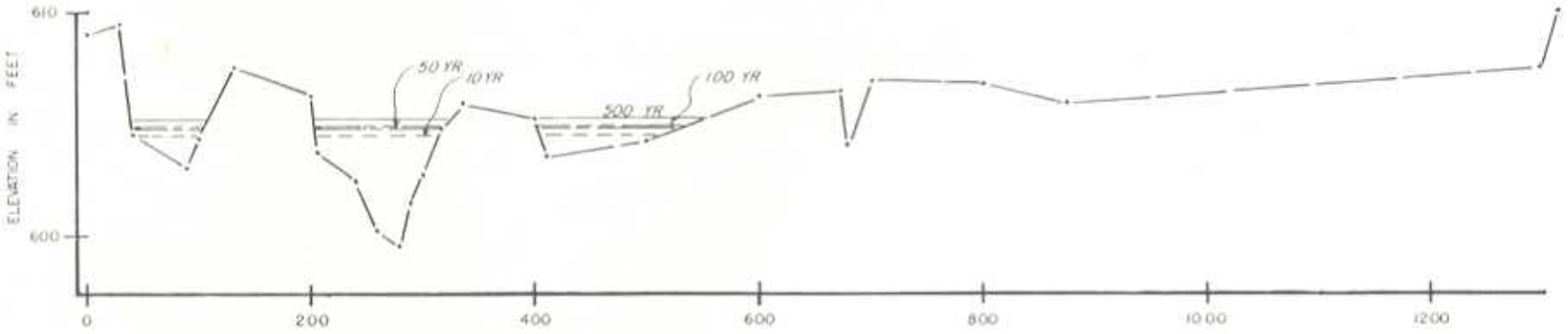
TALKEETNA SUBBASIN

MATANUSKA-SUSITNA BOROUGH, ALASKA

FIGURE 2

TYPICAL VALLEY SECTION

PRESENT CONDITIONS



DISTANCE IN FEET

SECTION TS-G

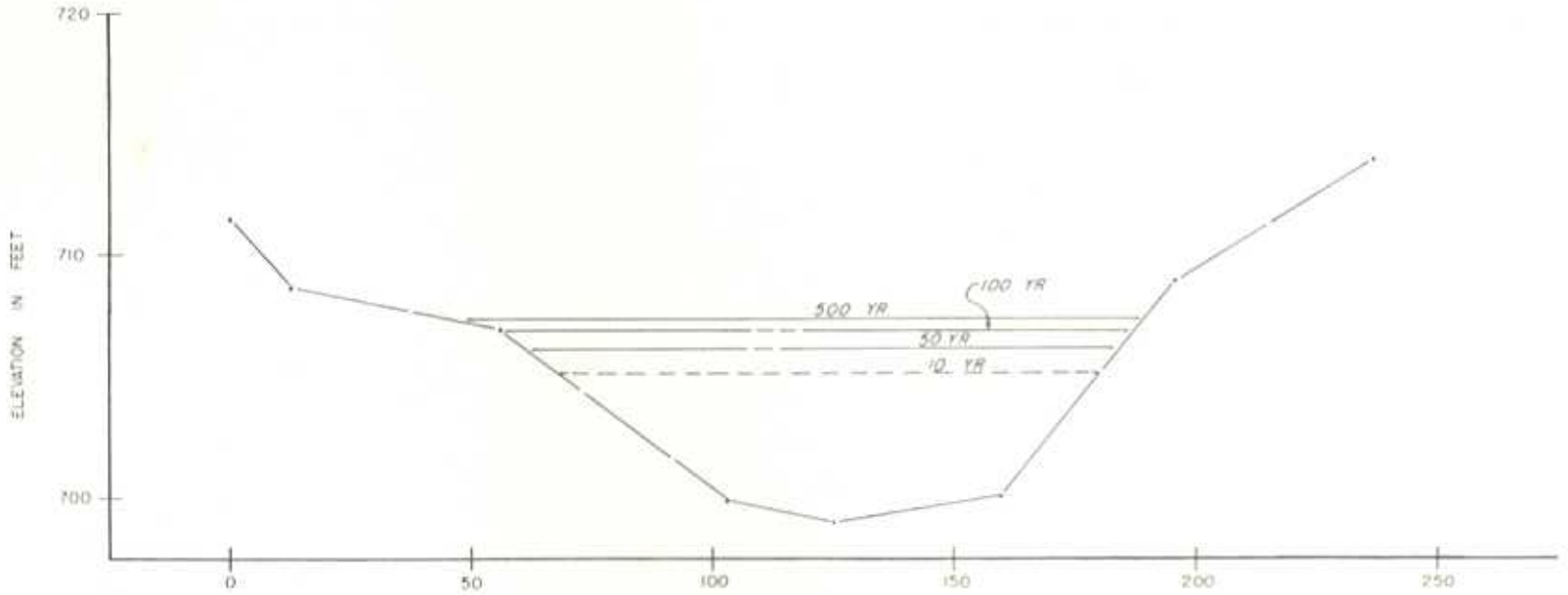
TROUBLESOME CREEK

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

FIGURE 3

TYPICAL VALLEY SECTION

PRESENT CONDITIONS



SECTION BY-D

BYERS CREEK

SOIL CONSERVATION SERVICE

U S DEPARTMENT OF AGRICULTURE

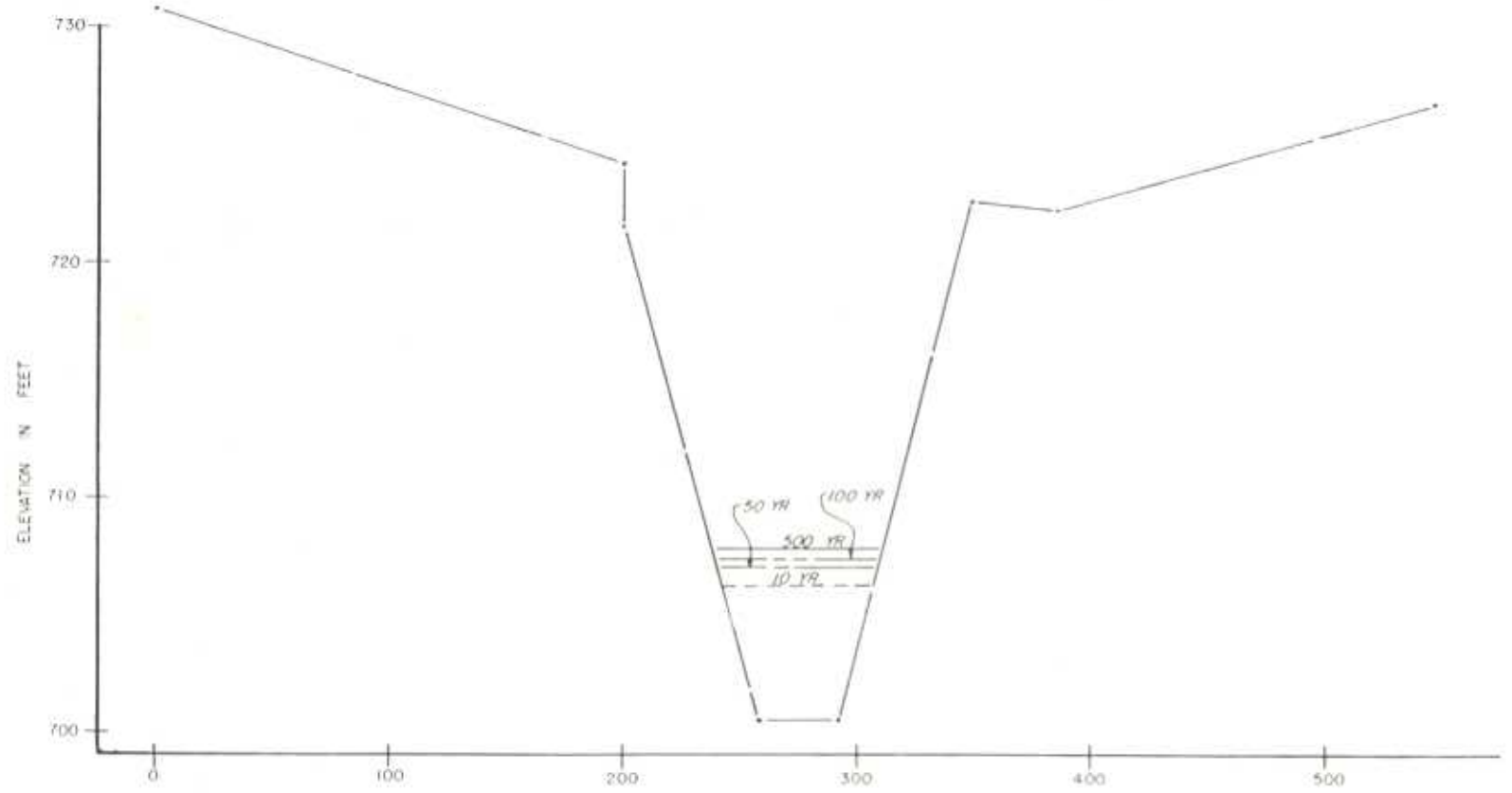
TALKEETNA SUBBASIN

MATANUSKA-SUSITNA BOROUGH, ALASKA

FIGURE 4

TYPICAL VALLEY SECTION

PRESENT CONDITIONS



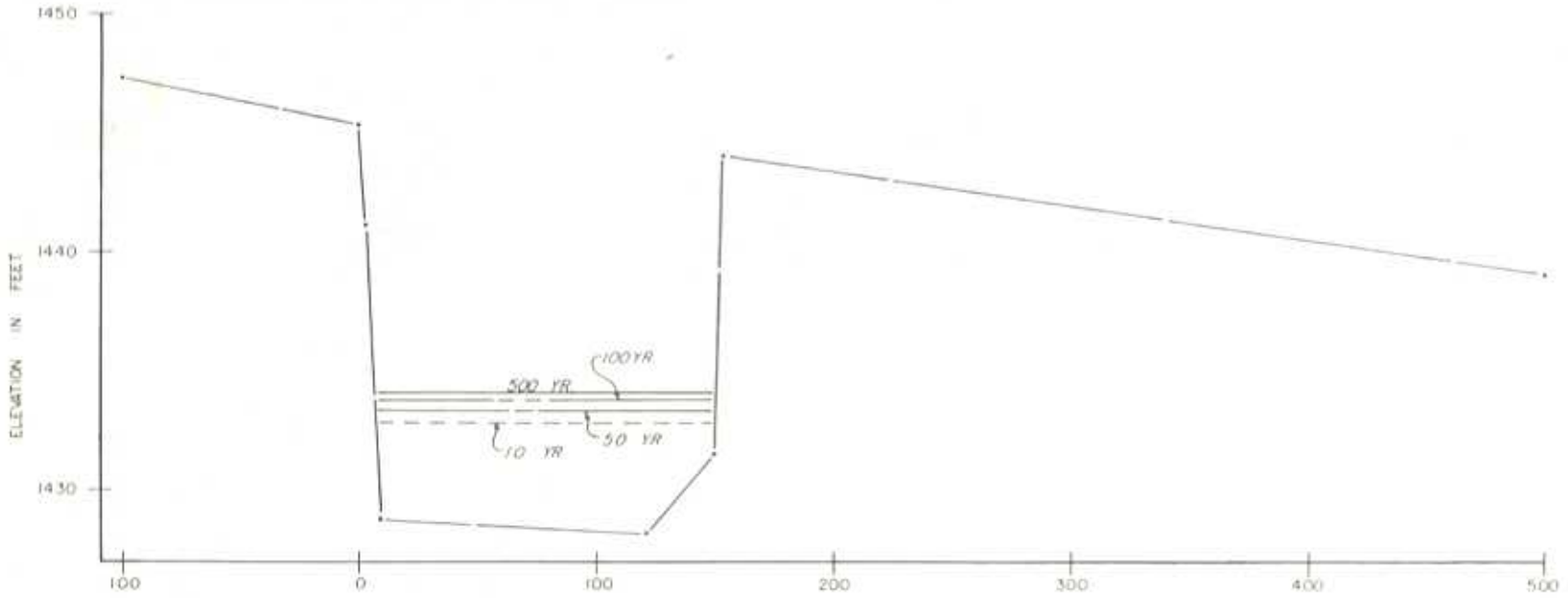
SECTION BY EPHY
BYERS CREEK

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

FIGURE 5

TYPICAL VALLEY SECTION

PRESENT CONDITIONS



DISTANCE IN FEET

SECTION HO-EARR

HONOLULU CREEK

SOIL CONSERVATION SERVICE

U S DEPARTMENT OF AGRICULTURE

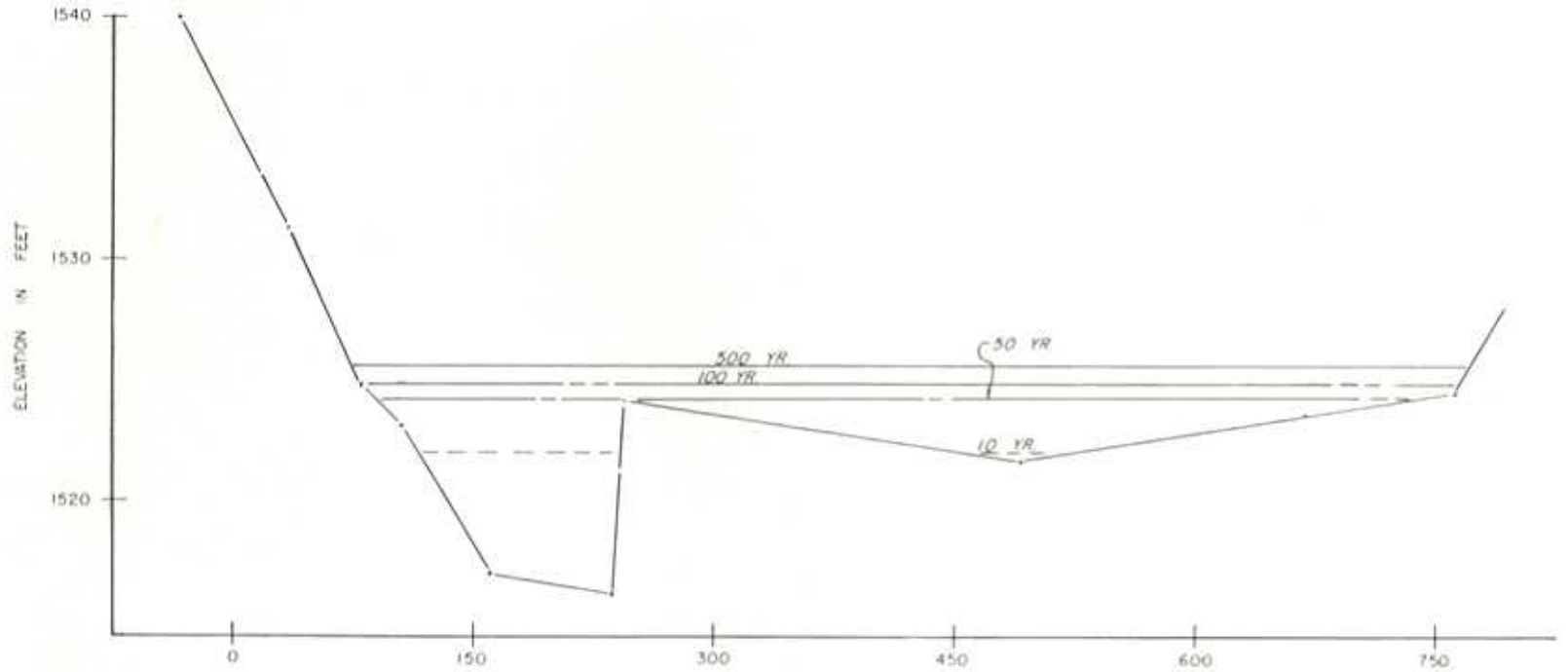
TALKEETNA SUBBASIN

MATANUSKA - SUSITNA BOROUGH , ALASKA

FIGURE 6

TYPICAL VALLEY SECTION

PRESENT CONDITIONS



SECTION HO-M

HONOLULU CREEK

SOIL CONSERVATION SERVICE

U.S. DEPARTMENT OF AGRICULTURE

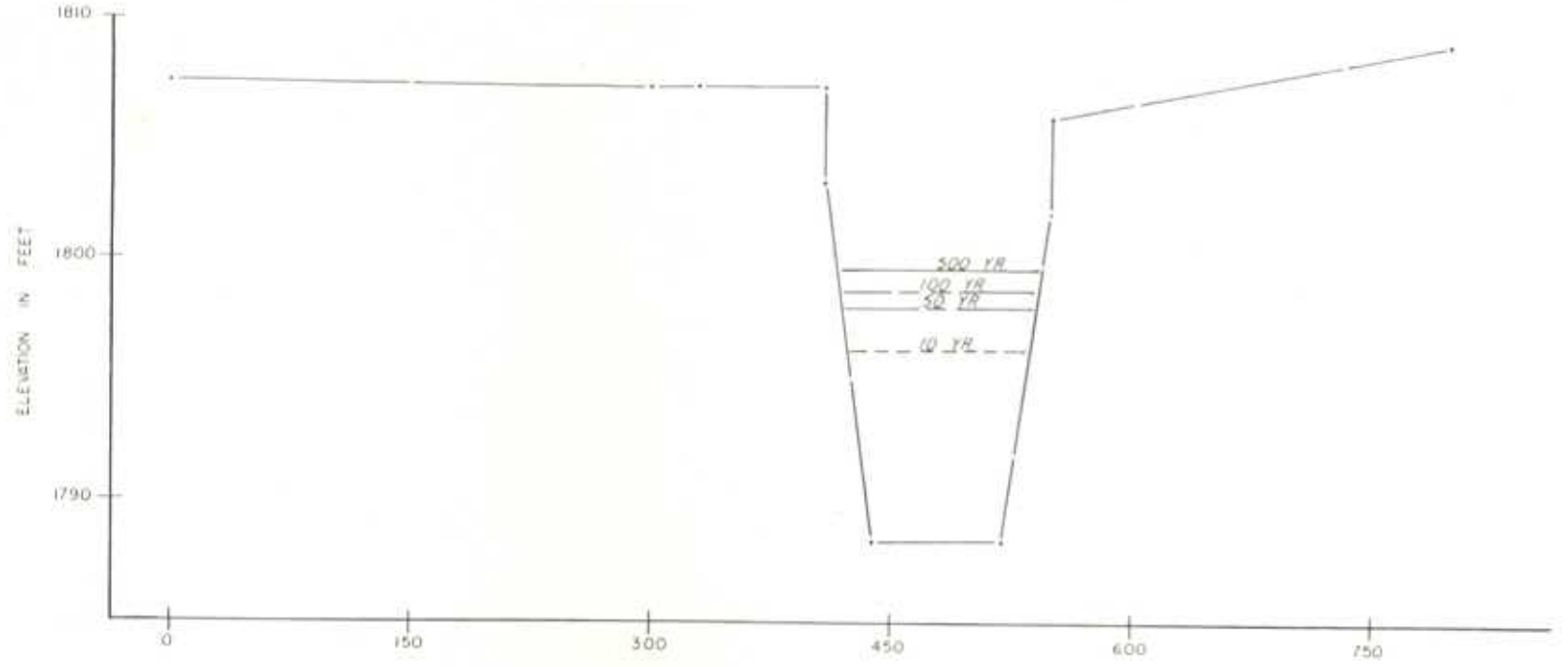
TALKEETNA SUBBASIN

MATANUSKA - SUSITNA BOROUGH, ALASKA

FIGURE 7

TYPICAL VALLEY SECTION

PRESENT CONDITIONS



DISTANCE IN FEET

SECTION EC-12HY

EAST FORK CHULITNA RIVER

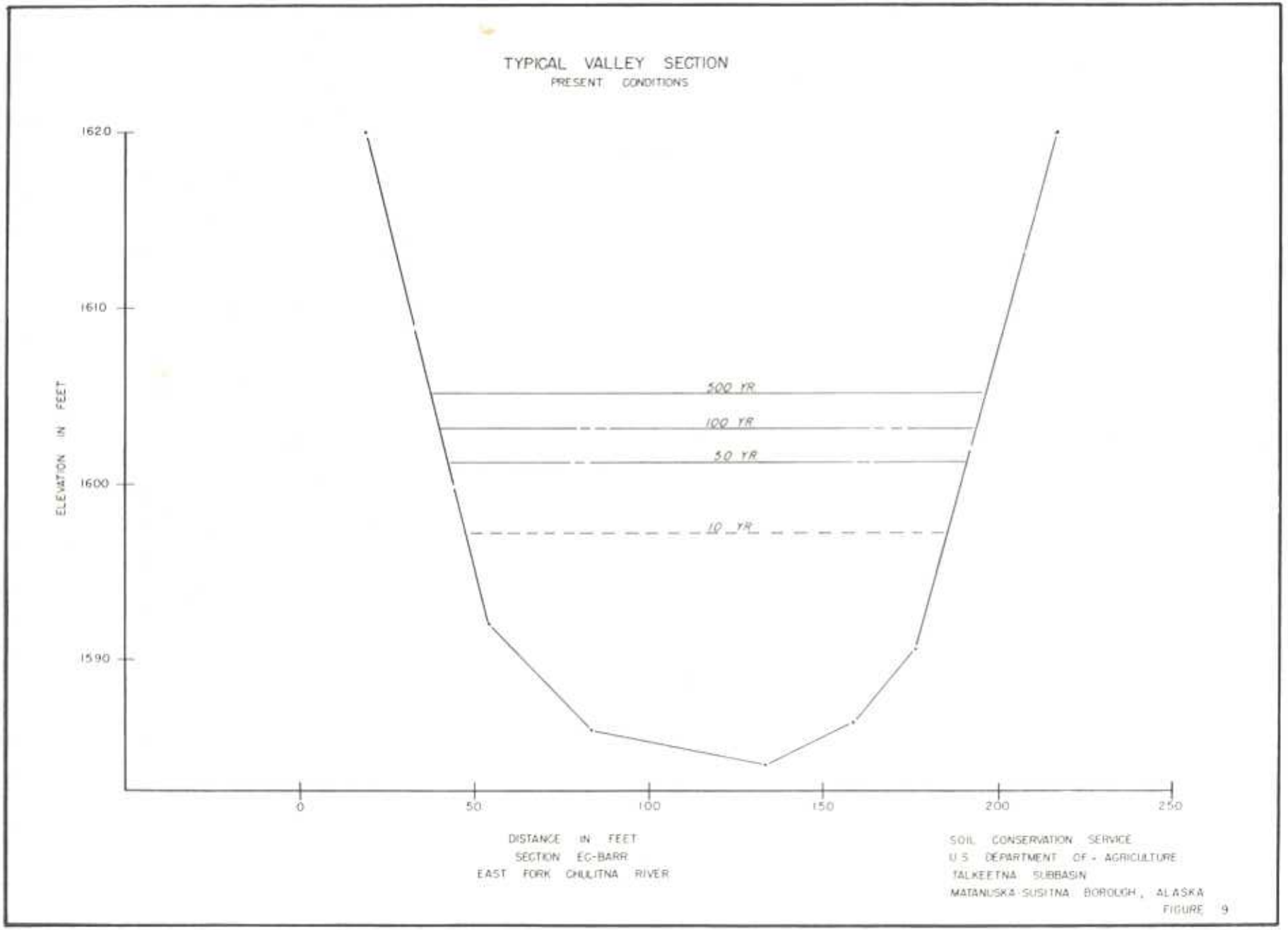
SOIL CONSERVATION SERVICE

U.S. DEPARTMENT OF AGRICULTURE

TALKEETNA SUBBASIN

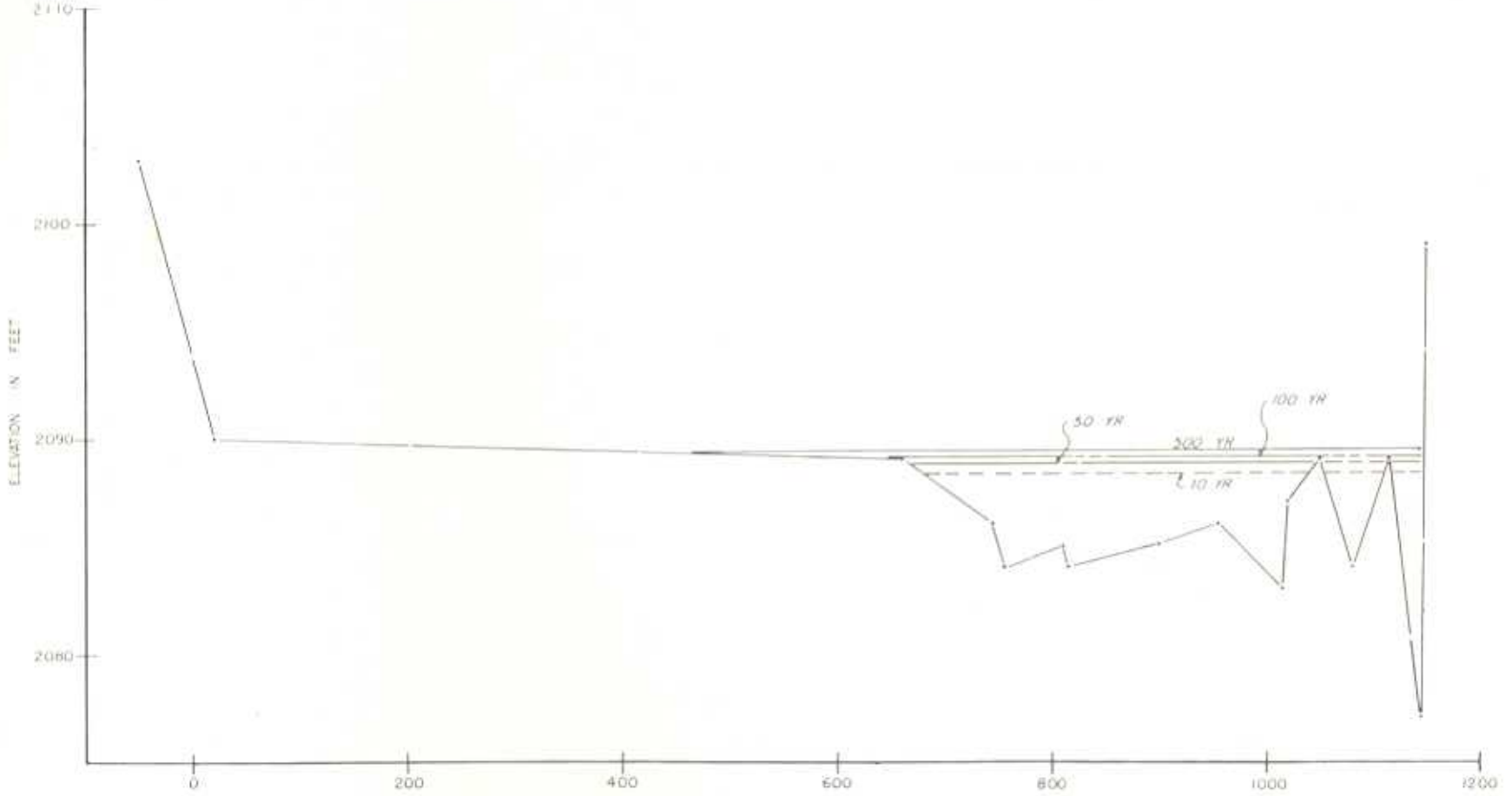
MATANUSKA-SUSITNA BOROUGH, ALASKA

FIGURE 8


TYPICAL VALLEY SECTION
PRESENT CONDITIONS
1620
1610
1600
1590
ELEVATION IN FEET
500 YR
100 YR
50 YR
10 YR
0
50
100
150
200
250
DISTANCE IN FEET
SECTION EC-BARR
EAST FORK CHULITNA RIVER
SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
TALKEETNA SUBBASIN
MATANUSKA-SUSITNA BOROUGH, ALASKA
FIGURE 9

TYPICAL VALLEY SECTION

PRESENT CONDITIONS



DISTANCE IN FEET

SECTION MC-U

MIDDLE FORK CHULITNA RIVER

SOIL CONSERVATION SERVICE

U.S. DEPARTMENT OF AGRICULTURE

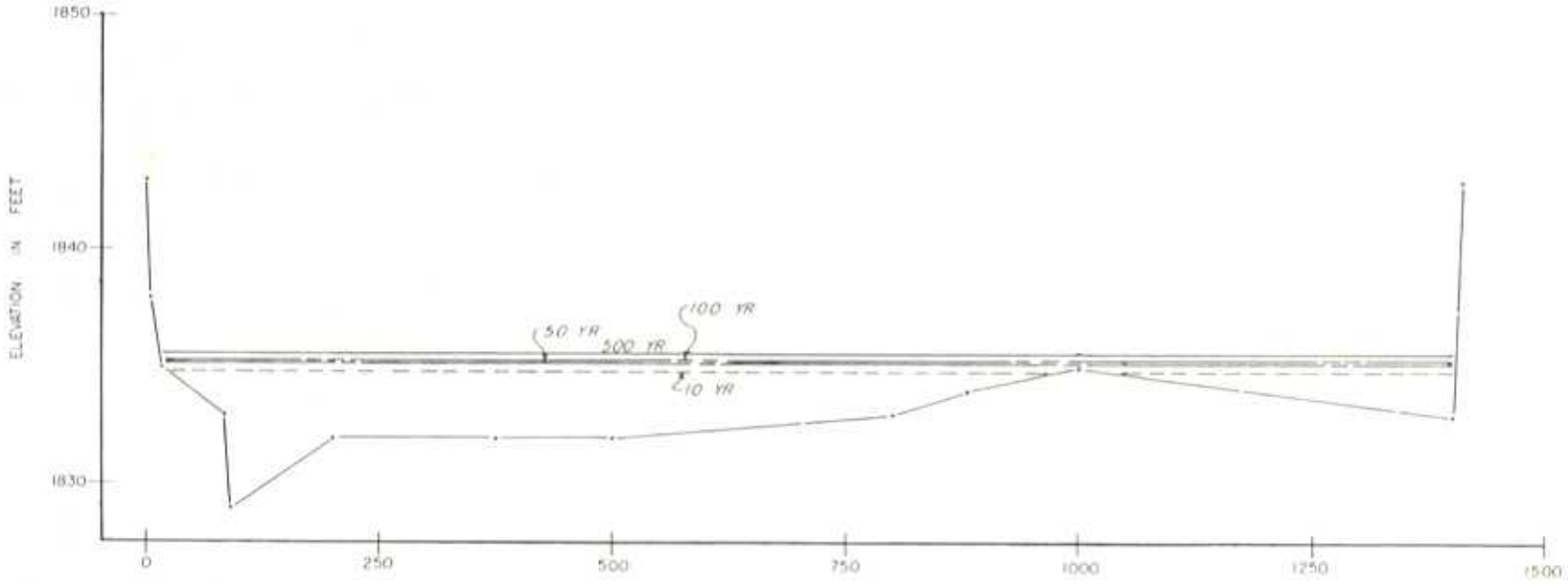
TALKEETNA SUBBASIN

MATANUSKA-SUSITNA BOROUGH, ALASKA

FIGURE 10

TYPICAL VALLEY SECTION

PRESENT CONDITIONS



SECTION MC-H

MIDDLE FORK CHULITNA RIVER

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

FIGURE 11

GLOSSARY

ANNUAL SERIES - A frequency series in which only the largest value in each year is used, such as the annual floods.

BACKWATER - The resulting high water due to a downstream obstruction or restriction or from high water elevations in an intersecting stream.

BM - Bench mark. See elevation reference mark.

CFS - Abbreviation for cubic feet per second. The rate of discharge or flow of water representing a volume of 1 cubic foot passing a given point during 1 second.

CHANNEL - A natural or artifically created open conduit that periodically or continuously conveys water. River, creek, stream, branch, and tributary are some of the terms used to describe channels.

CSM - Abbreviation for cubic feet per second per square mile. (Rate of discharge per square mile of drainage area.)

DRAINAGE AREA - The area, measured in a horizontal plane, which drains into a stream at a specified location. See watershed.

ELEVATION REFERENCE MARK - A fixed reference, usually placed on or near the ground, giving the measurement in elevation of that point in relation to mean sea level. Bench mark is the common term used by surveyors.

FLOOD - An overflow or inundation of normal dry lands from a stream or other body of water; the high streamflow overtopping the banks of a stream; or a high flow as measured by either stage or discharge.

FLOOD HAZARD AREA PHOTOMAP - A photographic background map that indicates areas likely to be flooded by the 100-year frequency or the one percent chance flood (it has one chance in 100 of being equaled or exceeded in any given year) from an adjoining stream or water body.

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

FLOOD FREQUENCY - The average interval of time between floods equal to or greater than a specified discharge or stage. It is generally expressed in years. Following are examples:

10-year flood or 10-year frequency flood. The flood which can be expected or exceeded on an average once in 10 years; and which would have a 10 percent chance of being equaled or exceeded in any given year.

50-year flood ... two percent chance ... in any given year.

100-year flood ... one percent chance ... in any given year.

500-year flood ... two-tenths percent chance ... in any given year.

FLOOD HAZARD - A general term meaning the risk to life or damage to property from overflows of rivers or stream channels, extraordinary waves or tides occurring on lake or estuary shores; floodflows in intermittent or normally dry streams; floods on tributary streams; floods caused by accumulated debris or ice in rivers; or other similar events.

FLOOD PEAK OR PEAK DISCHARGE - The highest value of the stage or discharge attained by a flood, thus, peak stage or peak discharge.

FLOOD PLAIN OR FLOOD-PRONE AREA - The land area situated on either side of a channel or body of water which is subject to flooding.

FLOOD PLAIN MANAGEMENT - The operation of an overall program of corrective and preventive measures for reducing flood damage, including but not limited to emergency preparedness plans, flood control works, and land use and control measures.

FLOOD PROFILES - A plot or graph defining the water surface elevation in relation to the distance along the stream during a particular flood.

FLOOD ROUTING - Determining the changes in a flood wave as it moves downstream through a valley or through a reservoir (then sometimes called reservoir routing). Graphic or numerical methods are used.

FREQUENCY-DISCHARGE-ELEVATION - The relationship of the flood frequency of discharges and the water elevations resulting from these

discharges at a surveyed cross section or other point along a stream. This data may be shown as a plotted curve or in table form.

GREENBELT AREA - A strip of land kept in its natural or relatively undeveloped state or in agricultural use which is planned around the periphery of urban development or in the flood plain of a stream or body of water.

HEADWATER - (1) The source of a stream. (2) The water upstream from a structure or point on a stream.

LEFT FLOOD PLAIN - The flood plain on the left side of a river, stream, or watercourse, looking downstream.

MANNING'S "n" VALUE - A coefficient of roughness in Manning's flow equation for determining stream velocities.

RIGHT FLOOD PLAIN - The flood plain on the right side of a river, stream, or watercourse, looking downstream.

RUNOFF - That portion of the precipitation on a drainage area that is discharged from the area in stream channels. Types include surface runoff, groundwater runoff, or seepage.

SEDIMENT - Solid material, both mineral and organic, that is in suspension, and is being transported, or has been moved from its site of origin by air, water, gravity, or ice, and has come to rest on the earth's surface.

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

SUPERCRITICAL FLOW - Those conditions of flow for which the depth is less than critical and the velocity is greater than critical. Critical flow is the term used to describe open channel flow when the discharge is maximum for a given specific energy head, or stated conversely, those which exist when the specific energy head is minimum for a given discharge.

TBM - Temporary bench mark. See elevation reference mark.

WATERSHED - The area contributing direct runoff to a stream. Usually it is assumed that base flow in the stream also comes from the same area. However, the groundwater watershed may be larger or smaller.

CONVERSION TABLE

Multiply inch-pound units	by	to obtain SI units
cubic feet per second (ft^3/s)	0.0283	cubic meters per second (m^3/s)
cubic feet per second per square mile [$(ft^3/s)/mi^2$]	0.0109	cubic meters per second per square kilometer [(m3/s)/km^2]
square miles (mi^2)	2.589	square kilometers (km^2)
feet (ft)	0.3048	meters (m)
inches (in.)	2.540	centimeters (cm)
degrees Fahrenheit (°F)	5/9(°F-32)	degrees Celsius (°C)

BIBLIOGRAPHY

1. U.S. Department of Agriculture, Soil Conservation Service: SCS National Engineering Handbook, Section 4, Hydrology, August 1972.

2. U.S. Department of Agriculture, Soil Conservation Service: SCS National Engineering Handbook, Section 5, Hydraulics, Supplement B, August 1956.

3. U.S. Department of Agriculture, Soil Conservation Service: WSP2 Computer Program, Technical Release No. 61, May 1976.

4. U.S. Department of Agriculture, Soil Conservation Service: A Method for Estimating Volume and Rate of Runoff in Small Watersheds, Technical Paper 149, April 1973.

5. U.S. Department of Agriculture, Soil Conservation Service: Urban Hydrology for Small Watersheds, Technical Release No. 55, January 1975.

6. U.S. Department of the Army, Office of the Chief Engineers: A Perspective on Flood Plain Regulations for Flood Plain Management. June 1, 1976.

7. U.S. Department of Commerce, National Oceanic Administration National Ocean Survey, National Geodetic Survey, Vertical Control Data, 1965 tentative adjustment, Line 101, First Order Leveling, September 1966.

8. U.S. Department of Commerce, Weather Bureau: Rainfall Frequency Atlas of the United States, Technical Paper No. 47, May 1963.

9. U.S. Department of the Interior, Geological Survey, 15 Minute Series (Topographic) Maps, Scale 1:63,360, 50 feet and 100 feet contour interval.

10. U.S. Department of Interior, Geologic Survey, Flood Characteristics of Alaskan Streams, 1979.

11. U.S. Department of Interior, Geological Survey, Annual Peak Flow Data Retrieval Computer Program.

12. U.S. Department of Interior, Geological Survey, Water Data Reports, Water Resources Data for Alaska, 1948-1977.

13. U.S. Department of Interior; Geological Survey, Annual Peak Flow Frequency Analysis, Computer Program Following WRC Guidelines, Rev. 07/20/79.

14. U.S. Water Resources Council: A Unified National Program for Flood Plain Management, July 1979.

15. U.S. Water Resources Council: Guidelines for Determining Flood Flow Frequency, Bulletin No. 17A, Rev. June 1977.

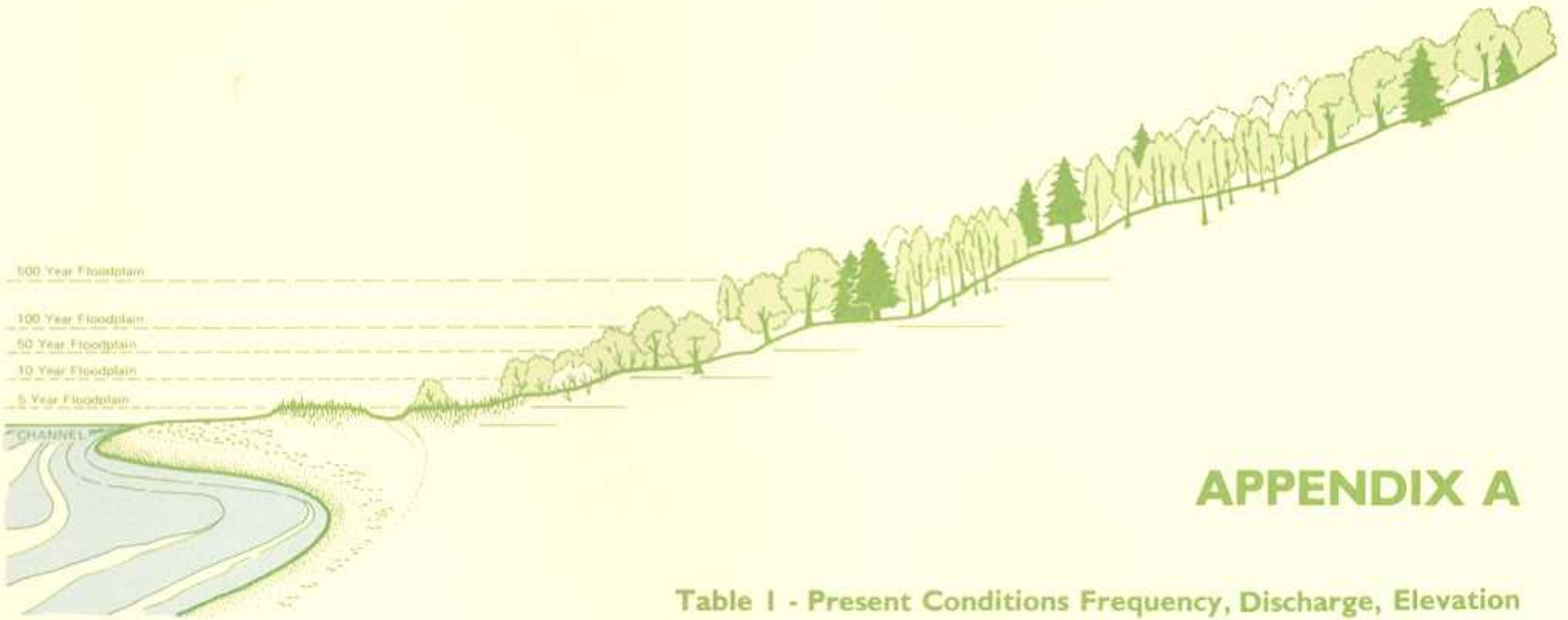
11. U.S. Department of Interior, Geological Survey, Annual Peak Flow Data Retrieval Computer Program.

12. U.S. Department of Interior, Geological Survey, Water Data Reports, Water Resources Data for Alaska, 1948-1977.

13. U.S. Department of Interior, Geological Survey, Annual Peak Flow Frequency Analysis, Computer Program Following WRC Guidelines, Rev. 07/20/79.

14. U.S. Water Resources Council: A Unified National Program for Flood Plain Management, July 1979.

15. U.S. Water Resources Council: Guidelines for Determining Flood Flow Frequency, Bulletin No. 17A, Rev. June 1977.



APPENDIX A

Table 1 - Present Conditions Frequency, Discharge, Elevation

Data at Valley Cross Sections

Elevations are approximate

Table 1. Present Conditions: Frequency-Discharge Elevation Data at Valley Section Troublesome, Byers, Honolulu Creeks, East and Middle Forks of Chulitna River Matanuska-Susitna Borough, Alaska.

(Elevations are Approximate)

Valley Section	Photo-Map (No.)	Profile Sheet (No.)	Drainage Area (Sq. Mi.)	10-Year Storm		50-Year Storm		100-Year Storm		500-Year Storm		Channel Bottom
				Disch. (cfs)	Elev. msl (feet)	Disch. (cfs)	Elev. msl (feet)	Disch. (cfs)	Elev. msl (feet)	Disch. (cfs)	Elev. msl (feet)	Elev. msl (feet)
Troublesome Creek												
TS-A	1	1	39.40	2550	574.5	3200	575.0	3500	575.5	4150	576.0	561.9
TS-1	1	1	39.40	2550	574.5	3200	575.0	3500	575.6	4150	576.1	564.7
TS-B	1	1	39.40	2550	575.1	3200	575.6	3500	576.1	4150	576.6	567.6
TS-2	1	1	39.40	2550	578.4	3200	579.0	3500	579.2	4150	579.7	572.0
TS-C	1	1	39.40	2550	582.5	3200	583.1	3500	583.2	4150	583.7	576.4
TS-3	1	1	39.40	2550	583.4	3200	583.9	3500	584.1	4150	584.7	577.2
TS-D	1	1	39.40	2550	584.6	3200	585.1	3500	585.3	4150	585.9	579.3
TSEPHY	1	1	39.26	2550	587.1	3200	588.0	3500	588.3	4150	589.0	581.0
TS-F	1	1	39.26	2550	587.5	3200	588.2	3500	588.5	4150	589.2	582.7
TS-G	1	1	39.26	2550	604.5	3200	604.8	3500	604.9	4150	605.2	599.7
TS-H	1	1	39.07	2550	625.1	3200	625.5	3500	625.6	4150	625.9	620.0
TS-I	1	2	37.72	2550	654.8	3200	655.1	3500	655.2	4150	655.5	650.0
TS-J	1	2	37.72	2550	704.8	3200	705.1	3500	705.2	4150	705.5	700.0
TS-K	1	2	36.94	2550	747.0	3200	747.3	3500	747.5	4150	747.8	742.0
Byers Creek												
BY-A	1	3	49.84	3210	677.1	4100	677.7	4500	678.0	5000	678.2	669.0
BY-1	1	3	49.84	3210	680.5	4100	681.2	4500	681.6	5000	682.0	673.5
BY-B	1	3	49.84	3210	684.6	4100	685.5	4500	685.9	5000	686.3	678.0
BY-2	1	3	49.84	3210	693.5	4100	694.3	4500	694.6	5000	694.9	687.5
BY-C	1	3	49.84	3210	702.9	4100	703.7	4500	704.0	5000	704.3	697.0
BY-3	1	3	49.84	3210	704.5	4100	705.3	4500	705.7	5000	706.1	698.0
BY-D	1	3	49.84	3210	705.7	4100	706.6	4500	706.9	5000	707.4	699.0
BYEPHY	1	3	49.67	3210	706.2	4100	707.0	4500	707.4	5000	707.8	700.5

Table I. Present Conditions: Frequency-Discharge Elevation Data at Valley Section Troublesome, Byers, Honolulu Creeks, East and Middle Forks of Chulitna River Matanuska-Susitna Borough, Alaska.

(Elevations are Approximate)

Valley Section	Photo-Map (No.)	Profile Sheet (No.)	Drainage Area (Sq. Mi.)	10-Year Storm		50-Year Storm		100-Year Storm		500-Year Storm		Channel Bottom
				Disch. (cfs)	Elev. msl (feet)	Disch. (cfs)	Elev. msl (feet)	Disch. (cfs)	Elev. msl (feet)	Disch. (cfs)	Elev. msl (feet)	Elev. msl (feet)
Byers Creek (cont.)												
BY-F	1	3	49.67	3210	708.3	4100	709.4	4500	709.8	5000	710.3	701.5
BY-G	1	3	49.67	3210	723.5	4100	724.4	4500	724.8	5000	725.1	717.5
BY-H	1	4	49.67	3210	740.5	4100	741.5	4500	742.0	5000	742.6	733.0
BY-I	1	4	48.65	3210	756.9	4100	757.9	4500	758.2	5000	758.8	750.0
BY-J	1	4	48.65	3210	777.1	4100	778.0	4500	778.5	5000	779.1	770.0
BY-K	1	5	47.11	3210	807.1	4100	808.0	4500	808.5	5000	809.1	800.0
Honolulu Creek												
HO-A	2	6	77.74	4100	1400.0	5100	1401.5	5600	1402.0	6600	1402.3	1390.3
HO-1	2	6	77.74	4100	1403.9	5100	1404.6	5600	1405.1	6600	1405.4	1399.3
HO-B	2	6	77.74	4100	1412.2	5100	1412.6	5600	1412.9	6600	1413.2	1408.3
HO-2	2	6	77.74	4100	1418.1	5100	1418.6	5600	1418.8	6600	1419.2	1414.3
HO-C	2	6	77.74	4100	1424.3	5100	1424.9	5600	1425.2	6600	1425.6	1420.3
HO-3	2	6	77.74	4100	1428.5	5100	1429.2	5600	1429.5	6600	1430.0	1423.8
HO-D	2	6	77.74	4100	1432.2	5100	1432.8	5600	1433.2	6600	1433.6	1427.3
HOEARR	2	6	77.74	4100	1432.8	5100	1433.4	5600	1433.8	6600	1434.2	1428.3
HO-F	2	6	72.00	4100	1433.6	5100	1434.2	5600	1434.5	6600	1435.0	1429.3
HO-4	2	6	72.00	4100	1443.6	5100	1444.1	5600	1444.3	6600	1444.9	1439.3
HO-H	2	6	72.00	4100	1458.2	5100	1458.6	5600	1458.7	6600	1459.2	1454.3
HO-5	2	7	70.00	4100	1483.9	5100	1484.3	5600	1484.6	6600	1485.1	1480.0
HO-J	2	7	70.00	4100	1503.7	5100	1503.7	5600	1503.9	6600	1504.4	1499.3
HO-6	2	7	69.00	4100	1516.9	5100	1517.2	5600	1517.5	6600	1517.9	1513.3
HOLPHY	2	7	67.31	3720	1520.3	4680	1523.8	5100	1524.6	6000	1525.5	1516.0
HO-M	2	7	67.31	3720	1522.0	4680	1524.1	5100	1524.8	6000	1525.6	1516.2
HO-N	2	8	67.00	3720	1537.0	4680	1537.7	5100	1538.1	6000	1538.5	1531.2
HO-O	2	8	65.00	3720	1558.9	4680	1559.5	5100	1559.8	6000	1560.2	1553.2
HO-P	2	9	62.88	3270	1604.5	4400	1605.1	4600	1605.4	5500	1605.9	1599.2

Table 1. Present Conditions: Frequency-Discharge Elevation Data at Valley Section Troublesome, Byers, Honolulu Creeks, East and Middle Forks of Chulitna River Matanuska-Susitna Borough, Alaska.

(Elevations are Approximate)

Valley Section	Photo-Map (No.)	Profile Sheet (No.)	Drainage Area (Sq. Mi.)	10-Year Storm		50-Year Storm		100-Year Storm		500-Year Storm		Channel Bottom
				Disch. (cfs)	Elev. msl (feet)	Disch. (cfs)	Elev. msl (feet)	Disch. (cfs)	Elev. msl (feet)	Disch. (cfs)	Elev. msl (feet)	Elev. msl (feet)
East Fork of Chulitna River												
EC-A	2	10	182.0	7280	1597.0	9200	1601.0	10,000	1603.0	10,800	1605.0	1583.0
EC-BARR	2	10	181.94	7280	1597.2	9200	1601.1	10,000	1603.1	11,800	1605.1	1584.0
EC-C	2	10	181.60	7280	1597.3	9200	1601.2	10,000	1603.2	11,800	1605.2	1585.0
EC-D	2	10	181.46	7280	1606.3	9200	1607.2	10,000	1607.7	11,800	1608.6	1598.9
EC-E	2	11	177.23	7280	1646.6	9200	1646.9	10,000	1647.1	11,800	1647.4	1639.9
EC-F	2	11	174.51	7280	1705.5	9200	1705.9	10,000	1706.0	11,800	1706.3	1698.9
EC-G	3	12	170.79	7280	1728.7	9200	1729.2	10,000	1729.4	11,800	1729.7	1721.9
EC-H	3	13	158.30	7280	1760.8	9200	1761.2	10,000	1761.4	11,800	1761.7	1753.9
EC-I	3	13	157.0	7280	1782.9	9200	1783.2	10,000	1783.4	11,800	1783.7	1775.9
EC-I1	3	13	157.5	7280	1795.8	9200	1796.1	10,000	1796.3	11,800	1796.7	1787.0
EC-I2HY	3	13	157.5	7280	1796.3	9200	1798.0	10,000	1798.7	11,800	1799.6	1788.4
EC-I3	3	13	157.5	7280	1798.2	9200	1799.9	10,000	1800.5	11,800	1801.6	1789.0
EC-J	3	14	156.5	7280	1809.4	9200	1810.5	10,000	1811.0	11,800	1811.9	1800.0
EC-K	3	14	156.0	7280	1818.2	9200	1818.8	10,000	1819.0	11,800	1819.5	1810.9
EC-L	3	14	155.5	7280	1827.9	9200	1828.3	10,000	1828.5	11,800	1828.8	1820.9
EC-M	3	15	154.2	6500	1854.2	8350	1854.9	9000	1855.1	10,600	1855.7	1846.5
EC-N	3	15	153.9	6500	1868.7	8350	1869.2	9000	1869.4	10,600	1869.8	1861.9
EC-O	3	16	153.7	6150	1885.8	7800	1886.2	8500	1886.3	10,100	1886.7	1878.9
EC-P	3	16	153.0	6150	1906.8	7800	1907.1	8500	1907.3	10,100	1907.6	1899.9
EC-Q	3	17	152.0	6150	1968.2	7800	1968.5	8500	1968.6	10,100	1968.9	1961.9
EC-R	3	17	151.4	6150	2007.6	7800	2008.5	8500	2008.8	10,100	2009.4	2000.0
EC-S	3	18	148.7	6150	2062.1	7800	2062.6	8500	2062.8	10,100	2063.1	2055.9
EC-T	3	19	147.0	6150	2106.2	7800	2106.6	8500	2106.7	10,100	2107.0	2099.9
EC-U	3	19	147.0	6150	2134.4	7800	2134.8	8500	2135.0	10,100	2135.3	2127.9
EC-V	3	20	145.0	6150	2158.5	7800	2158.8	8500	2159.0	10,100	2159.3	2151.9
EC-W	3	20	144.0	6150	2189.7	7800	2190.7	8500	2191.0	10,100	2191.6	2181.0

Table 1. Present Conditions: Frequency-Discharge Elevation Data at Valley Section Troublesome, Byers, Honolulu Creeks, East and Middle Forks of Chulitna River Matanuska-Susitna Borough, Alaska.

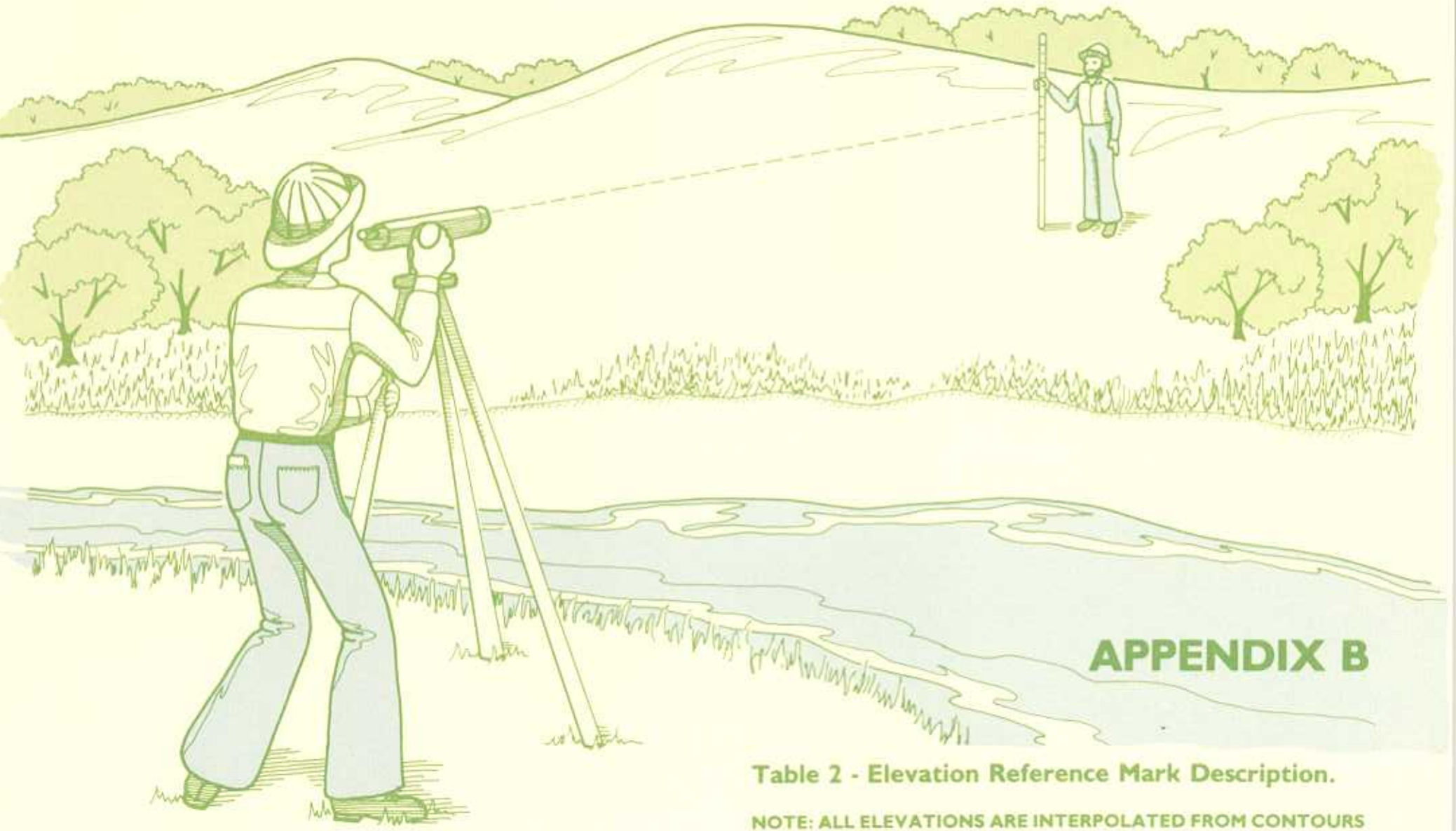
(Elevations are Approximate)

Valley Section	Photo-Map (No.)	Profile Sheet (No.)	Drainage Area (Sq. Mi.)	10-Year Storm		50-Year Storm		100-Year Storm		500-Year Storm		Channel Bottom
				Disch. (cfs)	Elev. msl (feet)	Disch. (cfs)	Elev. msl (feet)	Disch. (cfs)	Elev. msl (feet)	Disch. (cfs)	Elev. msl (feet)	Elev. msl (feet)
Middle Fork Chulitna River												
MC-A	2	21	133.5	5910	1602.8	7480	1603.2	8160	1603.5	9600	1604.0	1592.0
MC-B	2	22	131.9	5910	1654.7	7480	1655.1	8160	1655.2	9600	1655.5	1649.0
MC-C	2	23	131.9	5910	1705.6	7480	1706.0	8160	1706.1	9600	1706.4	1700.0
MC-D	3	24	128.1	5910	1726.7	7480	1727.2	8160	1727.2	9600	1727.6	1721.0
MC-E	3	24	128.0	5910	1754.7	7480	1755.2	8160	1755.2	9600	1755.6	1749.0
MC-F	3	25	126.0	5910	1780.8	7480	1781.2	8160	1781.3	9600	1781.6	1775.0
MC-G	3	26	122.6	5910	1805.7	7480	1806.2	8160	1806.4	9600	1806.6	1800.0
MC-H	3	27	122.0	5910	1834.8	7480	1835.2	8160	1835.3	9600	1835.6	1829.0
MC-I	3	27	120.0	5910	1843.0	7480	1843.4	8160	1843.4	9600	1843.9	1837.2
MC-J	3	27	117.4	5400	1843.4	6800	1843.8	7400	1843.9	8800	1844.3	1837.6
MC-K	3	27	117.0	5400	1843.8	6800	1844.2	7400	1844.3	8800	1844.6	1837.9
MC-L	3	28	116.0	5400	1852.9	6800	1853.2	7400	1853.3	8800	1853.6	1847.0
MC-M	3	28	115.0	5400	1861.8	6800	1862.2	7400	1862.3	8800	1862.6	1857.0
MC-N	3	29	114.0	5400	1880.7	6800	1881.0	7400	1881.1	8800	1881.5	1876.0
MC-O	3	29	114.0	5400	1904.7	6800	1905.0	7400	1905.2	8800	1905.5	1900.0
MC-P	3	30	113.7	5400	1952.3	6800	1952.6	7400	1952.8	8800	1953.0	1948.0
MC-Q	3	31	113.0	5400	2004.3	6800	2004.6	7400	2004.8	8800	2005.0	2000.0
MC-R	3	31	109.7	5400	2015.3	6800	2015.7	7400	2015.7	8800	2015.9	2011.0
MC-S	3	32	109.0	5400	2054.4	6800	2054.5	7400	2054.7	8800	2054.9	2050.0
MC-T	3	33	105.0	5400	2074.7	6800	2075.5	7400	2075.6	8800	2076.0	2069.0
MC-U	4	34	100.8	4700	2088.3	6050	2088.8	6600	2089.1	7800	2089.4	2077.0
MC-V	4	34	97.0	4700	2105.2	6050	2105.9	6600	2106.0	7800	2106.5	2094.0
MC-W	4	35	95.0	4700	2130.7	6050	2131.1	6600	2131.4	7800	2131.7	2120.0
MC-X	4	35	92.0	4700	2155.7	6050	2156.1	6600	2156.4	7800	2156.7	2145.0
MC-BB	4	36	90.0	4250	2174.3	5400	2174.7	5900	2175.0	7000	2175.3	2169.2
MC-Y	4	36	89.0	4250	2179.0	5400	2179.5	5900	2179.6	7000	2180.0	2174.2
MCZPHY	4	36	87.2	4250	2179.6	5400	2180.0	5900	2180.2	7000	2180.9	2174.2

Table 1. Present Conditions: Frequency-Discharge Elevation Data at Valley Section Troublesome, Byers, Honolulu Creeks, East and Middle Forks of Chulitna River Matanuska-Susitna Borough, Alaska.

(Elevations are Approximate)

Valley Section	Photo-Map (No.)	Profile Sheet (No.)	Drainage Area (Sq. Mi.)	10-Year Storm Disch. (cfs)	10-Year Storm Elev. msl (feet)	50-Year Storm Disch. (cfs)	50-Year Storm Elev. msl (feet)	100-Year Storm Disch. (cfs)	100-Year Storm Elev. msl (feet)	500-Year Storm Disch. (cfs)	500-Year Storm Elev. msl (feet)	Channel Bottom Elev. msl (feet)
Middle Fork Chulitna River (cont.)												
MC-AA	4	36	88.0	4250	2180.6	5400	2181.3	5900	2181.5	7000	2181.9	2175.2
MC-AB	4	36	85.0	4250	2182.0	5400	2182.7	5900	2183.0	7000	2183.4	2176.0
MCACAR	4	36	80.0	4250	2188.5	5400	2189.1	5900	2189.2	7000	2191.5	2182.9
MC-AD	4	36	75.0	4250	2188.6	5400	2189.1	5900	2189.3	7000	2191.5	2183.4
MC-AE	4	36	70.0	4250	2205.7	5400	2206.1	5900	2206.2	7000	2206.6	2202.4
MC-AF	4	37	69.7	3600	2230.1	4600	2230.4	4970	2230.6	5900	2230.9	2225.0
MC-AG	4	38	69.0	3600	2304.1	4600	2304.4	4970	2304.6	5900	2304.8	2299.0
MC-AH	4	38	68.3	3600	2334.4	4600	2334.6	4970	2335.0	5900	2335.2	2329.0
MC-AI	4	39	64.7	3600	2360.4	4600	2360.8	4970	2361.0	5900	2361.2	2355.0
MC-AJ	4	39	64.7	3600	2382.4	4600	2382.8	4970	2383.0	5900	2383.2	2377.0



APPENDIX B

Table 2 - Elevation Reference Mark Description.

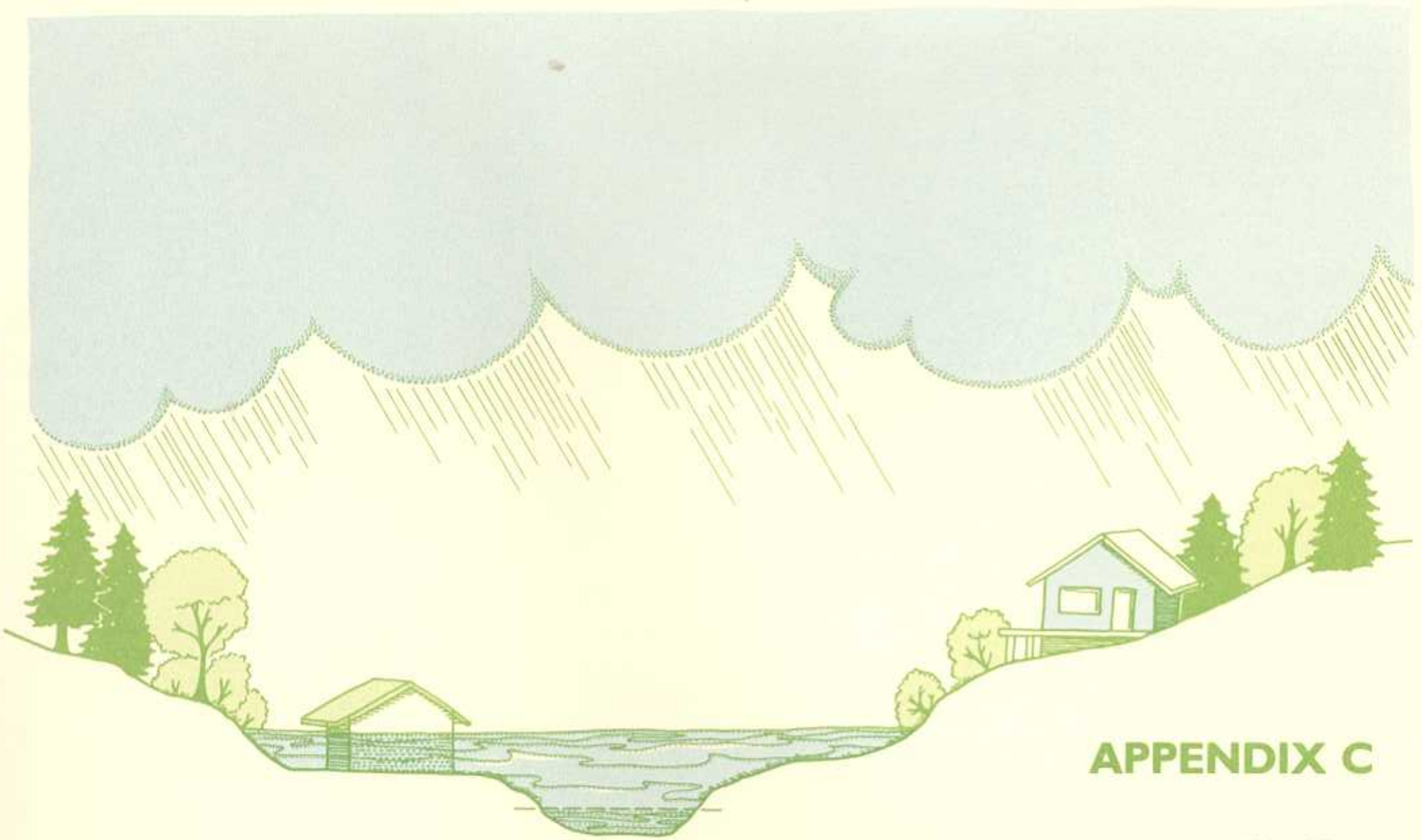
NOTE: ALL ELEVATIONS ARE INTERPOLATED FROM CONTOURS ON USGS QUADRANGLE SHEETS

Table 2. Elevation Reference Mark Description: Troublesome, Byers, Honolulu Creeks - East and Middle Forks of Chulitna River Matanuaks-Susitna Borough, Alaska

(Elevations are Approximate)

BM No.	Photo-Map (No.)	Elev [1] MSl (feet)	Description and Location of Elevation Markers
TR-1	1	598.0	S.E. corner of Parks Highway Bridge over Troublesome Creek. Disk marked Alaska Department of Highways.
By-1	1	725.1	S.E. corner of Parks Highway Bridge over Byers Creeks.
C-2	3	1850.5	Top of stake about 400 feet south of Parks Highway Bridge over East Fork of Chulitna River, by mile post 185
H-2	2	1528.9	Alaska Highway Commission disk on Southeast corner of Parks Highway Bridge over Honolulu Creek.
MF-2	4	2191.8	Top of concrete guard rail on northwesterly end of Parks Highway Bridge over the Middle Fork of the Chulitna River.

[1] All elevations based on interpolations from USGS Quadrangles, scale 1:63,360 contour interval 50 and 100 feet.



APPENDIX C

Table 3 - 100-year Flood Data

—PRESENT CONDITIONS-

TABLE 3 100-YEAR FLOOD DATA - PRESENT CONDITIONS
TROUBLESOME, BYERS, HONOLULU CREEKS - EAST AND MIDDLE FORKS OF CHULITNA RIVER
MATANUSKA-SUSITNA BOROUGH, ALASKA

Valley Section	Photo Sheet (No.)	Profile Sheet (No.)	Profile Station (feet)	Flood Widths		Average Velocity (feet/sec.)
				Distance to Left (ft.)	Distance to Right (ft.)	
Troublesome Creek						
TS-A	1	1	00	5	620	0.9
TS-1	1	1	370	5	620	1.6
TS-B	1	1	740	5	195	3.0
TS-2	1	1	1690	0	195	4.2
TS-C	1	1	2110	0	195	4.6
TS-3	1	1	2320	0	195	4.5
TS-D	1	1	2540	450	0	2.5
TSEPHY	1	1	2640	980	0	10.7
TS-F	1	1	2740	980	0	2.8
TS-G	1	1	3910	160	300	7.4
TS-H	1	1	5540	0	85	6.0
TS-I	1	2	6340	0	85	7.4
TS-J	1	2	7920	0	5	7.4
TS-K	1	2	10560	0	5	6.3
Byers Creek						
BY-A	1	3	00	60	40	5.3
BY-1	1	3	790	60	40	6.4
BY-B	1	3	1580	40	30	6.6
BY-2	1	3	2640	40	30	7.7
BY-C	1	3	3700	30	30	8.0
BY-3	1	3	3920	30	30	7.0
BY-D	1	3	4120	50	30	6.6
BYEPHY	1	3	4220	20	30	12.8
BY-F	1	3	4320	20	30	10.0
BY-G	1	3	5280	20	30	12.0
BY-H	1	4	7390	20	30	9.1

TABLE 3 100-YEAR FLOOD DATA - PRESENT CONDITIONS
TROUBLESOME, BYERS, HONOLULU CREEKS - EAST AND MIDDLE FORKS OF CHULITNA RIVER
MATANUSKA-SUSITNA BOROUGH, ALASKA

Valley Section	Photo Sheet (No.)	Profile Sheet (No.)	Profile Station (feet)	Flood Widths Distance to Left (ft.)	Flood Widths Distance to Right (ft.)	Average Velocity (feet/sec.)
Byers Creek (cont.)						
BY-I	1	4	8980	20	30	9.5
BY-J	1	4	11090	20	30	9.8
BY-K	1	5	14260	20	30	9.8
Honolulu Creek						
HO-A	2	6	900	40	0	3.3
HO-1	2	6	1510	40	0	7.4
HO-B	2	6	2220	0	0	9.6
HO-2	2	6	2650	0	0	9.8
HO-6	2	6	3170	10	10	9.0
HO-3	2	6	3810	10	10	7.5
HO-D	2	6	4440	10	0	7.3
HOEARR	2	6	4540	0	0	8.0
HO-F	2	6	4640	0	0	8.4
HO-4	2	6	5490	0	0	8.7
HO-H	2	6	6760	10	0	10.2
HO-5	2	7	8500	10	0	9.7
HO-J	2	7	10300	10	0	9.7
HO-6	2	7	11150	10	0	10.8
HOLPHY	2	7	11250	0	520	12.1
HO-M	2	7	11350	0	520	2.8
HO-N	2	8	13147	30	390	2.1
HO-O	2	8	15580	30	390	8.5
HO-P	2	9	20430	30	410	7.1

TABLE 3 100-YEAR FLOOD DATA - PRESENT CONDITIONS
TROUBLESOME, BYERS, HONOLULU CREEKS - EAST AND MIDDLE FORKS OF CHULITNA RIVER
MATANUSKA-SUSITNA BOROUGH, ALASKA

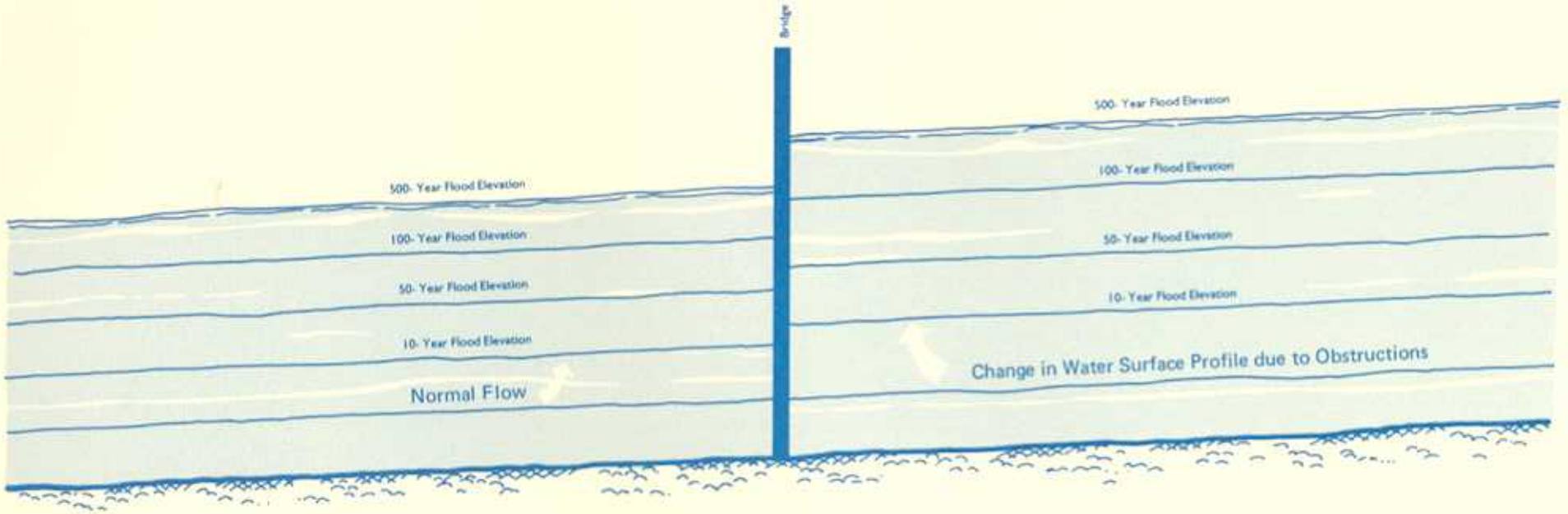
Valley Section	Photo Sheet (No.)	Profile Sheet (No.)	Profile Station (feet)	Flood Widths		Average Velocity (feet/sec.)
				Distance to Left (ft.)	Distance to Right (ft.)	
East Fork of Chulitna River						
EC-A	2	10	-100	20	20	4.2
EC-BARR	2	10	00	20	20	4.5
EC-C	2	10	100	20	20	4.7
EC-D	2	10	2060	510	200	2.4
EC-E	3	11	6090	510	200	4.0
EC-F	3	11	11830	530	200	4.2
EC-G	3	12	15100	530	200	3.6
EC-H	3	13	19480	530	150	3.6
EC-I	3	13	22650	530	150	3.6
EC-I1	3	13	24160	0	20	4.0
ECI2HY	3	13	24260	500	250	11.5
EC-I3	3	13	24360	500	250	2.0
EC-J	3	14	25810	0	20	9.6
EC-K	3	14	27830	100	480	2.9
EC-L	3	14	29300	500	480	3.5
EC-M	3	15	33320	420	400	4.7
EC-N	3	15	35800	500	450	3.1
EC-O	3	16	38490	100	100	3.4
EC-P	3	16	41770	500	150	3.4
EC-Q	3	17	46250	100	500	4.5
EC-R	3	17	49000	0	0	10.4
EC-S	3	18	54280	100	500	3.8
EC-T	3	19	58450	100	400	4.0
EC-U	3	19	62040	540	10	3.5
EC-V	3	20	65210	540	10	3.5
EC-W	3	20	69010	0	0	8.8

TABLE 3 100-YEAR FLOOD DATA - PRESENT CONDITIONS
TROUBLESOME, BYERS, HONOLULU CREEKS - EAST AND MIDDLE FORKS OF CHULITNA RIVER
MATANUSKA-SUSITNA BOROUGH, ALASKA

Valley Section	Photo Sheet (No.)	Profile Sheet (No.)	Profile Station (feet)	Flood Widths		Average Velocity (feet/sec.)
				Distance to Left (ft.)	Distance to Right (ft.)	
Middle Fork of Chulitna River						
MC-A	2	21	1210	90	800	0.8
MC-B	2	22	9660	90	800	2.6
MC-C	2	23	17160	80	800	2.8
MC-D	3	24	21280	80	800	2.6
MC-E	3	24	26770	500	800	2.6
MC-F	3	25	31680	700	800	2.5
MC-G	3	26	36640	100	800	2.4
MC-H	3	27	42030	70	800	2.5
MC-I	3	27	44040	0	650	2.5
MC-J	3	27	44140	40	600	5.5
MC-K	3	27	44240	70	1200	3.2
MC-L	3	28	46460	70	1200	2.0
MC-M	3	28	48680	70	1200	2.2
MC-N	3	29	52750	70	700	2.5
MC-O	3	29	57760	70	1200	2.4
MC-P	3	30	63680	70	70	2.9
MC-Q	3	31	70010	70	70	2.9
MC-R	3	31	71390	70	70	2.9
MC-S	3	32	76400	70	100	2.9
MC-T	3	33	81100	420	0	3.8
MC-U	4	34	84480	100	10	3.7
MC-V	4	34	88650	100	0	3.9
MC-W	4	35	92080	20	0	4.7
MC-X	4	35	95060	20	10	4.7
MC-BB	4	36	98040	20	10	4.7
MC-Y	4	36	98690	50	0	5.4
MCZPHY	4	36	98790	600	0	10.1

TABLE 3 100-YEAR FLOOD DATA - PRESENT CONDITIONS
TROUBLESOME, BYERS, HONOLULU CREEKS - EAST AND MIDDLE FORKS OF CHULITNA RIVER
MATANUSKA-SUSITNA BOROUGH, ALASKA

Valley Section	Photo Sheet (No.)	Profile Sheet (No.)	Profile Station (feet)	Flood Widths		Average Velocity (feet/sec.)
				Distance to Left (ft.)	Distance to Right (ft.)	
Middle Fork of the Chulitna River (cont.)						
MC-AA	4	36	98,890	600	0	8.1
MC-AB	4	36	99,060	800	0	4.9
MC-ACAR	4	36	99,160	1000	0	7.7
MC-AD	4	36	99,260	1000	0	1.2
MC-AE	4	36	101,960	1000	0	2.5
MC-AF	4	37	103,960	40	0	6.3
MC-AG	4	38	109,670	40	0	7.3
MC-AH	4	38	114,210	40	0	5.3
MC-AI	4	39	118,170	40	0	5.3
MC-AJ	4	39	121,490	40	0	5.3

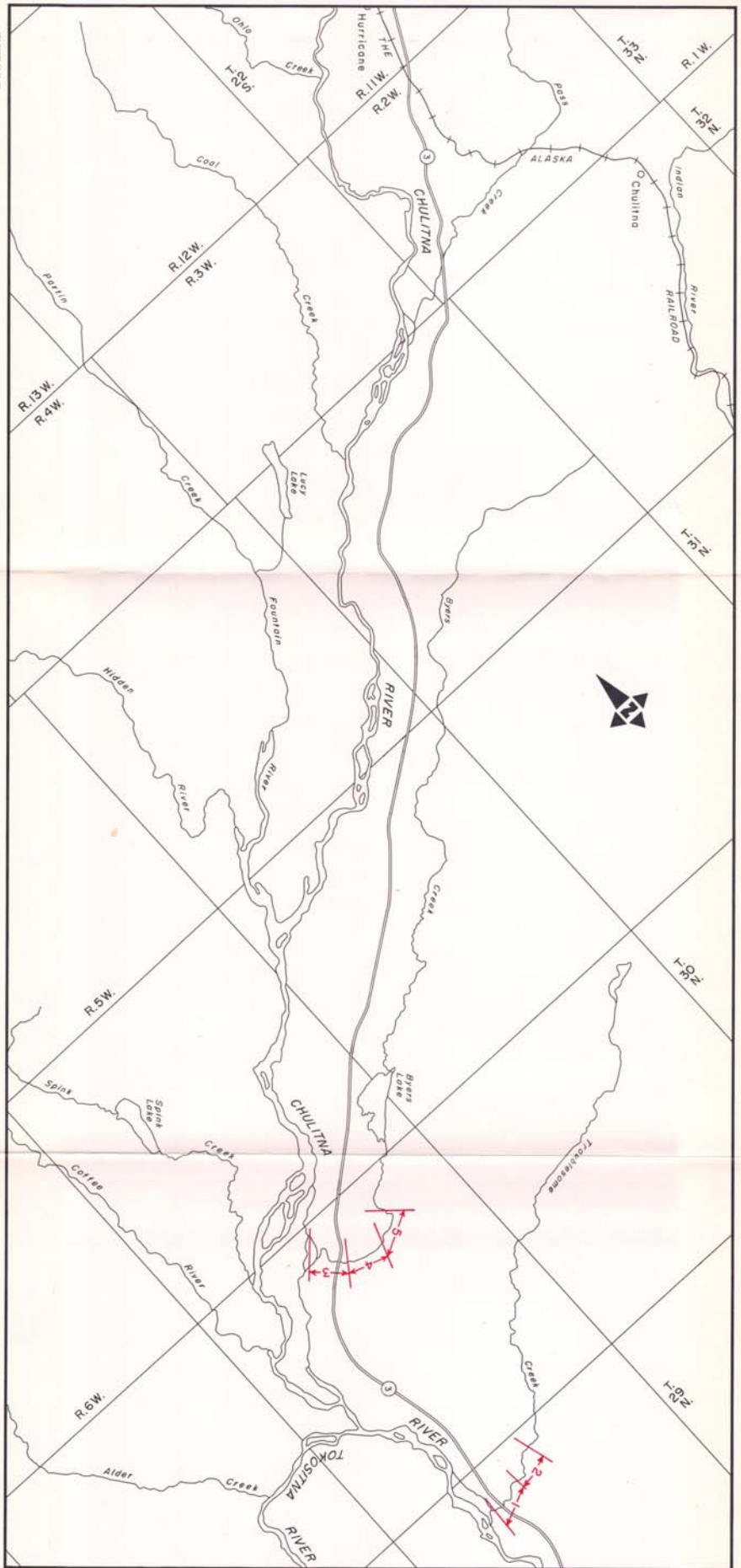


APPENDIX D

Exhibit 1 - Flood Profile Index

Exhibit 2 - Flood Profile Sheets

NOTE: ELEVATIONS ARE APPROXIMATE UNLESS OTHERWISE NOTED IN TABLE 1 (APPENDIX A)

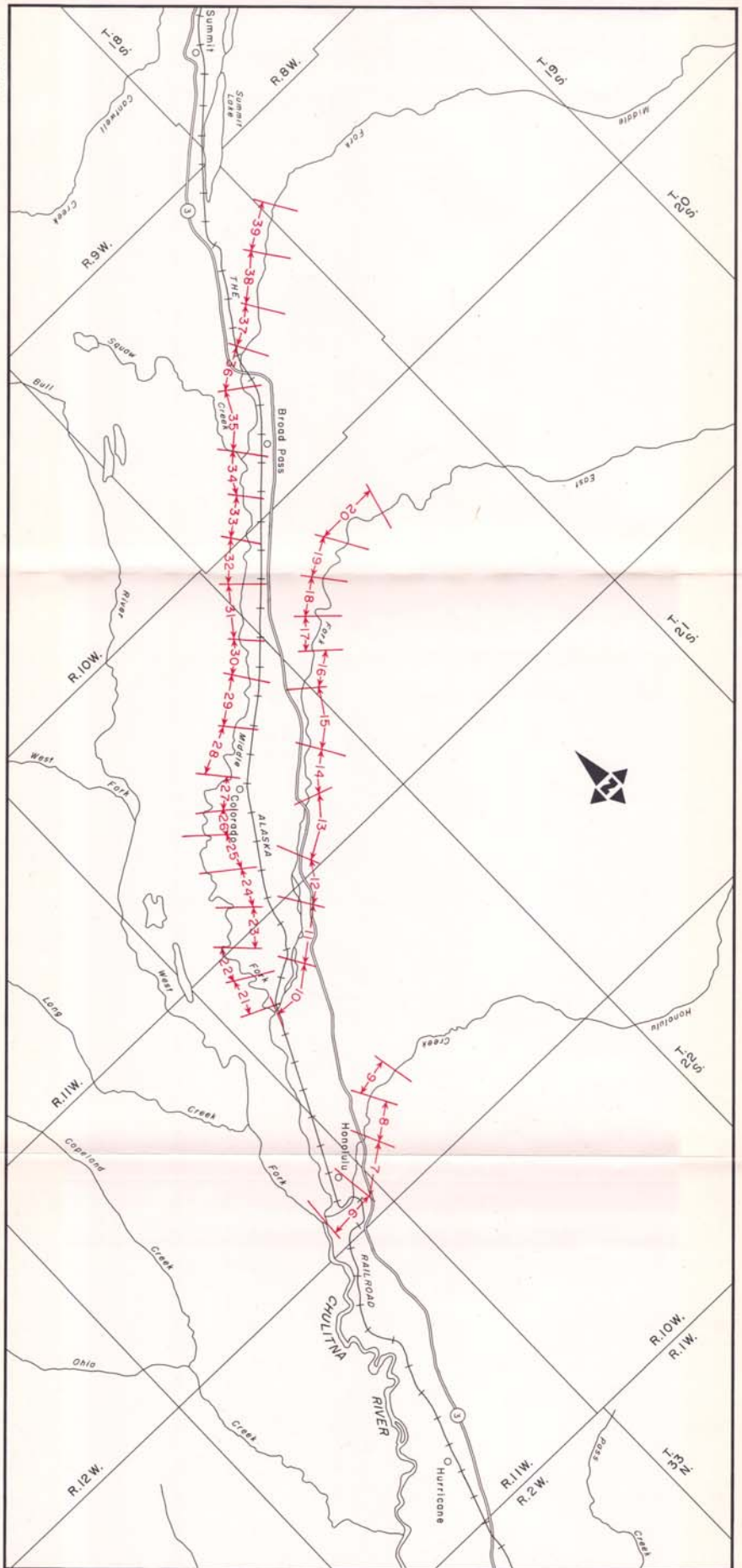


U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TALKEETNA SUBBASIN
FLOOD HAZARD ANALYSES
ALASKA

FLOOD PROFILE INDEX

TROUBLESOME, BYERS AND HONOLULU CREEKS,
EAST AND MIDDLE FORKS OF CHULITNA RIVER

EXHIBIT 1



LEGEND

36 — Flood Profile Sheet Coverage

0 1 2 3 4 MILES

SCALE 1:93,500

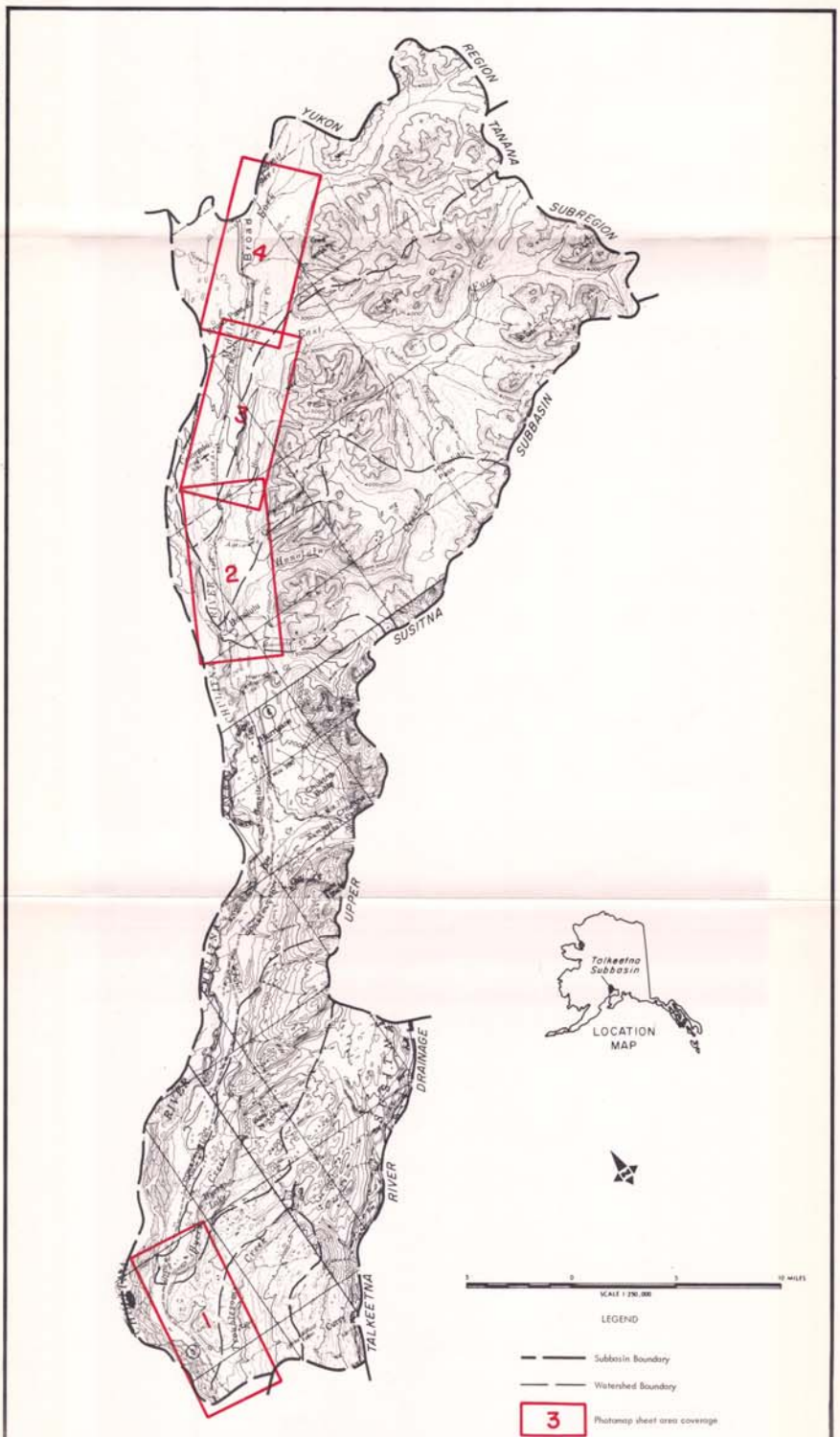
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TALKEETNA SUBBASIN
FLOOD HAZARD ANALYSES
ALASKA

SHEET 1 OF 3

FLOOD PROFILE INDEX

TROUBLESOME, BYERS AND HONOLULU CREEKS,
EAST AND MIDDLE FORKS OF CHULITNA RIVER

EXHIBIT 1

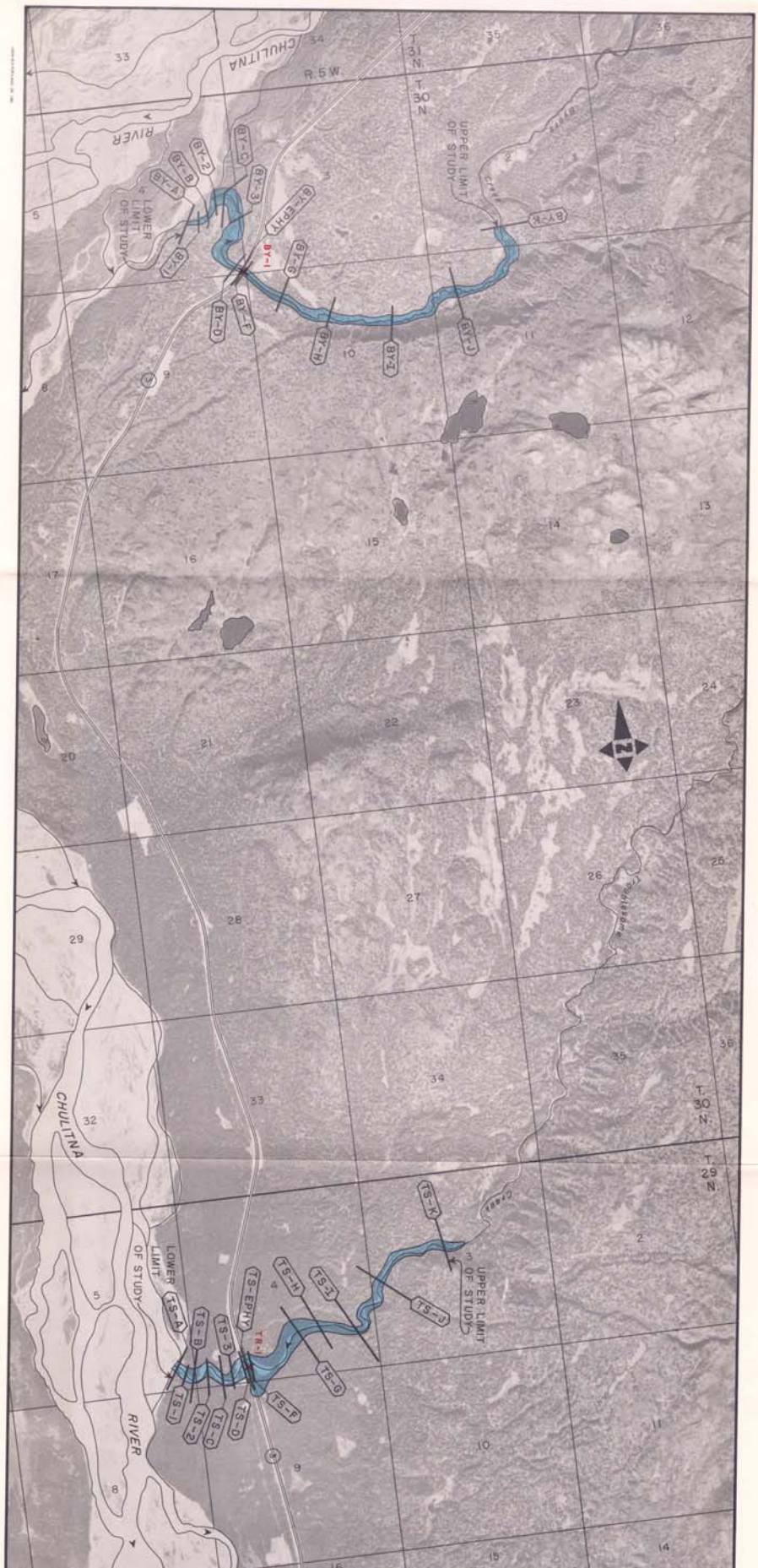


U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TALKEETNA SUBBASIN
FLOOD HAZARD ANALYSES
ALASKA

PHOTOMAP INDEX

TROUBLESOME, BYERS AND HONOLULU CREEKS,
EAST AND MIDDLE FORKS OF CHULITNA RIVER

EXHIBIT 3



LEGEND

100 Year Flood Hazard Area (Approximate)

Stream Channel

GS-B Cross Section Location

X TR-1 Elevation Reference Marks

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

2000 0 2000

Scale in Feet

NASA Photography 8-76

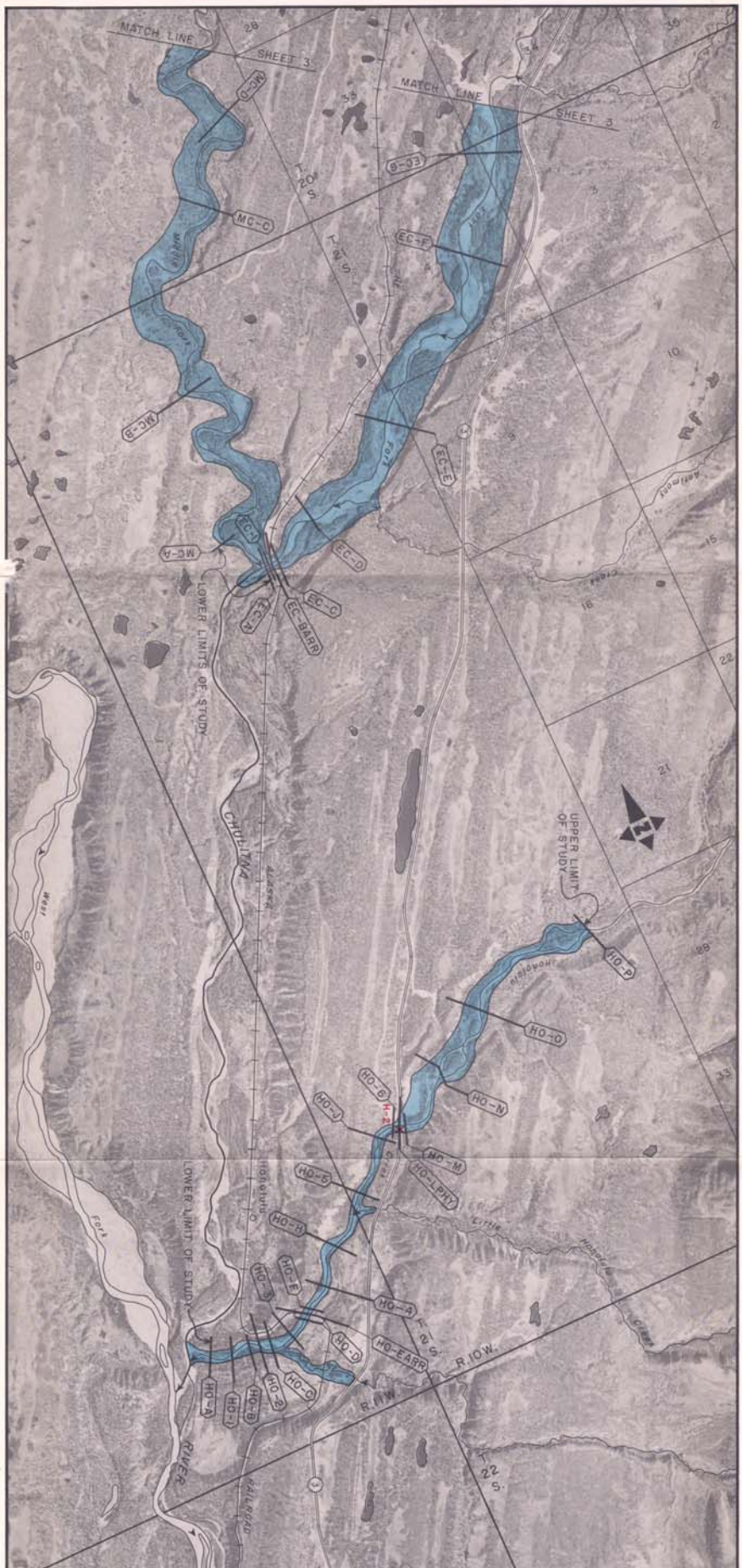
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TALKEETNA SUBBASIN
FLOOD HAZARD ANALYSES
ALASKA

FLOOD HAZARD AREA

TROUBLESOME AND BYERS CREEKS

SHEET 1 OF 4

EXHIBIT 4



LEGEND

100 Year Flood Hazard Area (Approximate)

GS-B Cross Section Location

Stream Channel

X TR-1 Elevation Reference Marks

Limits of flooding may vary from actual location on the ground

2000 0 2000

Scale in Feet

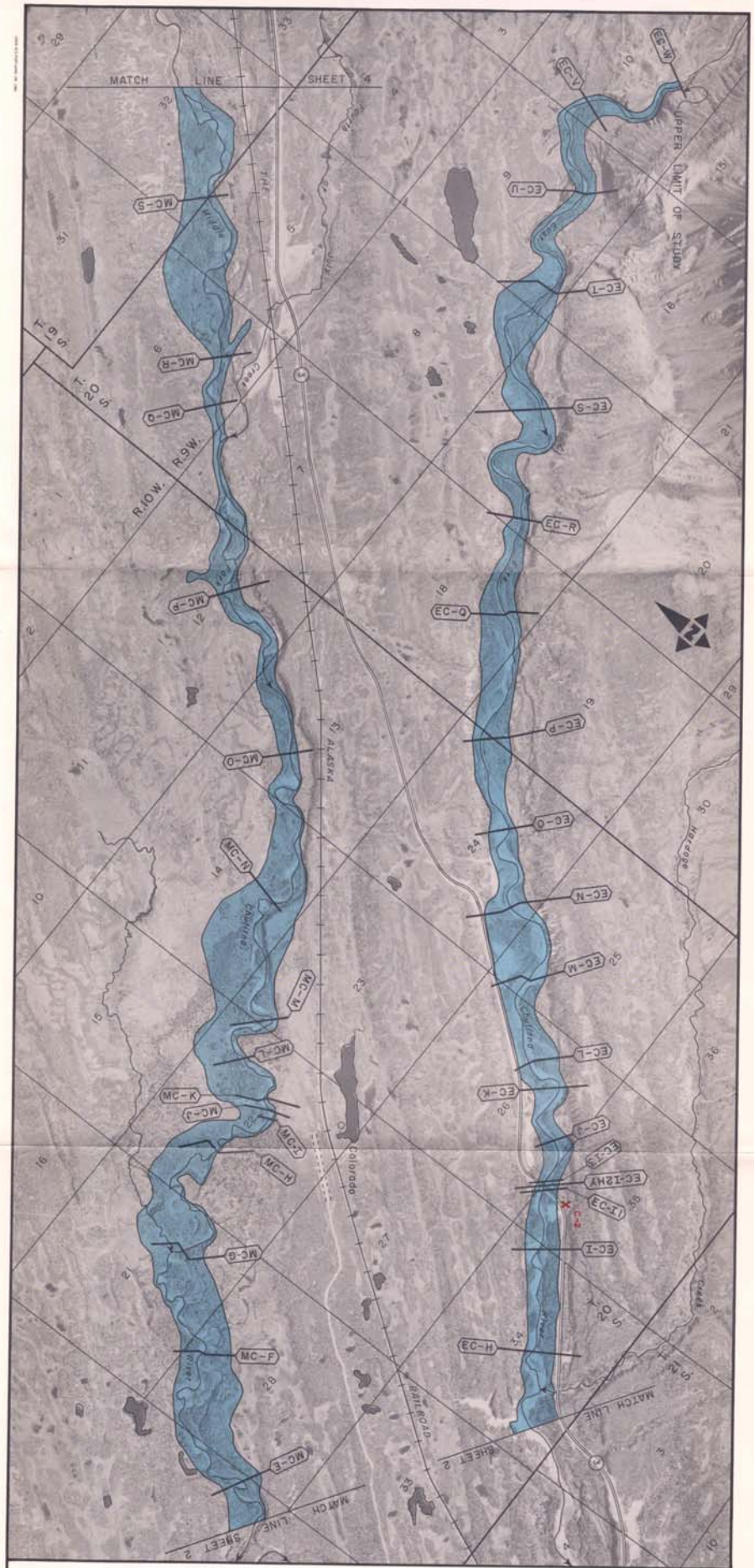
NASA Photography 8-76

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

FLOOD HAZARD AREA

HONOLULU CREEK, EAST AND MIDDLE FORKS OF CHULITNA RIVER

EXHIBIT 4



LEGEND

100 Year Flood Hazard Area (Approximate)

Stream Channel

GS-B Cross Section Location

X TR-1 Elevation Reference Marks

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

2000 0 2000

Scale in Feet

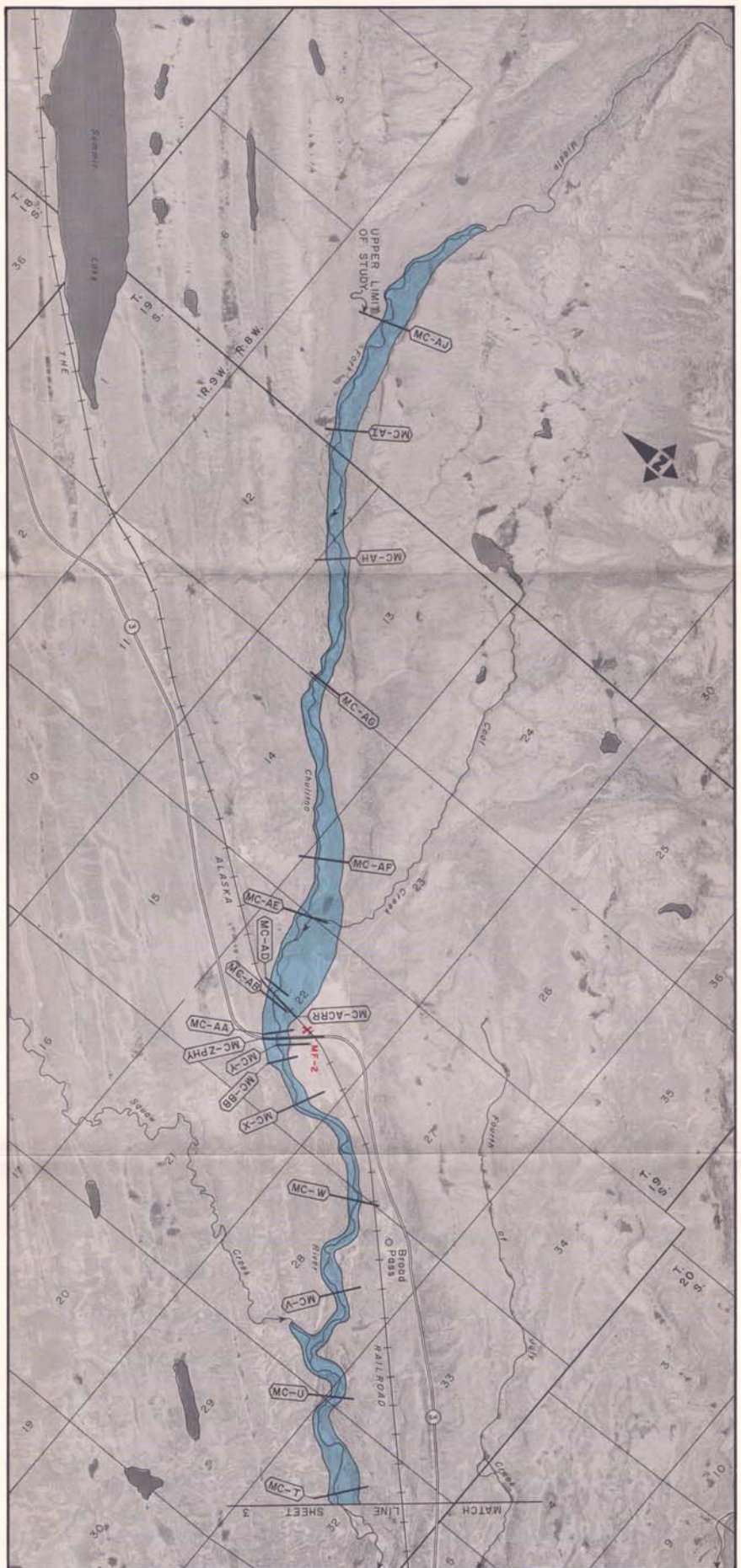
NASA Photography 8-76

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

FLOOD HAZARD AREA

EAST AND MIDDLE FORKS OF CHULITNA RIVER

EXHIBIT 4



LEGEND

100 Year Flood Hazard Area (Approximate)

Stream Channel

GS-B Cross Section Location

X TR-1 Elevation Reference Marks

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

2000 0 2000

Scale in Feet

NASA Photography 8-76

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

FLOOD HAZARD AREA

MIDDLE FORK OF CHULITNA RIVER

EXHIBIT 4