SUSITNA
HYDROELECTRIC PROJECT

FEDERAL ENERGY REGULATORY COMMISSION
PROJECT No. 7114

RESPONSE OF AQUATIC HABITAT SURFACE AREAS TO MAINSTEM DISCHARGE IN THE TALKEETNA TO DEVIL CANYON REACH OF THE SUSITNA RIVER, ALASKA

PREPARED BY

EWT&A
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UNDER CONTRACT TO

HARZA - EBASCO
SUSITNA JOINT VENTURE

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ALASKA POWER AUTHORITY

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Susitna File No. [illegible]

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Report By
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and
Woody Trihey

Under Contract to
Harza-Ebasco Susitna Joint Venture

Prepared for
Alaska Power Authority

Final Report
June 1984

NOTICE

ANY QUESTIONS OR COMMENTS CONCERNING
THIS REPORT SHOULD BE DIRECTED TO
THE ALASKA POWER AUTHORITY
SUSITNA PROJECT OFFICE

ACKNOWLEDGEMENTS

This work was undertaken in cooperation with the Alaska Department of Fish and Game SuHydro Aquatic Study Team and R&M Consultants Inc., Anchorage, Alaska. ADF&G SuHydro personnel participated in the derivation of definitions for the various habitat types and the development of the aquatic habitat classification key. The aerial photography missions were scheduled through Mr. Steve Bredthauer, R&M Consultants, Inc. He did an exceptional job given the highly variable nature of streamflow and weather conditions. Aerial photography was flown and continuous photo mosaics prepared by Air Photo Tech, Inc., Anchorage, Alaska, under contract to the Harza-Ebasco Susitna Joint Venture.

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INTRODUCTION

The proposed Susitna hydroelectric project will alter the natural streamflow, thermal, and sediment regimes of the Susitna River. The river segment downstream from Devil Canyon to the Chulitna River confluence (Talkeetna) would experience notable alterations in naturally occurring streamflow patterns, due to its proximity to the proposed damsites and the limited amount of influence that tributary inflows have on total discharge in this river segment. With-project mainstem discharges, as measured at the U.S. Geological Survey (USGS) Gold Creek gaging station, are expected to be lower during summer and notably higher during winter months.

Five species of Pacific salmon and 14 other anadromous and/or resident fish species utilize a variety of aquatic habitats in the Talkeetna-to-Devil Canyon reach of the Susitna River (Acres American Inc. 1983; Alaska Department of Fish and Game 1984). Alteration of the natural streamflow p erns by construction and operation of the proposed Susitna hydroelectric project is expected to affect the amount and seasonal availability of the aquatic habitats presently being utilized by these species.

Knowledge of the location and areal extent of various aquatic habitat types at different mainstem discharges will facilitate forecasting the effects of reduced streamflows on the availability of aquatic habitat to resident and anadromous fish. This report describes the surface area response of six aquatic habitat types occurring in the Talkeetna-to-Devil Canyon reach of the Susitna River to changes in mainstem discharge.

Aquatic habitat mapping and surface area measurements on 1 inch=1,000 feet aerial photography were used to determine the location and amount of aquatic habitat types within the Talkeetna-to-Devil Canyon reach of the Susitna River at mainstem discharges of 23,000, 16,000, 12,500, and 9,000 cubic feet per second (cfs). These discharges provide an adequate basis for evaluating the changes in wetted surface area of several discrete habitat types over a broad range of potential with-project streamflows. It should be emphasized, however, that this report makes no statements concerning the suitability of these habitat types for habitation by fish, nor how the quality of these habitats may change in response to varying mainstem discharges.

METHODS

Habitat Type Designations

Aquatic habitats associated with the Susitna River between Talkeetna and Devil Canyon were classified into six general categories: mainstem, side channel, side slough, upland slough, tributary mouth, and tributary. The geographical location and persistence of certain habitat types, such as tributaries and their mouths, are generally fixed, although their surface areas may respond significantly to changes in discharge. In other instances, transformations of one habitat type into another may occur as river stage increases or decreases. For example, an area described as a side slough habitat would be classified as side channel habitat when turbid mainstem water overtops the upstream head of the side slough and inundates the former clear water area.

The visually recognizable attributes used in this study to delineate the six aquatic habitat types are described below. These descriptions are limited to physical characteristics present during summer that can be easily recognized from the air during helicopter reconnaissance flights. A more detailed description of each aquatic habitat type has been prepared by the Alaska Department of Fish and Game (1983).

Mainstem habitats are those channels of the river characterized by turbid glacial flow that convey more than 10 percent (approximate) of the total flow at a given site.

Side channel habitats are those channels of the river characterized by turbid glacial flow that convey less than 10 percent (approximate) of the total flow.

Side slough habitats contain clear water. Local surface water runoff and upwelling are the primary water sources that supply clear water to these habitats. Side sloughs have nonvegetated upper thalwegs that are overtopped during periods of moderate to high mainstem discharge. Once overtopped, side sloughs are considered side channels.

Upland sloughs are clear water habitats that depend upon upwelling and/or local runoff for their water sources. Upland sloughs possess vegetated upper thalwegs that are seldom overtopped by mainstem discharge.

Tributary mouth habitats are clear water habitats that exist where tributary contributions to the mainstem are visible. These habitats are manifest as a clear water plume extending into the turbid mainstem or side channel and extend into the tributary to the upper extent of backwater influence. The size of this plume is affected by the amount of tributary discharge and adjacent mainstem water surface elevations.

Tributary habitats are clear water reaches of tributary streams upstream of the tributary mouth habitats. For this analysis, tributary habitat was measured only to the boundary of the digitized portion of the photo plate.

Nonwetted areas were categorized as either vegetated islands or gravel bars. The areas identified as "background" consisted of both wetted and nonwetted surface areas that were within the river corridor but were not relevant to the analysis. Individual surface areas were classified using a descriptive key (Figure 1) adapted from the Alaska Department of Fish and Game (ADF&G) SuHydro classification index for aquatic habitat types and by professional judgment.

Field Methods

Complete photographic coverage was obtained of the Talkeetna-to-Devil Canyon reach at four Susitna River discharges. Black-and-white aerial photographs were obtained at an approximate scale of 1 inch=1,000 feet with a 60 percent overlap between adjacent photos when Susitna River discharges as measured at the USGS Gold Creek gaging station (No. 15292000) were 23,000, 16,000, 12,500, and 9,000 cfs. Dates of these

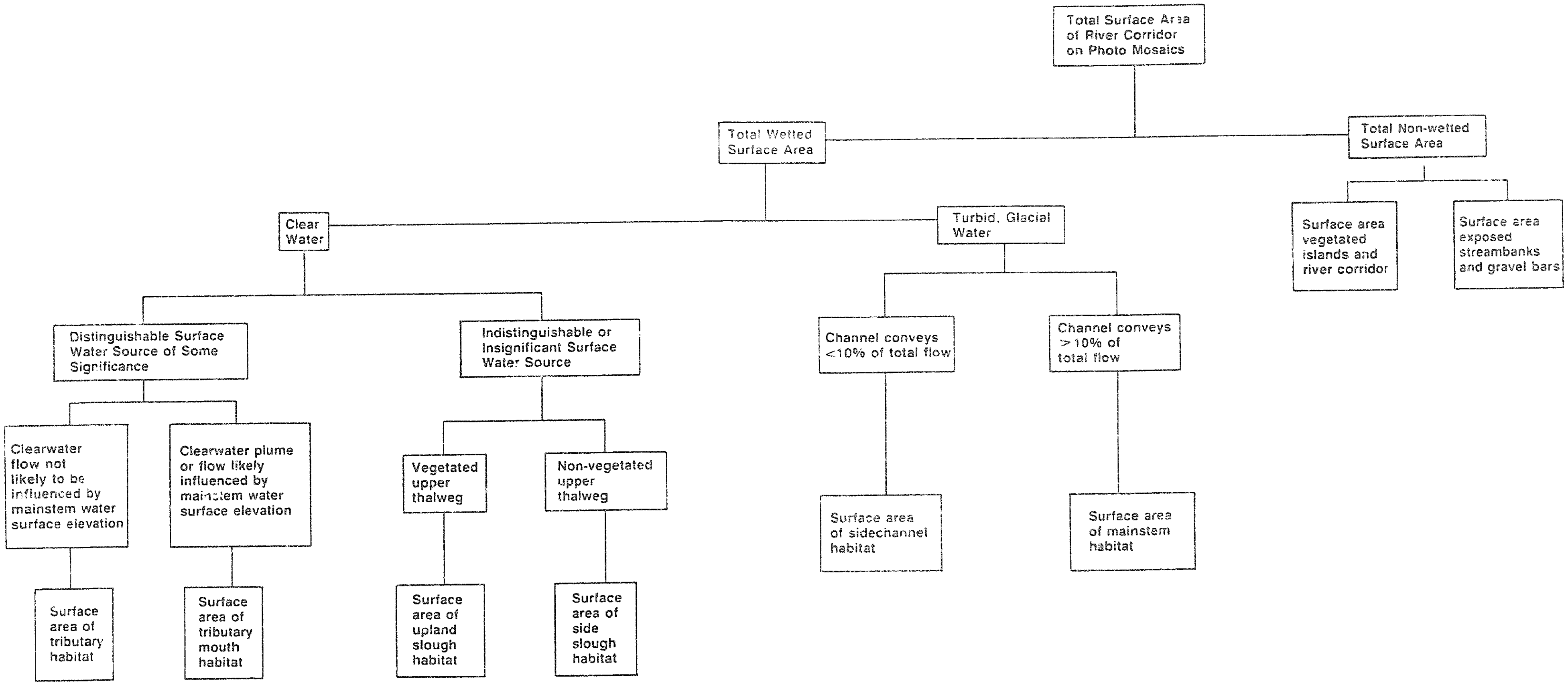

FIGURE 1 Key to aquatic habitat classification for the Talkeetna to Devil Canyon reach of the Susitna River. (RM 101 to 149).

flights were June 1, 1982, September 6, 1983, September 11, 1983, and October 10, 1983, respectively.

Helicopter reconnaissance flights were conducted over the Talkeetna-to-Devil Canyon reach at the same mainstem discharges at which the aerial photography was obtained. During each of these reconnaissance flights, aquatic habitat types were identified using the key presented as Figure 1, and their locations were mapped on 1 inch=1,000 feet blueline prints of the Susitna River. Dewatered gravel bars and streambank areas were sketched on the blueline prints as were boundaries of the various aquatic habitat types.

Office Procedures

Photo Plates and Enlargements

Photographic mosaics were prepared from the overlapping black-and-white photos to provide continuous 1 inch=1,000 feet coverage of the Talkeetna-to-Devil Canyon river segment for each of the four discharges. The photo mosaics were subdivided into eighteen sections of approximately the same length, with a small amount of overlap between adjoining river sections. The same dividing lines between adjoining segments were maintained for all four discharges, and a set of eighteen 4-1/2 inch by 15 inch photo plates were printed from the sectioned mosaics for each of the four discharges (Appendix 1). Each photo plate was carefully examined and areas that were too small in size to provide detailed resolution were enlarged to a scale of 1 inch=250 feet.

Habitat Type Boundaries

Aquatic habitat boundaries mapped on the blueline prints during the helicopter reconnaissance flights were transferred to individual photo plates and enlargements (Figure 2). Matchlines were drawn on adjoining plates to ensure that habitat areas would not be counted twice within overlapping sections near the edges of photo plates. The boundary of each enlargement area was established using identifiable features in the photography and drawn on both the plate and the individual enlargement to ensure that areas within the enlargement could be summed and compared with the enlargement area on the plate.

The external boundaries of the total area to be included in the surface area analysis (hereafter referred to as the corridor area) were defined on each plate, so that sub-areas within the corridor could be totaled and compared with the total corridor area by plate. The corridor boundaries were established using physical features identifiable on all four sets of photos. In many cases, it was necessary to go beyond the river channel boundaries to establish an identifiable corridor boundary. That area located between the corridor boundary and the river channel boundary was termed background (refer to Figure 2b). As the second index of quality control, the total digitized corridor area within the Talkeetna-to-Devil Canyon river segment was compared among the four sets of photography.

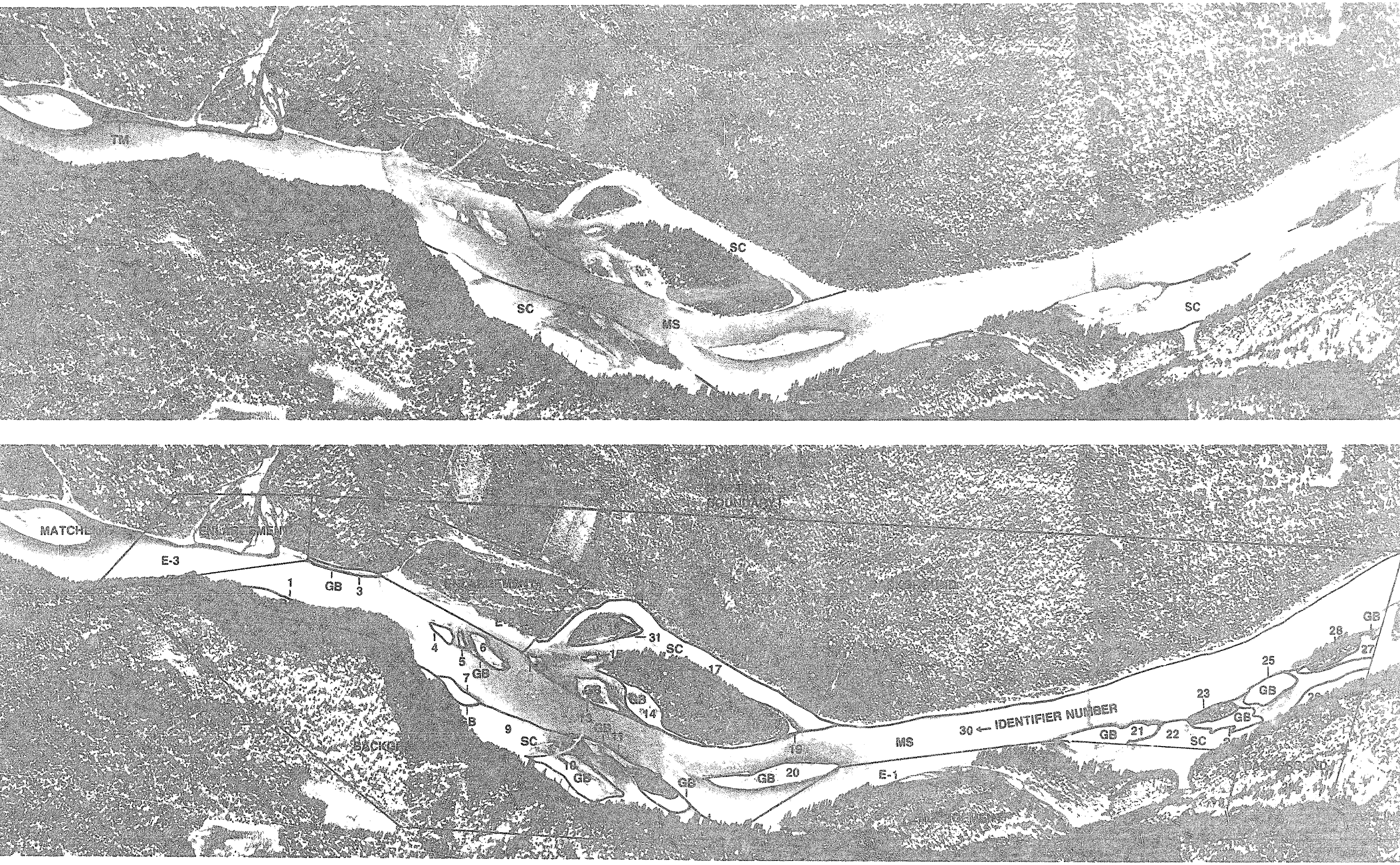

FIGURE 2a. Example of a Susitna River segment with habitat types mapped and classified.
2b. Example of the same river segment as delineated prior to digitizing.

Digitizing

Boundaries were drawn to distinguish between wetted and non-wetted surface areas within each aquatic habitat location on individual photo plates and enlargements (Figure 2b). Surface area measurements were made using a Numonics Corporation Electronic Graphics Calculator and Model 2400 DigiTablet. By tracing the perimeter of a given area, the area contained within the perimeter is calculated and displayed to an accuracy of 0.01 square inches. For the 1 inch=1,000 feet scale photography, this represents an accuracy of 10,000 square feet.

Each individual photo plate and its accompanying enlargements were digitized and evaluated separately. The total surface area of the corridor was digitized to establish a control area. Individual habitat areas, excluding those within a designated enlargement, were assigned a unique sequential number and their surface areas digitized. Replicate measurements were made of individual areas to ensure repeatability within 5 percent.

Following completion of these area measurements, the total surface area of enlargements appearing on the plate were digitized. Individual areas within each enlargement were then assigned a unique sequential number following the last number assigned to an individual area on the photo plate or previous enlargement. These areas were then digitized and the individual areas totaled for comparison to the total digitized area of the enlargement.

Following completion of digitizing for a given plate, individual area measurements were summed and compared to the total area measurement for the corridor. A difference of less than 5 percent was considered acceptable. This procedure was repeated for all 18 photo plates at each of four discharges. Thus, each digitized area on a photo plate or its associated enlargements had a unique identifying number associated with all four discharges, and the sum total of these individual areas was within 5 percent of the total corridor area.

Data Base

Area measurements were entered into a computerized data base for storage, sorting, and subsequent analysis. Each individual surface area measurement was entered as a separate record that enabled identification by discharge, photo plate (corresponding to a river mile index), and individual area number. Data may be retrieved in a variety of formats: by discharge, by river mile index, or by identifying and combining specific individual areas. In this way, the influence of mainstem discharge on the surface area of specific habitat types or locations could be investigated.

Correction factors were entered to standardize measurements to a common scale of 1 inch=1,000 feet. Surface areas within enlargement areas were divided by a factor of 16 to account for the four-fold difference in scale between 1 inch=250 feet and 1 inch=1,000 feet. Due to poor weather and associated low cloud cover, the 9,000 cfs photography was flown at a scale of 1 inch=920 feet whereas the other three sets of photography were obtained at a scale of 1 inch=1,000 feet. Therefore, all surface area measurements for the 9,000 cfs photography were multiplied by a factor of 0.85 to correct for the difference in scale.

Analysis Procedures

Total surface areas were calculated for the entire control corridor between Talkeetna and Devil Canyon by aquatic habitat type for each of the four discharges. Summations of surface area for the corridor and aquatic habitat types were also made by individual plate (Appendix 2). Percentages of the total surface area represented by each aquatic habitat type were calculated for each of the four discharges by river reach and individual plate.

A series of procedures were employed to evaluate the reliability of the digitizing. These procedures identified flow-dependent trends in the digitized data that would verify the accuracy and consistency of the methodology. Comparisons were made between total surface areas digitized at each of the four discharges for the corridor, vegetated bar, background, and tributary areas. In addition, percentages of the total surface area represented by each aquatic habitat type were calculated as were the percentages of total surface area for exposed gravel, vegetated bars and background area at each of the four discharges. These percentages were summed and the deviation from 100 percent was determined.

Average monthly discharges for the Susitna River at Gold Creek range from 1,500 cfs/day in winter to 28,000 cfs/day during summer, with the average annual discharge being 9,700 cfs/day (Figure 3a). Snowmelt runoff during June and early July accompanied by glacial melt and rainfall runoff during July and August provide remarkably stable and persistent high summer discharges (Figure 3 b, c, d).

From an analysis of hydrologic data, it was determined that the aerial photography obtained at a mainstem discharge of 23,000 cfs represents a typical mid-summer discharge for the Talkeetna-to-Devil Canyon reach of the Susitna River. Therefore, this photography was used to depict baseline mid-summer habitat surface areas, and the percent change in surface areas as a function of mainstem discharge was referenced to the digitized surface areas on the 23,000 cfs photography.

Because the change in surface area of aquatic habitat is a function of discharge and channel geometry, the Talkeetna-to-Devil Canyon reach was subdivided into four segments, each possessing somewhat different geomorphological characteristics. Total surface areas of each habitat type within these segments were determined to focus attention on the diversity of habitat types and surface area responses among the four river segments.

RESULTS

Total surface areas within the control corridor are presented in Table 1 by aquatic habitat type and sub-area for each photo mosaic. The areal equivalent of the precision of measurement for each individual digitized area is ± 0.23 acre.

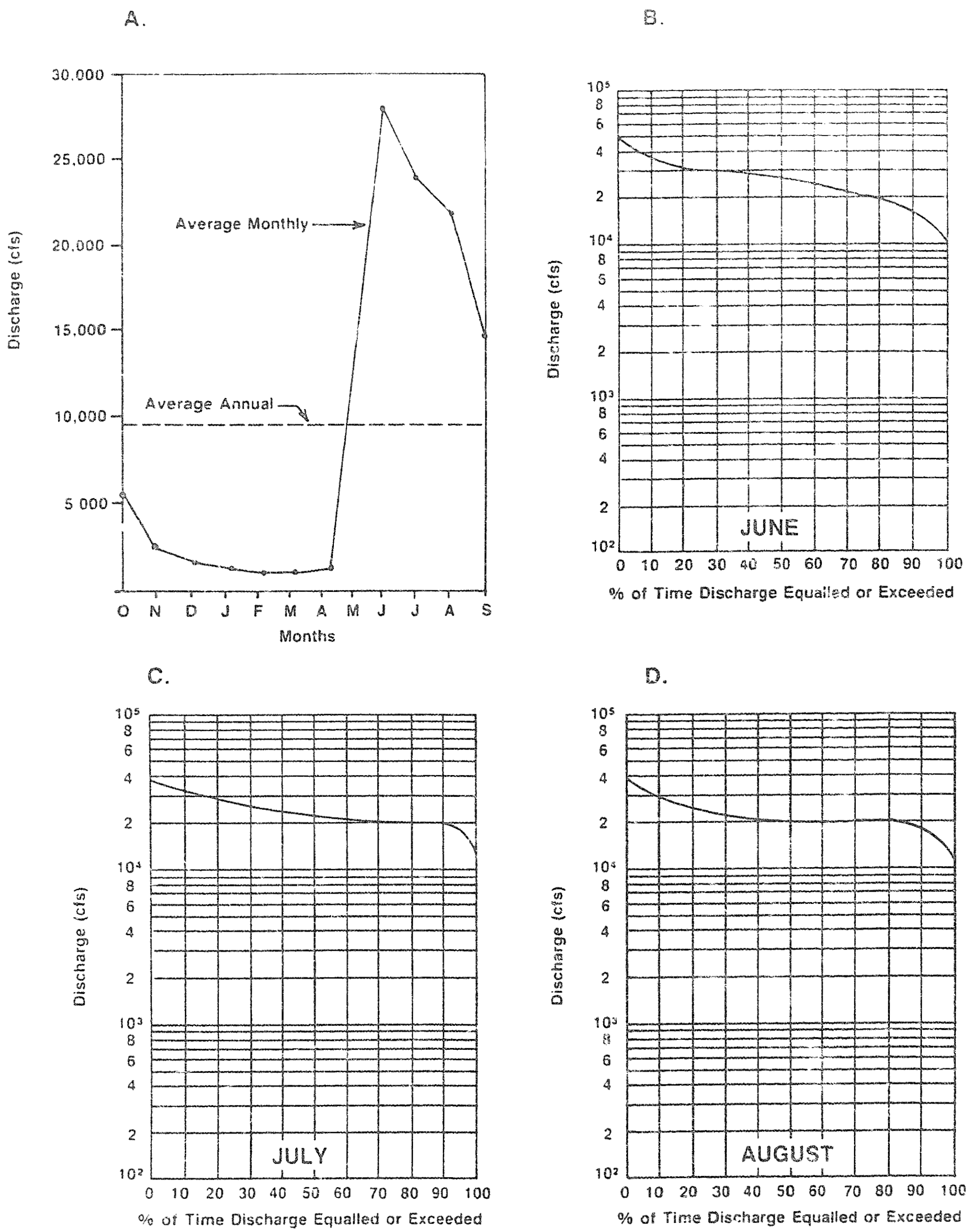

FIGURE 3 Average annual discharge and average monthly discharges for the Susitna River at Gold Creek (adapted from Scully, Leveen, and George 1978); b,c,d. Monthly flow duration curves for the Susitna River at Gold Creek (adapted from Acres American Inc. 1983).

Table 1. Total surface areas in acres within the Talkeetna-to-Devil Canyon river segment by category at four discharges.

Category	Surface Area by Discharge 9,000 cfs	12,500 cfs	16,000 cfs	23,000 cfs
Mainstem	2,399.30	2,850.45	3,158.47	3,737.17
Side Channel	761.54	1,095.46	1,222.17	1,240.69
Side Slough	155.64	118.06	85.78	52.54
Upland Slough	23.85	23.62	22.56	24.44
Tributary Mouth	13.84	26.20	25.30	12.08
Tributary	3.48	2.80	2.66	2.83
Gravel Bars	2,096.60	1,727.70	1,419.18	815.83
Vegetated Bars	1,714.20	1,919.11	2,011.35	1,718.41
Background	3,307.96	3,695.06	3,444.13	3,327.21
Total Corridor Area	10,476.41*	11,458.46	11,391.60	10,931.20

* Snow and shoreline ice complicated the digitizing of this set of photography.

The values presented in Table 1 were plotted to illustrate the surface area responses of individual habitat types to changes in mainstem discharge as measured at the USGS Gold Creek gaging station (Figure 4). Surface areas of mainstem and side channel habitats increased with increasing mainstem discharge. Concurrently, exposed gravel bars decreased with increasing discharge.

Surface area of side slough habitats increased with decreasing mainstem discharge. Upland slough surface area showed a declining trend with decreasing discharges.

Tributary mouth habitat was low at 9,000 cfs, increased at discharges of 12,500 and 16,000 cfs, then declined at 23,000 cfs. Surface area of vegetated bars remained relatively constant over the range of mainstem discharges. Tributary habitat increased slightly with decreasing discharge.

Percentages of total surface area within the control corridor are presented in Table 2 by category for each of the four discharges.

Table 3 presents the percentage change in the surface area of each habitat type with decreasing mainstem discharge as calculated from a baseline discharge of 23,000 cfs.

Figures 5-8 present the surface area response of individual habitat types to mainstem discharge in four segments of the Talkeetna-to-Devil Canyon reach. These segments extend from river miles (RM) 101 to 113, 113 to 122, 122 to 138, and 138 to 149. The percentage of the total

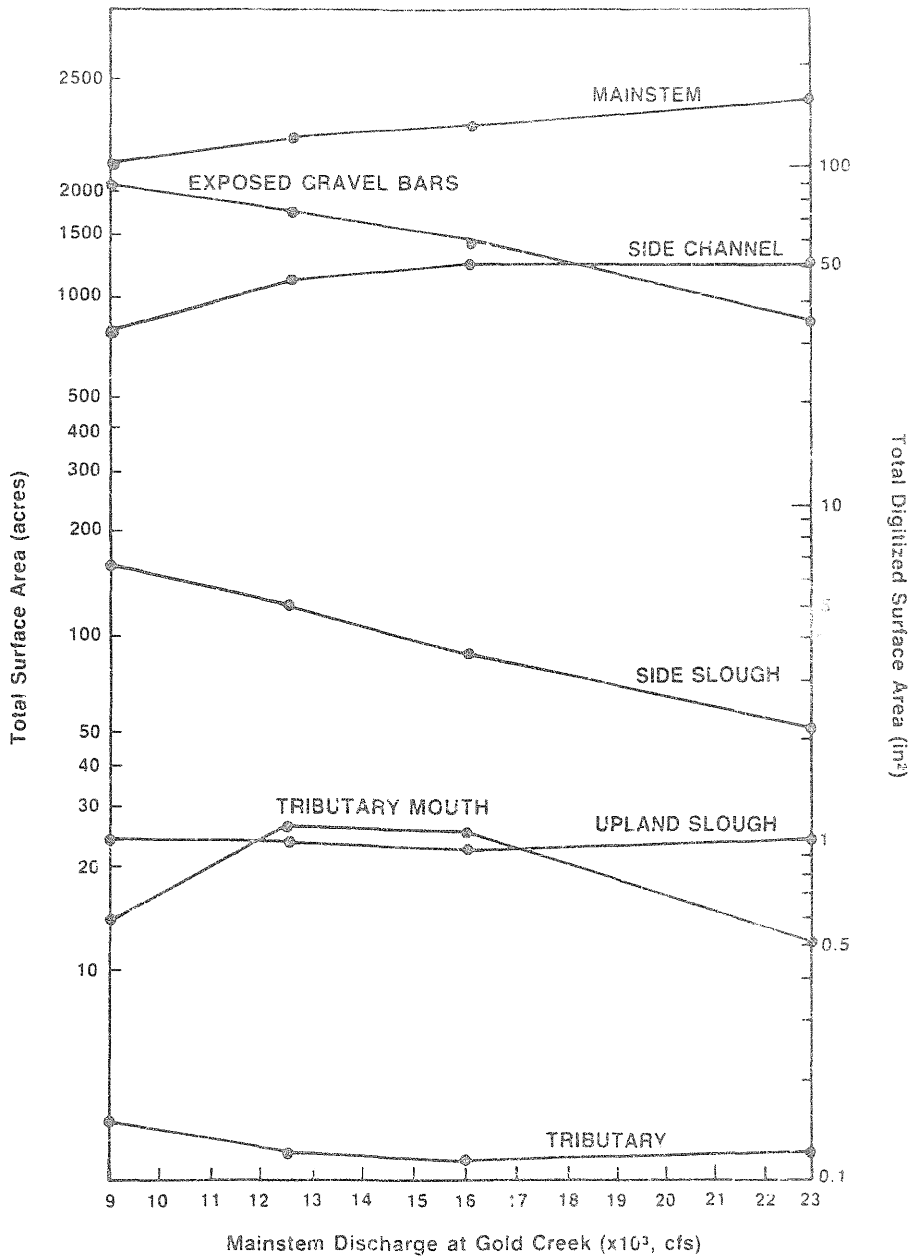

FIGURE 4 Surface area responses to mainstem discharge in the Talkeetna-to-Devil Canyon reach of the Susitna River (RM 101 to 149).

Table 2. Digitized surface areas within the Talkeetna-to-Devil Canyon river segment expressed as a percentage of the total corridor area less the background area.

Category	Percentage by Discharge			
	9,000 cfs	12,500 cfs	16,000 cfs	23,000 cfs
Mainstem	33.47	36.70	39.74	49.15
Side Channel	10.62	14.10	15.38	16.32
Side Slough	2.17	1.52	1.08	0.69
Upland Slough	0.33	0.30	0.28	0.32
Tributary Mouth	0.19	0.34	0.32	0.16
Tributary	0.05	0.04	0.03	0.04
Gravel Bars	29.25	22.24	17.86	10.73
Vegetated Bars	23.91	24.71	25.31	22.60

Table 3. Percentage change in digitized surface areas at three discharges relative to corresponding areas present at 23,000 cfs.

Category	Percentage Change by Discharge		
	9,000 cfs	12,500 cfs	16,500 cfs
Mainstem	-35.80	-23.73	-15.48
Side Channel	-38.62	-11.71	-1.49
Side Slough	196.22	130.99	63.26
Upland Slough	-2.40	-3.34	-7.69
Tributary Mouth	14.56	116.86	109.47
Tributary	23.21	-0.89	-6.09
Gravel Bars	156.99	111.77	73.96
Vegetated Bars	0.51	12.53	17.93
Background	-0.58	11.06	3.51

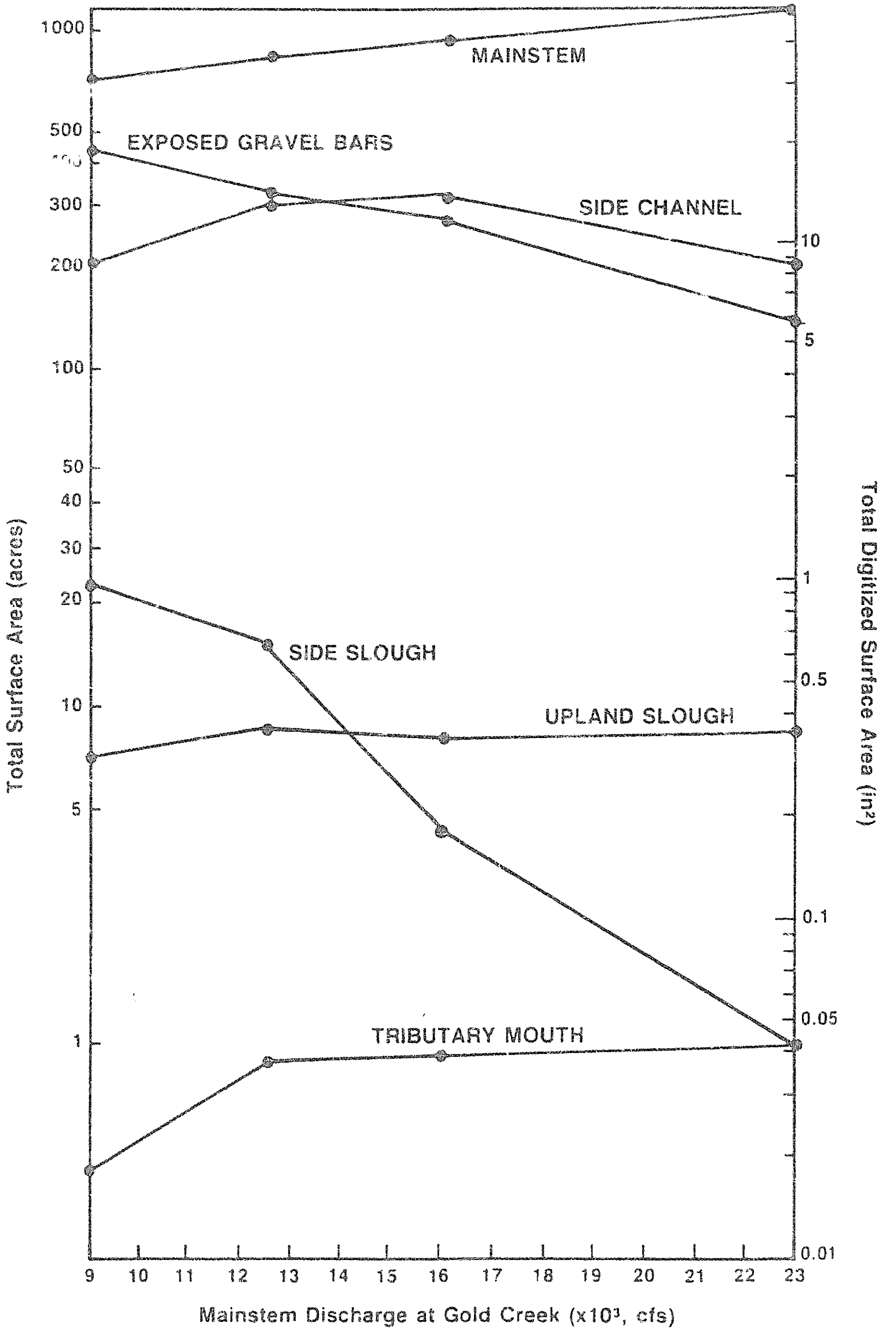

FIGURE 5 Surface area responses to mainstem discharge in the Talkeetna-to-Lane Creek reach of the Susitna River (RM 101 to 113).

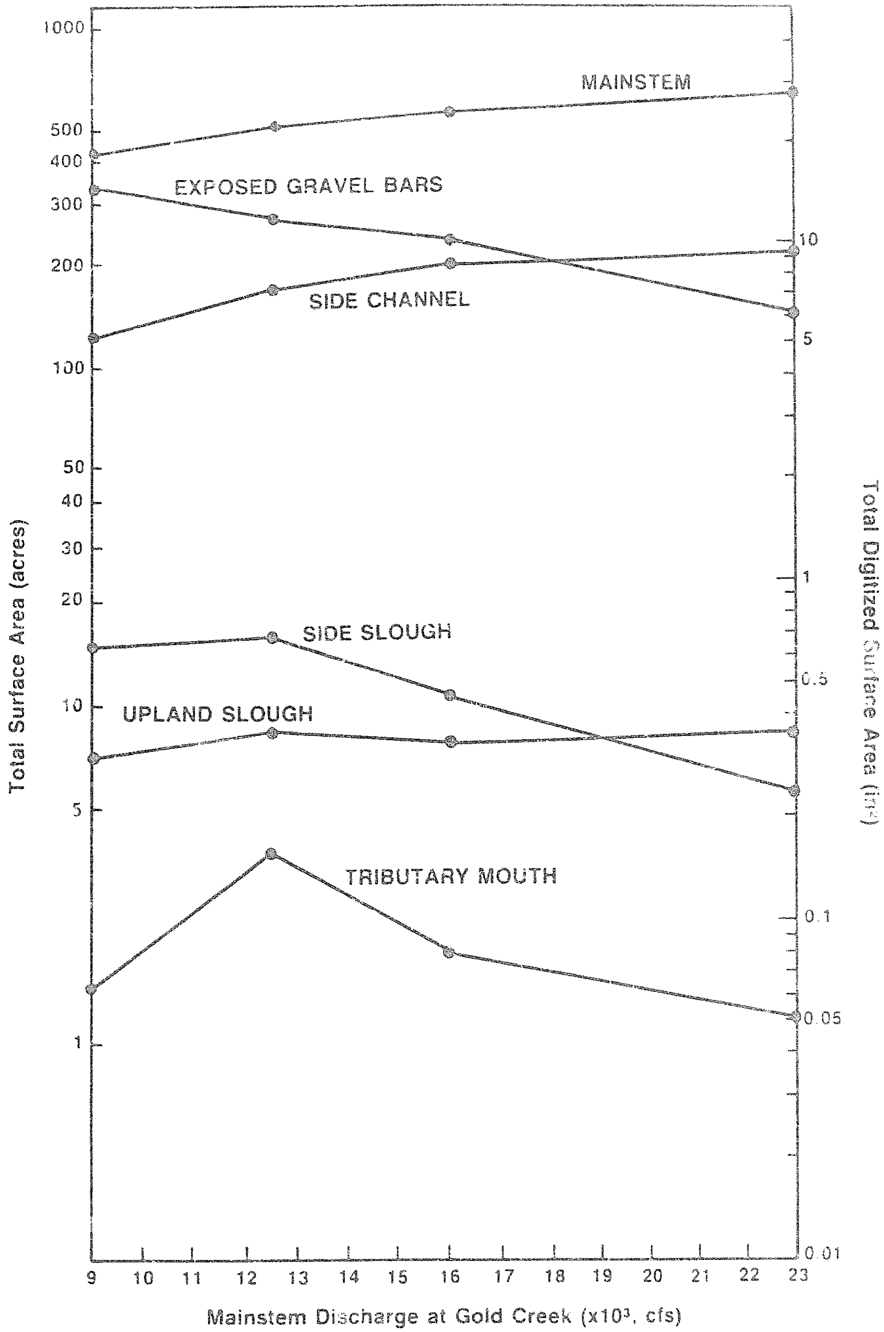

FIGURE 6 Surface area responses to mainstem discharge in the Lane Creek-to-Curry reach of the Susitna River (RM 113 to 122).

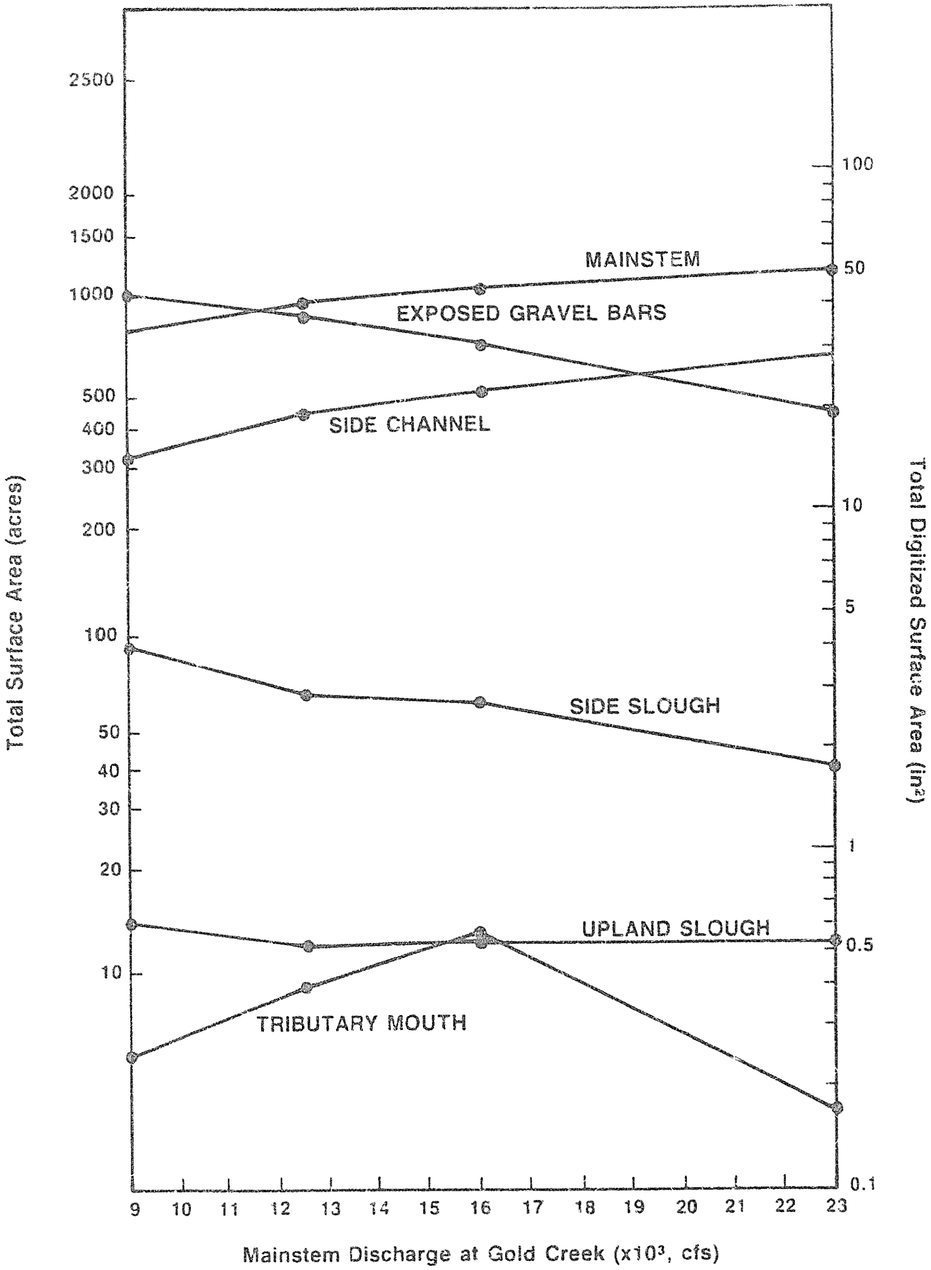

FIGURE 7 Surface area responses to mainstem discharge in the Curry-to-Gold Creek reach of the Susitna River (RM 122 to 138)

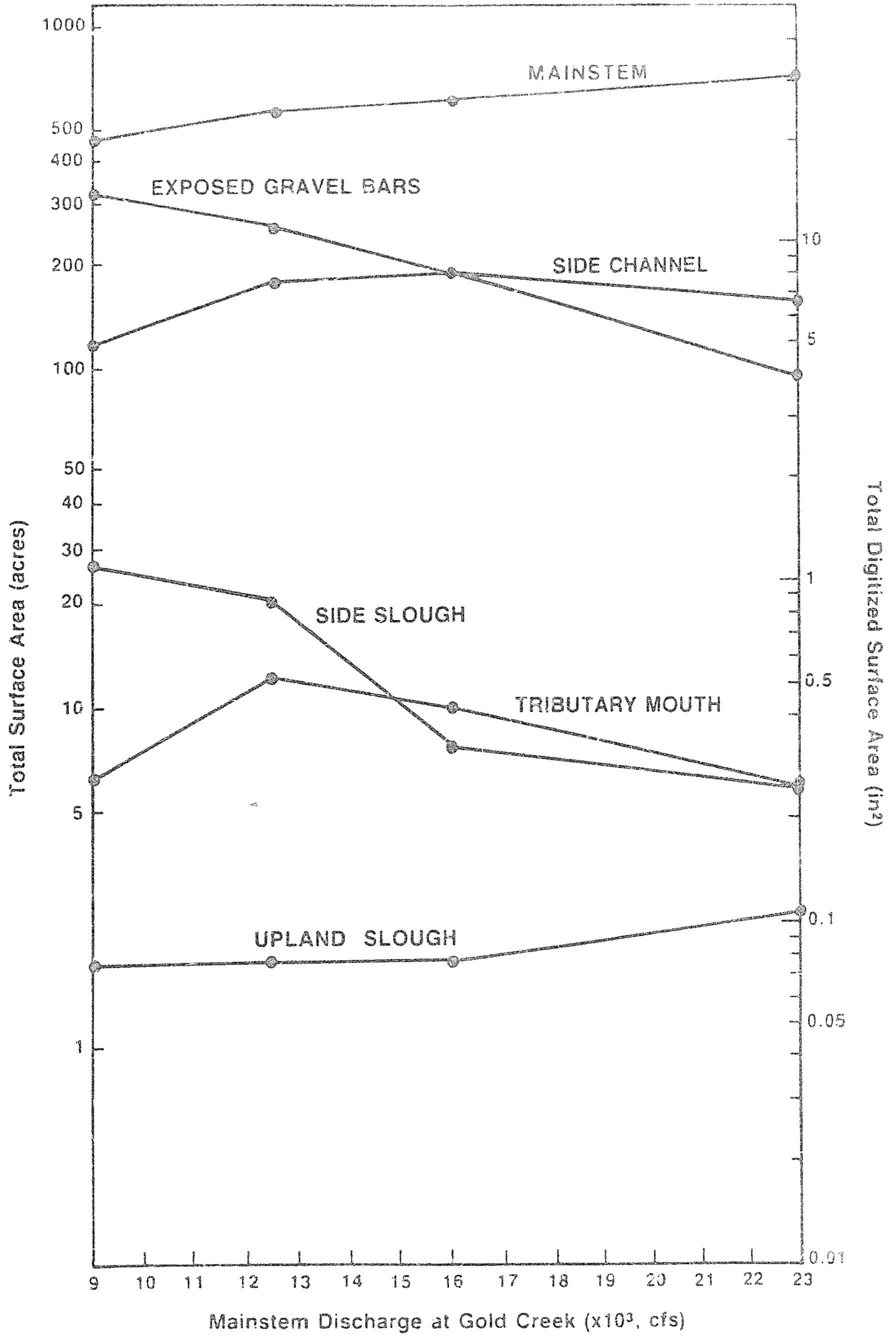

FIGURE 8 Surface area responses to mainstem discharge in the Gold Creek-to-Devil Canyon reach of the Susitna River (RM 138 to 149).

area that each habitat type represents varies for each of these river segments, but the general trends displayed by the entire study reach are evident in each segment.

Figure 9 presents a relative comparison of total surface areas calculated for various habitat categories within the entire Talkeetna-to-Devil Canyon reach and within the four segments for each of the four discharges. In all segments, mainstem and vegetated bar surface areas predominate. The greatest diversity occurs in the Lane Creek-to-Gold Creek reach of the Susitna River (RM 113 to 138), in which a greater percentage of the total surface area is represented by gravel and vegetated bars. This river segment is characterized by a more braided channel pattern.

DISCUSSION

Air photo interpretation is highly dependent on the quality of the photography. Although each set of photographs obtained in this study were generally clear and complete, the time of day, date, and prevailing weather conditions at the time the aerial photographic missions were flown affected the extent to which detailed riverine features were visible. The 9,000 cfs photographs, obtained on October 10, 1983, were taken after ice had begun to form along the river and a light snowfall had covered the ground. In some cases, this made the determination of the water's edge more difficult. In other cases, particularly for upland sloughs, the sharp contrast between the dark open water and the snow covered shoreline combined with a lack of deciduous foliation greatly assisted visual determination of the slough boundary.

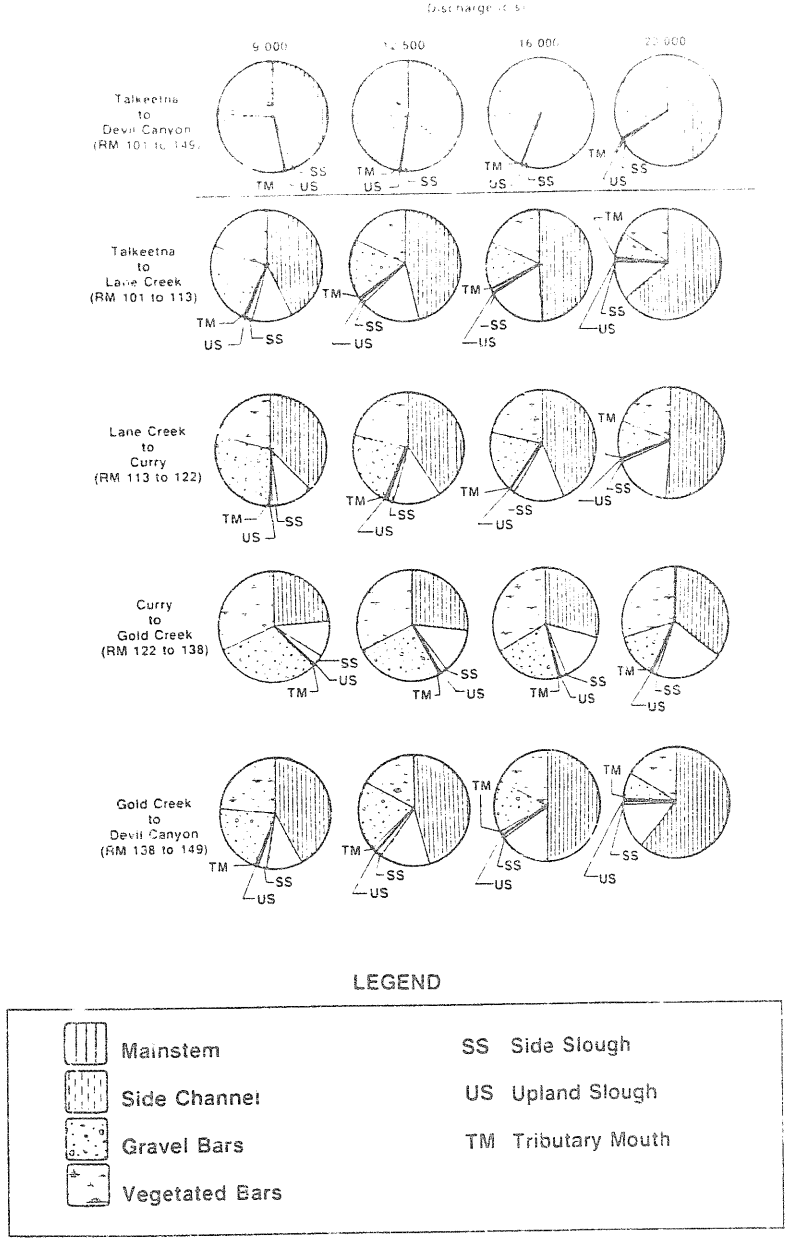

FIGURE 9 A comparison of relative amounts of the different habitat categories comprising various reaches of the Susitna River at four mainstem discharges.

The 23,000 cfs photographs, taken on June 1, 1982, were obtained at a time of the year when the sun was at a high angle and deciduous vegetation had not fully leafed-out. This resulted in few shadows, which enabled excellent delineation of water's edge and slough boundaries.

The 12,500 and 16,000 cfs photographs were obtained on September 11, 1983, and September 6, 1983, respectively. At this time of year the sun is at a low angle, and deciduous foliation is well developed, resulting in extensive shadows along the south and east shorelines. These shadows sometimes obscured the water's edge and made some surface area delineations difficult.

In spite of the minor differences in photographic detail, the accuracy and reliability of areal measurements obtained by the digitizing technique appear to be good. A comparison between total surface areas for the control corridor at each of the four discharges deviated from 1.1 to 5.3 percent of their arithmetic mean. This suggests that a high level of precision and good replicability were maintained during the digitizing of all four sets of aerial photgraphy. Total surface areas for vegetated bars and background areas were compared among the four discharges and were found to remain relatively constant. This would be expected due to the limited influence of the flow fluctuations on these areas.

Surface area responses are a function of streamflow and channel geometry. If channel geometry remains constant over time, the surface area responses can also be expected to remain constant. Within the level of precision of this work, small local changes that may have occurred in channel geometry were thought to have an insignificant effect on the accuracy of surface area estimates. Therefore, the results presented in this study are representative of open water conditions and existing channel geometry. If the operation of the proposed project results in no ice formation and does not significantly alter existing channel geometry in the Taikeetna-to-Devil Canyon reach, then the response patterns presented here are applicable to a year-round assessment of habitat availability under project conditions.

Definitions for aquatic habitat types used in this study represent a set of visually recognizable, streamflow dependent physical characteristics that do not restrict the occurrence of a particular habitat type to fixed geographical locations. An example of the flow-dependent nature of these definitions is reflected by side slough and side channel habitats. Side sloughs, by definition, are clear-water habitats in which the flow is maintained by upwelling and local surface water run-off. A non-vegetated alluvial berm and dewatered overflow channel separates the clear water habitat from the active channel. When mainstem discharge increases and river stage rises, the alluvial berm at the head of the slough is overtopped. Turbid mainstem water flows into the overflow channel and replaces the former clear water habitat with deeper, faster flowing, turbid water. The aquatic habitat at this location then fits the defintion of side channel habitat. Conversely, as mainstem discharge decreases, areas classified as side channels may become cut off from the mainstem flow at their upstream end and become clear water habitats. If these clear water areas are contiguous and connected to the mainstem at the downstream end of the channel, they are then classified as side sloughs. If these clear water areas were not contiguous and connected to the mainstem, they were considered "ponded water" and their surface area was included in the measurement of dewatered gravel bars.

Insufficient time and resources were available to make on-site inspections to determine whether the clear water flow in these cutoff side channels would be maintained by upwelling, or whether it was a short-term phenomenon attributable to bank storage draining into the channel.

Field sampling is necessary to determine the source of the clear water before assigning these new side slough habitats any significance in terms of fish habitat.

A reduction of mainstem and side channel surface area and an increase in side slough and exposed gravel bar surface areas was observed at lower discharges. This results from both the dewatering of areas and the change in their habitat classification. The increase in side slough area results primarily from a reclassification of side channel habitat and a minimization of backwater effects at the downstream end of the sloughs.

Surface areas of tributary streams were summed and found to increase slightly at a mainstem discharge of 9,000 cfs. As widths of the mainstem channels decrease with decreasing discharge, tributaries must flow a greater distance and, therefore, tributary surface area tends to increase at low mainstem discharge.

Tributary mouth habitat is dependent on tributary flow as well as mainstem discharge and channel geometry. The reduction of tributary mouth habitat at 9,000 cfs as indicated by this analysis is thought to be an artifact of the photography rather than the influence of mainstem discharge or channel geometry. The 9,000 cfs photographs were obtained October 10, 1983, well after the Susitna River had begun to clear. Because much less contrast existed between the clear water plume of the tributary and the more turbid mainstem water at this time of year, it is unlikely that the entire surface areas of the tributary mouth habitats were digitized. Therefore, the total amount of tributary mouth habitat surface area may be slightly under estimated at 9,000 cfs.

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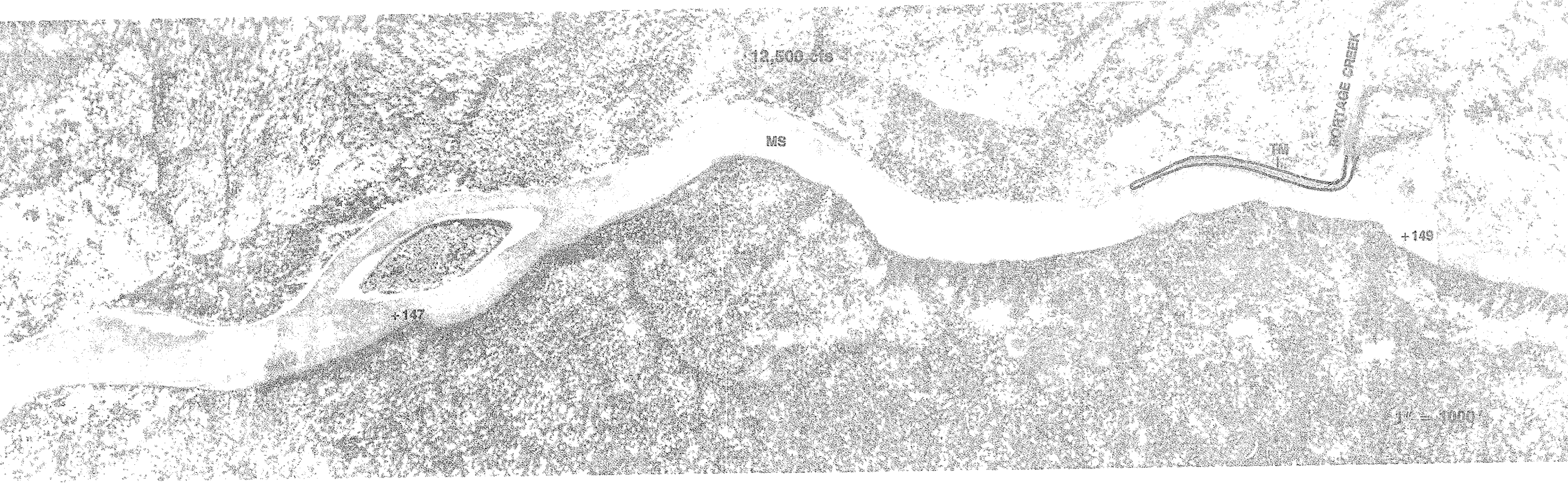
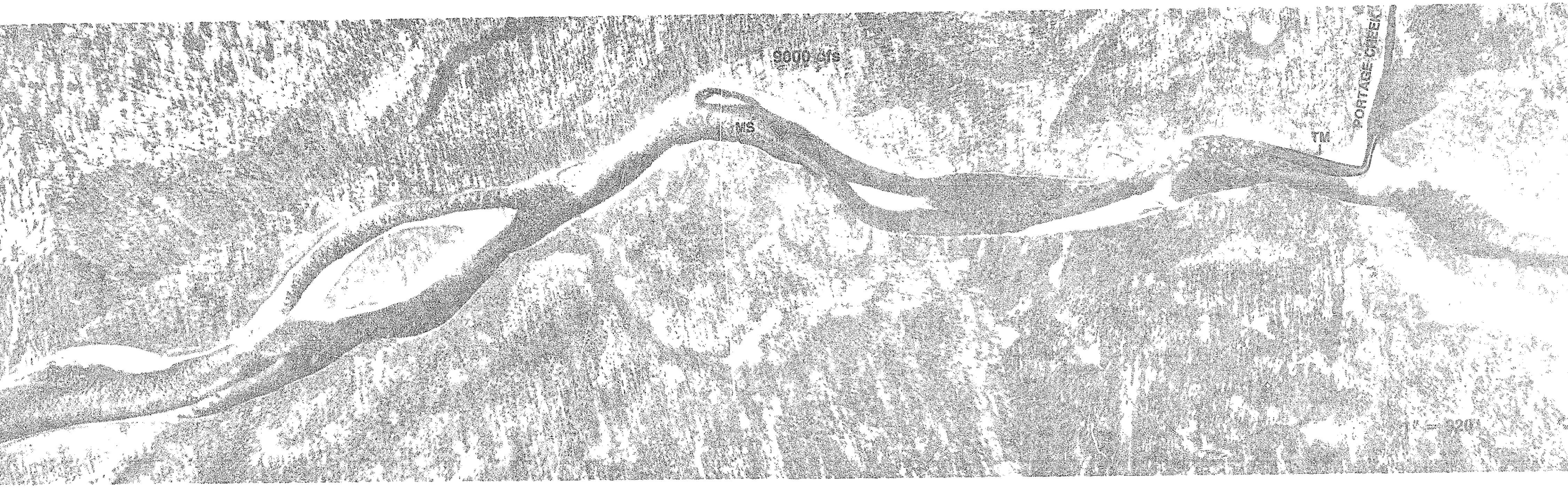
Appendix 1. Plates.





LEGEND

MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

MIDDLE SUSITNA RIVER

PLATE 1 OF 18 RIVER MILE 147 TO 149

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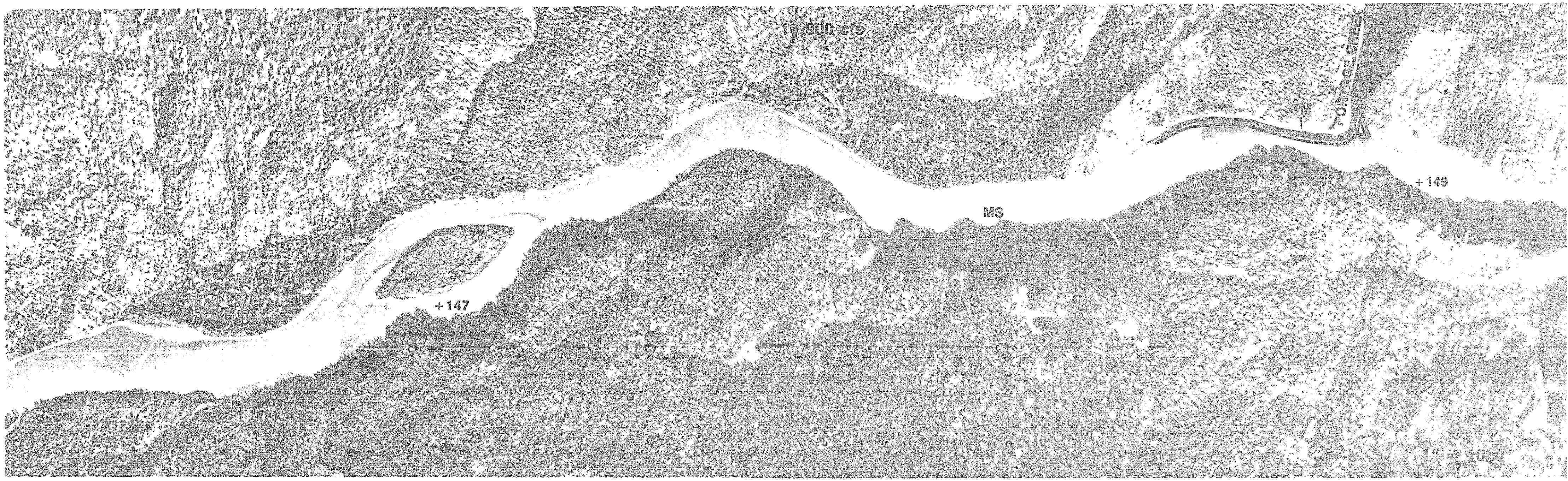

LEGEND

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US	UPLAND SLOUGH		

MIDDLE SUSITNA RIVER

PLATE 1 OF 18 RIVER MILE 147 TO 149

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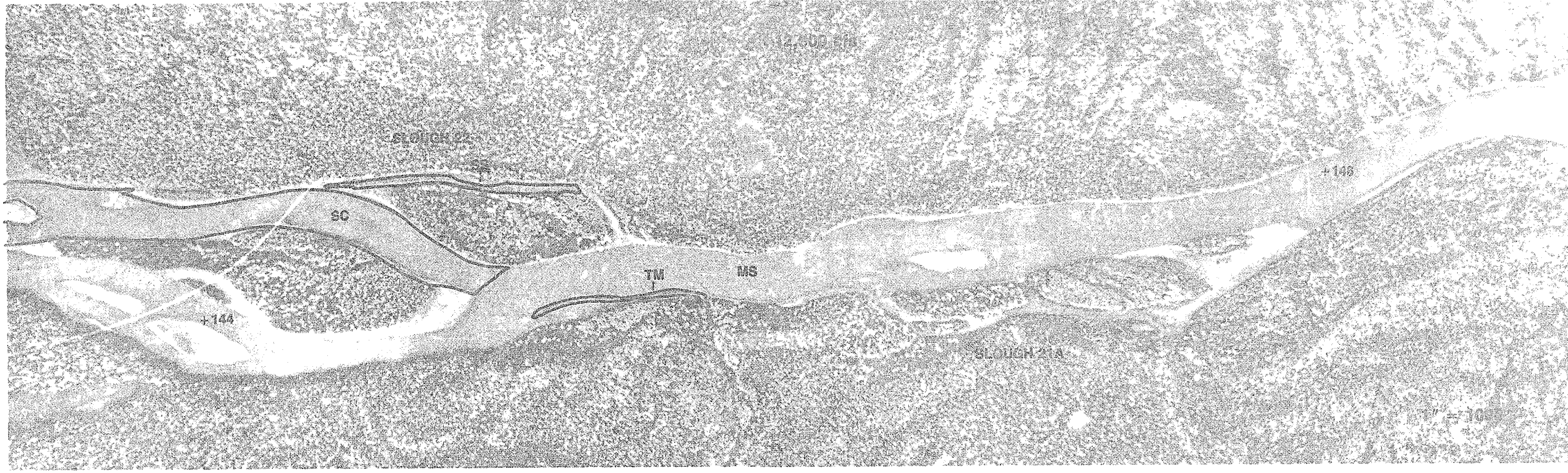
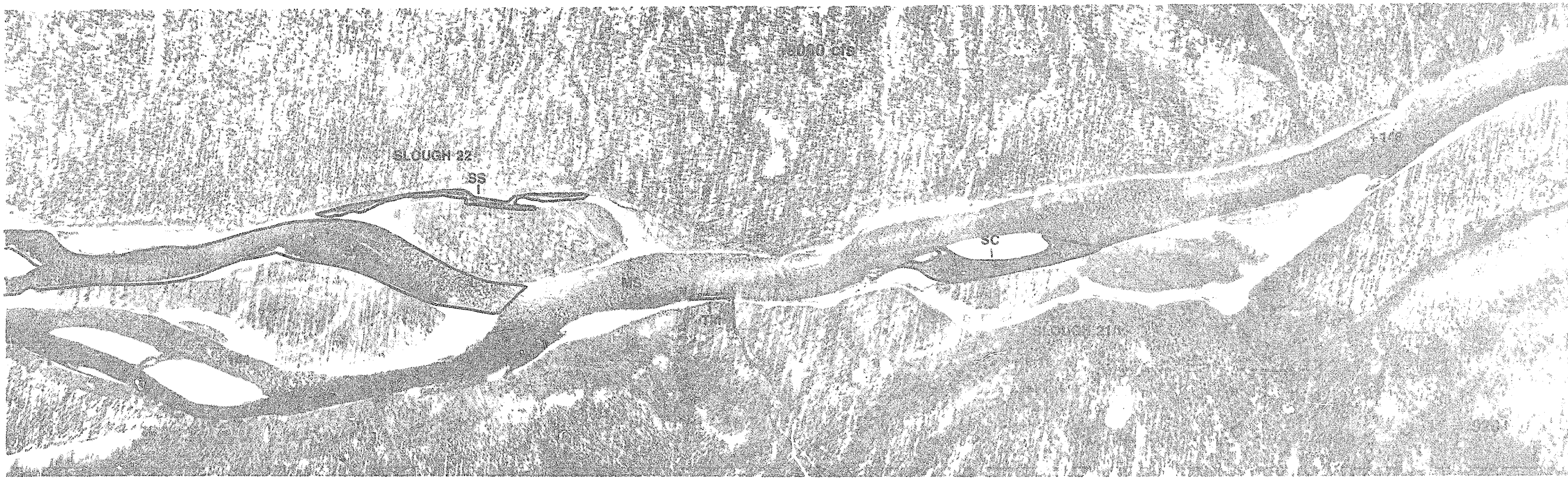
HARZA
SUSITNA





LEGEND

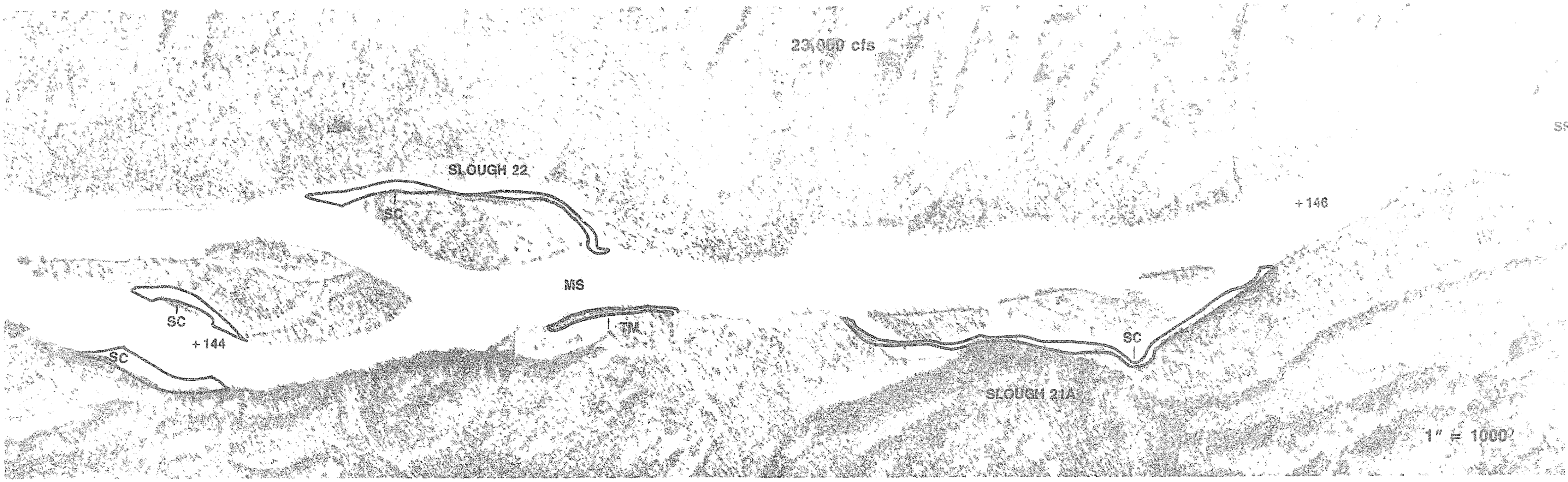
MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

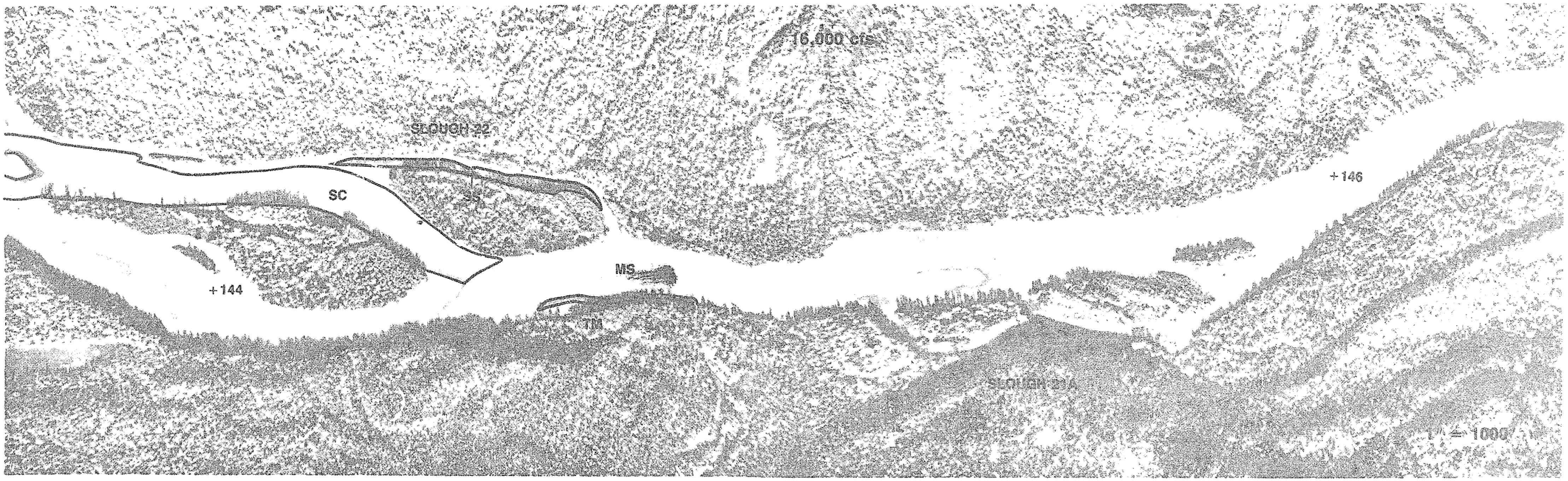
MIDDLE SUSITNA RIVER

PLATE 2 OF 18 RIVER MILE 144 TO 146

ALASKA POWER ...
SUSITNA HYDROELECTRIC P...

EWT&A HARZA-...
SUSITNA JOI...





LEGEND

MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

MIDDLE SUSITNA RIVER

PLATE 2 OF 18 RIVER MILE 144 TO 146

ALASKA POWER AUT
SUSITNA HYDROELECTRIC
EWT&A
E. WOODY TRIHEY & ASSOCIATES
HARZA-
SUSITNA J

LEGEND

MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

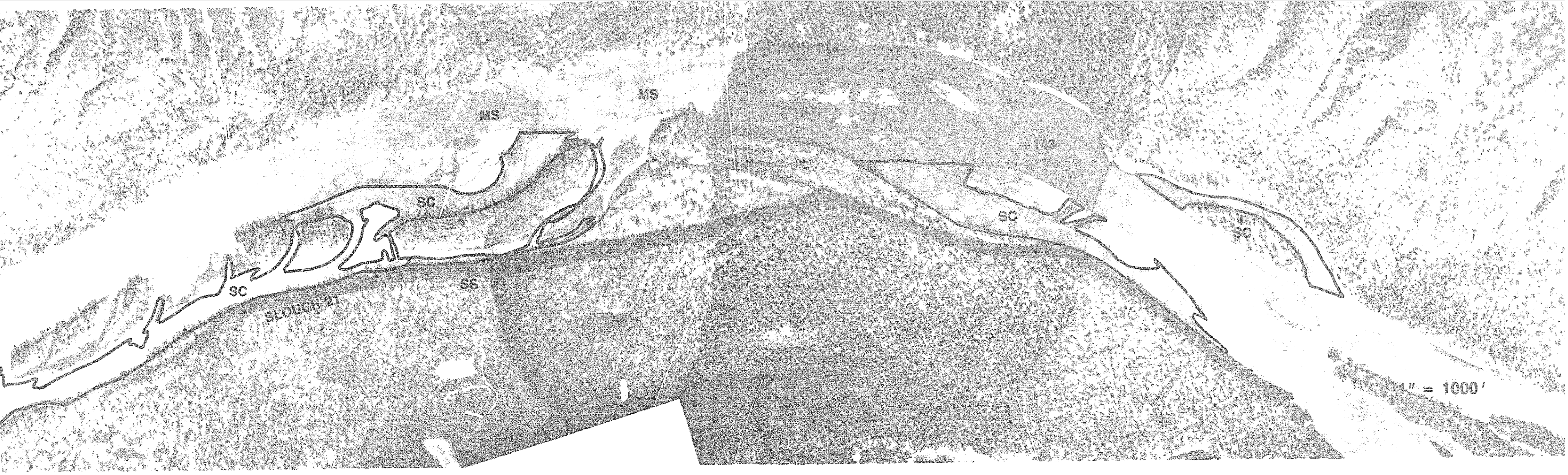
MIDDLE SUSITNA RIVER

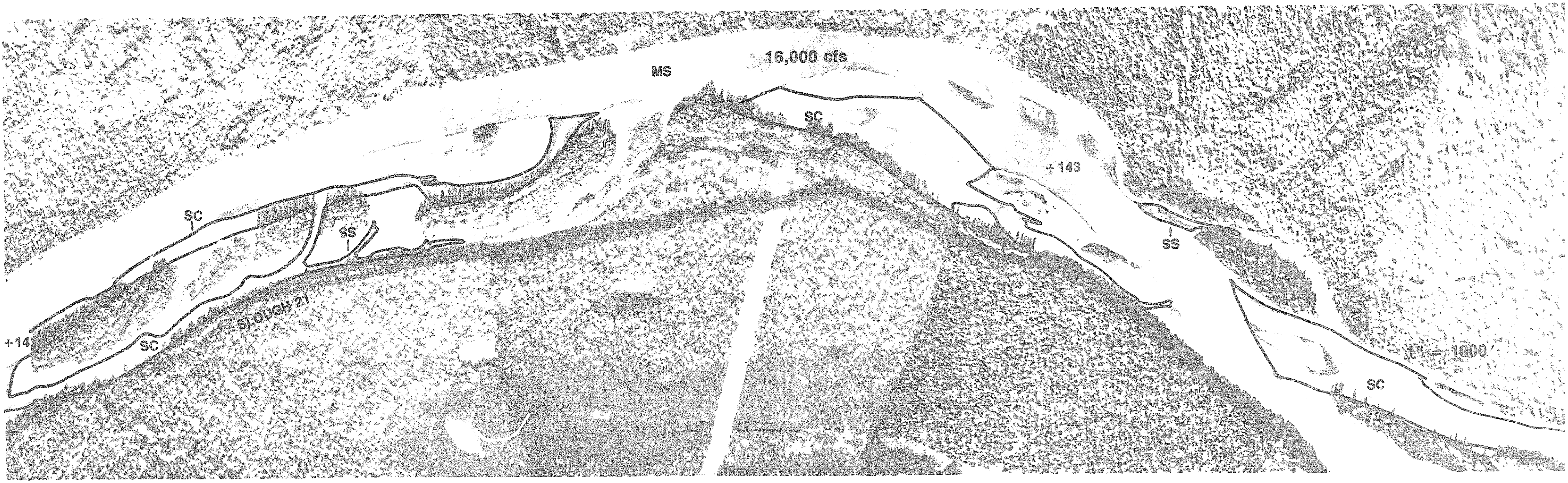
PLATE 3 OF 18 RIVER MILE 142 TO 144

ALASKA POWER AUTHOR
SUSITNA HYDROELECTRIC PROJEC

EWT&A
E. WOODY TRIHEY & ASSOCIATES

HARZA-EBA
SUSITNA JOINT VE





LEGEND

MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

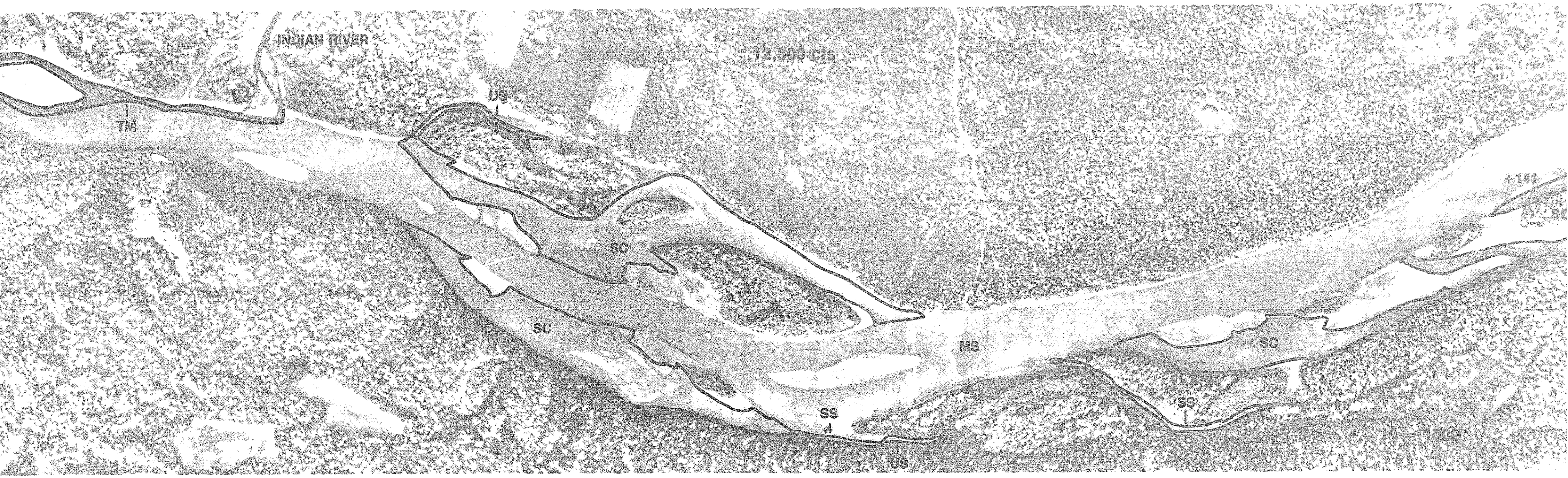
MIDDLE SUSITNA RIVER

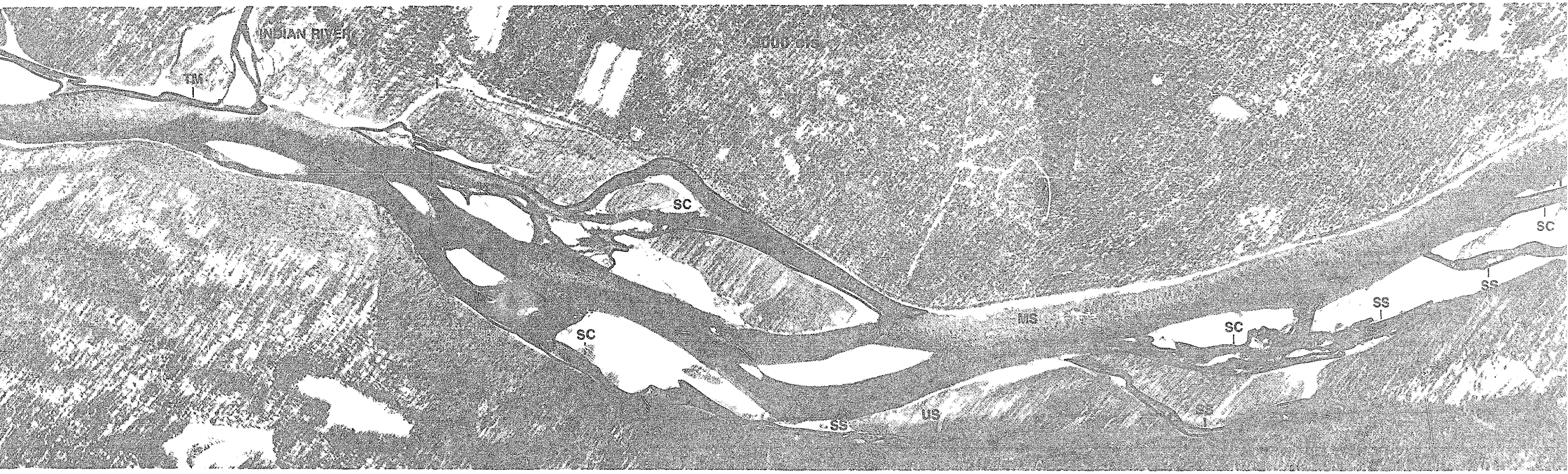
PLATE 3 OF 18 RIVER MILE 142 TO 144

ALASKA POWER AUTHO
SUSITNA HYDROELECTRIC PROJ

EWT&A
E. WOODY TRIHEY & ASSOCIATES

HARZA-EB
SUSITNA JOINT V





LEGEND

MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

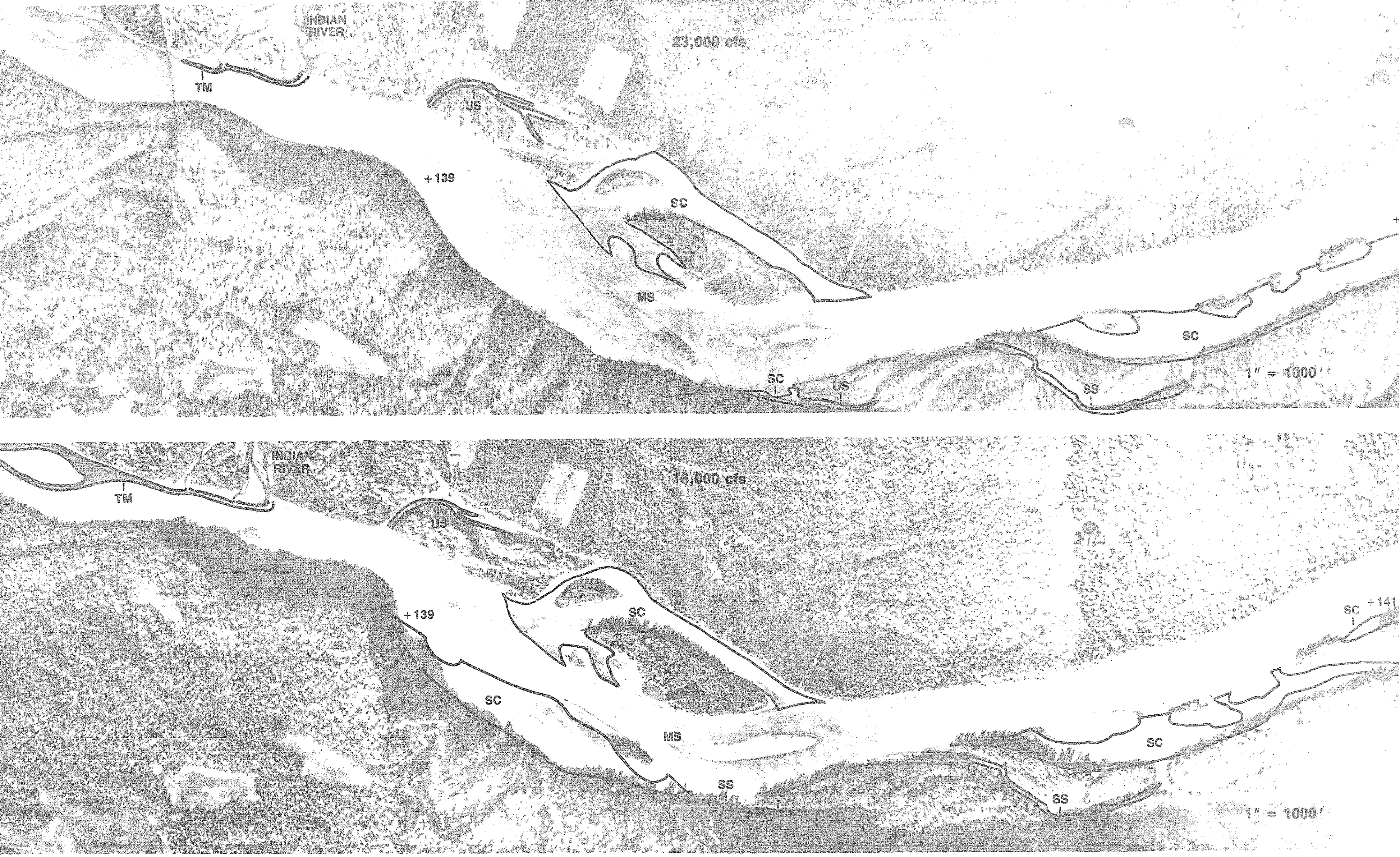
MIDDLE SUSITNA RIVER

PLATE 4 OF 18 — RIVER MILE 139 TO 141

ALASKA POWER AUTHORIT
SUSITNA HYDROELECTRIC PROJEC

EWT&A — E. WOODY TRIHEY & ASSOCIATES

HARZA-EBAS
SUSITNA JOINT VEN



LEGEND

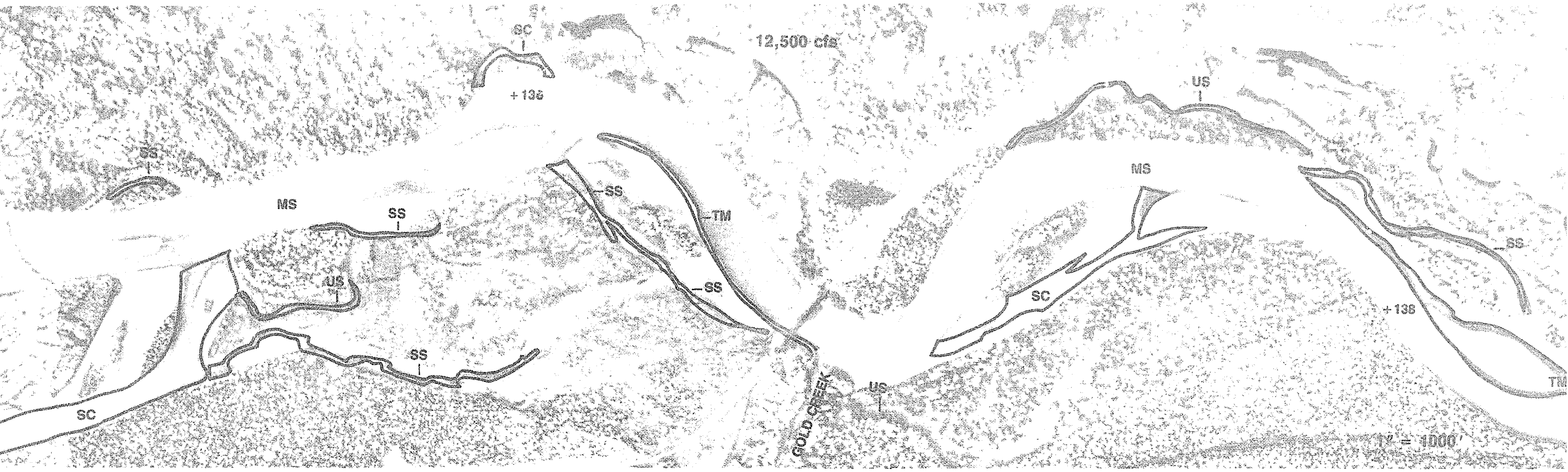
MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

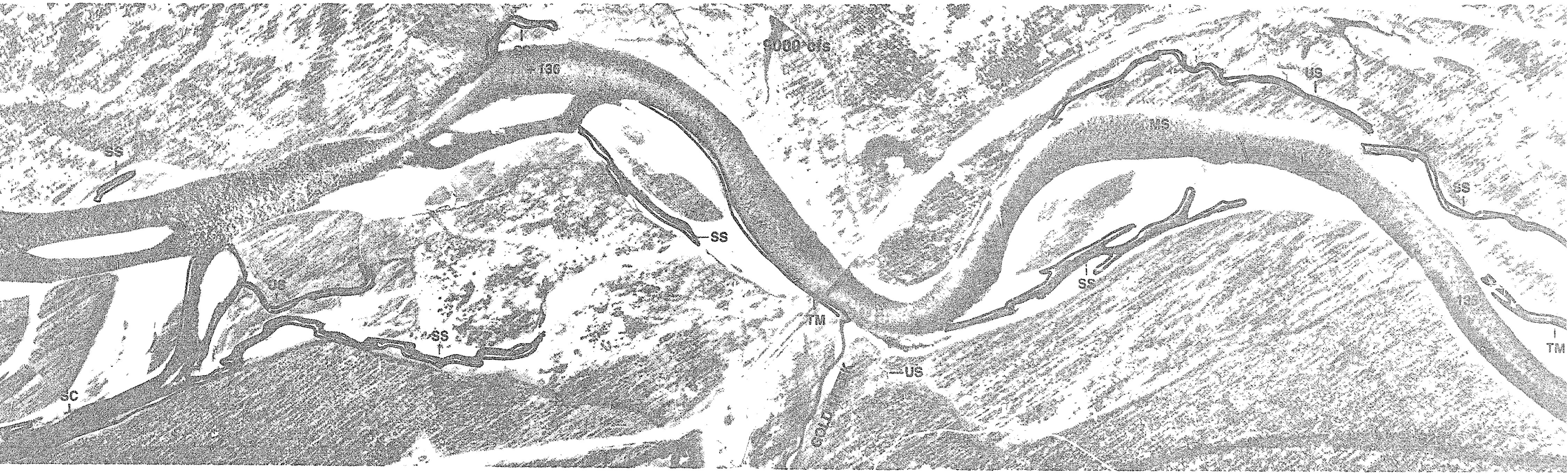
MIDDLE SUSITNA RIVER

PLATE 4 OF 18 RIVER MILE 139 TO 141

ALASKA POWER AUTHOR
SUSITNA HYDROELECTRIC PROJE

EWT&A
HARZA-EBA
SUSITNA JOINT VE





LEGEND

MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

MIDDLE SUSITNA RIVER

PLATE 5 OF 18 RIVER MILE 136 TO 138

ALASKA POWER AUTHORIT
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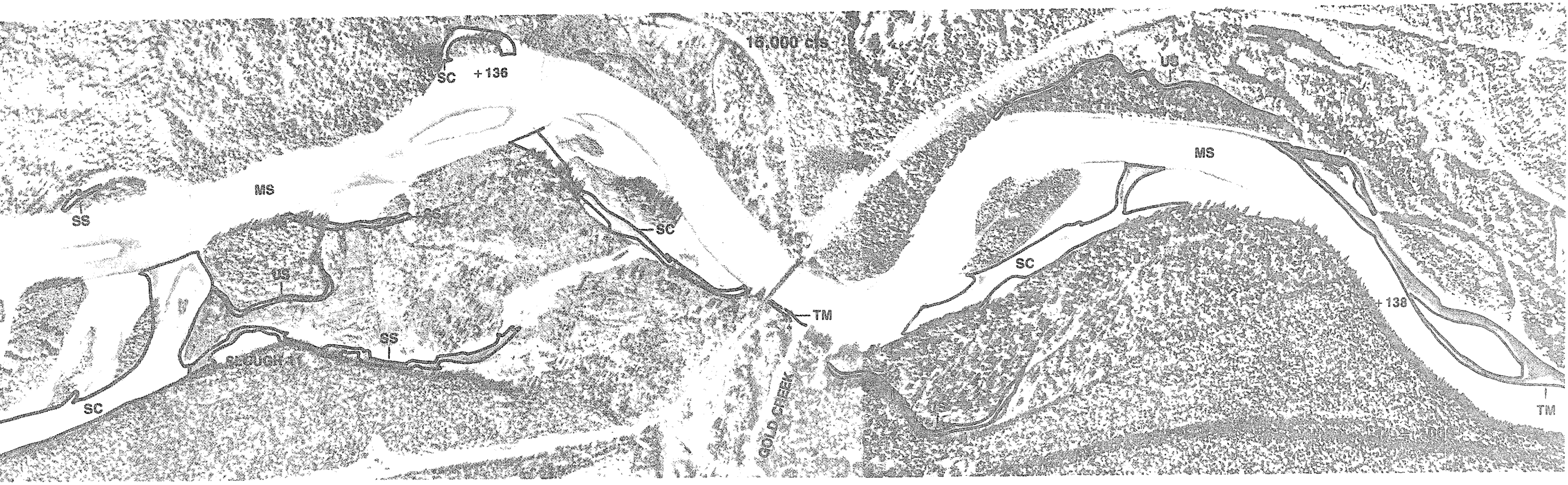
HARZA-EBAS
SUSITNA JOINT VENT



LEGEND

MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

MIDDLE SUSITNA RIVER

PLATE 5 OF 18 RIVER MILE 136 TO 138

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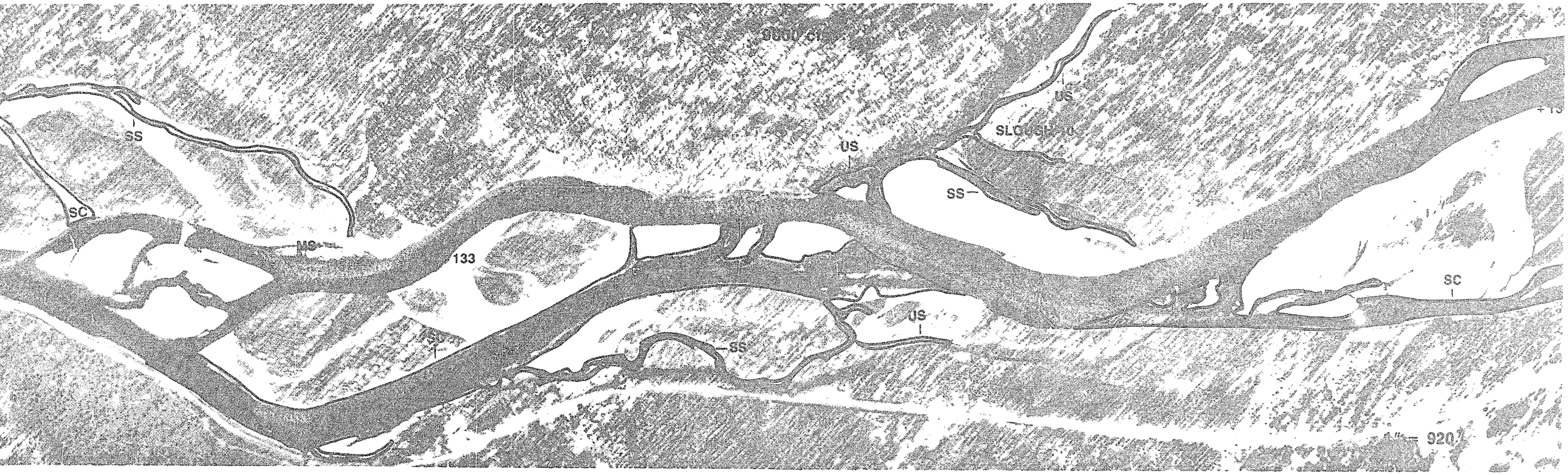
E. WOODY TRIHEY & ASSOCIATES

HARZA-EBAS
SUSITNA JOINT VENT



LEGEND

MS MAINSTEM
SC SIDE CHANNEL
SS SIDE SLOUGH
US UPLAND SLOUGH
TM TRIBUTARY MOUTH
T TRIBUTARY
\+ RIVER MILE

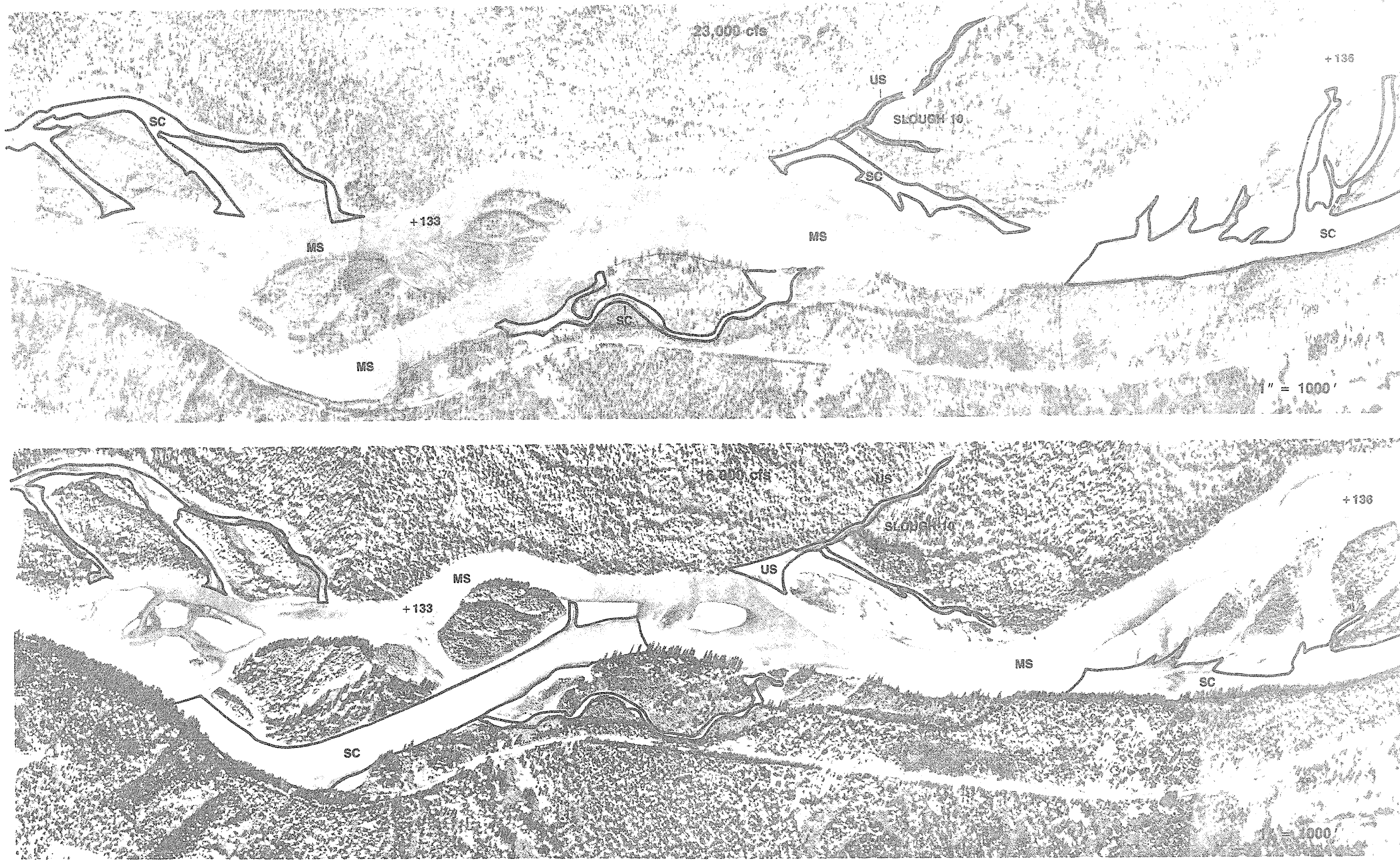
MIDDLE SUSITNA RIVER

PLATE 6 OF 18 RIVER MILE 133 TO 136

ALASKA POWER AUTHOR
SUSITNA HYDROELECTRIC PROJE

EWT&A
E. WOODY TRIHEY & ASSOCIATES

HARZA-EBA
SUSITNA JOINT VE



LEGEND

MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

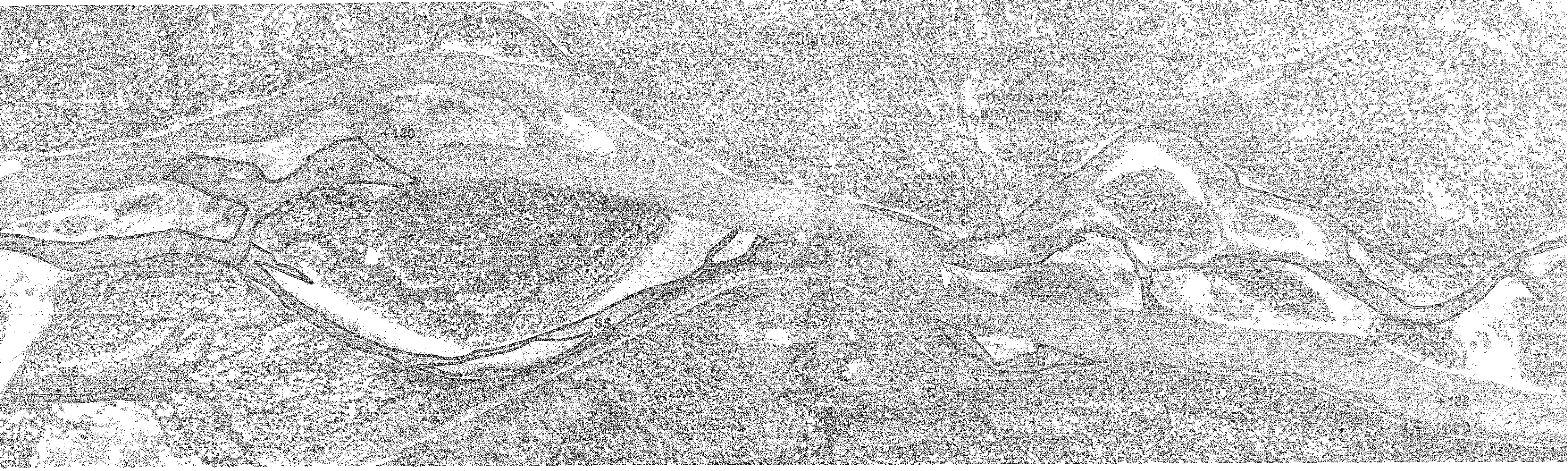
MIDDLE SUSITNA RIVER

PLATE 6 OF 18 RIVER MILE 133 TO 136

ALASKA POWER AUTHO
SUSITNA HYDROELECTRIC PRO

EWT&A
E. WOODY TRIHEY & ASSOCIATES

HARZA-EI
SUSITNA JOINT



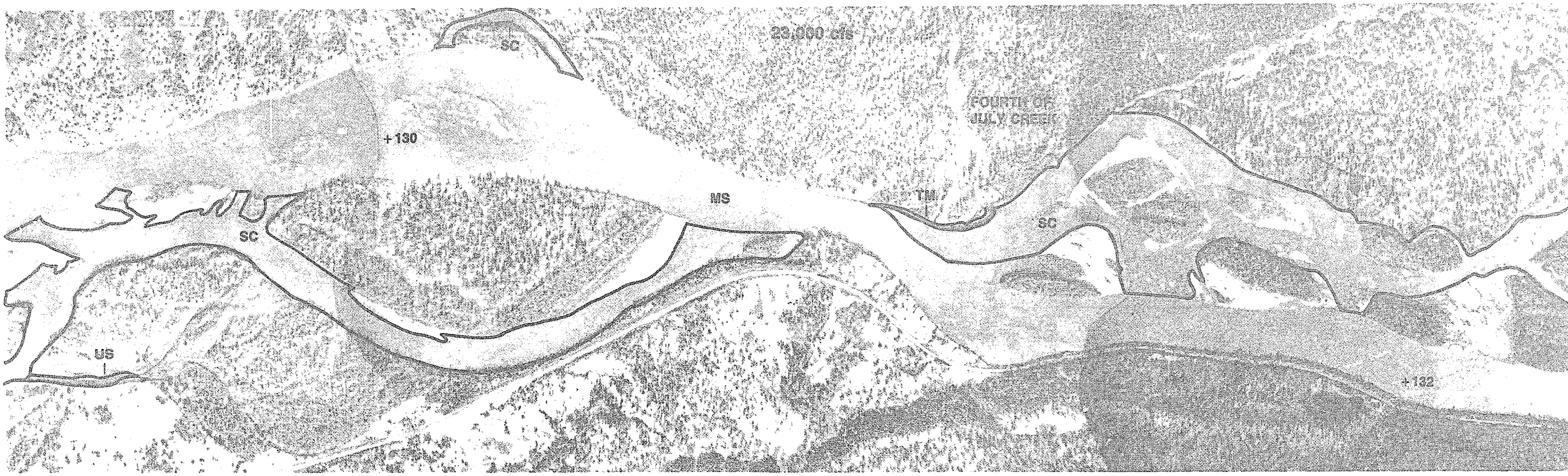
LEGEND

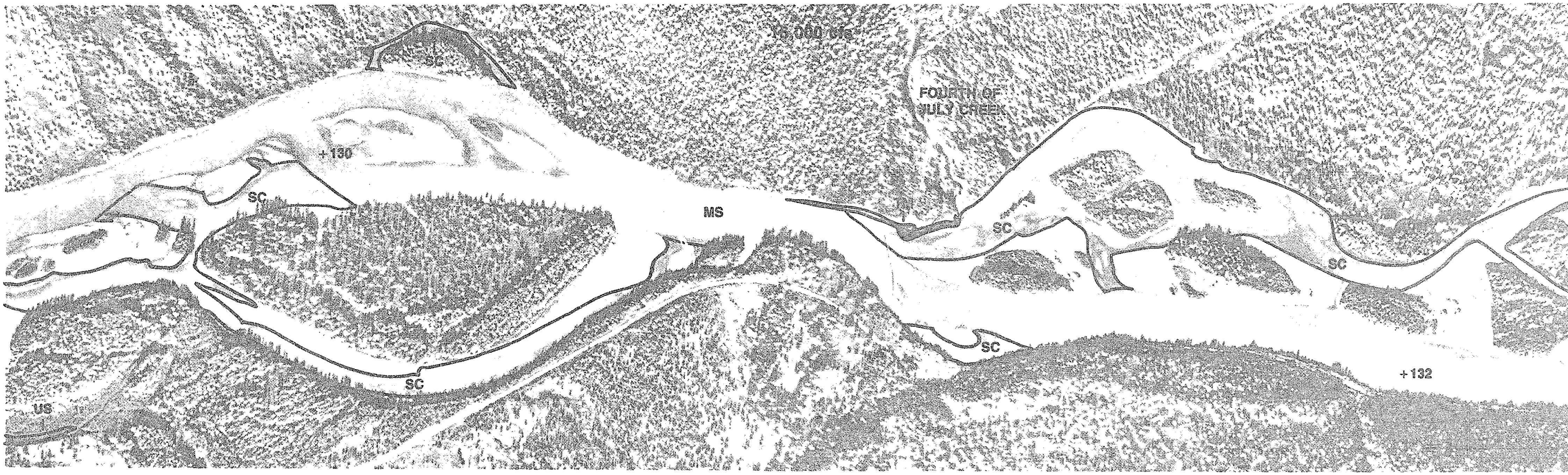
MS MAINSTEM
SC SIDE CHANNEL
SS SIDE SLOUGH
US UPLAND SLOUGH
TM TRIBUTARY MOUTH
T TRIBUTARY
\+ RIVER MILE

MIDDLE SUSITNA RIVER

PLATE 7 OF 18 RIVER MILE 130 TO 132

ALASKA POWER AUTHOR
SUSITNA HYDROELECTRIC PROJE
EWT&A
HARZA–EBA
SUSITNA JOINT VE





LEGEND

MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

MIDDLE SUSITNA RIVER

PLATE 7 OF 18 RIVER MILE 130 TO 132

ALASKA POWER AUTHO
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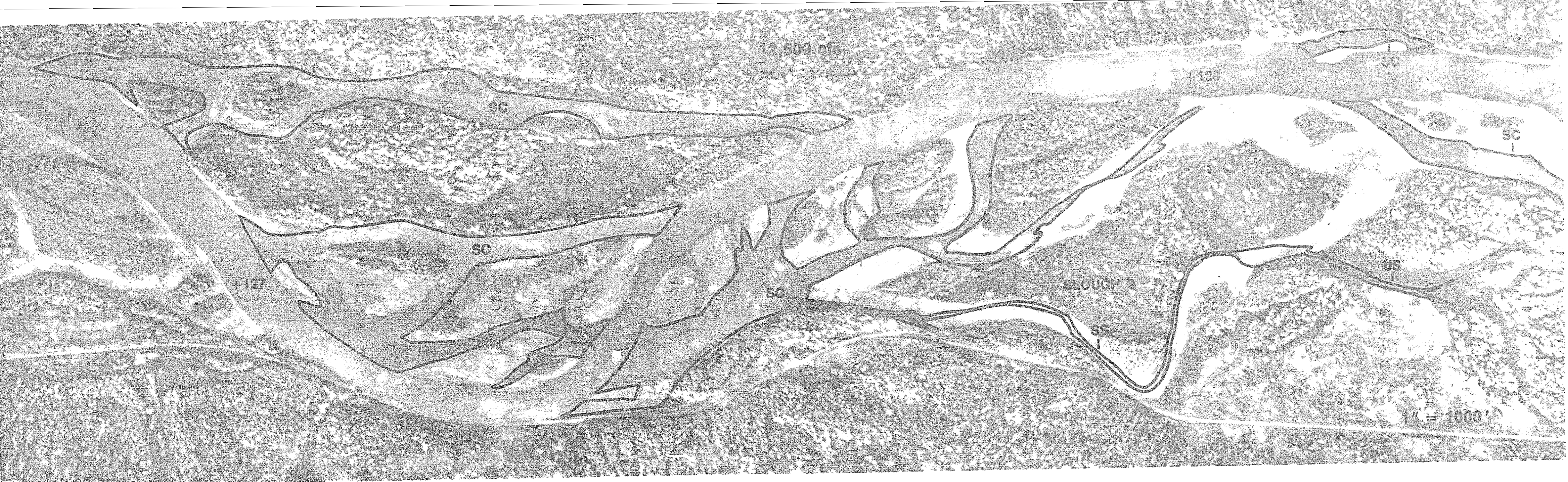
E. WOODY TRIHEY & ASSOCIATES

HARZA-EB
SUSITNA JOINT



LEGEND

MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

MIDDLE SUSITNA RIVER

PLATE 8 OF 18   RIVER MILE 127 TO 129

ALASKA POWER AUTHO
SUSITNA HYDROELECTRIC PRO

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E. WOODY TRIHEY & ASSOCIATES

HARZA-EB
SUSITNA JOINT

LEGEND

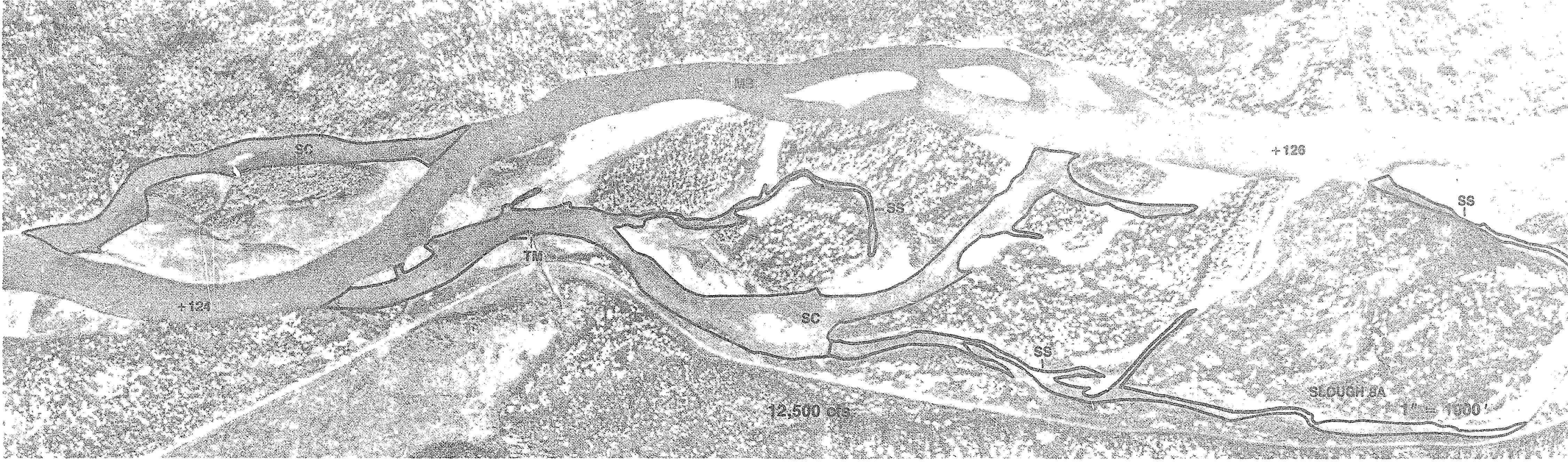
MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

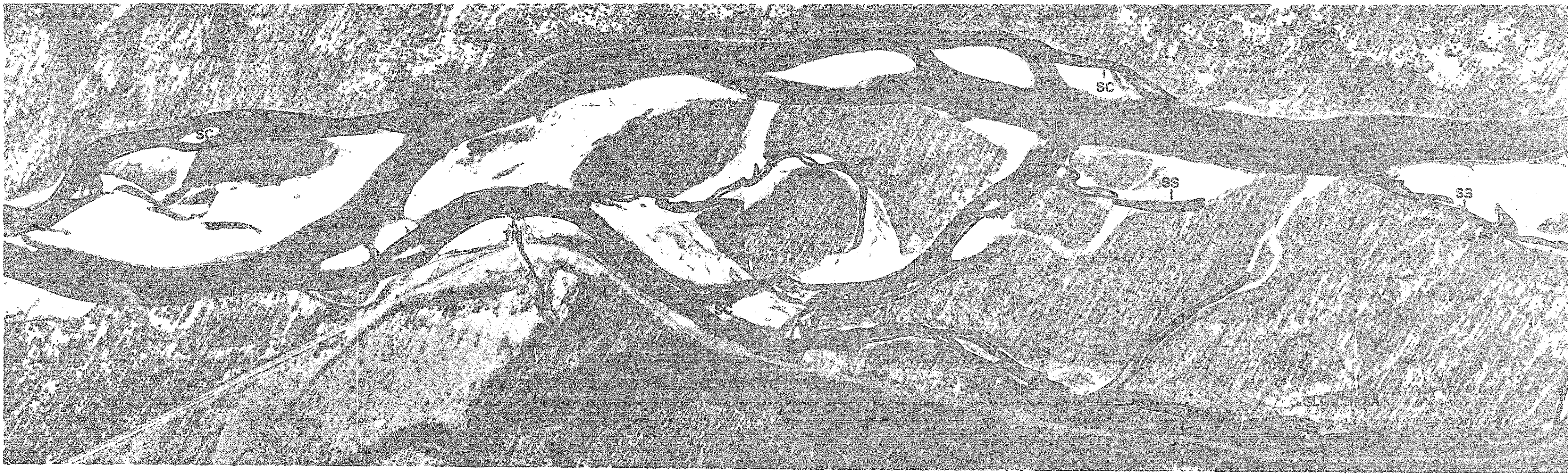
MIDDLE SUSITNA RIVER

PLATE 8 OF 18 RIVER MILE 127 TO 129

ALASKA POWER AUTHOR
SUSITNA HYDROELECTRIC PROJE

EWT&A HARZA-EBA
SUSITNA JOINT VE





LEGEND

MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

MIDDLE SUSITNA RIVER

PLATE 9 OF 18 RIVER MILE 124 TO 126

ALASKA POWER AUTHO
SUSITNA HYDROELECTRIC PROJ

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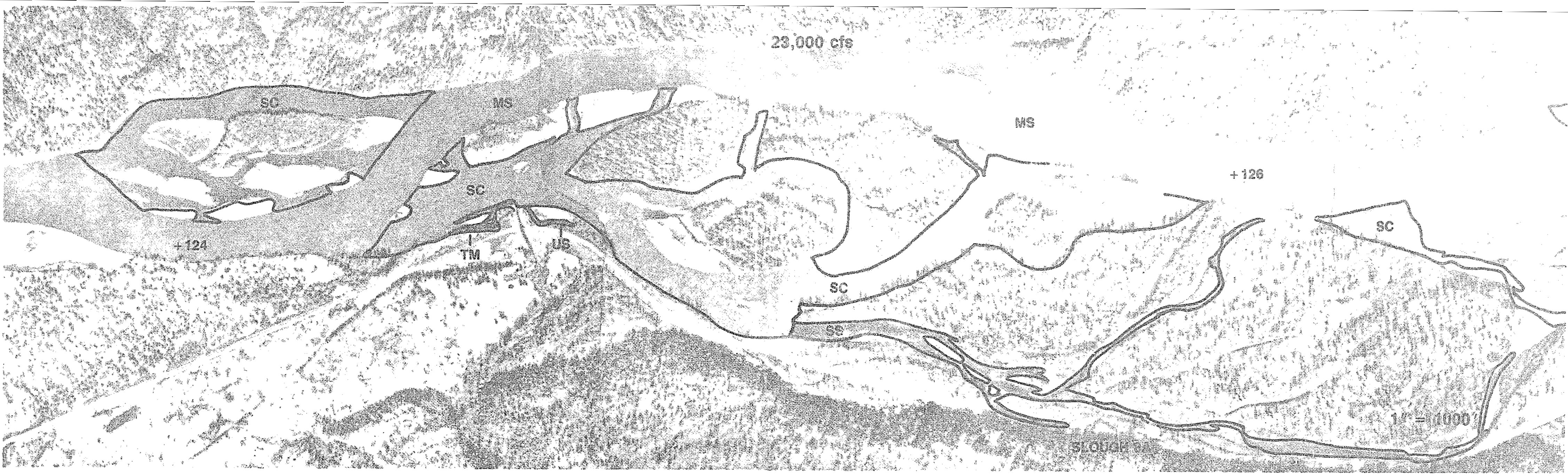
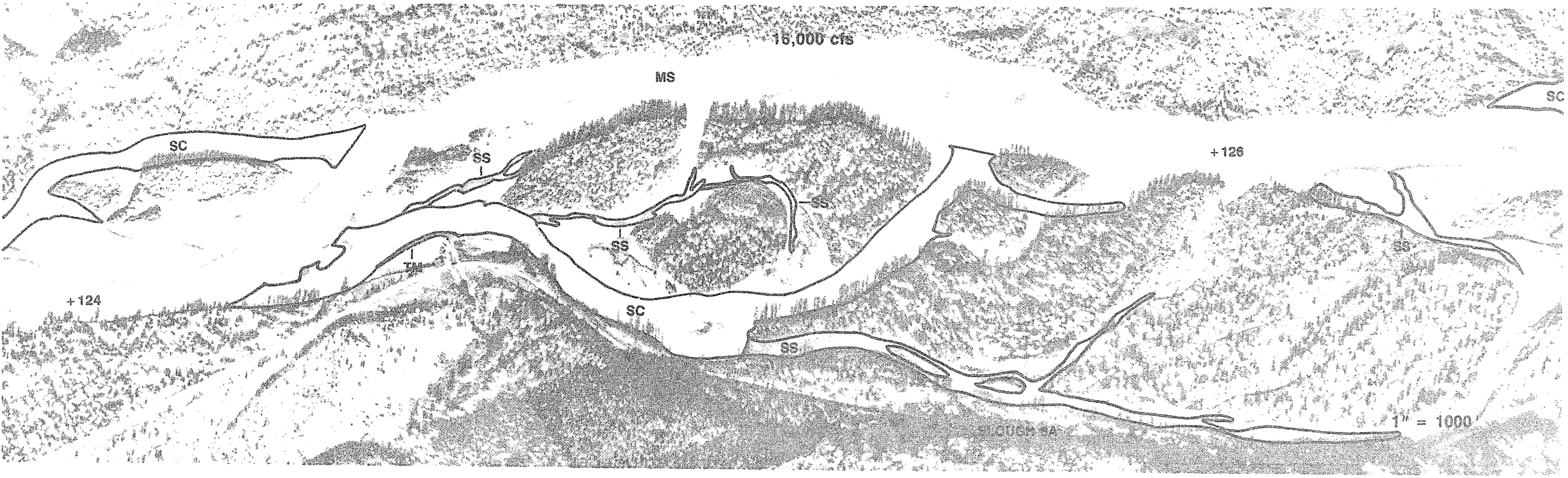
E. WOODY TRIHEY & ASSOCIATES

HARZA-EBA
SUSITNA JOINT V





LEGEND

MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

MIDDLE SUSITNA RIVER

PLATE 9 OF 18 RIVER MILE 124 TO 126

ALASKA POWER AUTHO
SUSITNA HYDROELECTRIC PRO.

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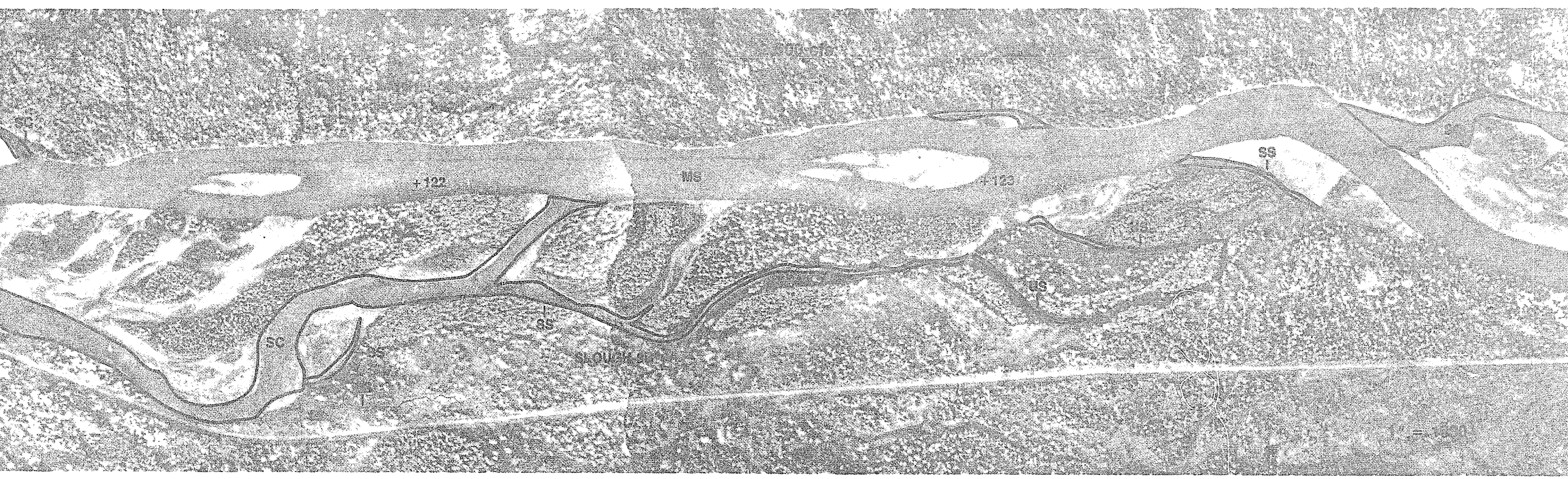
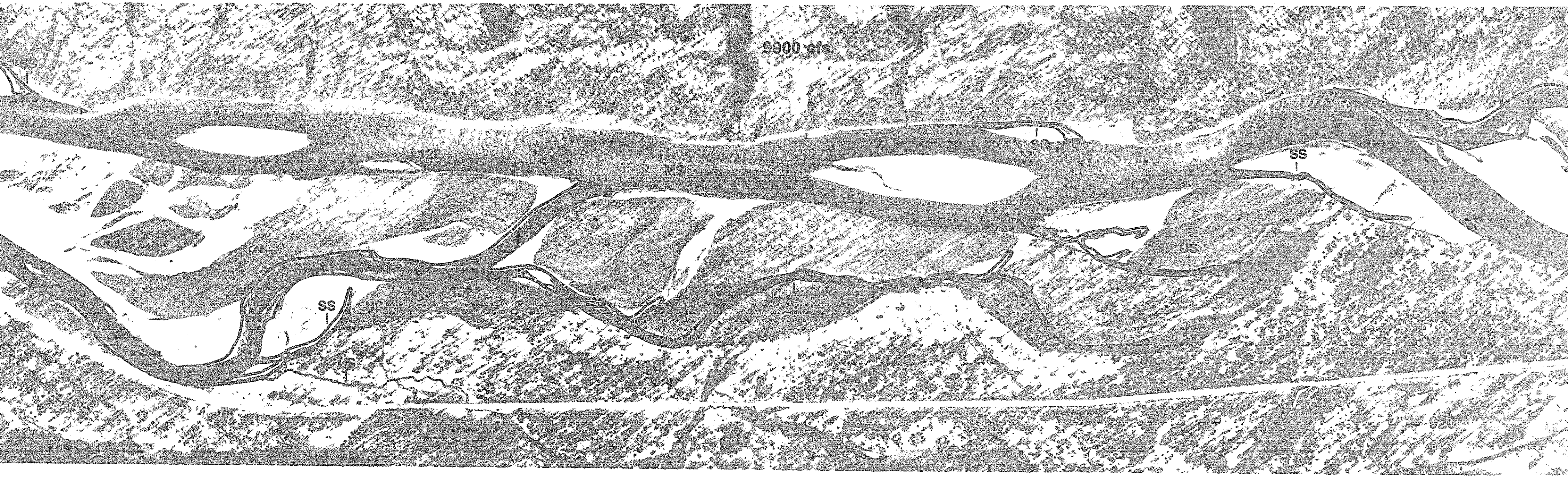
E. WOODY TRIHEY & ASSOCIATES

HARZA-EB
SUSITNA JOINT





LEGEND

MS MAINSTEM
SC SIDE CHANNEL
SS SIDE SLOUGH
US UPLAND SLOUGH
TM TRIBUTARY MOUTH
T TRIBUTARY
\+ RIVER MILE

MIDDLE SUSITNA RIVER

PLATE 10 OF 18 RIVER MILE 122 TO 124

ALASKA POWER AUTHOR
SUSITNA HYDROELECTRIC PROJE

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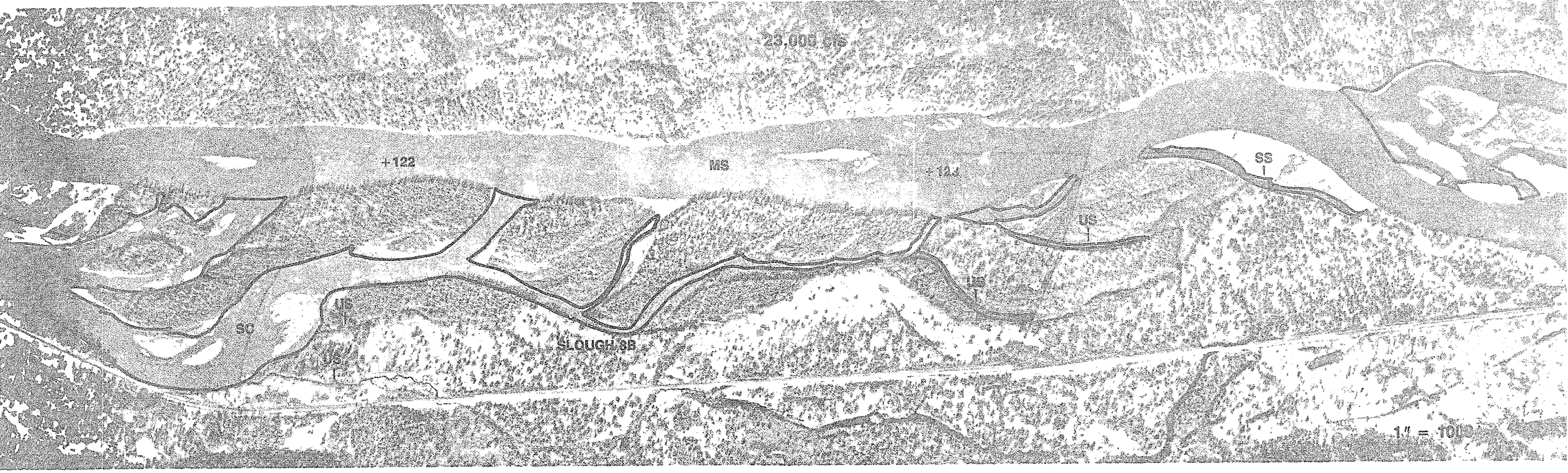
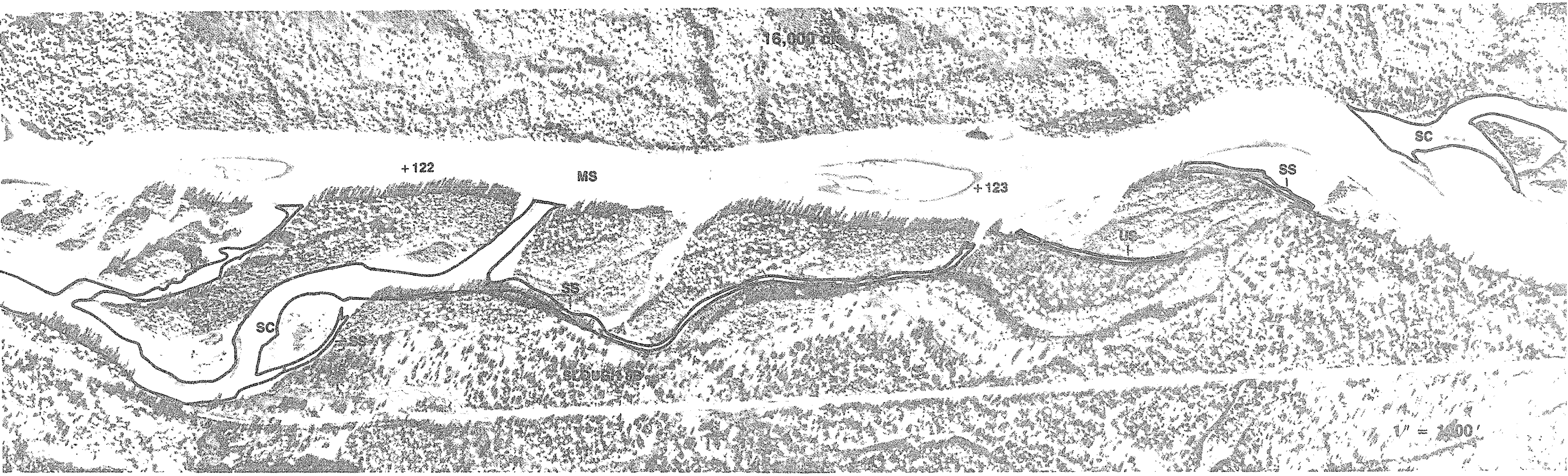
HARZA-EBA
SUSITNA JOINT VE





LEGEND

MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

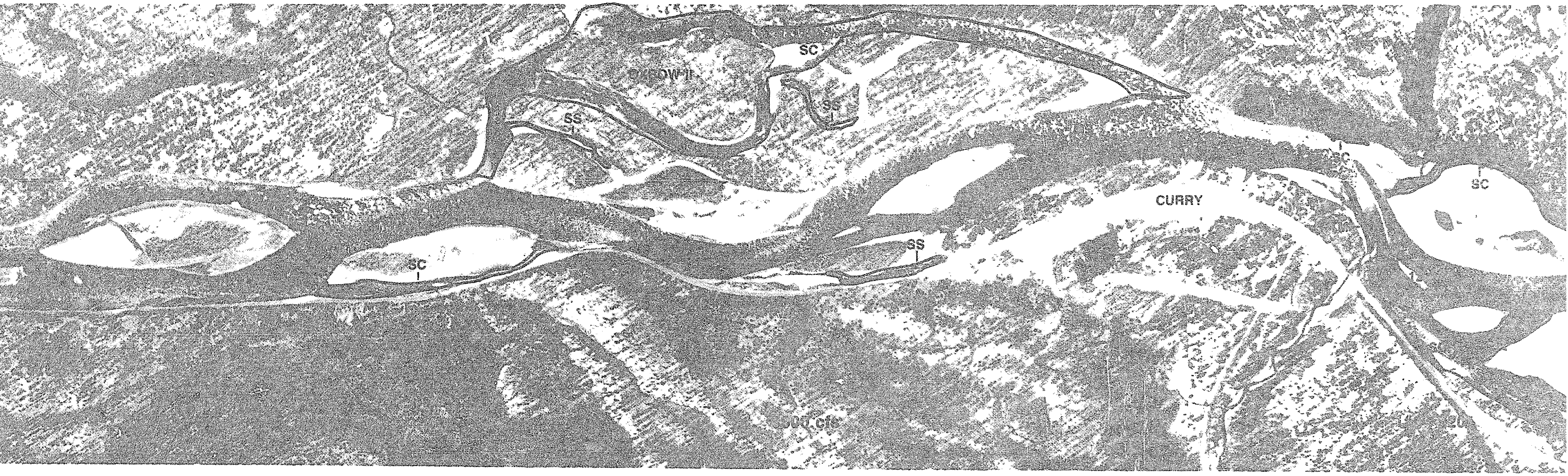
MIDDLE SUSITNA RIVER

PLATE 10 OF 18 RIVER MILE 122 TO 124

ALASKA POWER AUTHOR
SUSITNA HYDROELECTRIC PROJE

EWT&A
E. WOODY TRIHEY & ASSOCIATES

HARZA-EBA
SUSITNA JOINT V



LEGEND

MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

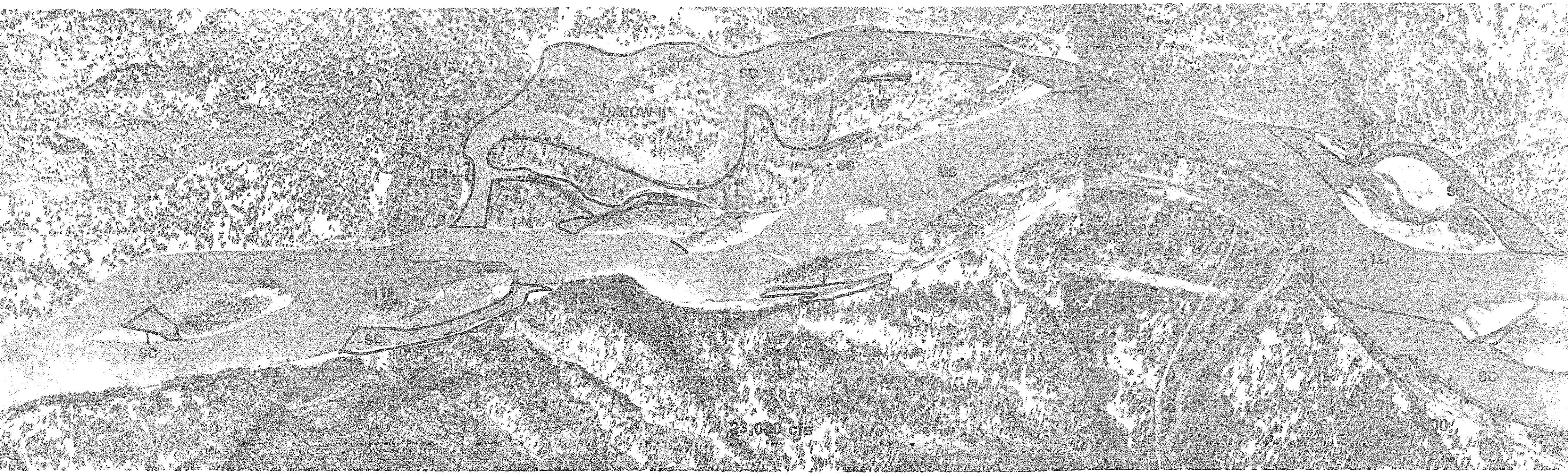
MIDDLE SUSITNA RIVER

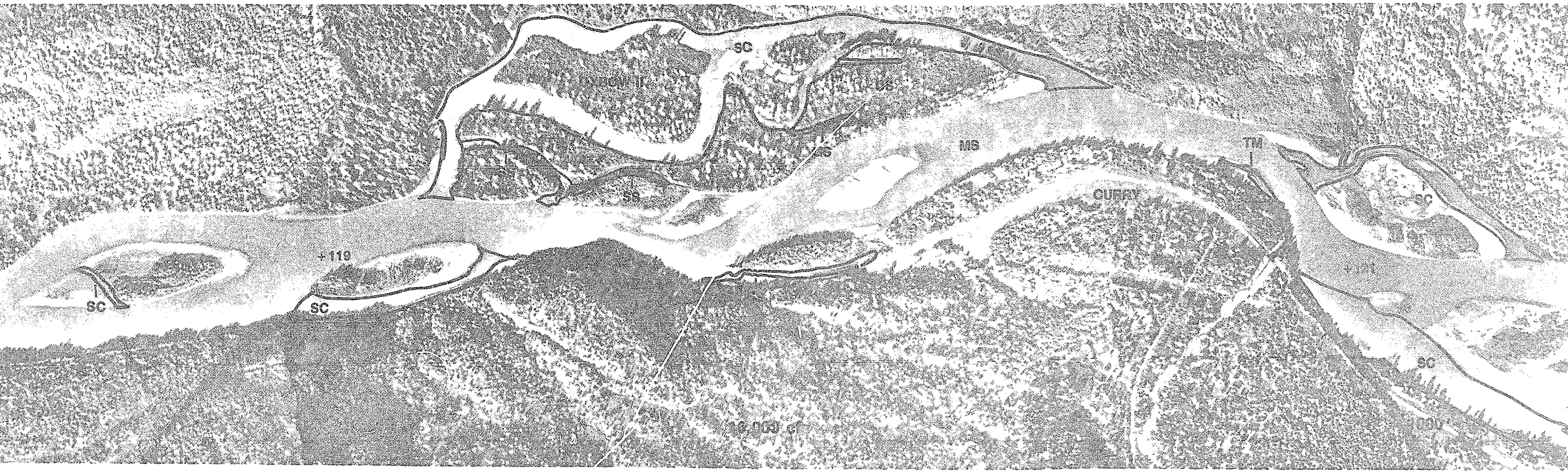
PLATE 11 OF 18 RIVER MILE 119 TO 121

ALASKA POWER AUTHOR
SUSITNA HYDROELECTRIC PROJE

EWT&A
E. WOODY TRIHEY & ASSOCIATES

HARZA-EBA
SUSITNA JOINT VE





EGEND

S MAINSTEM
SIDE CHANNEL
SIDE SLOUGH
UPLAND SLOUGH

TM TRIBUTARY MOUTH
T TRIBUTARY
\+ RIVER MILE

MIDDLE SUSITNA RIVER

PLATE 11 OF 18 RIVER MILE 119 TO 121

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

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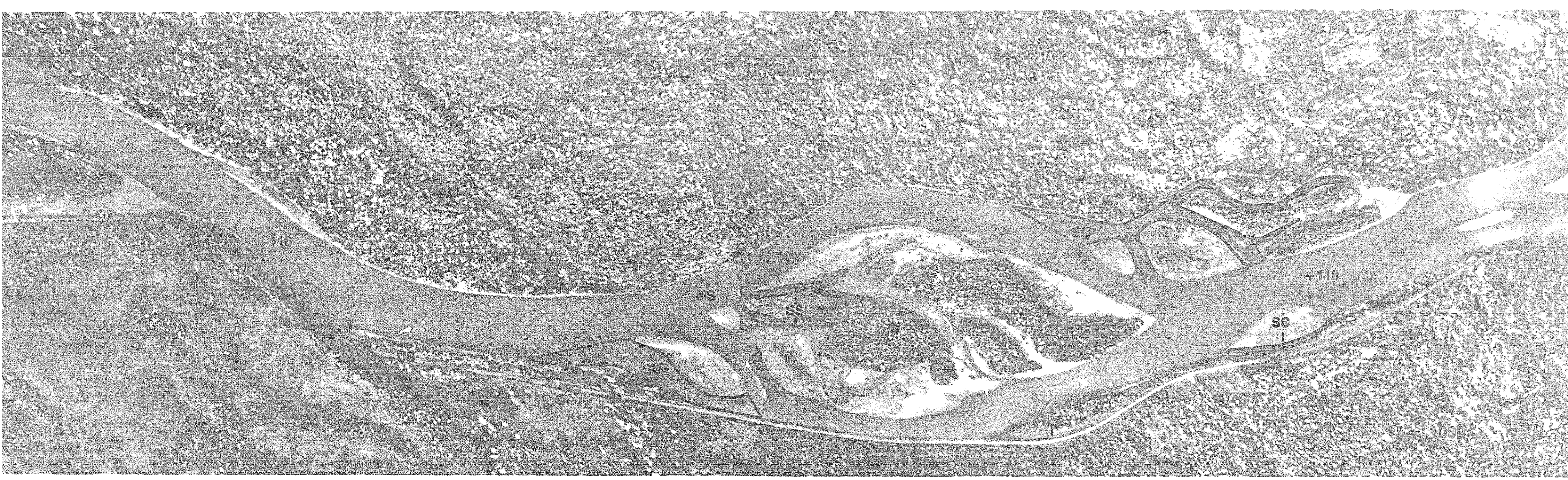
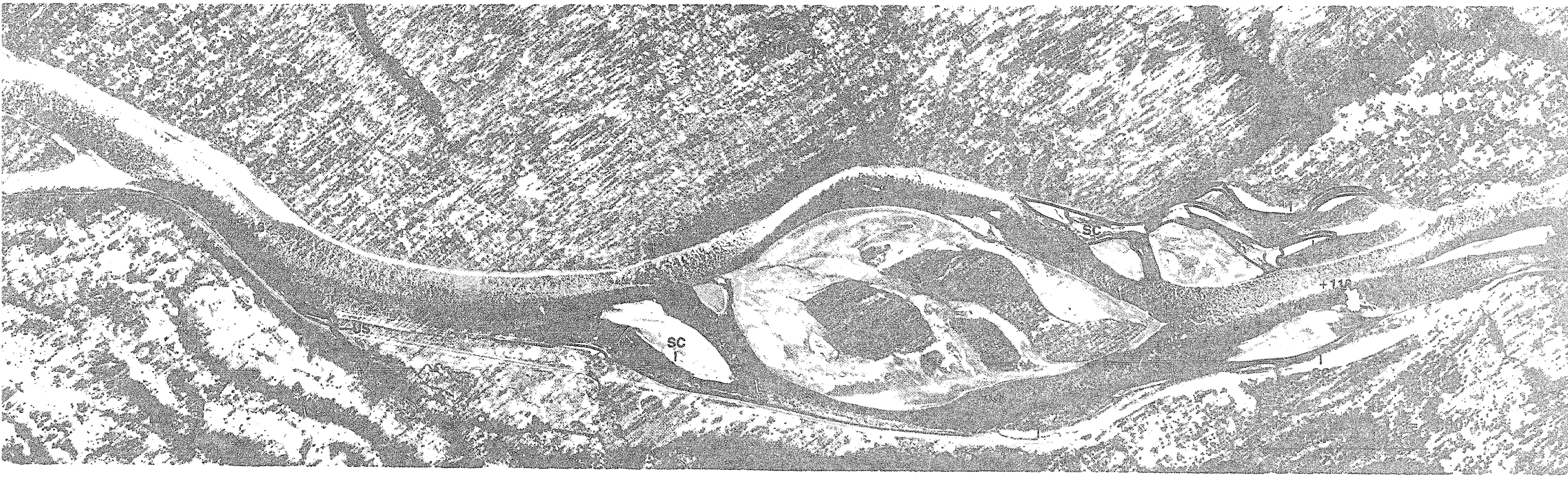
HARZA-EBASCO
SUSITNA JOINT VENTURE





LEGEND

MS MAINSTEM
SC SIDE CHANNEL
SS SIDE SLOUGH
US UPLAND SLOUGH
TM TRIBUTARY MOUTH
T TRIBUTARY
\+ RIVER MILE

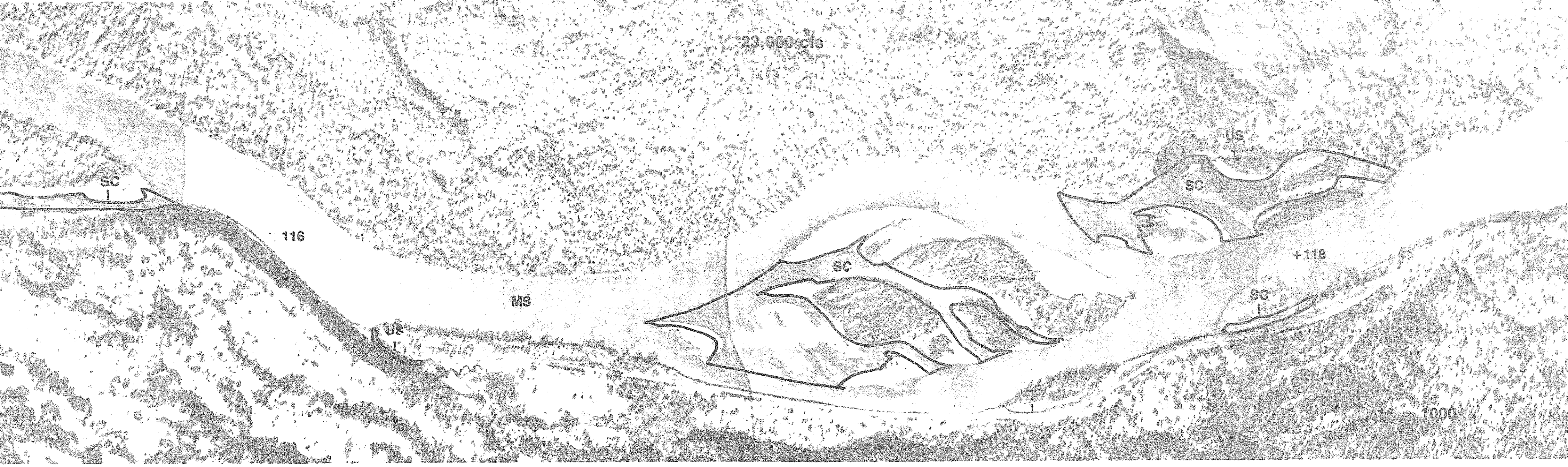
MIDDLE SUSITNA RIVER

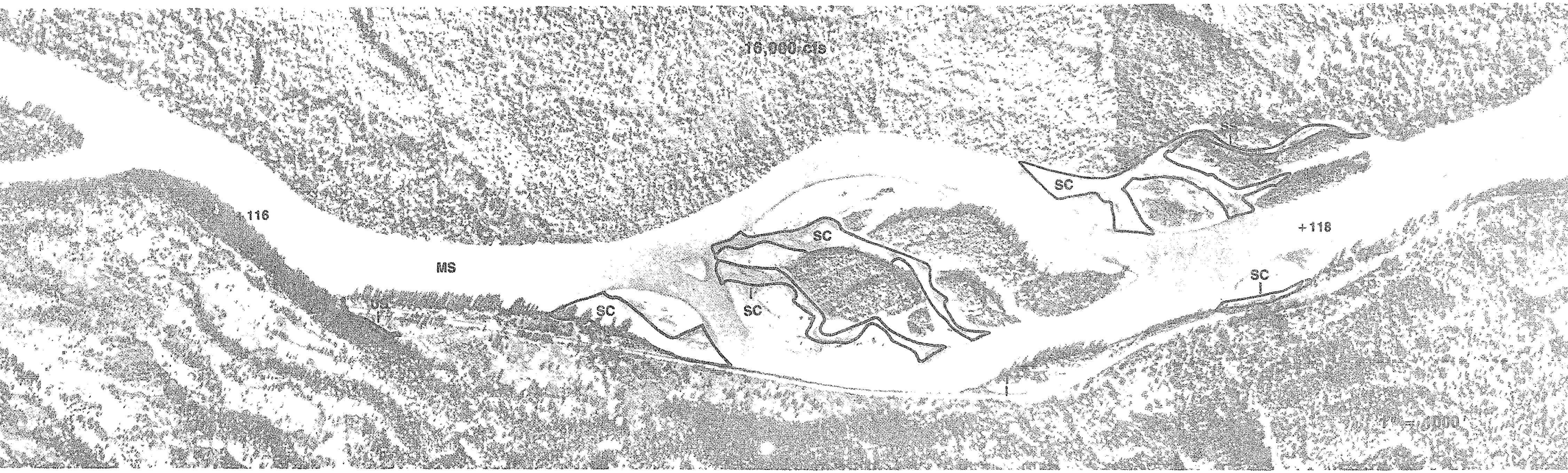
PLATE 12 OF 18 RIVER MILE 116 TO 118

ALASKA POWER AUTHORIT
SUSITNA HYDROELECTRIC PROJEC

EWT&A
E. WOODY TRIHEY & ASSOCIATES

HARZA-EBAS
SUSITNA JOINT VEN





LEGEND

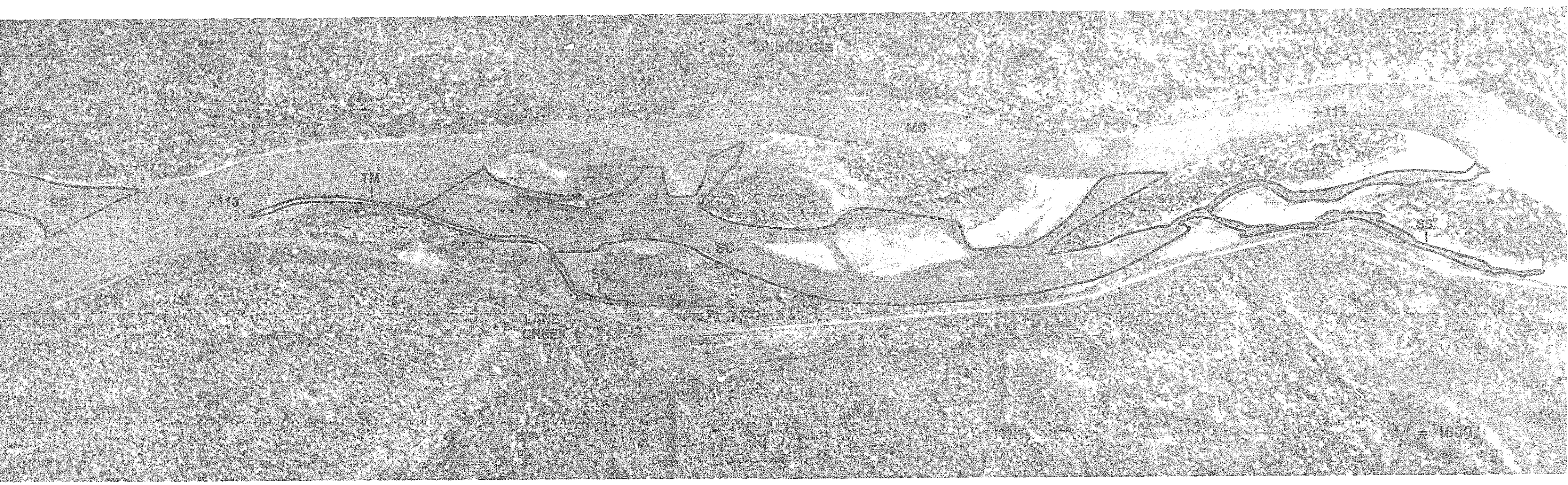
MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

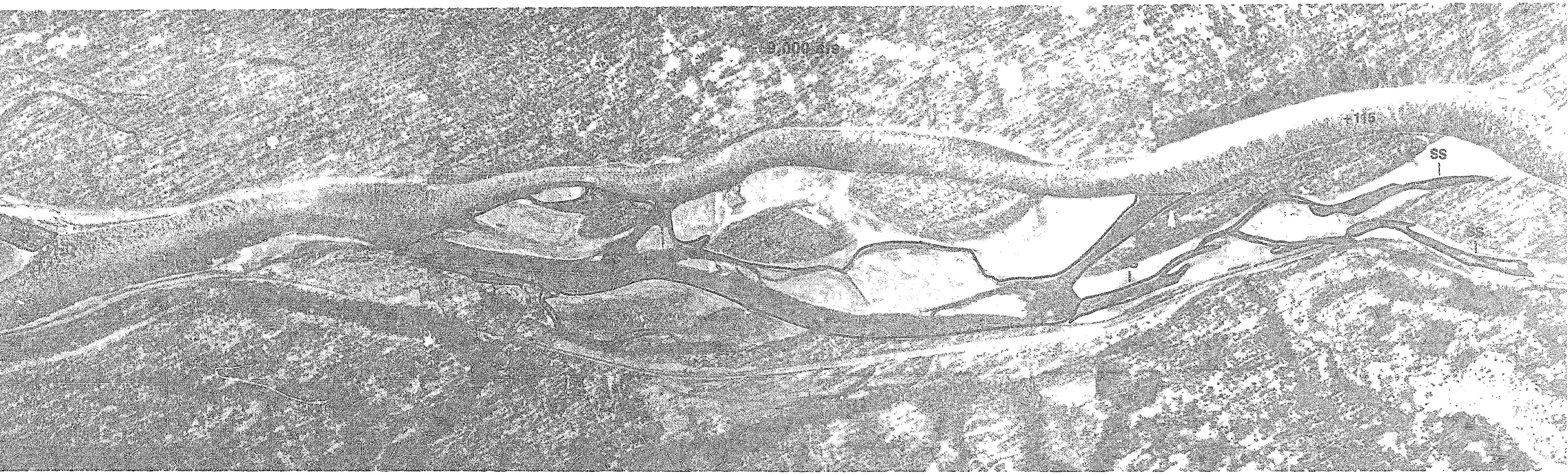
MIDDLE SUSITNA RIVER

PLATE 12 OF 18 RIVER MILE 116 TO 118

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

EWT&A
HARZA-EBASCO
SUSITNA JOINT VENTURE





LEGEND

MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

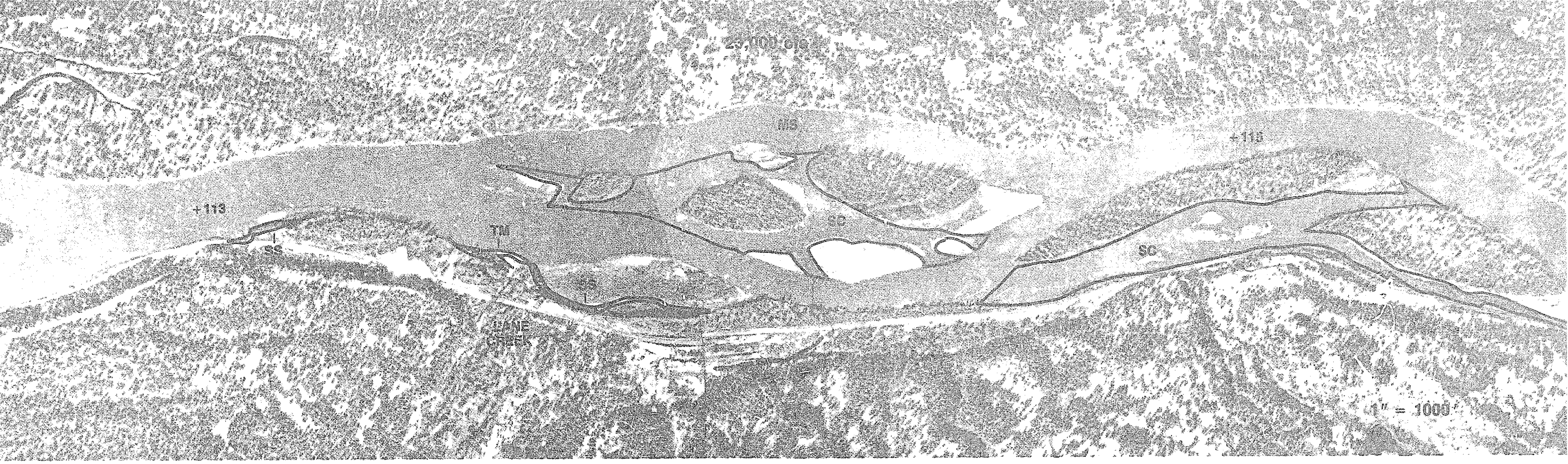
MIDDLE SUSITNA RIVER

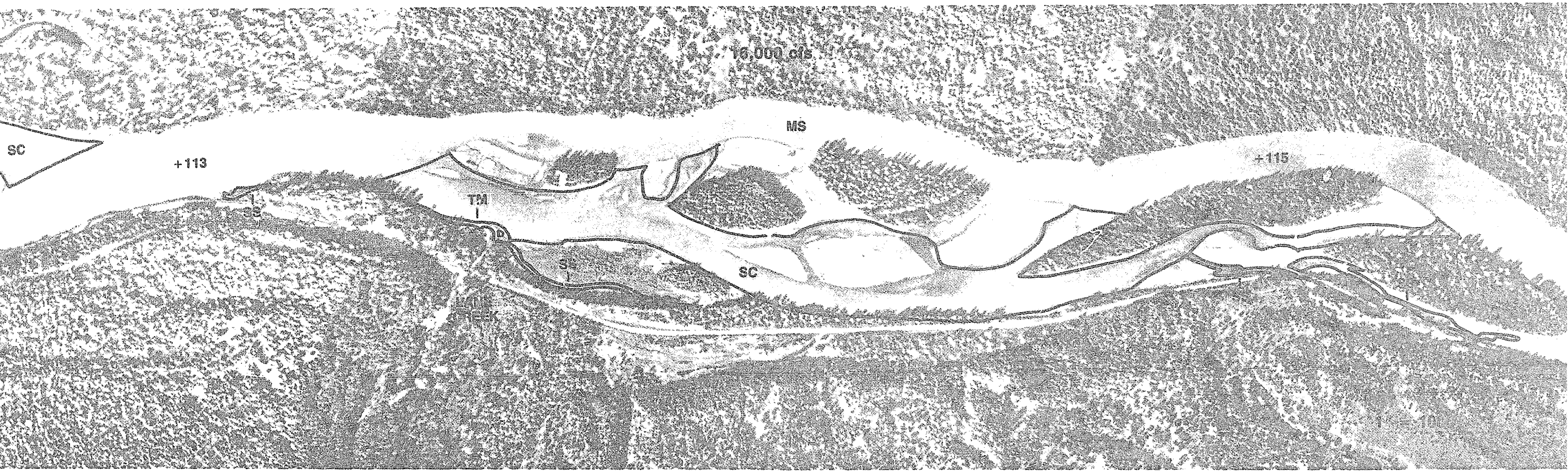
PLATE 13 OF 18 RIVER MILE 113 TO 115

ALASKA POWER AUTHOR
SUSITNA HYDROELECTRIC PROJE

EWT&A
E. WOODY TRIHEY & ASSOCIATES

HARZA-EBA
SUSITNA JOINT VE





EGEND

S	MAINSTEM	TM	TRIBUTARY MOUTH
C	SIDE CHANNEL	T	TRIBUTARY
S	SIDE SLOUGH	+	RIVER MILE
S	UPLAND SLOUGH		

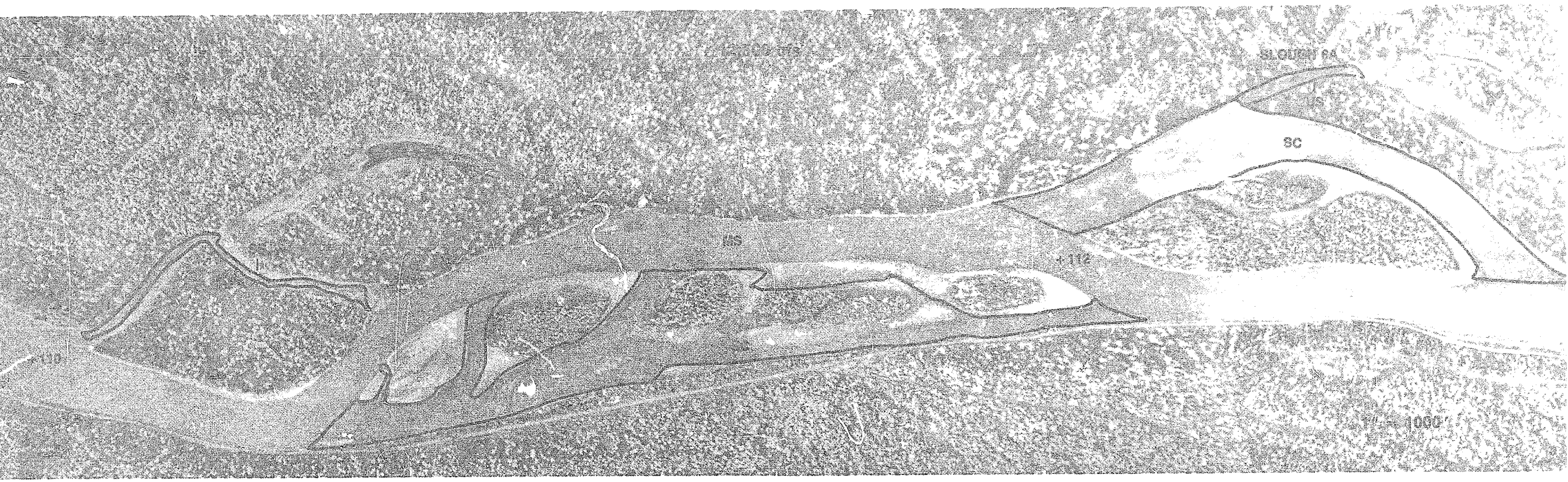
MIDDLE SUSITNA RIVER

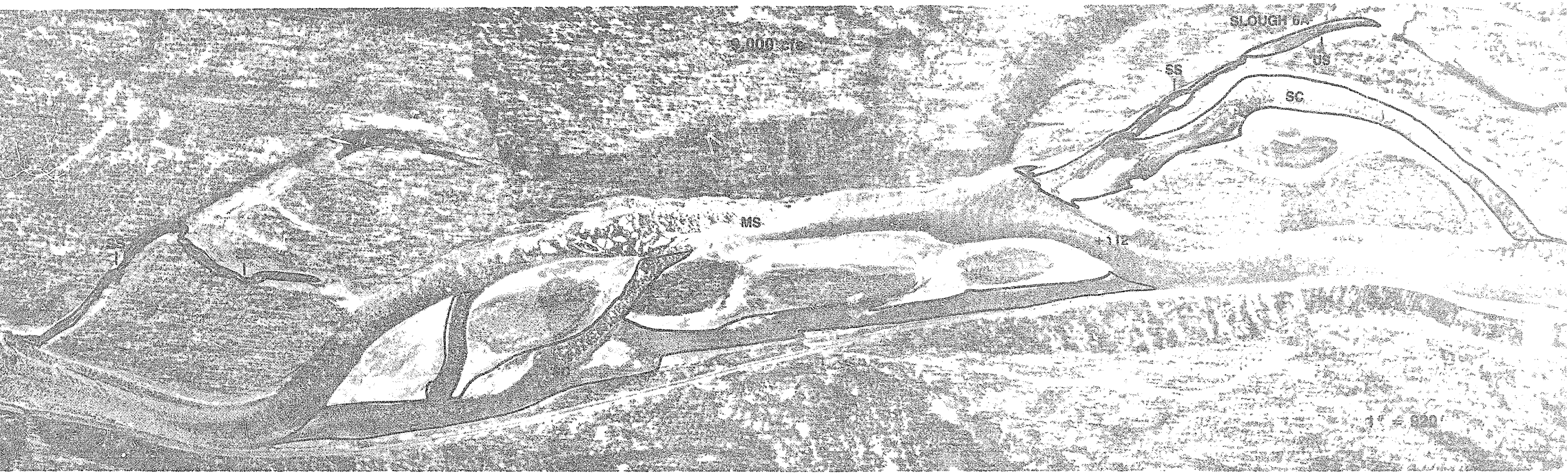
PLATE 13 OF 18 RIVER MILE 113 TO 115

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

EWT&A

HARZA-EBASCO
SUSITNA JOINT VENTUR





EGEND

S	MAINSTEM	TM	TRIBUTARY MOUTH
	SIDE CHANNEL	T	TRIBUTARY
	SIDE SLOUGH	+	RIVER MILE
	UPLAND SLOUGH		

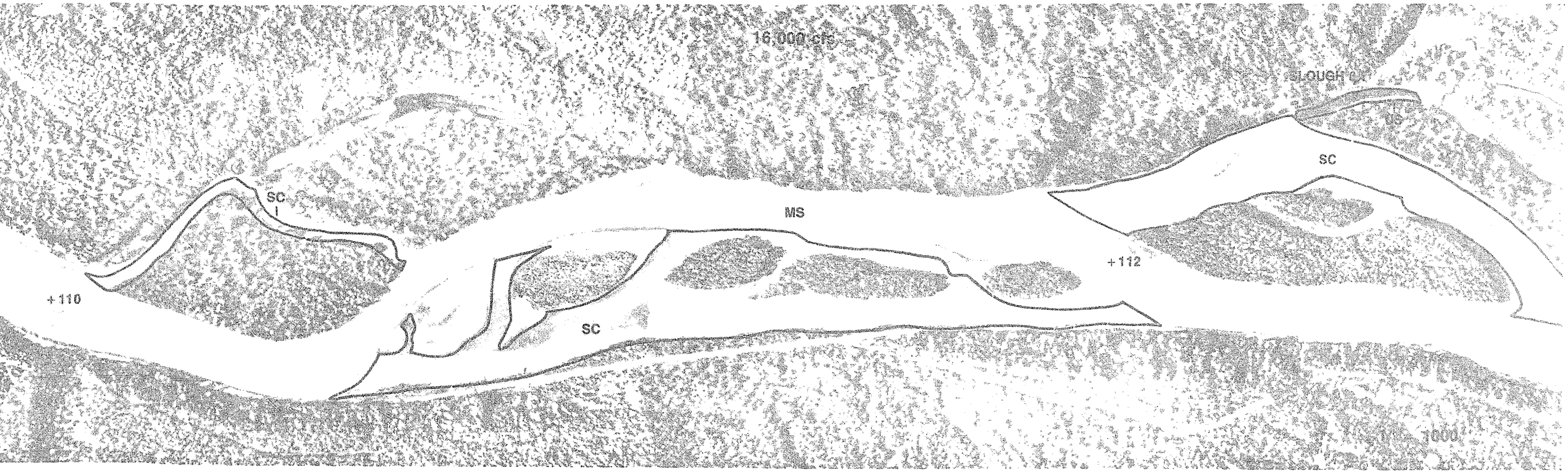
MIDDLE SUSITNA RIVER

PLATE 14 OF 18 RIVER MILE 110 TO 112

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

EWT&A
WOODWARD-CLYDE & ASSOCIATES

HARZA-EBASCO
SUSITNA JOINT VENTURE



LEGEND

MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

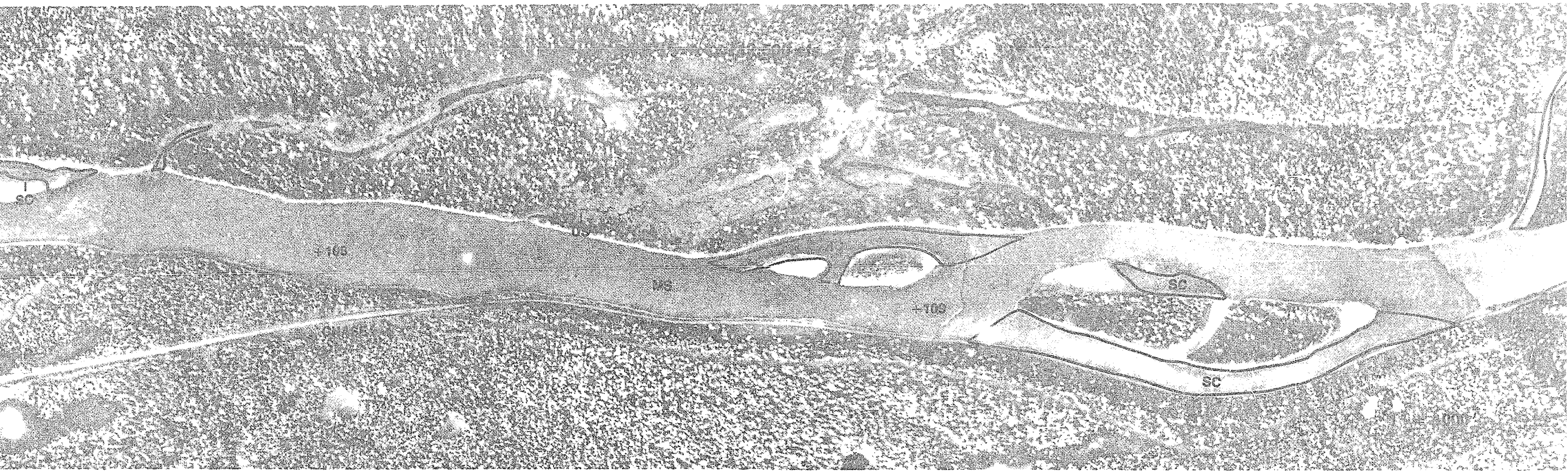
MIDDLE SUSITNA RIVER

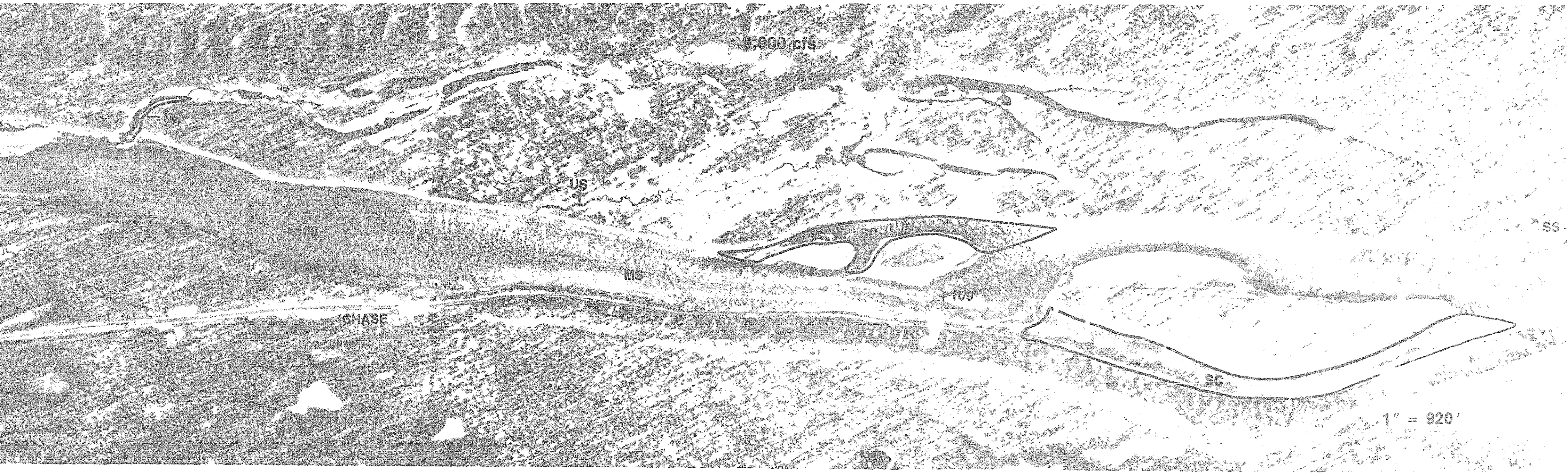
PLATE 14 OF 18 RIVER MILE 110 TO 112

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

EWT&A

HARZA-EBASCO
SUSITNA JOINT VENTURE





LEGEND

MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

MIDDLE SUSITNA RIVER

PLATE 15 OF 18 RIVER MILE 108 TO 110

ALASKA POWER AUTHORIT
SUSITNA HYDROELECTRIC PROJECT

EWT&A | HARZA-EBASC
SUSITNA JOINT VENTU

LEGEND

MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

MIDDLE SUSITNA RIVER

PLATE 15 OF 18 RIVER MILE 108 TO 110

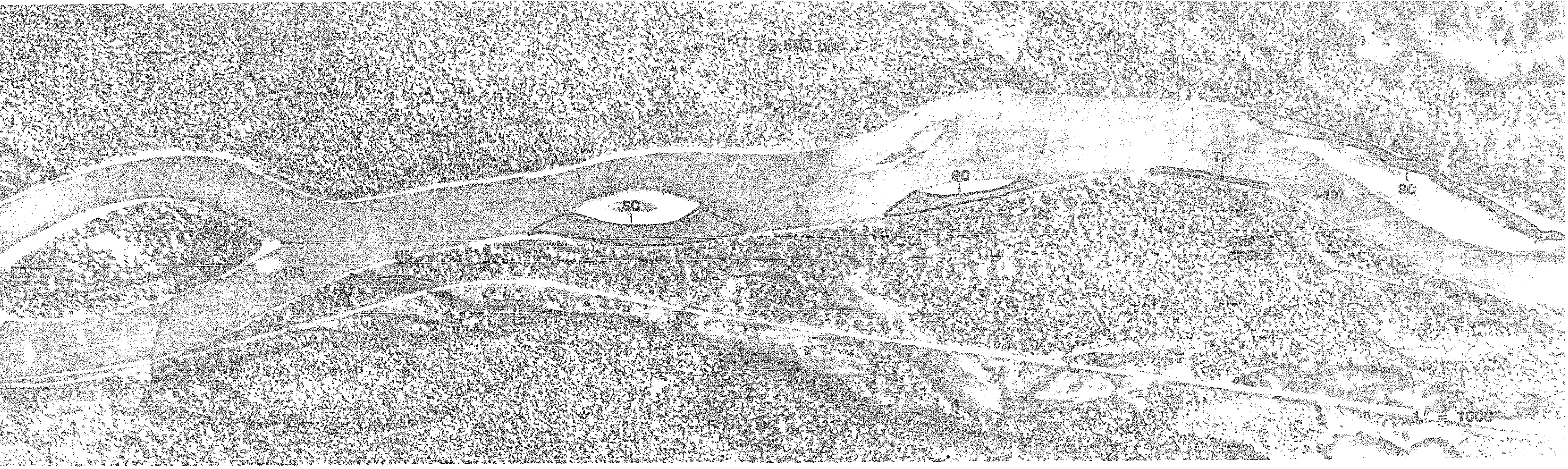
ALASKA POWER AUTHO

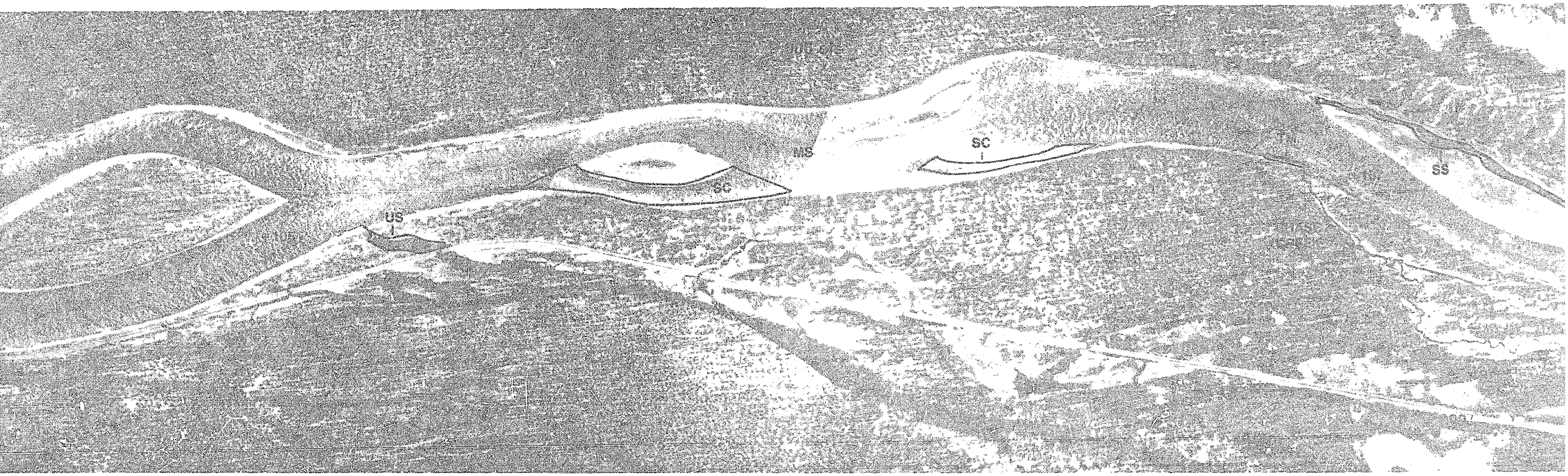
SUSITNA HYDROELECTRIC PROJ

EWT&A

HARZA-EB

SUSITNA JOINT V





LEGEND

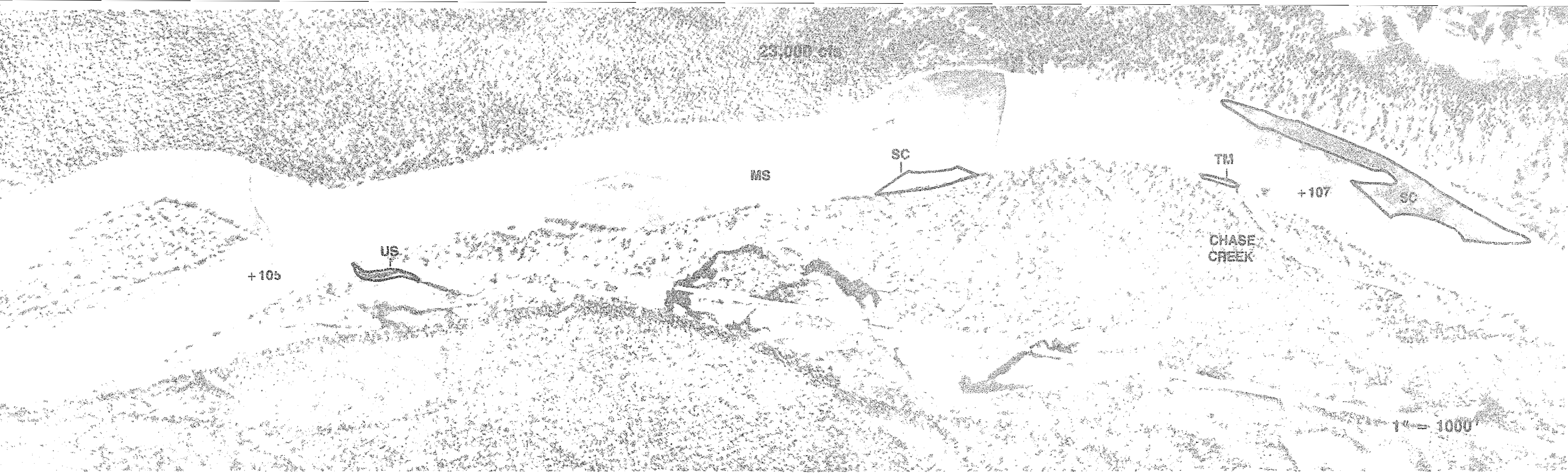
MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

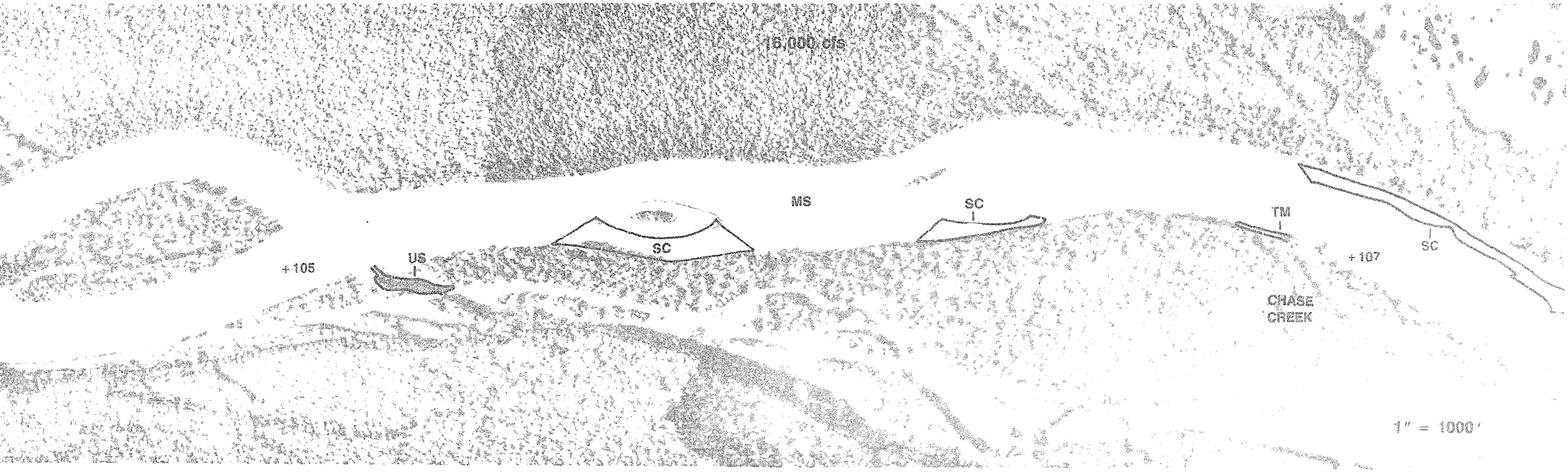
MIDDLE SUSITNA RIVER

PLATE 16 OF 18 RIVER MILE 105 TO 107

ALASKA POWER AUT[illegible]
SUSITNA HYDROELECTRIC PROJ[illegible]

EWT&A
[illegible]
SUSITNA JOINT V[illegible]





LEGEND

MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

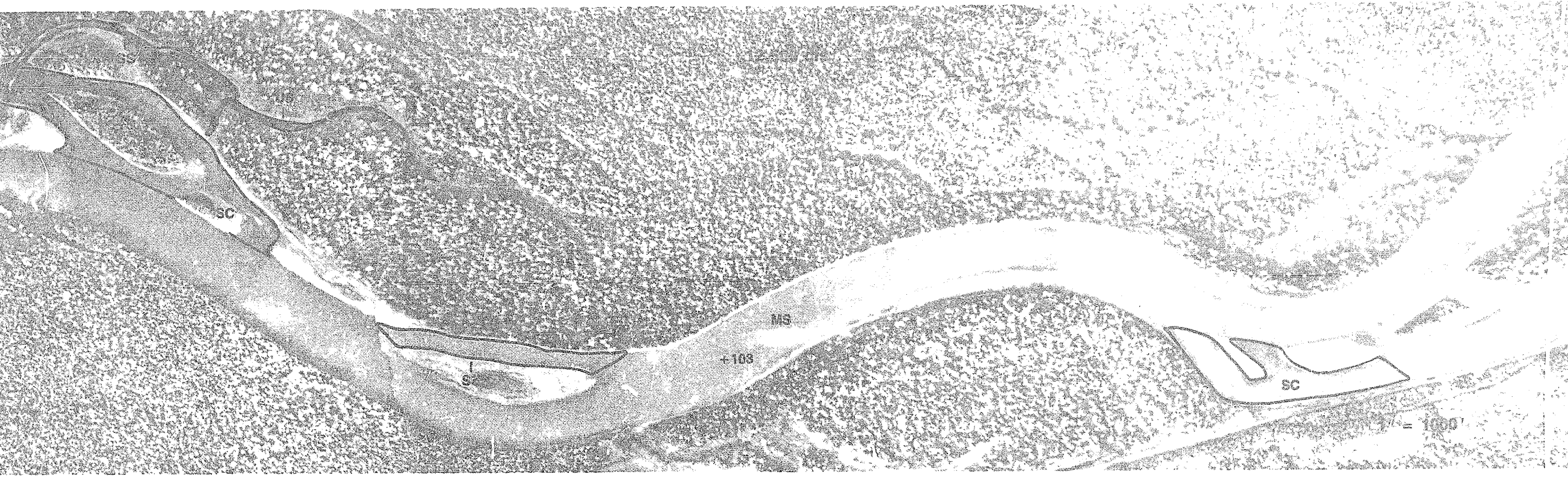
MIDDLE SUSITNA RIVER

PLATE 16 OF 18 RIVER MILE 105 TO 107

ALASKA POWER AUTHOR
SUSITNA HYDROELECTRIC PROJE

EWT&A

SUSITNA JOINT VE



LEGEND

MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

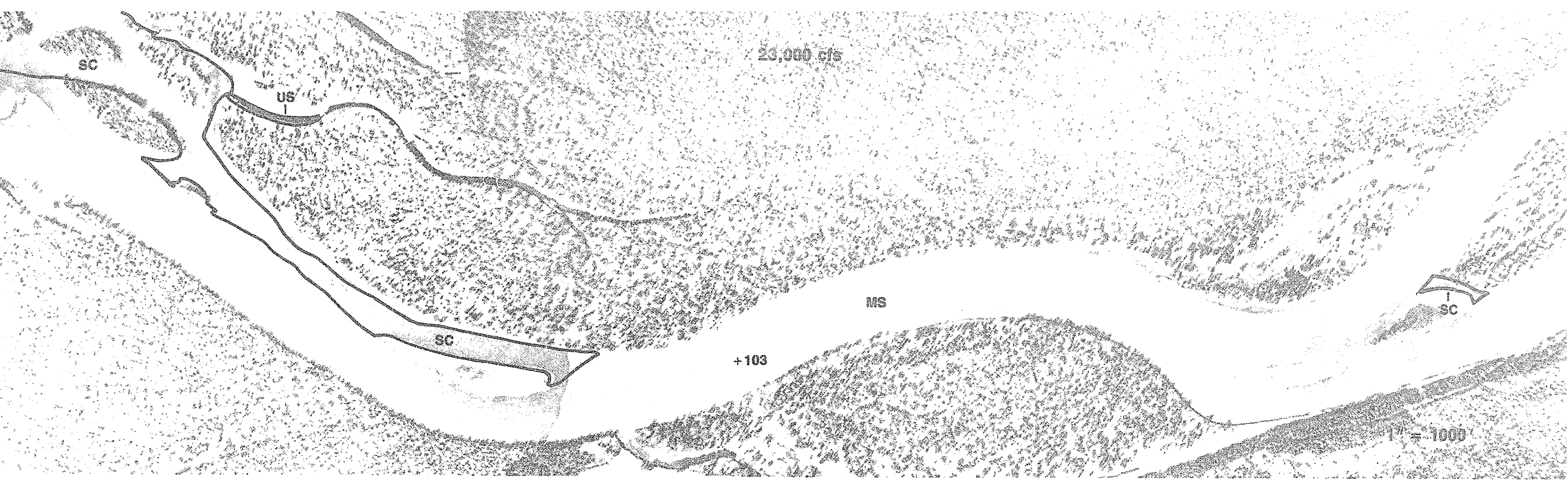
MIDDLE SUSITNA RIVER

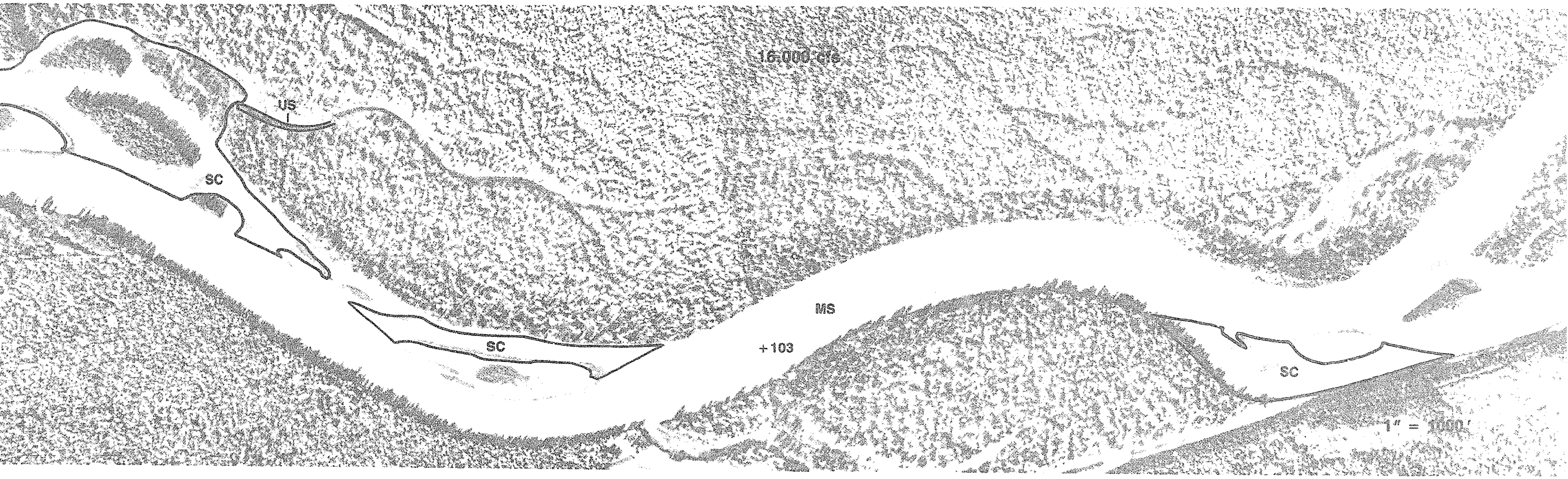
PLATE 17 OF 18 RIVER MILE 102 TO 104

ALASKA POWER AUTHORI
SUSITNA HYDROELECTRIC PROJECT

EWT&A

SUSITNA JOINT VENT





LEGEND

MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

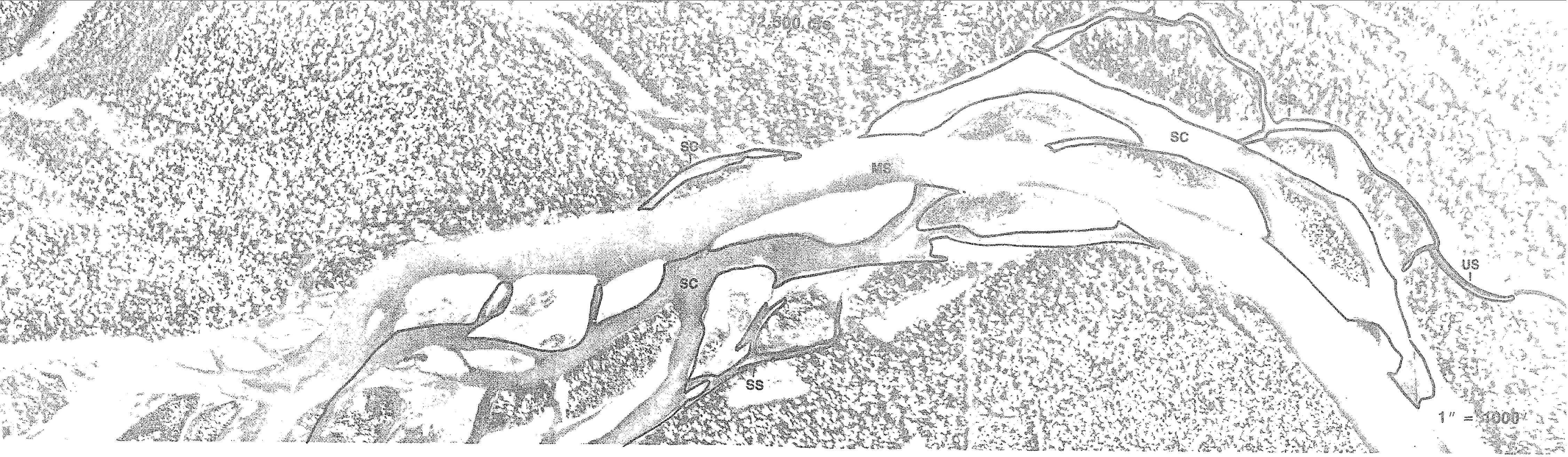
MIDDLE SUSITNA RIVER

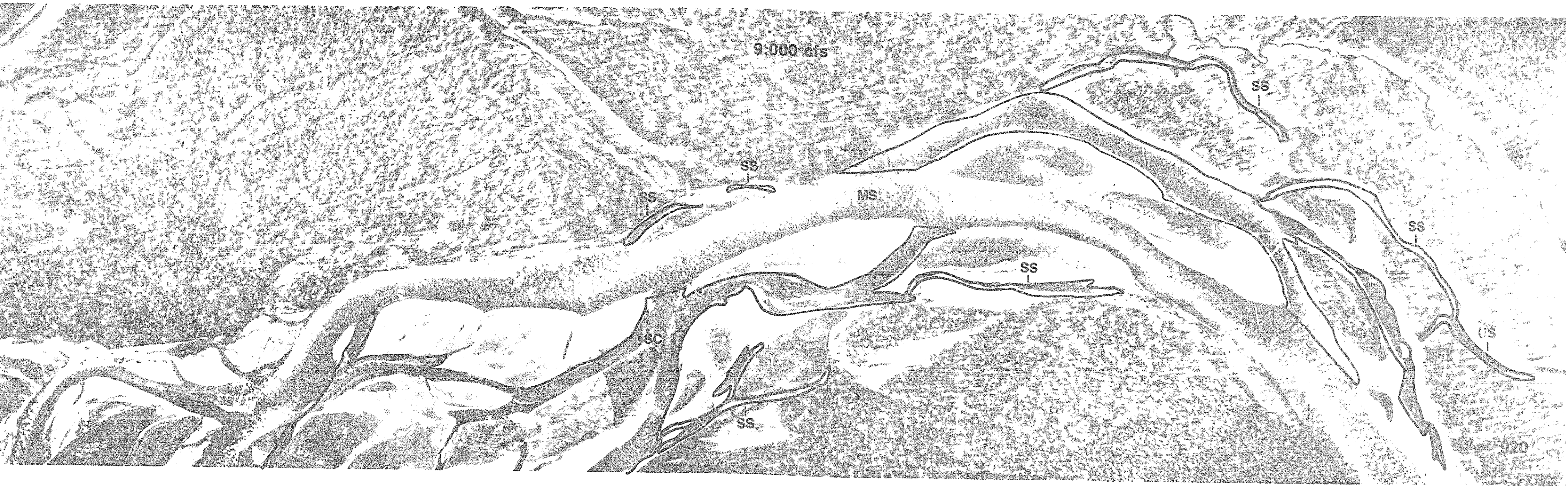
PLATE 17 OF 18 RIVER MILE 102 TO 104

ALASKA POWER AUTHORI
SUSITNA HYDROELECTRIC PROJEC

EWT&A
E. WOODY TRIHEY & ASSOCIATES

HARZA-EBAS
SUSITNA JOINT VEN





LEGEND

IS	MAINSTEM	TM	TRIBUTARY MOUTH
C	SIDE CHANNEL	T	TRIBUTARY
S	SIDE SLOUGH	+	RIVER MILE
JS	UPLAND SLOUGH		

MIDDLE SUSITNA RIVER

PLATE 18 OF 18 RIVER MILE 101 TO 102

ALASKA POWER AUTHORIT
SUSITNA HYDROELECTRIC PROJECT

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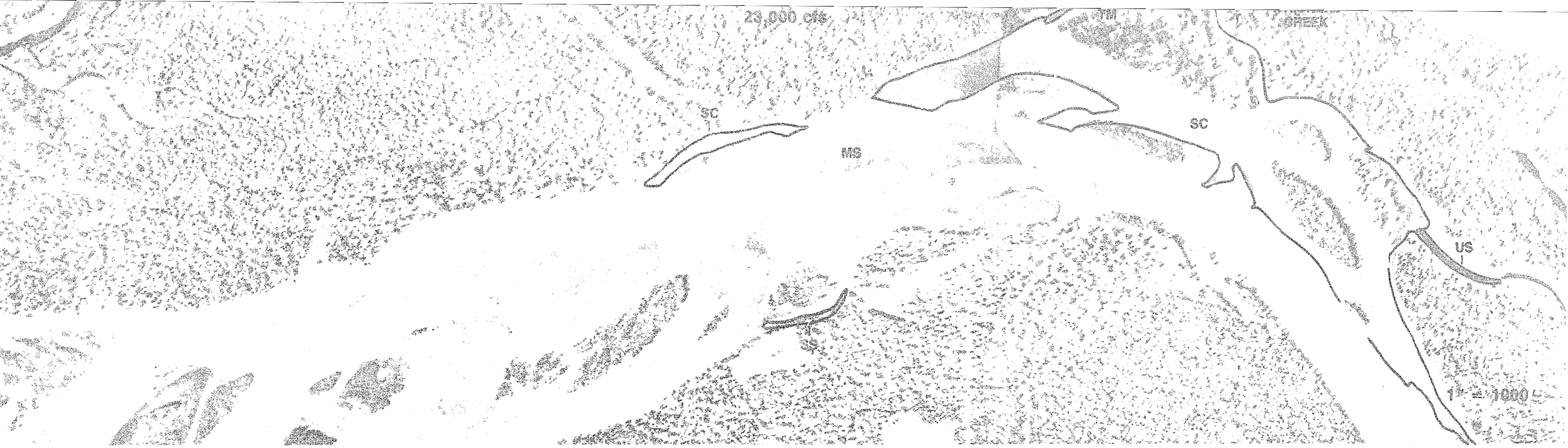
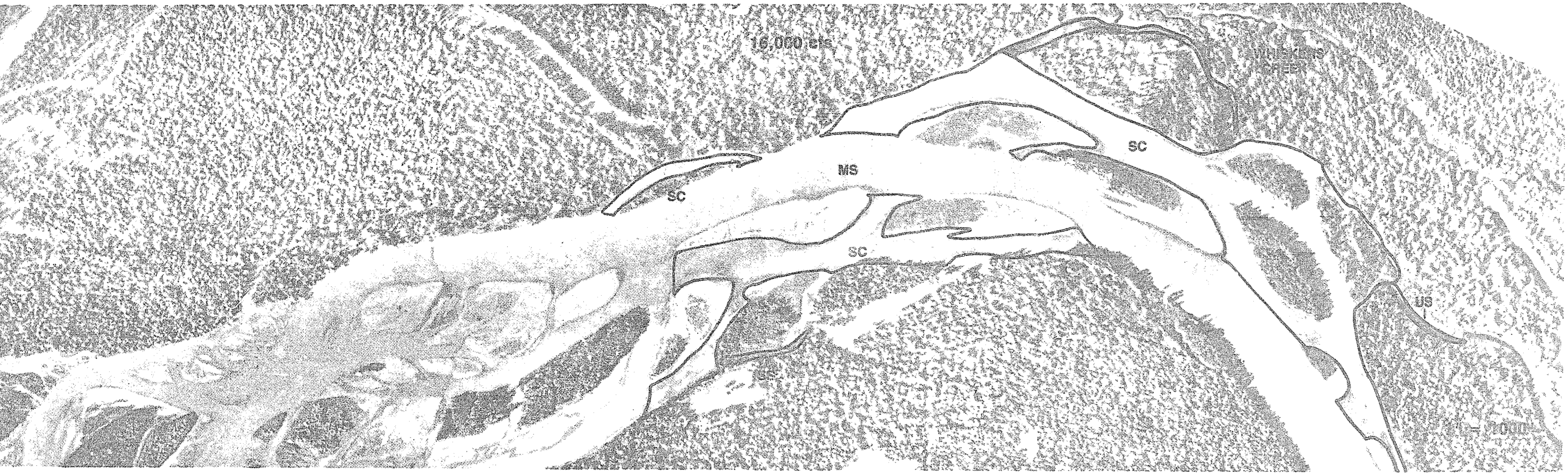
HARZA-EBASC
SUSITNA JOINT VENT





LEGEND

MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

MIDDLE SUSITNA RIVER

PLATE 18 OF 18 RIVER MILE 101 TO 102

ALASKA POWER AUTHOR
SUSITNA HYDROELECTRIC PROJE

EWT&A

HARZA-EBA
SUSITNA JOINT VE

Appendix 2. Digitized surface area totals by habitat type for each individual plate for four Gold Creek mainstem discharges.

Legend

Flow 1 = 9000 cfs	Type 1 = Mainstem	Type 5 = Tributary mouth	Type 9 = Background
Flow 2 = 12,500 cfs	Type 2 = Side channel	Type 6 = Tributary	
Flow 3 = 16,000 cfs	Type 3 = Side slough	Type 7 = Gravel bars	
Flow 4 = 23,000 cfs	Type 4 = Upland slough	Type 8 = Vegetated bars	

FLOW 1 PLATE # 1
TOTAL NUMBER 21
TOTAL AREA SQ. IN. 8.0881

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	5.5398	4	1.3850	68.5
TYPE 2	0.0000	0	0.0000	0.0
TYPE 3	0.0000	0	0.0000	0.0
TYPE 4	0.0000	0	0.0000	0.0
TYPE 5	.1217	1	.1217	1.5
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	1.9730	15	.1315	24.4
TYPE 8	.5126	1	.5126	6.3
TYPE 9	0.0000	0	0.0000	0.0
TOTAL	8.1471	21.	.2390	100.7

FLOW 1 PLATE # 2
TOTAL NUMBER 34
TOTAL AREA SQ. IN. 14.0699

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	5.3754	3	1.7918	38.2
TYPE 2	1.5340	2	.7670	10.9
TYPE 3	.0947	3	.0316	.7
TYPE 4	0.0000	0	0.0000	0.0
TYPE 5	.0119	1	.0119	.1
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	3.3103	19	.1742	23.5
TYPE 8	3.7125	6	.6188	26.4
TYPE 9	0.0000	0	0.0000	0.0
TOTAL	14.0388	34.	.3772	99.8

FLOW 1 PLATE # 3
TOTAL NUMBER 49
TOTAL AREA SQ. IN. 17.8021

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	4.6978	2	2.3489	26.4
TYPE 2	1.7992	4	.4498	10.1
TYPE 3	.6678	9	.0742	3.8
TYPE 4	0.0000	0	0.0000	0.0
TYPE 5	0.0000	[illegible]	0.0000	0.0
TYPE 6	.0054	[illegible]	.0054	.0
TYPE 7	5.4581	[illegible]	.2481	30.7
TYPE 8	2.2650	[illegible]	.2831	12.7
TYPE 9	3.0038	[illegible]	1.0013	16.9
TOTAL	17.8971	49.	.4901	100.5

FLOW 1 PLATE # 4
TOTAL NUMBER 94
TOTAL AREA SQ. IN. 37.4011

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	5.8082	3	1.9361	15.5
TYPE 2	1.8520	6	.3087	5.0
TYPE 3	.3992	6	.0665	1.1
TYPE 4	.0773	6	.0129	.2
TYPE 5	.1402	2	.0701	.4
TYPE 6	.0117	2	.0059	.0
TYPE 7	3.8767	51	.0760	10.4
TYPE 8	1.0151	10	.1015	2.7
TYPE 9	22.5385	8	2.8173	60.3
TOTAL	35.7189	94.	.5994	95.5

FLOW 1 PLATE # 5
TOTAL NUMBER 97
TOTAL AREA SQ. IN. 39.4822

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	6.5130	8	.8141	16.5
TYPE 2	.6160	3	.2053	1.6
TYPE 3	.6290	14	.0449	1.6
TYPE 4	.1856	4	.0464	.5
TYPE 5	.1947	2	.0974	.5
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	6.4325	40	.1608	16.3
TYPE 8	3.1299	16	.1956	7.9
TYPE 9	21.8094	10	2.1809	55.2
TOTAL	39.5101	97.	.4162	100.1

FLOW 1 PLATE # 6
TOTAL NUMBER 111
TOTAL AREA SQ. IN. 34.1038

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	4.9980	6	.8330	14.7
TYPE 2	3.0804	7	.4401	9.0
TYPE 3	.4457	4	.1114	1.3
TYPE 4	.1373	4	.0343	.4
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	7.6213	63	.1210	22.3
TYPE 8	5.9873	20	.2994	17.6
TYPE 9	12.0030	7	1.7147	35.2
TOTAL	34.2[illegible]0	111.	.3749	100.5

FLOW 1 PLATE #
TOTAL NUMBER 87
TOTAL AREA SQ. IN. 34.8982

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	4.7619	5	.9524	13.6
TYPE 2	3.4277	6	.5713	9.8
TYPE 3	.7019	2	.3510	2.0
TYPE 4	.0056	1	.0056	.0
TYPE 5	.0366	1	.0366	.1
TYPE 6	.0570	2	.0285	.2
TYPE 7	7.1375	43	.1660	20.5
TYPE 8	5.9161	21	.2817	17.0
TYPE 9	12.7537	6	2.1256	36.5
TOTAL	34.7980	87.	.5021	99.7

FLOW 1 PLATE # 8
TOTAL NUMBER 93
TOTAL AREA SQ. IN. 36.5725

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	6.6199	4	1.6550	18.1
TYPE 2	3.0702	6	.5117	8.4
TYPE 3	.4640	3	.1547	1.3
TYPE 4	.0806	1	.0806	.2
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	.0017	1	.0017	.0
TYPE 7	9.0030	45	.2000	24.6
TYPE 8	11.3493	30	.3783	31.0
TYPE 9	5.6665	3	1.8888	15.5
TOTAL	36.2542	93.	.5412	99.1

FLOW 1 PLATE # 9
TOTAL NUMBER 100
TOTAL AREA SQ. IN. 31.9967

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	5.5941	6	.9324	17.5
TYPE 2	2.5353	4	.6338	7.9
TYPE 3	1.2930	14	.0924	4.0
TYPE 4	.0058	1	.0058	.0
TYPE 5	.0159	1	.0159	.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	7.6115	50	.1522	23.8
TYPE 8	13.1606	19	.6927	41.1
TYPE 9	1.8460	5	.3692	5.8
TOTAL	32.0622	100.	.3216	100.2

FLOW 1 PLATE # 10
TOTAL NUMBER 67
TOTAL AREA SQ. IN. 27.5233

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	4.9212	5	.9842	17.9
TYPE 2	1.2658	4	.3165	4.6
TYPE 3	.4682	5	.0936	1.7
TYPE 4	.1944	5	.0389	.7
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	5.1390	33	.1557	18.7
TYPE 8	4.7113	11	.4283	17.1
TYPE 9	10.9506	4	2.7377	39.8
TOTAL	27.6505	67.	.5283	100.5

FLOW 1 PLATE # 11
TOTAL NUMBER 78
TOTAL AREA SQ. IN. 31.2830

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	6.1538	5	1.2308	19.7
TYPE 2	2.4838	6	.4140	7.9
TYPE 3	.1006	3	.0335	.3
TYPE 4	.0342	2	.0171	.1
TYPE 5	.0415	2	.0208	.1
TYPE 6	.0095	2	.0048	.0
TYPE 7	4.6676	32	.1459	14.9
TYPE 8	5.0342	15	.3356	16.1
TYPE 9	12.0644	11	1.0968	38.6
TOTAL	30.5896	78.	.3666	97.8

FLOW 1 PLATE # 12
TOTAL NUMBER 47
TOTAL AREA SQ. IN. 20.1540

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	7.2344	4	1.8086	35.9
TYPE 2	.7787	3	.2596	3.9
TYPE 3	.0926	3	.0309	.5
TYPE 4	.0139	1	.0139	.1
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	5.2626	23	.2288	26.1
TYPE 8	2.1823	9	.2425	10.8
TYPE 9	4.5386	4	1.1347	22.5
TOTAL	20.1071	47.	.4132	99.7

FLOW 1 PLATE # 1[illegible]

TOTAL NUMBER 59

TOTAL AREA SQ. IN. 19.2070

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	5.6056	6	.9343	29.2
TYPE 2	2.1148	6	.3525	11.0
TYPE 3	.4559	6	.0760	2.4
TYPE 4	0.0000	0	0.0000	0.0
TYPE 5	.0219	1	.0219	.1
TYPE 6	.0104	1	.0104	.1
TYPE 7	5.1016	27	.1889	26.6
TYPE 8	2.8675	8	.3584	14.9
TYPE 9	2.9649	4	.7412	15.4
TOTAL	19.1426	59.	.2982	99.7

FLOW 1 PLATE # 14

TOTAL NUMBER 53

TOTAL AREA SQ. IN. 28.3389

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	5.4498	4	1.3625	19.2
TYPE 2	3.0336	3	1.0112	10.7
TYPE 3	.2424	4	.0606	.9
TYPE 4	.1325	2	.0663	.5
TYPE 5	.0085	1	.0085	.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	4.6061	24	.1919	16.3
TYPE 8	4.9909	9	.5545	17.6
TYPE 9	9.7413	6	1.6236	34.4
TOTAL	28.2051	53.	.5421	99.5

FLOW 1 PLATE # 15

TOTAL NUMBER 27

TOTAL AREA SQ. IN. 19.5996

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	6.9799	3	2.3266	35.6
TYPE 2	1.3654	2	.6827	7.0
TYPE 3	0.0000	0	0.0000	0.0
TYPE 4	.0410	2	.0205	.2
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	1.9236	12	.1603	9.8
TYPE 8	1.2236	3	.4079	6.2
TYPE 9	8.1066	5	1.6213	41.4
TOTAL	19.6401	27.	.5799	100.2

FLOW 1 PLATE # 1[illegible]

TOTAL NUMBER 32

TOTAL AREA SQ. IN. 25.2722

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	8.1766	3	2.7255	32.4
TYPE 2	.4605	2	.2303	1.8
TYPE 3	.1259	1	.1259	.5
TYPE 4	.0587	1	.0587	.2
TYPE 5	.0098	1	.0098	.0
TYPE 6	.0115	1	.0115	.0
TYPE 7	2.6934	14	.1924	10.7
TYPE 8	1.5722	3	.5241	6.2
TYPE 9	12.1369	6	2.0228	48.0
TOTAL	25.2455	32.	.6557	99.9

FLOW 1 PLATE # 17

TOTAL NUMBER 14

TOTAL AREA SQ. IN. 10.0108

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	5.6307	1	5.6307	56.2
TYPE 2	.8796	2	.4398	8.8
TYPE 3	0.0000	0	0.0000	0.0
TYPE 4	0.0000	0	0.0000	0.0
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	3.0563	8	.3820	30.5
TYPE 8	.4095	3	.1365	4.1
TYPE 9	0.0000	0	0.0000	0.0
TOTAL	9.9761	14.	.7321	99.7

FLOW 1 PLATE # 18

TOTAL NUMBER 66

TOTAL AREA SQ. IN. 22.7779

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	4.4389	4	1.1097	19.5
TYPE 2	2.8711	7	.4102	12.6
TYPE 3	.5979	6	.0997	2.6
TYPE 4	.0720	1	.0720	.3
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	.0446	1	.0446	.2
TYPE 7	6.4433	26	.2478	28.3
TYPE 8	4.6226	17	.2719	20.3
TYPE 9	3.9509	4	.9877	17.3
TOTAL	[illegible]87	66.	.3604	101.1

FLOW 2 PLATE # 1
TOTAL NUMBER 15
TOTAL AREA SQ. IN. 8.7193

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	6.3881	3	2.1294	73.3
TYPE 2	0.0000	0	0.0000	0.0
TYPE 3	0.0000	0	0.0000	0.0
TYPE 4	0.0000	0	0.0000	0.0
TYPE 5	.1594	1	.1594	1.8
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	1.4750	10	.1475	16.9
TYPE 8	.5773	1	.5773	6.6
TYPE 9	0.0000	0	0.0000	0.0
TOTAL	8.5998	15.	.3348	98.6

FLOW 2 PLATE # 2
TOTAL NUMBER 52
TOTAL AREA SQ. IN. 15.2198

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	6.5672	4	1.6418	43.1
TYPE 2	1.9217	4	.4804	12.6
TYPE 3	.2021	1	.2021	1.3
TYPE 4	0.0000	0	0.0000	0.0
TYPE 5	.0647	1	.0647	.4
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	2.3502	34	.0691	15.4
TYPE 8	4.0025	8	.5003	26.3
TYPE 9	0.0000	0	0.0000	0.0
TOTAL	15.1084	52.	.3287	99.3

FLOW 2 PLATE # 3
TOTAL NUMBER 50
TOTAL AREA SQ. IN. 19.2524

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	5.3616	2	2.6808	27.8
TYPE 2	2.3689	3	.7896	12.3
TYPE 3	.6429	5	.1286	3.3
TYPE 4	0.0000	0	0.0000	0.0
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	4.5995	25	.1840	23.9
TYPE 8	2.3545	13	.1811	12.2
TYPE 9	3.4995	2	1.7497	18.2
TOTAL	18.8259	50.	.6348	97.8

FLOW 2 PLATE # 4
TOTAL NUMBER 73
TOTAL AREA SQ. IN. 41.6744

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	7.2102	3	2.4034	17.3
TYPE 2	3.6117	8	.4515	8.7
TYPE 3	.0742	3	.0247	.2
TYPE 4	.0801	3	.0267	.2
TYPE 5	.3263	1	.3263	.8
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	3.1515	40	.0788	7.6
TYPE 8	2.1243	9	.2360	5.1
TYPE 9	25.1131	6	4.1855	60.3
TOTAL	41.6914	73.	.8592	100.0

FLOW 2 PLATE # 5
TOTAL NUMBER 93
TOTAL AREA SQ. IN. 45.6356

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	7.2006	8	.9001	15.8
TYPE 2	1.8079	5	.3616	4.0
TYPE 3	.4140	8	.0518	.9
TYPE 4	.2020	3	.0673	.4
TYPE 5	.3059	2	.1530	.7
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	5.4081	40	.1352	11.9
TYPE 8	3.5968	15	.2398	7.9
TYPE 9	27.0669	12	2.2556	59.3
TOTAL	46.0022	93.	.4627	100.8

FLOW 2 PLATE # 6
TOTAL NUMBER 94
TOTAL AREA SQ. IN. 41.7254

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	6.3696	4	1.5924	15.3
TYPE 2	4.1779	6	.6963	10.0
TYPE 3	.2545	3	.0848	.6
TYPE 4	.1392	3	.0464	.3
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	6.3725	52	.1225	15.3
TYPE 8	6.6871	19	.3520	16.0
TYPE 9	17.5865	7	2.5124	42.1
TOTAL	41.5877	94.	.5008	99.7

FLOW 2 PLATE #
TOTAL NUMBER 92
TOTAL AREA SQ. IN. 36.0865

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	6.4581	4	1.6145	17.9
TYPE 2	2.6179	6	.4363	7.3
TYPE 3	.5937	2	.2969	1.6
TYPE 4	.0118	1	.0118	.0
TYPE 5	.0756	1	.0756	.2
TYPE 6	.0465	2	.0233	.1
TYPE 7	6.2516	39	.1603	17.3
TYPE 8	6.5369	28	.2335	18.1
TYPE 9	13.1595	9	1.4622	36.5
TOTAL	35.7516	92.	.4794	99.1

FLOW 2 PLATE # 8
TOTAL NUMBER 90
TOTAL AREA SQ. IN. 38.5323

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	6.7254	5	1.3451	17.5
TYPE 2	5.7064	6	.9511	14.8
TYPE 3	.3442	3	.1147	.9
TYPE 4	.0722	1	.0722	.2
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	7.5901	43	.1765	19.7
TYPE 8	12.0039	31	.3872	31.2
TYPE 9	6.1364	1	6.1364	15.9
TOTAL	38.5786	90.	1.0204	100.1

FLOW 2 PLATE # 9
TOTAL NUMBER 86
TOTAL AREA SQ. IN. 35.0650

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	6.8590	5	1.3718	19.6
TYPE 2	3.4705	4	.8676	9.9
TYPE 3	.8065	6	.1344	2.3
TYPE 4	.0104	1	.0104	.0
TYPE 5	.0107	1	.0107	.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	7.3070	43	.1699	20.8
TYPE 8	14.7529	23	.6414	42.1
TYPE 9	2.0604	3	.6868	5.9
TOTAL	35.2[illegible]	86.	.4326	100.6

FLOW 2 PLATE # 10
TOTAL NUMBER 54
TOTAL AREA SQ. IN. 28.5158

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	6.8026	3	2.2675	23.9
TYPE 2	1.5268	2	.7634	5.4
TYPE 3	.4684	4	.1171	1.6
TYPE 4	.0817	3	.0272	.3
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	4.4816	28	.1601	15.7
TYPE 8	5.7340	12	.4778	20.1
TYPE 9	9.7868	2	4.8934	34.3
TOTAL	28.8819	54.	.9674	101.3

FLOW 2 PLATE # 11
TOTAL NUMBER 81
TOTAL AREA SQ. IN. 34.3280

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	7.6742	7	1.0963	22.4
TYPE 2	3.1267	6	.5211	9.1
TYPE 3	.4134	4	.1034	1.2
TYPE 4	.0403	2	.0202	.1
TYPE 5	.0333	3	.0111	.1
TYPE 6	.0114	3	.0038	.0
TYPE 7	3.5615	32	.1113	10.4
TYPE 8	5.9586	13	.4584	17.4
TYPE 9	13.4753	11	1.2250	39.3
TOTAL	34.2947	81.	.3945	99.9

FLOW 2 PLATE # 12
TOTAL NUMBER 51
TOTAL AREA SQ. IN. 21.8035

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	8.3831	7	1.1976	38.4
TYPE 2	.9303	3	.3101	4.3
TYPE 3	.0854	3	.0285	.4
TYPE 4	.0223	2	.0112	.1
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	4.6001	21	.2191	21.1
TYPE 8	2.7610	10	.2761	12.8
TYPE 9	5.0271	5	1.0054	23.1
TOTAL	21.4094	51.	.[illegible]42	98.2

FLOW 2 PLATE # 13
TOTAL NUMBER 61
TOTAL AREA SQ. IN. 21.1050

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	6.6998	6	1.1166	31.7
TYPE 2	3.4947	5	.6989	16.6
TYPE 3	.1964	3	.0655	.9
TYPE 4	0.0000	0	0.0000	0.0
TYPE 5	.1269	1	.1269	.6
TYPE 6	.0072	1	.0072	.0
TYPE 7	4.0999	32	.1281	19.4
TYPE 8	3.4211	7	.4887	16.2
TYPE 9	2.9225	6	.4871	13.8
TOTAL	20.9685	61.	.3466	99.4

FLOW 2 PLATE # 14
TOTAL NUMBER 52
TOTAL AREA SQ. IN. 30.0336

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	6.3428	5	1.2686	21.1
TYPE 2	4.7282	3	1.5761	15.7
TYPE 3	.2866	1	.2866	1.0
TYPE 4	.1800	2	.0900	.6
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	2.8592	29	.0986	9.5
TYPE 8	5.4640	8	.6830	18.2
TYPE 9	9.8054	4	2.4514	32.6
TOTAL	29.6662	52.	.7171	98.8

FLOW 2 PLATE # 15
TOTAL NUMBER 30
TOTAL AREA SQ. IN. 20.7850

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	7.6291	3	2.5430	36.7
TYPE 2	1.8884	4	.4721	9.1
TYPE 3	0.0000	0	0.0000	0.0
TYPE 4	.0361	2	.0181	.2
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	1.3786	14	.0985	6.6
TYPE 8	1.2862	3	.4287	6.2
TYPE 9	8.5947	4	2.1487	41.4
TOTAL	20.8131	30.	.6343	100.1

FLOW 2 PLATE # 16
TOTAL NUMBER 29
TOTAL AREA SQ. IN. 25.8958

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	9.1357	2	4.5679	35.3
TYPE 2	.8561	3	.2854	3.3
TYPE 3	0.0000	0	0.0000	0.0
TYPE 4	.0630	1	.0630	.2
TYPE 5	.0381	1	.0381	.1
TYPE 6	.0050	1	.0050	.0
TYPE 7	1.9516	14	.1394	7.5
TYPE 8	1.6234	3	.5411	6.3
TYPE 9	12.1970	4	3.0493	47.1
TOTAL	25.8699	29.	.9655	99.9

FLOW 2 PLATE # 17
TOTAL NUMBER 14
TOTAL AREA SQ. IN. 11.1839

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	7.1361	1	7.1361	63.8
TYPE 2	.9560	2	.4780	8.5
TYPE 3	0.0000	0	0.0000	0.0
TYPE 4	0.0000	0	0.0000	0.0
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	2.4348	8	.3044	21.8
TYPE 8	.4935	3	.1645	4.4
TYPE 9	0.0000	0	0.0000	0.0
TOTAL	11.0204	14.	.8981	98.5

FLOW 2 PLATE # 18
TOTAL NUMBER 78
TOTAL AREA SQ. IN. 25.1399

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	5.2054	4	1.3014	20.7
TYPE 2	4.5218	9	.5024	18.0
TYPE 3	.3596	3	.1199	1.4
TYPE 4	.0898	1	.0899	.4
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	.0520	1	.0520	.2
TYPE 7	5.3753	40	.1344	21.4
TYPE 8	4.6072	16	.2880	18.3
TYPE 9	4.5047	4	1.1262	17.9
TOTAL	24.7153	78.	.4015	98.3

FLOW 3 PLATE # 1

TOTAL NUMBER 14

TOTAL AREA SQ. IN. 7.7600

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	6.5228	3	2.1743	84.1
TYPE 2	0.0000	0	0.0000	0.0
TYPE 3	0.0000	0	0.0000	0.0
TYPE 4	0.0000	0	0.0000	0.0
TYPE 5	.1417	1	.1417	1.8
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	.5565	9	.0618	7.2
TYPE 8	.5333	1	.5333	6.9
TYPE 9	0.0000	0	0.0000	0.0
TOTAL	7.7543	14.	.3235	99.9

FLOW 3 PLATE # 2

TOTAL NUMBER 24

TOTAL AREA SQ. IN. 15.2144

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	7.5092	4	1.8773	49.4
TYPE 2	1.5324	1	1.5324	10.1
TYPE 3	.2067	1	.2067	1.4
TYPE 4	0.0000	0	0.0000	0.0
TYPE 5	.0662	1	.0662	.4
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	2.0198	12	.1683	13.3
TYPE 8	4.0855	5	.8171	26.9
TYPE 9	0.0000	0	0.0000	0.0
TOTAL	15.4198	24.	.5187	101.4

FLOW 3 PLATE # 3

TOTAL NUMBER 37

TOTAL AREA SQ. IN. 18.1971

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	6.5672	2	3.2836	36.1
TYPE 2	3.0272	3	1.0091	16.6
TYPE 3	0.0000	0	0.0000	0.0
TYPE 4	0.0000	0	0.0000	0.0
TYPE 5	.0153	1	.0153	.1
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	3.9927	21	.1901	21.9
TYPE 8	2.7733	9	.3081	15.2
TYPE 9	1.2349	1	1.2349	6.8
TOTAL	17.6109	37.	.6712	96.8

FLOW 3 PLATE # 4

TOTAL NUMBER 65

TOTAL AREA SQ. IN. 39.1701

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	7.2625	3	2.4208	18.5
TYPE 2	3.9288	4	.9822	10.0
TYPE 3	.1357	1	.1357	.3
TYPE 4	.0802	3	.0267	.2
TYPE 5	.2216	1	.2216	.6
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	1.9583	38	.0515	5.0
TYPE 8	2.2337	8	.2792	5.7
TYPE 9	23.7367	7	3.3910	60.6
TOTAL	39.5575	65.	.8343	101.0

FLOW 3 PLATE # 5

TOTAL NUMBER 74

TOTAL AREA SQ. IN. 40.2656

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	8.1761	7	1.1680	20.3
TYPE 2	2.0846	6	.3474	5.2
TYPE 3	.3414	4	.0854	.8
TYPE 4	.2094	3	.0698	.5
TYPE 5	.4351	3	.1450	1.1
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	4.4794	29	.1545	11.1
TYPE 8	3.4602	15	.2307	8.6
TYPE 9	21.6815	7	3.0974	53.8
TOTAL	40.8677	74.	.5987	101.5

FLOW 3 PLATE # 6

TOTAL NUMBER 75

TOTAL AREA SQ. IN. 36.6748

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	7.4647	5	1.4929	20.4
TYPE 2	3.9660	7	.5666	10.8
TYPE 3	.3277	2	.1639	.9
TYPE 4	.1838	2	.0919	.5
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	5.4577	37	.1475	14.9
TYPE 8	6.8987	16	.4311	18.8
TYPE 9	13.0014	6	2.1669	35.5
TOTAL	37.2995	75.	.5627	101.7

FLOW 3 PLATE # [illegible]
TOTAL NUMBER 65
TOTAL AREA SQ. IN. 33.7960

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	7.4809	2	3.7405	22.1
TYPE 2	4.4831	5	.8966	13.3
TYPE 3	0.0000	0	0.0000	0.0
TYPE 4	.0118	1	.0118	.0
TYPE 5	.1052	1	.1052	.3
TYPE 6	.0431	1	.0431	.1
TYPE 7	5.2011	33	.1576	15.4
TYPE 8	6.7703	18	.3761	20.0
TYPE 9	9.5661	4	2.3915	28.3
TOTAL	33.6616	65.	.8580	99.6

FLOW 3 PLATE # 8
TOTAL NUMBER 81
TOTAL AREA SQ. IN. 37.3554

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	7.5000	3	2.5000	20.1
TYPE 2	6.2198	4	1.5550	16.7
TYPE 3	.6107	1	.6107	1.6
TYPE 4	.0607	1	.0607	.2
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	6.3092	46	.1372	16.9
TYPE 8	12.1648	23	.5289	32.6
TYPE 9	5.0567	3	1.6856	13.5
TOTAL	37.9219	81.	.7864	101.5

FLOW 3 PLATE # 9
TOTAL NUMBER 75
TOTAL AREA SQ. IN. 34.1873

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	6.8245	5	1.3653	20.0
TYPE 2	3.3274	4	.8319	9.7
TYPE 3	1.0765	5	.2153	3.1
TYPE 4	.0058	1	.0058	.0
TYPE 5	.0270	1	.0270	.1
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	5.5998	40	.1400	16.4
TYPE 8	15.8623	16	.9914	46.4
TYPE 9	2.3298	3	.7766	6.8
TOTAL	35.0556	75.	.4837	102.5

FLOW [illegible] PLATE # [illegible]
TOTAL NUMBER 56
TOTAL AREA SQ. IN. 32.3475

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	7.5347	5	1.5069	23.3
TYPE 2	2.0750	3	.6917	6.4
TYPE 3	.3810	4	.0953	1.2
TYPE 4	.0672	3	.0224	.2
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	3.9027	25	.1561	12.1
TYPE 8	5.9471	12	.4956	18.4
TYPE 9	13.3068	4	3.3267	41.1
TOTAL	33.2145	56.	.6994	102.7

FLOW 3 PLATE # 11
TOTAL NUMBER 75
TOTAL AREA SQ. IN. 36.0395

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	8.3548	6	1.3925	23.2
TYPE 2	3.6324	7	.5189	10.1
TYPE 3	.1745	2	.0873	.5
TYPE 4	.0130	2	.0065	.0
TYPE 5	.0436	4	.0109	.1
TYPE 6	.0077	1	.0077	.0
TYPE 7	3.0003	30	.1000	8.3
TYPE 8	6.2809	12	.5234	17.4
TYPE 9	14.9712	11	1.3610	41.5
TOTAL	36.4784	75.	.4454	101.2

FLOW 3 PLATE # 12
TOTAL NUMBER 46
TOTAL AREA SQ. IN. 22.0703

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	9.4581	5	1.8916	42.9
TYPE 2	1.1710	6	.1952	5.3
TYPE 3	.0662	2	.0331	.3
TYPE 4	.0068	1	.0068	.0
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	4.0820	17	.2401	18.5
TYPE 8	2.6498	10	.2650	12.0
TYPE 9	4.9801	5	.9960	22.6
TOTAL	22.4140	46.	.4871	101.5

FLOW 3 PLATE # 13
TOTAL NUMBER 55
TOTAL AREA SQ. IN. 21.1129

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	7.2757	6	1.2126	34.5
TYPE 2	4.0877	5	.8175	19.4
TYPE 3	.2316	4	.0579	1.1
TYPE 4	0.0000	0	0.0000	0.0
TYPE 5	.0385	1	.0385	.2
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	3.5263	27	.1306	16.7
TYPE 8	3.3942	8	.4243	16.1
TYPE 9	2.9858	4	.7465	14.1
TOTAL	21.5398	55.	.3809	102.0

FLOW 3 PLATE # 14
TOTAL NUMBER 39
TOTAL AREA SQ. IN. 31.8337

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	6.6849	1	6.6849	21.0
TYPE 2	5.3803	4	1.3451	16.9
TYPE 3	0.0000	0	0.0000	0.0
TYPE 4	.1827	2	.0914	.6
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	2.7313	22	.1242	8.6
TYPE 8	6.4544	8	.8068	20.3
TYPE 9	10.7730	2	5.3865	33.8
TOTAL	32.2066	39.	1.6043	101.2

FLOW 3 PLATE # 15
TOTAL NUMBER 26
TOTAL AREA SQ. IN. 21.7788

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	8.1148	3	2.7049	37.3
TYPE 2	1.9187	2	.9594	8.8
TYPE 3	0.0000	0	0.0000	0.0
TYPE 4	.0426	2	.0213	.2
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	.9892	11	.0899	4.5
TYPE 8	1.4251	3	.4750	6.5
TYPE 9	9.2055	5	1.8411	42.3
TOTAL	21.6969	26.	.6769	99.6

FLOW 3 PLATE # 16
TOTAL NUMBER 28
TOTAL AREA SQ. IN. 26.9817

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	9.9736	3	3.3245	37.0
TYPE 2	.8630	3	.2877	3.2
TYPE 3	0.0000	0	0.0000	0.0
TYPE 4	.0712	1	.0712	.3
TYPE 5	.0078	1	.0078	.0
TYPE 6	.0073	1	.0073	.0
TYPE 7	1.2995	12	.1083	4.8
TYPE 8	1.7385	3	.5795	6.4
TYPE 9	12.8776	4	3.2194	47.7
TOTAL	26.8385	28.	.8451	99.5

FLOW 3 PLATE # 17
TOTAL NUMBER 17
TOTAL AREA SQ. IN. 11.2601

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	7.4385	1	7.4385	66.1
TYPE 2	1.4902	4	.3726	13.2
TYPE 3	0.0000	0	0.0000	0.0
TYPE 4	0.0000	0	0.0000	0.0
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	1.9704	10	.1970	17.5
TYPE 8	.3317	2	.1659	2.9
TYPE 9	0.0000	0	0.0000	0.0
TOTAL	11.2308	17.	.9082	99.7

FLOW 3 PLATE # 18
TOTAL NUMBER 60
TOTAL AREA SQ. IN. 25.2100

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	7.4192	1	7.4192	29.4
TYPE 2	4.0429	5	.8086	16.0
TYPE 3	.1840	1	.1840	.7
TYPE 4	.0463	1	.0463	.2
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	.0576	1	.0576	.2
TYPE 7	4.7347	32	.1480	18.8
TYPE 8	4.5987	16	.2874	18.2
TYPE 9	4.2987	3	1.4329	17.1
TOTAL	25.3821	60.	1.1538	100.7

FLOW 4 PLATE # 1
TOTAL NUMBER 11
TOTAL AREA SQ. IN. 7.4819

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	6.5992	3	2.1997	88.2
TYPE 2	0.0000	0	0.0000	0.0
TYPE 3	0.0000	0	0.0000	0.0
TYPE 4	0.0000	0	0.0000	0.0
TYPE 5	.0788	1	.0788	1.1
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	.1763	6	.0294	2.4
TYPE 8	.5625	1	.5625	7.5
TYPE 9	0.0000	0	0.0000	0.0
TOTAL	7.4168	11.	.3189	99.1

FLOW 4 PLATE # 2
TOTAL NUMBER 27
TOTAL AREA SQ. IN. 14.5336

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	9.0269	4	2.2567	62.1
TYPE 2	.7442	4	.1861	5.1
TYPE 3	0.0000	0	0.0000	0.0
TYPE 4	0.0000	0	0.0000	0.0
TYPE 5	.0251	1	.0251	.2
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	.9593	11	.0872	6.6
TYPE 8	3.8689	7	.5527	26.6
TYPE 9	0.0000	0	0.0000	0.0
TOTAL	14.6244	27.	.3453	100.6

FLOW 4 PLATE # 3
TOTAL NUMBER 43
TOTAL AREA SQ. IN. 18.1609

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	8.7487	2	4.3744	48.2
TYPE 2	2.9556	3	.9852	16.3
TYPE 3	.1077	1	.1077	.6
TYPE 4	0.0000	0	0.0000	0.0
TYPE 5	.0141	1	.0141	.1
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	2.2010	28	.0786	12.1
TYPE 8	2.3446	7	.3349	12.9
TYPE 9	.8647	1	.8647	4.8
TOTAL	17.2364	43.	.7511	94.9

FLOW 4 PLATE # 4
TOTAL NUMBER 52
TOTAL AREA SQ. IN. 37.5406

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	8.7175	3	2.9058	23.2
TYPE 2	3.4536	4	.8634	9.2
TYPE 3	.1497	1	.1497	.4
TYPE 4	.1122	3	.0374	.3
TYPE 5	.1458	1	.1458	.4
TYPE 6	.0029	1	.0029	.0
TYPE 7	.8940	23	.0389	2.4
TYPE 8	2.0508	9	.2279	5.5
TYPE 9	22.2722	7	3.1817	59.3
TOTAL	37.7987	52.	.8393	100.7

FLOW 4 PLATE # 5
TOTAL NUMBER 62
TOTAL AREA SQ. IN. 38.1748

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	9.2207	5	1.8441	24.2
TYPE 2	2.5474	7	.3639	6.7
TYPE 3	.5853	2	.2927	1.5
TYPE 4	.2617	3	.0872	.7
TYPE 5	.0337	1	.0337	.1
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	2.6729	30	.0891	7.0
TYPE 8	2.4934	8	.3117	6.5
TYPE 9	20.7144	6	3.4524	54.3
TOTAL	38.5295	62.	.7194	100.9

FLOW 4 PLATE # 6
TOTAL NUMBER 68
TOTAL AREA SQ. IN. 35.5166

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	10.4192	7	1.4885	29.3
TYPE 2	3.0350	6	.5058	8.5
TYPE 3	0.0000	0	0.0000	0.0
TYPE 4	.0898	2	.0449	.3
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	4.6594	32	.1456	13.1
TYPE 8	5.2166	14	.3726	14.7
TYPE 9	12.6745	7	1.8049	35.6
TOTAL	36.0535	68.	.4847	101.5

FLOW 4 PLATE # 7
TOTAL NUMBER 46
TOTAL AREA SQ. IN. 32.0548

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	8.7299	2	4.3650	27.2
TYPE 2	5.3678	4	1.3420	16.7
TYPE 3	0.0000	0	0.0000	0.0
TYPE 4	.0118	1	.0118	.0
TYPE 5	.0806	1	.0806	.3
TYPE 6	.0530	1	.0530	.2
TYPE 7	2.5104	18	.1395	7.8
TYPE 8	5.8495	15	.3900	18.2
TYPE 9	9.3271	4	2.3318	29.1
TOTAL	31.9301	46.	.9682	99.6

FLOW 4 PLATE # 8
TOTAL NUMBER 71
TOTAL AREA SQ. IN. 40.7479

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	8.7691	3	2.9230	21.5
TYPE 2	9.0145	5	1.8029	22.1
TYPE 3	.2260	1	.2260	.6
TYPE 4	.0584	1	.0584	.1
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	4.0517	40	.1013	9.9
TYPE 8	10.5267	17	.6192	25.8
TYPE 9	8.5960	4	2.1490	21.1
TOTAL	41.2424	71.	.8755	101.2

FLOW 4 PLATE # 9
TOTAL NUMBER 80
TOTAL AREA SQ. IN. 32.4582

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	6.6518	4	1.6705	20.6
TYPE 2	5.4142	5	1.0828	16.7
TYPE 3	.8290	3	.2763	2.6
TYPE 4	.0058	1	.0058	.0
TYPE 5	.0535	1	.0535	.2
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	3.1206	47	.0664	9.6
TYPE 8	13.8267	16	.8642	42.6
TYPE 9	3.4285	3	1.1428	10.6
TOTAL	33.3601	80.	.5736	102.8

FLOW 4 PLATE # 10
TOTAL NUMBER 61
TOTAL AREA SQ. IN. 30.5603

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	7.9927	4	1.9982	26.2
TYPE 2	3.1788	4	.7947	10.4
TYPE 3	.1097	1	.1097	.4
TYPE 4	.1095	4	.0274	.4
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	2.1618	32	.0676	7.1
TYPE 8	5.2271	13	.4021	17.1
TYPE 9	12.5634	3	4.1878	41.1
TOTAL	31.3430	61.	.8430	102.6

FLOW 4 PLATE # 11
TOTAL NUMBER 61
TOTAL AREA SQ. IN. 33.2661

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	8.9395	3	2.9798	26.9
TYPE 2	4.2007	8	.5251	12.6
TYPE 3	.1682	3	.0561	.5
TYPE 4	.0403	2	.0202	.1
TYPE 5	.0147	2	.0074	.0
TYPE 6	.0097	1	.0097	.0
TYPE 7	2.0860	22	.0948	6.3
TYPE 8	5.1340	12	.4278	15.4
TYPE 9	12.7531	8	1.5941	38.3
TOTAL	33.3462	61.	.6350	100.2

FLOW 4 PLATE # 12
TOTAL NUMBER 47
TOTAL AREA SQ. IN. 20.7518

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	9.7557	3	3.2519	47.0
TYPE 2	2.2992	5	.4598	11.1
TYPE 3	0.0000	0	0.0000	0.0
TYPE 4	.0125	2	.0063	.1
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	1.9922	25	.0797	9.6
TYPE 8	2.1587	7	.3084	10.4
TYPE 9	4.7135	5	.9427	22.7
TOTAL	20.9318	47.	.5610	100.9

FLOW 4 PLATE # 13
TOTAL NUMBER 39
TOTAL AREA SQ. IN. 19.7516

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	10.0656	3	3.3552	51.0
TYPE 2	3.1184	2	1.5592	15.8
TYPE 3	.0707	2	.0354	.4
TYPE 4	0.0000	0	0.0000	0.0
TYPE 5	.0374	1	.0374	.2
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	2.2139	21	.1054	11.2
TYPE 8	3.2637	8	.4080	16.5
TYPE 9	1.4439	2	.7220	7.3
TOTAL	20.2136	39.	.6914	102.3

FLOW 4 PLATE # 14
TOTAL NUMBER 29
TOTAL AREA SQ. IN. 30.4436

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	9.0010	1	9.0010	29.6
TYPE 2	3.9372	4	.9843	12.9
TYPE 3	0.0000	0	0.0000	0.0
TYPE 4	.1689	2	.0845	.6
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	.9911	12	.0826	3.3
TYPE 8	5.1018	7	.7288	16.8
TYPE 9	11.3548	3	3.7849	37.3
TOTAL	30.5548	29.	1.6296	100.4

FLOW 4 PLATE # 15
TOTAL NUMBER 21
TOTAL AREA SQ. IN. 19.9599

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	9.9469	3	3.3156	49.8
TYPE 2	.2142	3	.0714	1.1
TYPE 3	0.0000	0	0.0000	0.0
TYPE 4	.1109	2	.0555	.6
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	.1950	5	.0390	1.0
TYPE 8	1.3428	3	.4476	6.7
TYPE 9	8.2138	5	1.6428	41.2
TOTAL	20.0276	21.	.6191	100.3

FLOW 4 PLATE # 16
TOTAL NUMBER 22
TOTAL AREA SQ. IN. 25.7459

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	10.6390	4	2.6598	41.3
TYPE 2	.7388	2	.3694	2.9
TYPE 3	0.0000	0	0.0000	0.0
TYPE 4	.0374	1	.0374	.1
TYPE 5	.0070	1	.0070	.0
TYPE 6	.0090	1	.0090	.0
TYPE 7	.5155	7	.0736	2.0
TYPE 8	1.6276	3	.5425	6.3
TYPE 9	12.1234	3	4.0411	47.1
TOTAL	25.6977	22.	.8600	99.8

FLOW 4 PLATE # 17
TOTAL NUMBER 14
TOTAL AREA SQ. IN. 11.0410

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	8.8291	1	8.8291	80.0
TYPE 2	.6573	2	.3287	6.0
TYPE 3	0.0000	0	0.0000	0.0
TYPE 4	0.0000	0	0.0000	0.0
TYPE 5	0.0000	0	0.0000	0.0
TYPE 6	0.0000	0	0.0000	0.0
TYPE 7	1.1013	9	.1224	10.0
TYPE 8	.3832	2	.1916	3.5
TYPE 9	0.0000	0	0.0000	
TOTAL	10.9709	14.	1.0524	9.4

FLOW 4 PLATE # 18
TOTAL NUMBER 62
TOTAL AREA SQ. IN. 24.7089

SUM BY HABITAT:

	TOTAL	NUMBER	MEAN	PERCENT
TYPE 1	10.6863	1	10.6863	43.2
TYPE 2	3.1601	[illegible]	1.0534	12.8
TYPE 3	.0421	1	.0421	.2
TYPE 4	.0452	1	.0452	.2
TYPE 5	.0354	1	.0354	[illegible]
TYPE 6	.0486	1	.0486	.2
TYPE 7	3.[illegible]11	34	.0892	12.3
TYPE 8	[illegible].3651	17	.2274	15.6
TYPE 9	3.91[illegible]	[illegible]	1.3034	15.8
TOTAL	[illegible]4.8241	62.	1.[illegible]	1[illegible].5