SEDIMENT TRANSPORT CHARACTERISTICS OF SELECTED STREAMS IN THE SUSITNA RIVER BASIN, ALASKA, OCTOBER 1983 TO SEPTEMBER 1984

U.S. GEOLOGICAL SURVEY
OPEN-FILE REPORT 86-424W

Prepared in cooperation with the
ALASKA POWER AUTHORITY

U.S. DEPARTMENT OF THE INTERIOR
MARCH 3, 1849

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SEDIMENT TRANSPORT CHARACTERISTICS OF SELECTED STREAMS IN THE SUSITNA RIVER BASIN, ALASKA, OCTOBER 1983 TO SEPTEMBER 1984

by James M. Knott, Stephen W. Lipscomb, and Terry W. Lewis

OPEN-FILE REPORT 86-424W

Prepared in cooperation with the

ALASKA POWER AUTHORITY

Anchorage, Alaska

1986

UNITED STATES DEPARTMENT OF THE INTERIOR

DONALD PAUL HODEL, Secretary

GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information
write to:

District Chief
U.S. Geological Survey
Water Resources Division
4230 University Drive, Suite 201
Anchorage, Alaska 99508-4664

Copies of this report can
be purchased from:

U.S. Geological Survey
Books and Open-File Reports Section
Federal Center, Bldg. 41
Box 25425
Denver, Colorado 80225
Telephone: (303) 236-7476

CONTENTS

ILLUSTRATIONS

Page

TABLES

CONVERSION TABLE

For the convenience of readers who prefer metric (International System) units rather than the inch-pound units used in this report, the following conversion factors may be used:

Multiply inch-pound unit	by	to obtain metric unti
inch (in.)	25.40	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.590	square kilometer (km^2)
acre-foot (acre-ft)	1,233	cubic meter (m^3)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
ton, short	0.9072	megagram (Mg)
ton per day (ton/d)	0.9072	megagram per day (Mg/d)
degree Fahrenheit (°F)	° C=5/9 (°F-32)	degree Celsius (°C)

Milligram per liter (mg/L) is a standard reporting unit for which no inch-pound equivalent is used.

SEDIMENT TRANSPORT CHARACTERISTICS OF SELECTED STREAMS IN THE SUSITNA RIVER BASIN, ALASKA, OCTOBER 1983 TO SEPTEMBER 1984

By James M. Knott, Stephen W. Lipscomb, and Terry W. Lewis

ABSTRACT

The upper reaches of the Susitna River have been considered for development of a large power-generation system for southcentral Alaska. This report presents a summary and discussion of sediment and hydraulic data obtained from October 1983 to September 1984 at ten sites on the Susitna, Chulitna, Talkeetna, and Yentna Rivers. Sediment data include measurements of suspended-sediment and bedload discharge and analyses of particle-size distribution of suspended sediment, bedload, and bed material; hydraulic data include measurements of width, average depth and velocity, and water-surface slope. Relations between water and sediment discharge are developed for selected sites.

Sediment loads for the 1984 water year were estimated for the Yentna, Chulitna, and Talkeetna Rivers and for four sites on the Susitna River. About 25 million tons of sediment was transported by the Susitna River at Susitna Station during the 1984 water year. The Yentna and Chulitna Rivers contributed more than 20 million tons of sediment to the Susitna River.

About 90 percent of suspended material (silt, clay, and sand) transported past upstream sites reached Susitna Station during 1984. However, only 56 percent of the transported coarse sand and gravel, as estimated for the upstream sites, reached Susitna Station during the same period.

INTRODUCTION

The Susitna River is one of the major rivers in Alaska, ranking fifth in drainage area. The upper reaches of the river are being considered as potential sites for several dams and reservoirs that would be part of a large power-generation system in southcentral Alaska.

This report presents a summary and discussion of sediment and hydraulic data collected at selected sites in the Susitna River basin in the area between the proposed damsites and Cook Inlet (fig. 1 and table 1). The data were collected during the period October 1983 to September 1984 as part of a cooperative program between the Alaska Power Authority and the U.S. Geological Survey. Selected data from Knott and Lipscomb (1983, 1985) for the 1981-83 water years and the data collected in 1984 are used to estimate the total amount of sediment (suspended sediment and bedload) transported by the major rivers in the basin during the 1984 water year. An attempt is made to develop relations between water and sediment discharge for various sites in the basin.

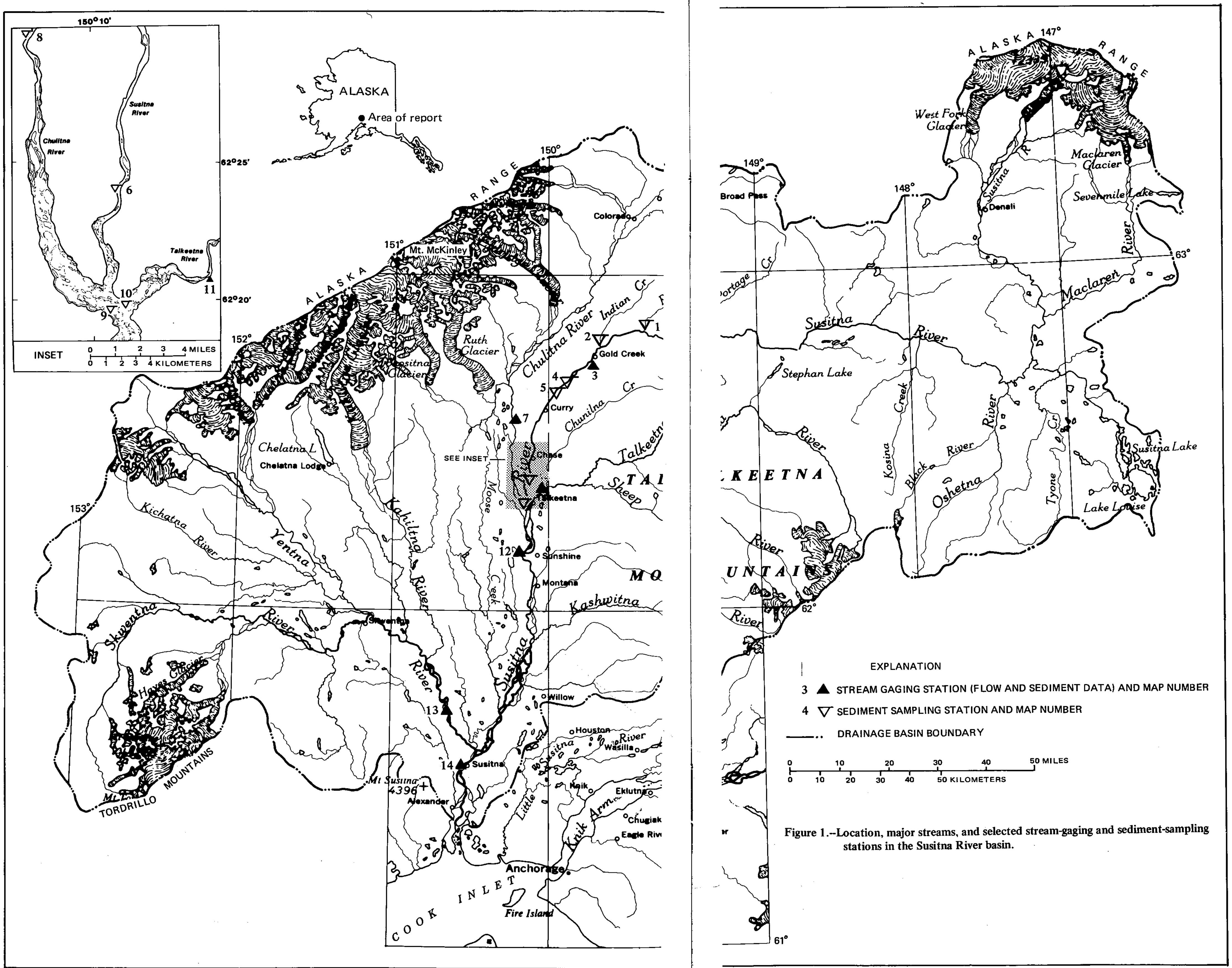

Figure 1.--Location, major streams, and selected stream-gaging and sediment-sampling stations in the Susitna River basin.

DESCRIPTION OF AREA

The Susitna River basin (fig. 1) lies on the southern flank of the Alaska Range in southcentral Alaska. The relief of the basin, which has a drainage area of about 19,400 mi^2, is a contrast of steep rugged mountains towering above wide valley lowlands. Altitudes range from 20,320 ft at Mt. McKinley to sea level where the Susitna River empties into Cook Inlet.

Tributaries to the Susitna River are commonly referred to as either glacial or nonglacial streams. The nonglacial streams are noted for their clarity, even during intense summer rainstorms. Glacial streams are turbid throughout most of the open-water season (May through September). The Susitna River and its larger tributaries are all affected to some degree by glacial runoff.

CLIMATE

The climate of the Susitna River basin is divided into two broad categories according to maps prepared by Searby (1968). The higher altitude parts of the basin are included in the Continental Zone, where diurnal and annual temperature variations are great. Mean annual temperature ranges from 15 to 25 °F (Hartman and Johnson, 1978). The lowlands lie in the Transition Zone where temperatures are less variable than in the Continental Zone. Mean annual temperatures generally range from 25 to 35 °F.

Mean annual precipitation of the basin ranges from less than 20 in. near the mouth of the Susitna River to more than 80 in. at higher altitudes (National Weather Service, 1972). Climatological records for the Talkeetna weather station are probably representative of lowland areas. A summary of climatological data for this station (Selkregg, 1974) indicates that mean daily temperatures range from 38 to 62 °F in summer, and from -9 to 18 °F in winter; extremes range from -44 to 85 °F. Annual precipitation averages 28 in., about 60 percent of which is rainfall.

DATA COLLECTION AND ANALYSIS

Beginning in 1981, systematic measurements of sediment discharge and hydraulic stream properties have been made to define the amount and distribution of sediment transported by the Susitna River and its major tributaries between Gold Creek and Sunshine (fig. 1). In 1981, data were collected at four sites in July, August, and September. Two of the sites were on the Susitna River, one at Gold Creek (map No. 3) and the other at the Parks Highway crossing at Sunshine (map No. 12). The remaining two sites were located on major tributaries to the Susitna River, one each on the Chulitna (map No. 7) and Talkeetna Rivers (map No. 11).

During 1982 the data-collection program was expanded to obtain weekly samples during the open-water season (May to September). A new sampling site was established on the Susitna River, upstream of the Chulitna River confluence (map No. 6). The stream-gaging station and the monthly collection of suspended-sediment samples were continued at Gold Creek. During 1983, bedload sampling sites were established on the Susitna River (map Nos. 9 and 10) and during 1984 on the Susitna (map No. 14) and Yentna (map No. 13) Rivers. Suspended-sediment data have been obtained for the Susitna River at Susitna Station and Yentna River sites since 1975 and 1981, respectively (Still and Jones, 1985). At each site, data collection included:

1) Suspended-sediment samples
2) Bedload samples
3) Bed-material samples
4) Water-discharge measurements
5) Measurements of depth and width

Selected samples of suspended sediment, bedload, and bed material were analyzed for particle-size distribution. Streamflow characteristics were defined from data available for existing stream-gaging stations. At sampling sites that did not coincide with stream-gaging stations, sufficient discharge measurements were obtained to develop stage-discharge relations. Summer measurements were made from a boat; either a cableway or sextant was used to determine stationing along the measuring section. Winter measurements were made by attaching a sampler to a rod and lowering the sampler through holes drilled in the ice.

Depth integrated, suspended-sediment samples were collected using a standard point-integrating P-61 sampler (Guy and Norman, 1970). Samples include those particles (usually finer than 2.0 mm) transported in the stream between the water surface and a point about 0.5 ft above the streambed. Two samples were obtained at each of five selected verticals in the stream cross section (at centroids of flow) and analyzed to determine average values of suspended-sediment concentration and the particle-size distribution of sediment in the water-sediment mixture. The two samples from each vertical profile were generally composited to obtain one analysis, but in a few instances the individual samples were analyzed.

Sediment transported within 0.25 ft of the streambed was sampled using a bedload sampler (Helley and Smith, 1971) designed for collecting coarse material (0.25-76.2 mm). Sampling time, number of sampling points, stream width and depth, and weight of dry sediment were recorded as a basis for calculating bedload discharge. Trap efficiency of the sampler was assumed to be 1.0. Characteristics of the Helley-Smith sampler and procedures for its use have not yet been fully evaluated. In the interim, the Geological Survey follows a provisional method of obtaining samples at about 20 equally spaced verticals based largely on field tests by Emmett (1980).

Some of the sediment transported in suspension cannot be accurately sampled because the lowest depth accessible by the P-61 sampler is about 0.5 ft above the riverbed. Silt-clay concentrations are generally assumed to be uniformly distributed throughout the total depth of the river and the concentration of this material in the unsampled zone (between riverbed and 0.5 ft above bed) is considered to be approximately the same as that in the sampled zone. The concentration of suspended sand in the unsampled zone, however, is generally larger than that in the sampled zone because sand particles tend to settle toward the riverbed if flow velocities are not sufficient to keep them in suspension. At least part of the medium to coarse sand fraction (0.25-2.0 mm) in the unsampled zone is trapped by the bedload sampler (from riverbed to 0.25 ft).

A preliminary examination of the amount of sand transported in suspension and as bedload (tables 2 and 3) suggest that attempting to account for unsampled sand would generally increase reported concentrations of suspended sand (table 2) at most sites by about 1 percent. At some sites, however, such as the Yentna River and the Susitna River at Susitna Station, the amount of sand transported in the unsampled zone is perhaps 10 percent of the total suspended sand.

A few bed-material samples were obtained at each site using a 6-inch diameter pipe dredge. At some sites, deep water and a swift current, armoring, and the presence of coarse particles on the streambed made sampling difficult. Although indicative of the sizes of particles present in the streambed (less than 150 mm), bed-material data presented in this report may not be representative of actual particle-size distributions. Surface and sub-surface samples were also obtained where the streambed was exposed or where water depths were less than 2 ft. These samples, obtained with a sampler similar to a McNeil sampler (McNeil and Ahnell, 1964) are probably representative of actual particle-size distributions.

Measurements of depth and width at sampling sections were usually made during bedload measurements. Depths were measured by sounding with the Helley-Smith sampler at 16 to 25 verticals in the cross section. Stream width was determined from station markings on cableways or from sextant readings. Average velocity was determined by dividing the rated discharge of the stream by the cross-sectional area (width x depth).

SEDIMENT DISCHARGE

Sediment Transport

Sediment is transported in suspension, by rolling and bouncing along the streambed, or as a combination of both. Suspended sediment, as the name implies, consists of particles that are transported in a stream while being held in suspension by the turbulent components of the flowing water. Coarse sediment that is transported on or near the streambed constitutes the bedload. Clay- and silt-size particles usually are moved in suspension and gravel particles move on or near the streambed. Sand-size particles may be transported either as suspended load, as bedload, or both.

Suspended-Sediment Concentration and Discharge

Suspended-sediment data for the period October 1983 to September 1984 are listed in table 2. Suspended-sediment concentrations for the winter (October to April) when the rivers are lowest are generally less than 10 mg/L. During 1984, spring breakup occurred at all sampling sites in early May. Suspended-sediment concentrations through late May ranged from less than 5 mg/L for Portage and Indian Creeks to more than 400 mg/L at most sites on the Susitna, Chulitna, and Talkeetna Rivers. The amount of sand-size material (0.062-2.0 mm) was generally large relative to the finer silt-clay fraction (less than 0.062 mm) suggesting that sediment was supplied primarily from the erosion of stream channels by snowmelt.

Suspended-sediment concentrations at individual sampling sites are most variable during the summer (June to August). The larger concentrations typically occur during periods of storm runoff.

The Susitna River near Talkeetna (map No. 6) and the Talkeetna River near Talkeetna (map No. 11) are least affected by glacial runoff; glaciers cover 5 and 7 percent of their respective drainage areas. Sampled concentrations at these sites ranged from about 200 to 1,000 mg/L, and averaged about 400 mg/L during June to August 1984. Suspended-sediment discharge of the Susitna and Talkeetna Rivers averaged 28,000 and 12,000 ton/d respectively.

The drainage area of the Chulitna River above the sampling site (2,580 mi^2) is about 40 percent as large as the drainage area of the Susitna River near Talkeetna. Twenty-seven percent of the Chulitna River drainage area is covered by glaciers. Summer concentrations of suspended sediment in the Chulitna River are typically more than twice as high (800 mg/L) as those for either the Susitna or Talkeetna Rivers near Talkeetna. Suspended-sediment discharge of the Chulitna River averaged 62,000 ton/d during June to August 1984 (see table 5 later in text).

Suspended-sediment data obtained at the sampling site designated Susitna River below Chulitna River near Talkeetna (map Nos. 9 and 10 for the right and left channels, respectively) are representative of the combined discharge of the Susitna River near Talkeetna and Chulitna River below canyon near Talkeetna (map No. 8). The site, about 1 mi below the confluence of the Chulitna and Susitna Rivers, includes two major channels (separated by a stable, vegetated island) and several minor channels. At this site, the right channel (as viewed looking downstream) of the Susitna River carries the entire flow of the Chulitna River along with smaller but varying amounts of "crossover" flow from the Susitna's left channel. Suspended-sediment concentration and discharge for the right channel were typically several times higher than that of the left channel in the period June through August 1984.

Suspended-sediment concentrations for the Susitna River at Sunshine ranged from 569 to 999 mg/L from June through August 1984. Suspended-sediment concentrations at this site represent the result of the mixing of the Chulitna, Susitna, and Talkeetna Rivers. Suspended-sediment discharge for the Susitna River at Sunshine, from June through August, averaged about 110,000 ton/d which agrees closely with the sum of sediment discharges for the Chulitna, Susitna, and Talkeetna Rivers (102,000 ton/d).

The Yentna River, with a drainage area of 6,180 mi^2 (above the gaging station) is the largest tributary to the Susitna River. Samples of suspended-sediment concentration ranged from 363 to 792 mg/L during June to August. Concentrations for the Susitna River at Susitna Station (563 to 700 mg/L) fall within the range in concentration for the Yentna River and Susitna River at Sunshine.

Suspended-sediment concentrations and discharge usually decline during September and October as cooler weather reduces the melting rate of high-altitude snowpacks and glaciers. In 1984, no major storms occurred during this period and sampled concentrations of the sites at Susitna and Talkeetna Rivers near Talkeetna were less than 30 mg/L. Concentrations for the Chulitna and Yentna Rivers declined substantially below summer values but remained greater than 100 mg/L by late September.

Relation Between Suspended-Sediment Discharge and Water Discharge

A common method for analyzing sediment-transport characteristics at a site is to construct a graph of sediment discharge versus water discharge. This relation is generally illustrated by a plot on logarithmic paper and is referred to as a sediment-transport curve. Data for May to September 1982-84 reported in Knott and Lipscomb (1983 and 1985) and in this report were used to develop transport curves for the silt-clay and sand size fractions of suspended sediment for the Susitna, Chulitna, and Talkeetna Rivers (figs. 2-6). Historical data (U.S. Geological Survey, 1975-84) were used to develop similar curves for the Susitna and Yentna Rivers near Susitna Station (figs. 7-8). Coefficients of determination (r^2) were computed from a least-squares fit of log-transformed values to provide a measure of the variance of sediment discharge to water discharge. The transport curves for suspended sediment should be considered representative only for the period of open water (May to September). Particle-size data obtained for samples collected in winter periods (October to April) are too few to construct similar curves.

The transport curves of silt-clay size material for all sampling sites near Talkeetna show a similar trend; that is, the silt-clay size discharge increases at a similar exponential rate relative to increases in water discharge. Exponents of water discharge, Q, in the relations (figs. 2-5) ranged from 2.86 to 3.14; r^2 ranged from 0.74 to 0.93. The increase in silt-clay size discharge relative to increases in water discharge is considerably smaller for sampling sites on the Yentna River and Susitna River at Sunshine and Susitna Station (figs. 6-8). The progressive decrease in exponents from Talkeetna to Susitna Station may be due to lags in peak sediment concentration relative to peak water discharge or to an increased distance from sediment sources.

Transport curves for suspended sand-size material indicate a larger variation in exponents than those for silt-clay size material (fig. 2-5). Exponents of water discharge for sites near Talkeetna range from 2.21 to 3.39; r^2 values range from 0.86 to 0.88. The trend of decreasing exponents with distance downstream from Talkeetna also occurs for the transport of suspended sand.

Transport curves of total suspended-sediment discharge for winter periods (October to April) were prepared from recent historical data (figs. 9-15). Pre-1975 data generally were excluded from the analyses because of apparent shifts in transport relations for several rivers following the extremely wet year of 1971. Because of the paucity of suspended-sediment data for winter months, most relations between water and suspended-sediment discharge for October to April periods are not well defined.

Bedload Discharge and Hydraulic Characteristics

The bedload and hydraulic data for the sampling sites are summarized in table 3. Bedload data are expressed both as discharge in tons per day, and in terms of their particle-size distribution in percent finer than the indicated sieve size.

Winter samples (through ice cover) of bedload have been collected twice at most sites -- once in March 1983 and again in February 1984. Bedload discharges computed from samples collected in February and March probably indicate near-minimum rates of transport because these are the months of minimum streamflow. Bedload discharges of the Chulitna, Susitna, and Talkeetna Rivers near Talkeetna were extremely low, ranging from zero to about 2 ton/d. In February 1984, bedload discharge of the Susitna River increased to 52 ton/d at the site "below Chulitna River near Talkeetna" and to more than 200 ton/d at Sunshine. Bedload at all sites was predominantly sand during the winter, but large amounts of gravel were transported at sampling sites on the Chulitna River and the Susitna River at Sunshine (table 3).

During the 1984 open-water period, bedload discharge of the Susitna River near Talkeetna ranged from 14 to 894 ton/d (table 3). During this same period, water discharge ranged from 8,460 to 40,900 ft^3/s. The transported material consists primarily of sand (81-100 percent) and lesser fractions of gravel (0-19 percent).

Bedload discharge of the Chulitna River below the canyon ranged from 2,090 to 6,590 ton/d and water discharges ranged from 7,480 to 23,300 ft^3/s. During low-flow periods in May and September, the particle-size distribution of bedload on the Chulitna River tended toward a high percentage of sand (63-87 percent). Gravel was the primary constituent of the bedload (52-69 percent) during the summer.

During the open-water period, bedload discharge of the Talkeetna River near Talkeetna ranged from 48 to 2,690 ton/d for water discharges ranging from 2,900 to 23,400 ft^3/s. Typically, the bedload at this site consisted mainly of sand (70-99 percent). The percentage of gravel exceeded that of sand only during the high flow of August 26, 1984.

Bedload discharge at Susitna River below the Chulitna River was measured separately in each of two major channels about 1 mi downstream from the confluence. Bedload transport rates in each channel roughly correspond to rates measured at upstream sites on the Chulitna and Susitna Rivers near Talkeetna. A large part of the water discharge, however, crosses over from the Susitna River and mixes with flow originating from the Chulitna River. Bedload transport rates in the right channel are similar to those measured at the upstream Chulitna River site. Transport rates ranged from 652 to 12,200 ton/d with gravel constituting about 50 to 80 percent of the bedload. Bedload during low flows was predominantly sand (60-80 percent). Bedload rates in the left channel are typically much lower than those in the right channel and are similar to those measured at the Susitna River near Talkeetna. Bedload ranged from 18 to 1,430 ton/d with sand comprising about 70 to 90 percent of the bedload.

Bedload discharge of the Susitna River at Sunshine ranged from 1,190 to 3,590 ton/d at flows ranging from 17,800 to 99,700 ft^3/s. Sand and gravel fractions generally varied with water discharge. During low flows the bedload mixture was about 80 to 90 percent sand and 10 to 20 percent gravel. During the summer, the percentage of sand was generally about 60 percent, except for the high flow of August 25 when 80 percent of the bedload was sand. The bedload was predominantly sand during winter measurements.

Bedload measurements for the Yentna and Susitna Rivers near Susitna Station were initiated in 1984. The Yentna River transported a large amount of bedload (6,800-11,300 ton/d) but the range in quantity of bedload transported was small; low flows seem to transport as much bedload as do higher flows. Most of the bedload was sand (85-91 percent). Bedload transported by the Susitna River at Susitna Station during 1984, ranged from 3,250 to 8,590 ton/d and was also mostly sand (76-96 percent). The amount of bedload sand transported past Susitna Station is lower than that of the Yentna River. Because the Susitna River above the confluence of the Yentna River also contributes a considerable amount of similar material, a large part of the bedload sand measured at the upper sites may be transported past Susitna Station as suspended sediment, may be deposited between the sites, or may be moving at very slow velocities relative to the water. Recent studies by Emmett and others (1983) indicate that bedload may move at speeds of 0.01 to 0.1 percent of the mean velocity of the flow.

Channel cross sections for selected sites, with a corresponding plot of bedload discharge at individual sampling points, are shown on figures 16-22. In most cases maximum bedload movement occurs in the zone between the thalweg (maximum channel depth) and the mid-channel.

The volume of bedload material at individual sampling points was visually estimated and converted to equivalent weight during sampling. Individual samples were composited for sieve analyses. The estimated weights were used, together with the actual weight of the composited sample, to give an estimate of bedload for each sampling point.

Relation Between Bedload Discharge and Water Discharge

A relation between bedload discharge and water discharge can be defined using methods similar to those for suspended sediment. Log-transformed data and a least-squares analysis were generally used to obtain a best-fit line through the plotted points. Transport curves and corresponding equations describing the relations are shown in figures 23-36.

The line of best fit for the transport curves, as computed by the least-squares method, provides a reasonable relation between sand or gravel discharge and water discharge for most of the monitoring sites. The relations generally indicate that sand and gravel discharge increase with corresponding increases in water discharge. The scatter of data points about the fitted lines, however, varies widely from site to site, suggesting that bedload discharge is influenced by factors other than water discharge. The other factors probably include hydraulic characteristics of the river (depth, width, velocity, slope), particle size, the available supply of coarse sediment, and time lags between the movement of coarse material and runoff. Part of the scatter of the data may also be due to sampler bias. The Helley-Smith sampler is generally considered to be in the experimental stage of development.

Relations between water and bedload discharge are less reliable than those for suspended sediment. Relations with coefficients of determination larger than 0.5 are shown as solid lines. Dashed lines are used for relations with coefficients of determination that are smaller than 0.5 or for relations obtained by a visual fit.

The line of best fit, computed by the least-squares method, provides a reasonable relation between bedload and water discharge from the Susitna River near Talkeetna (fig. 23). The scatter of data points about the line is small and is uniform for the entire range of flow.

Bedload data for the Chulitna River have an extremely large scatter (fig. 24). The distribution of the data is unusual in that bedload appears to increase with increasing discharge at relatively low flows and then decrease at higher flows. Decreases in bedload occur abruptly at flows of 17,000 to 18,000 ft^3/s and at 28,000 to 30,000 ft^3/s, indicating a reduced supply of coarse sediment at the sampling site. A preliminary analysis of the data for seasonal trends suggests that part of the variability in bedload transport is due to a time lag between bedload and water discharge. A major change in channel shape occurs about 8 mi upstream from the sampling site. At this point, the river is constricted to a narrow canyon. The supply of bed material in the canyon is small relative to that available in an extensive braided channel reach upstream from the canyon. Comparisons of periods of high bedload transport with hydrographs of stream discharge indicate that coarse sediment requires about 20 to 40 days to travel from the head of the canyon to the sampling site compared to several hours for the water to travel the same distance. If the extreme variability in bedload is assumed to be largely the result of changes in the supply of coarse sediment, some approximate relations between bedload and water discharge can be developed.

Three relations were estimated for the transport of sand and gravel at the Chulitna River sampling site. The relations for low flow (7,000–17,500 ft^3/s) were obtained by least-squares analysis. These relations are assumed to represent a general steady-flow condition during which the supply of coarse sediment above the canyon is in equilibrium with the supply passing the sampling site. The transport relations for high flows (greater than 29,000 ft^3/s) were estimated by shifting the slope of the low-flow relations to represent a minimum sediment supply at the sampling site. Transport relations for intermediate flows were obtained by averaging the relations for low flows and high flows.

Bedload data for the Susitna River below Chulitna River (fig. 25) have a large scatter, but the data indicate a rough trend of increased bedload with increases in discharge. The relations between sand and gravel discharge and water discharge were obtained by least-squares analysis.

Bedload-transport relations for the Talkeetna River (fig. 26) are reasonably well defined and generally indicate a large exponential increase in bedload with water discharge, similar to that for the Susitna River near Talkeetna. Least-squares analysis was used to obtain the transport curve for gravel. The transport curve for sand discharge was obtained by visually fitting a straight line through the data. The average relation between bedload sand and water discharge is obscured by the repeated occurrence of high bedload lagging behind periods of storm runoff. The large displacement of the data, relative to the trend of most of the points, suggests that the supply of coarse sediment is highly variable during some periods.

Bedload data for the Susitna River at Sunshine (fig. 27) have a large scatter; the pattern of variability generally corresponds to that of the Susitna River below Chulitna River.

Bedload data for the sampling sites Yentna River near Susitna Station and Susitna River at Susitna Station (figs. 28-29) are considered insufficient to define a relation between bedload and water discharge. Comparison of the data with transport relations for Susitna River at Sunshine, however, suggests that the discharge of sand and gravel increases at small exponential rates with increases in discharge. Transport curves of total bedload discharge (figs. 30-36) for summer periods (May to September) were developed by combining curves for sand and gravel.

A few samples of bed material were collected from May through September 1984. Analyses of these samples are listed in table 4. Samples representative of the sediment present in submerged parts of the channels were extremely difficult to obtain because the rivers were too deep and swift for direct access to streambeds. Samples considered representative of particles finer than 128 mm, however, were obtained at most of the sampling sites.

ESTIMATED TOTAL SEDIMENT LOAD

The sediment load from a drainage basin is commonly expressed in terms of weight (short or metric tons) or volume (acre-feet or cubic meters). Sediment loads may be estimated by different methods, depending on the amount and type of available data. If daily records of streamflow are available, but sediment discharge has been measured only infrequently, the method most commonly used requires defining a relation between instantaneous sediment discharge and water discharge and applying this relation to daily values of water discharge. This method was used initially to estimate sediment load for this study. At some sites, however, a single sediment-transport curve could not be applied for the open-water period because of seasonal changes in the amount and particle-size distribution of sediment for given water discharges. At the "Chulitna River below canyon" site, the scatter of bedload-discharge data was such that even the definition of a bedload-water discharge relation is subjective. Thus, several alternative methods were selected to estimate sediment load for the 1984 water year.

Suspended-sediment loads were estimated using the Colby shift-control method (Colby, 1956). According to Colby, part of the scatter of sediment data in sediment transport relations is due to random or very short-term fluctuations in concentration, particularly the concentration of the coarse sediments. Part of the scatter may be due to an actual change that may persist for days, weeks, or seasons. If it is assumed that most of the observed scatter is due to seasonal changes and complex mixing of sediment produced from glacial melt and storm runoff, Colby's method would produce the most accurate estimates.

Colby suggests that if a change in the relation between water and sediment discharge persists for several days or more, the transport curve should be shifted to pass through or near each individual measurement. The method is subjective because judgment is used to decide whether the measurement is representative of an actual change or of a random fluctuation. An important advantage in using this method is that the accuracy of fit of the transport curve is of small importance.

Bedload also was estimated using the Colby shift-control method. At sites on the Chulitna and Talkeetna Rivers where the scatter in bedload-discharge data was extreme and regression equations did not fit the data, the initial transport curve was estimated by a visual best-fit of the data. Sediment-transport curves were constructed for silt-clay, sand, and gravel size components for both suspended sediment and bedload discharge measurements.

Estimated total sediment loads for the 1984 water year are summarized in table 5. Monthly and annual loads are given for four sites on the Susitna River and for one site on each tributary, the Chulitna, Talkeetna, and Yentna Rivers.

Total sediment load (sum of suspended load and bedload) of the Susitna River increases from 3.1 million tons in the middle reach of the river near Talkeetna to more than 25 million tons near the mouth at Susitna Station. The Chulitna, Talkeetna, and Yentna Rivers account for most of the increase, contributing 7.2, 1.2, and 12.9 million tons, respectively.

Suspended load of the Susitna River and its tributaries ranged from about 91 to 98 percent of the total load during 1984. A large part of the suspended load consisted of silt-clay size material (less than 0.062 mm) which is easily held in suspension and is generally transported large distances at nearly the same velocity as the flowing water. It is unlikely that any appreciable deposition occurs in the reach from Talkeetna to Susitna Station because the monthly amount of silt-clay size material transported at upstream sites is about the same as that transported at downstream sites. Similar comparisons for suspended-sand loads also show a good agreement in the amount of this material transported at upstream and downstream sites.

Bedload, which generally consists of medium sand to very coarse gravel (0.25-64.0 mm) at most sites, is subject to large variations in transport rate, depending on flow characteristics and the available supply of coarse sediment.

Annual bedload transport at the various sampling sites during 1984 ranged from about 50,000 to 1.2 million tons. Annual bedload was smallest at Susitna River near Talkeetna and largest at Yentna River near Susitna Station. Medium to coarse sand accounted for more than 80 percent of bedload at each site. The Chulitna River near Talkeetna transported about 630,000 tons during 1984, most of which was fine to coarse gravel (2.0-64.0 mm).

The small number of samples obtained for the Yentna and Susitna Rivers near Susitna Station in 1984 is considered insufficient to determine an average relation for estimating monthly bedload. An estimate of seasonal bedload was made, however, by averaging the individual measurements. Measurements obtained during the open-water period showed little change with water discharge. Two bedload measurements obtained during February and April 1985 were averaged to estimate the amount of bedload transported during the winter (October to April).

SUMMARY AND CONCLUSIONS

The total sediment load of the Susitna River near its mouth (at Susitna Station) during the 1984 water year was estimated to be about 25 million tons. This estimate, as well as estimates of sediment load for other sites on the Susitna River and its tributaries, are based primarily on measurements of suspended-sediment and bedload discharge made during the 1982-84 water years. Suspended-sediment data collected in winter periods prior to 1982 were used to develop sediment-transport relations for sites at which the 1982-84 data were insufficient.

Estimates of total sediment load for the major tributaries of the Susitna River and the Susitna River near Talkeetna site account for most of the sediment passing Susitna Station, the farthest downstream sampling site. The Yentna and Chulitna Rivers contributed about 20 million tons of sediment, or 80 percent of the total for the 1984 water year. The Susitna and Talkeetna Rivers accounted for an additional 4 million tons of sediment during the same period. The combined drainage area of the above sites is about 17,000 mi^2, or 88 percent of that for the Susitna River at Susitna Station.

About 90 percent of the suspended material (silt, clay, and sand) transported past upstream sites reached Susitna Station during 1984. However, only 56 percent of the coarse sand and gravel estimated to have been transported past the upstream sites reached Susitna Station during the same period.

Sediment-transport relations developed in this report for many of the sampling sites should be considered provisional. Relations developed between water and suspended-sediment discharge generally provide a reasonable fit to the data except for winter periods, when few data are available. Relations between water and bedload discharge are less reliable than those for suspended sediment.

REFERENCES CITED

Colby, B. R., 1956, Relationship of sediment discharge to streamflow: U.S. Geological Survey open-file report, 170 p.

Emmett, W. W., 1980, A field calibration of the sediment-trapping characteristics of the Helley-Smith bedload sampler: U.S. Geological Survey Professional Paper 1139, 44 p.

Guy, H. P., and Norman, V. W., 1970, Field methods for measurement of fluvial sediment: U.S. Geological Survey Techniques of Water Resources Investigations Book 3, Chapter C2, 59 p.

Hartman, C. W. and Johnson, P. R., 1978, Environmental atlas of Alaska (2nd ed.): University of Alaska, Institute of Water Resources, 95 p.

Helley, E. J., and Smith, Winchell, 1971, Development and calibration of a pressure-difference bedload sampler: U.S. Geological Survey open-file report, 18 p.

Knott, J. M., and Lipscomb, S. W., 1983, Sediment discharge data for selected sites in the Susitna River basin, Alaska, 1981-82: U.S. Geological Survey Open-File Report 83-870, 45 p.

__________ 1985, Sediment discharge data for selected sites in the Susitna River basin, Alaska, October 1982 to February 1984: U.S. Geological Survey Open-File Report 85-157, 68 p.

McNeil, W. J., and Ahnell, W. H., 1964, Success of pink salmon spawning relative to size of spawning bed materials: University of Washington, Fisheries Research Insitute Report 469, 14 p.

National Weather Service, 1972, Mean annual precipitation--inches: National Weather Service [Alaska], map.

Searby, H. W., 1968, Climates of the States -- Alaska: Environmental Data Service ESSA, Climatology of the United States, No. 60-49.

Selkregg, L. L., editor, 1974, Alaska regional profiles -- southcentral region: University of Alaska, Arctic Environmental Information and Data Center, 255 p.

Still, P. J., and Jones, K. V., 1985, Alaska index: Streamflow and water-quality records to September 30, 1983: U.S. Geological Survey Open-File Report 85-332, 173 p.

U.S. Geological Survey, 1975-84, Water resources data for Alaska: U.S. Geological Survey Water-Data Reports.

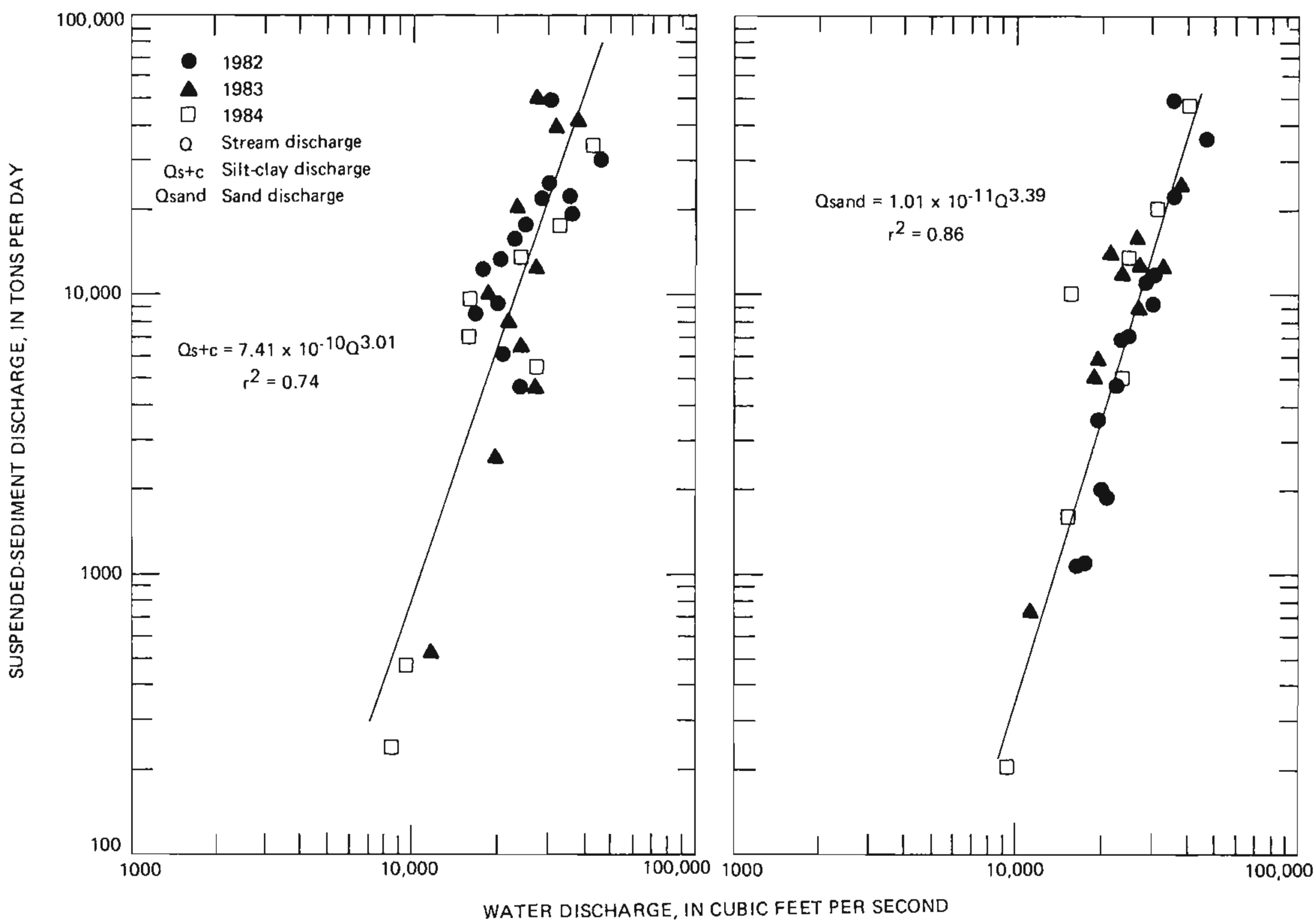

Figure 2.--Sediment-transport curves of suspended silt-clay and sand discharge for Susitna River near Talkeetna, May to September, 1982-84. (Map number 6)

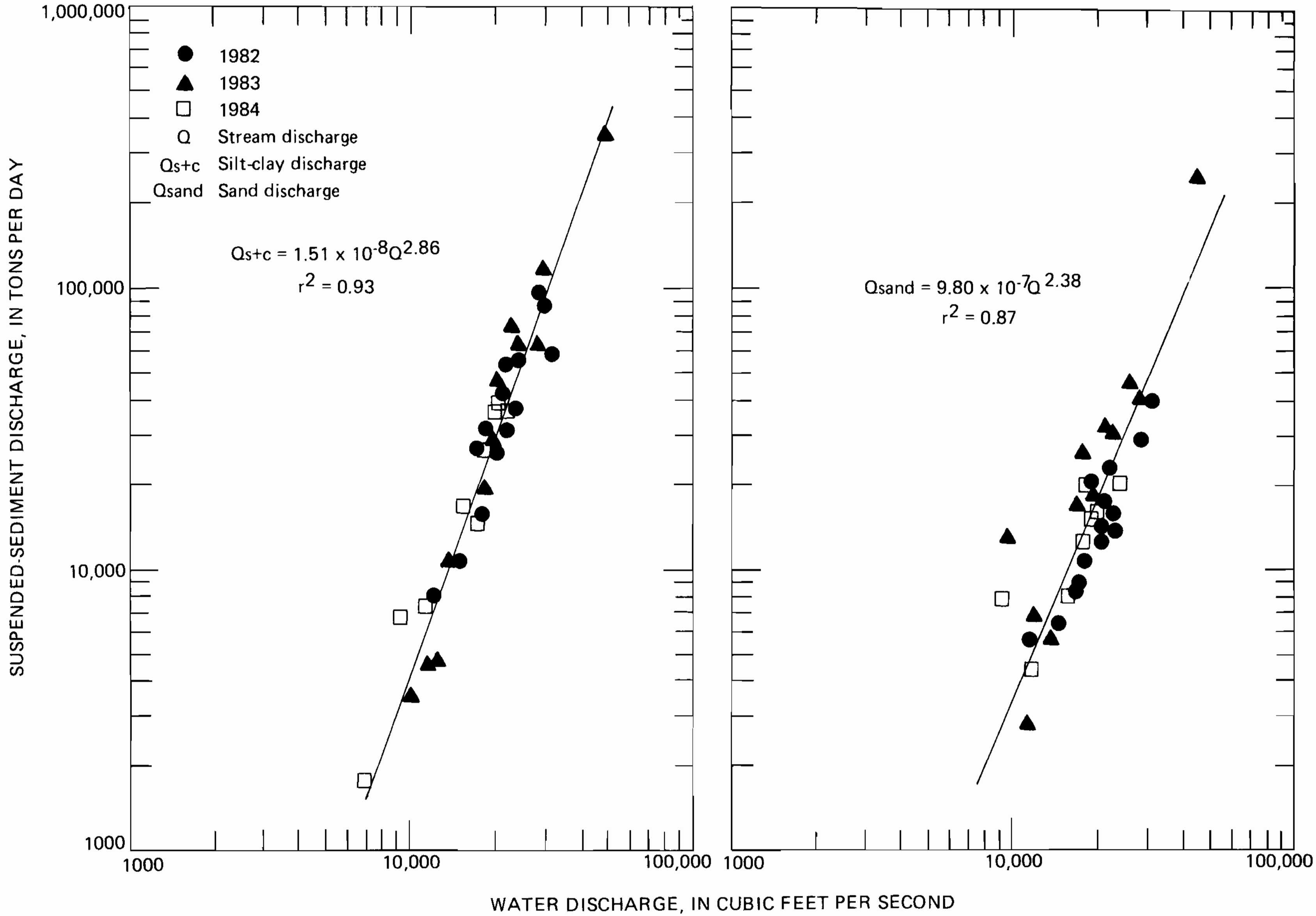

Figure 3.--Sediment-transport curves of suspended silt-clay and sand discharge for Chulitna River below canyon near Talkeetna, May to September, 1982-84. (Map number 8)

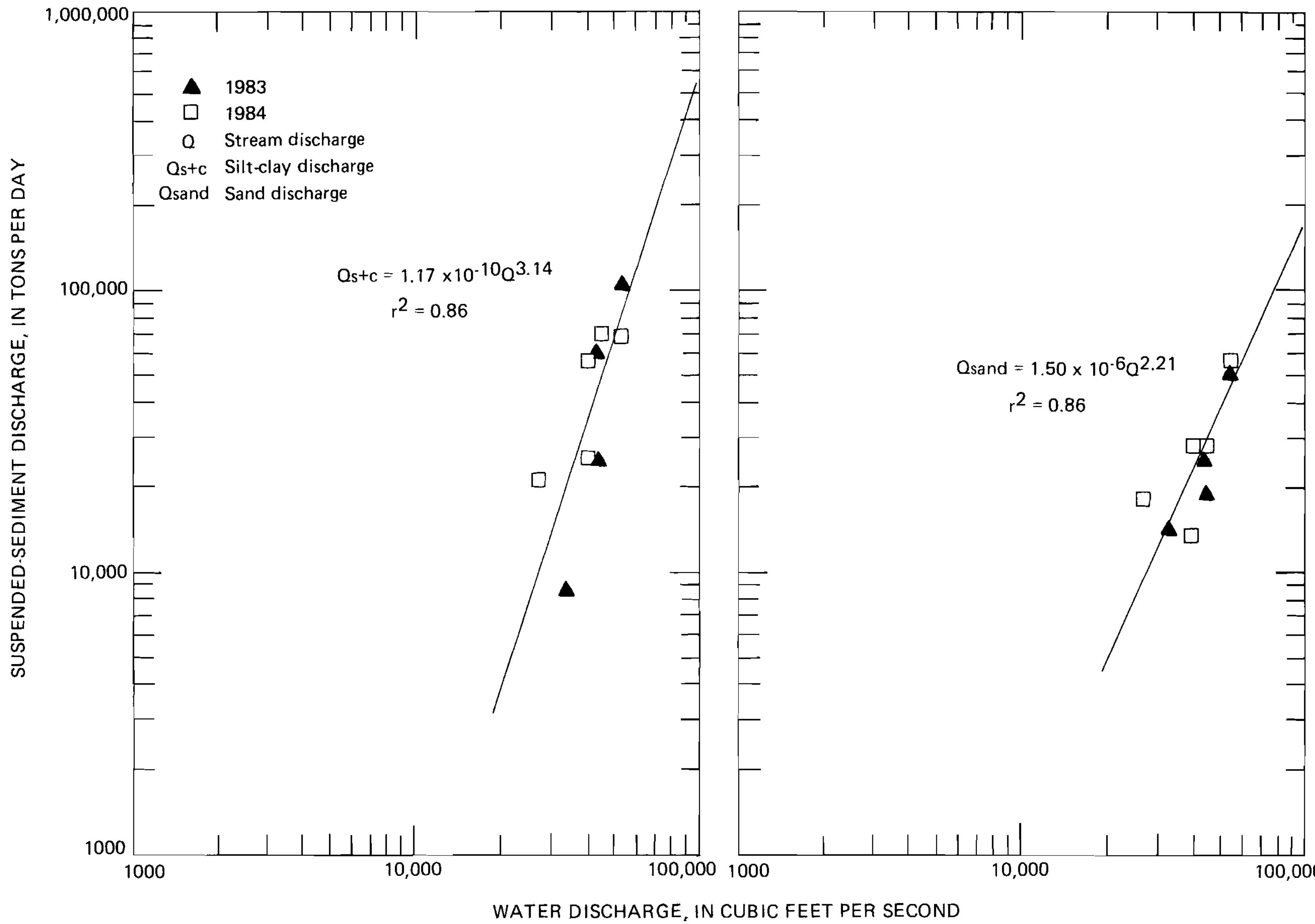

Figure 4.--Sediment-transport curves of suspended silt-clay and sand discharge for Susitna River below Chulitna River near Talkeetna (sum of right and left channels), May to September, 1983 and 1984. (Map numbers 9 and 10)

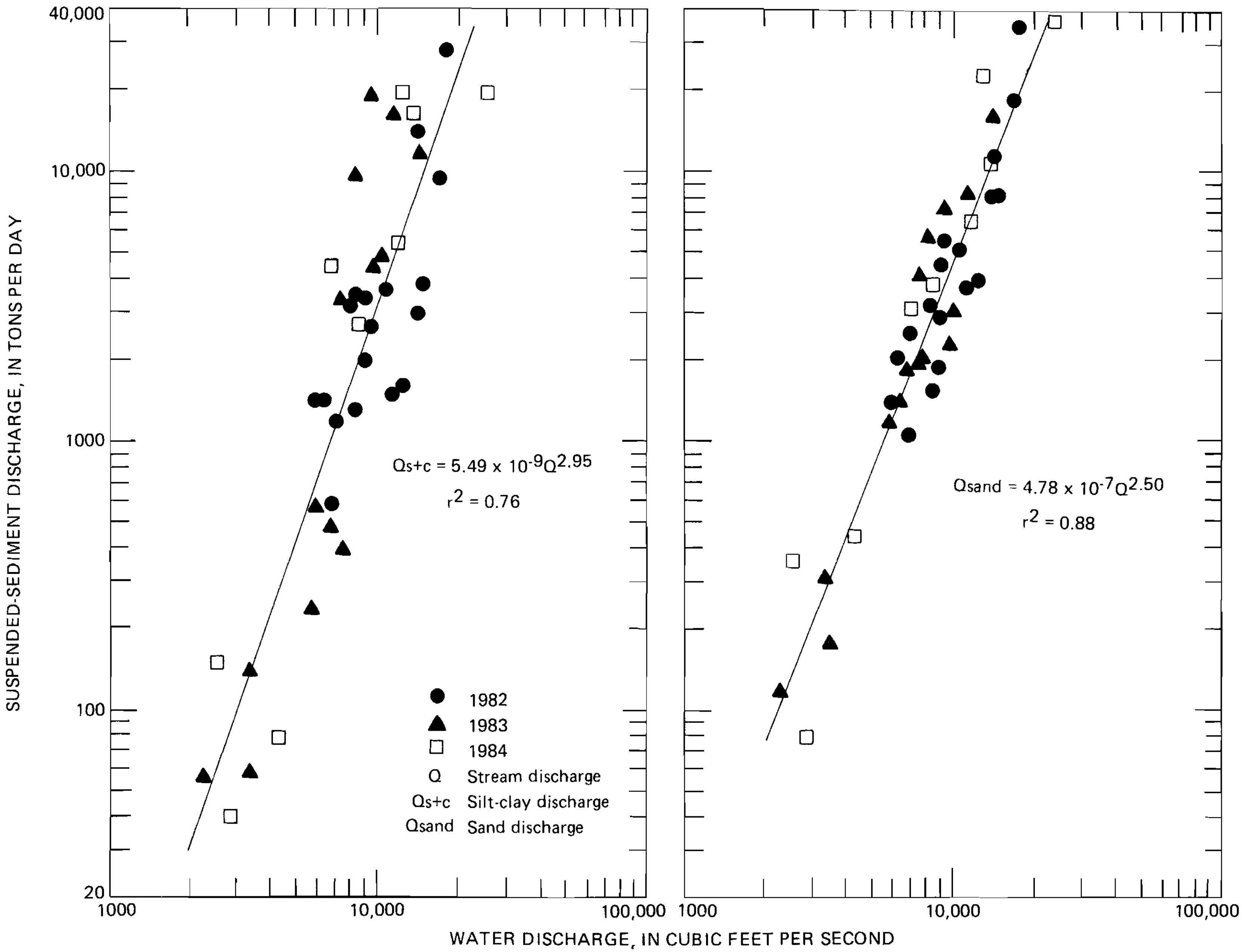

Figure 5.--Sediment-transport curves of suspended silt-clay and sand discharge for Talkeetna River near Talkeetna, May to September, 1982-84. (Map number 11)

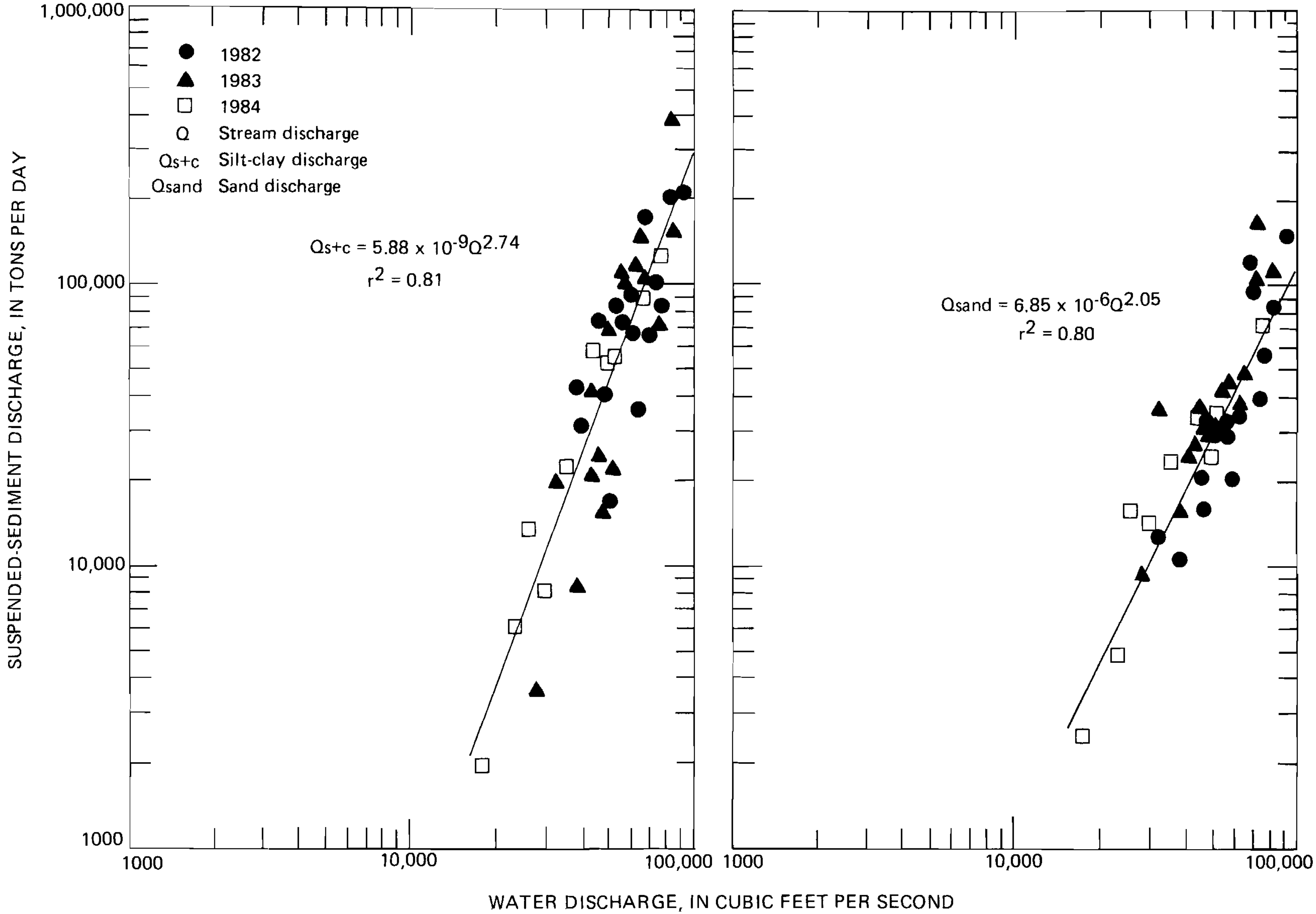

Figure 6.--Sediment-transport curves of suspended silt-clay and sand discharge for Susitna River at Sunshine, May to September, 1982-84. (Map number 12)

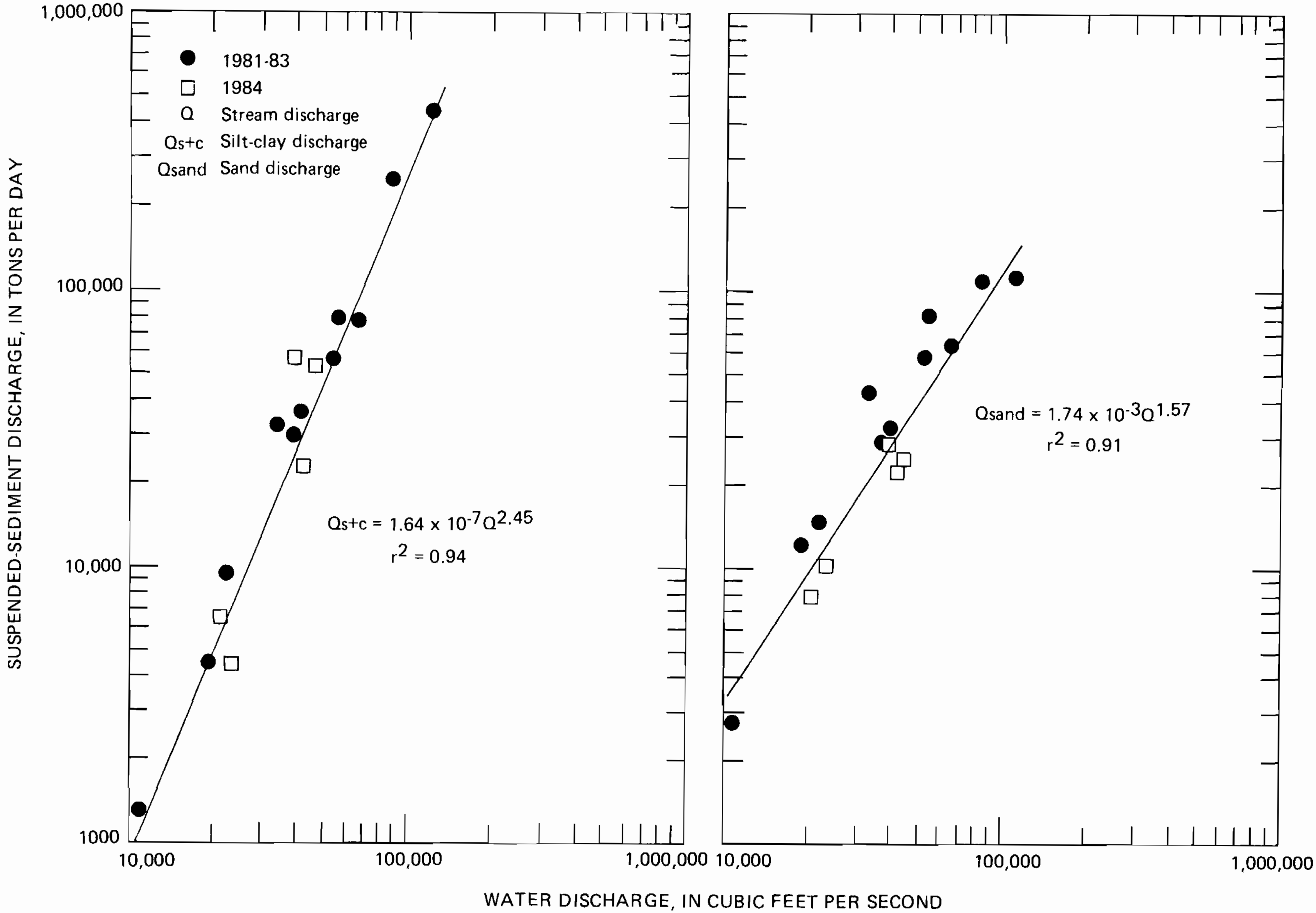

Figure 7.--Sediment-transport curves of suspended silt-clay and sand discharge for Yentna River near Susitna Station, May to September, 1981-84. (Map number 13)

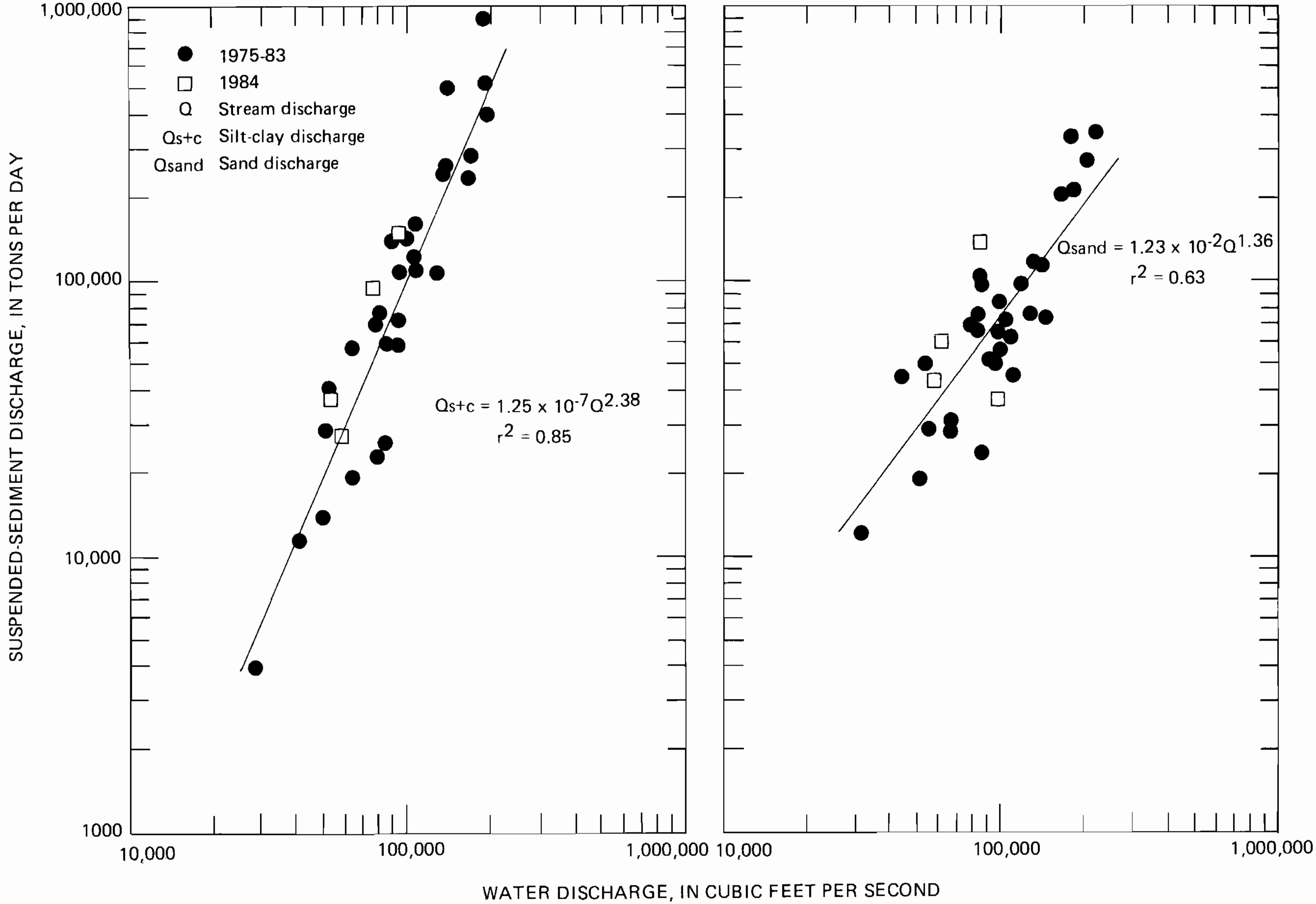

Figure 8.--Sediment-transport curves of suspended silt-clay and sand discharge for Susitna River at Susitna Station, May to September, 1975-84. (Map number 14)

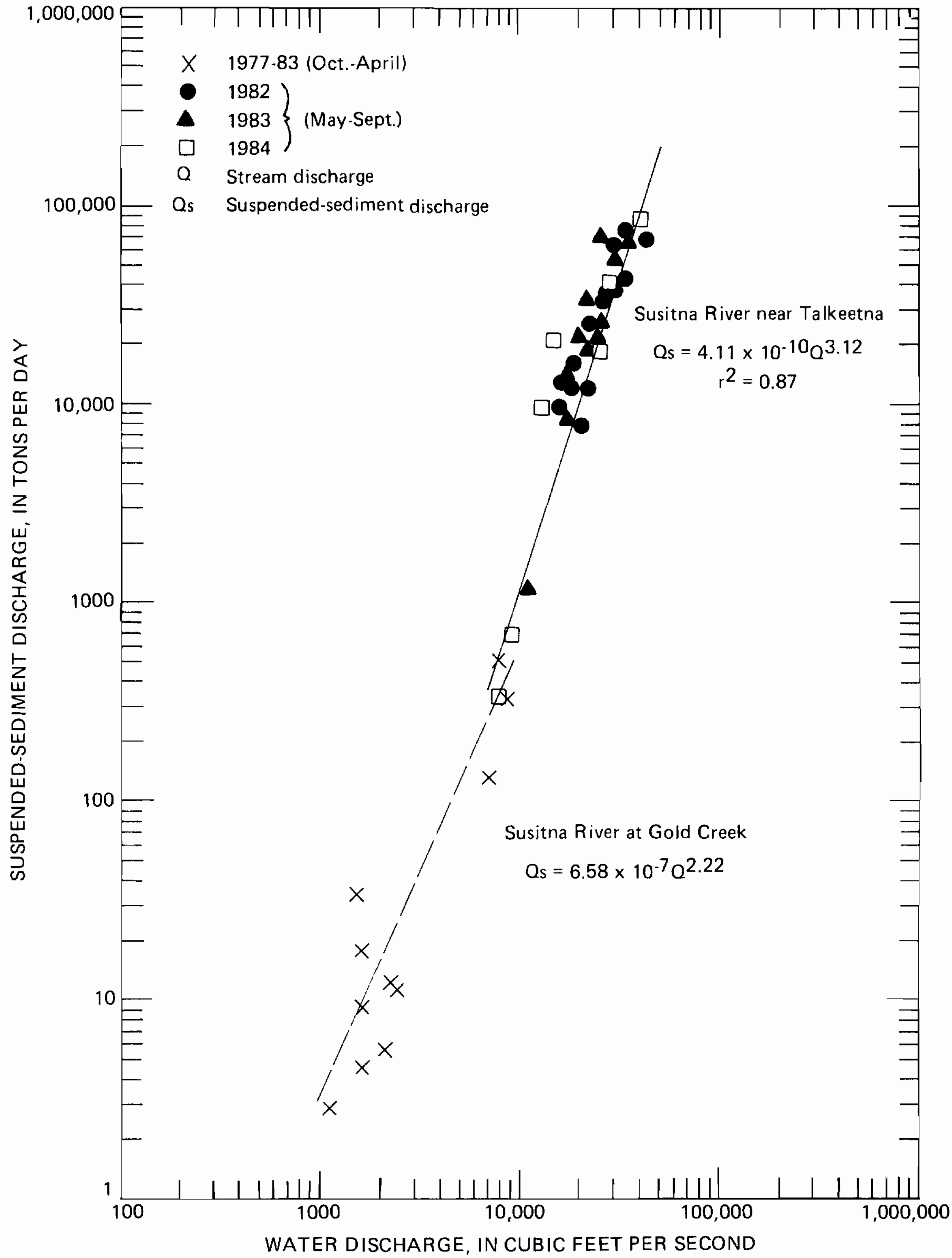

Figure 9.--Relation between suspended-sediment discharge and water discharge for Susitna River near Talkeetna, May to September, 1982-84 (map number 6) and Susitna River at Gold Creek, October to April, 1977-83. (Map number 3)

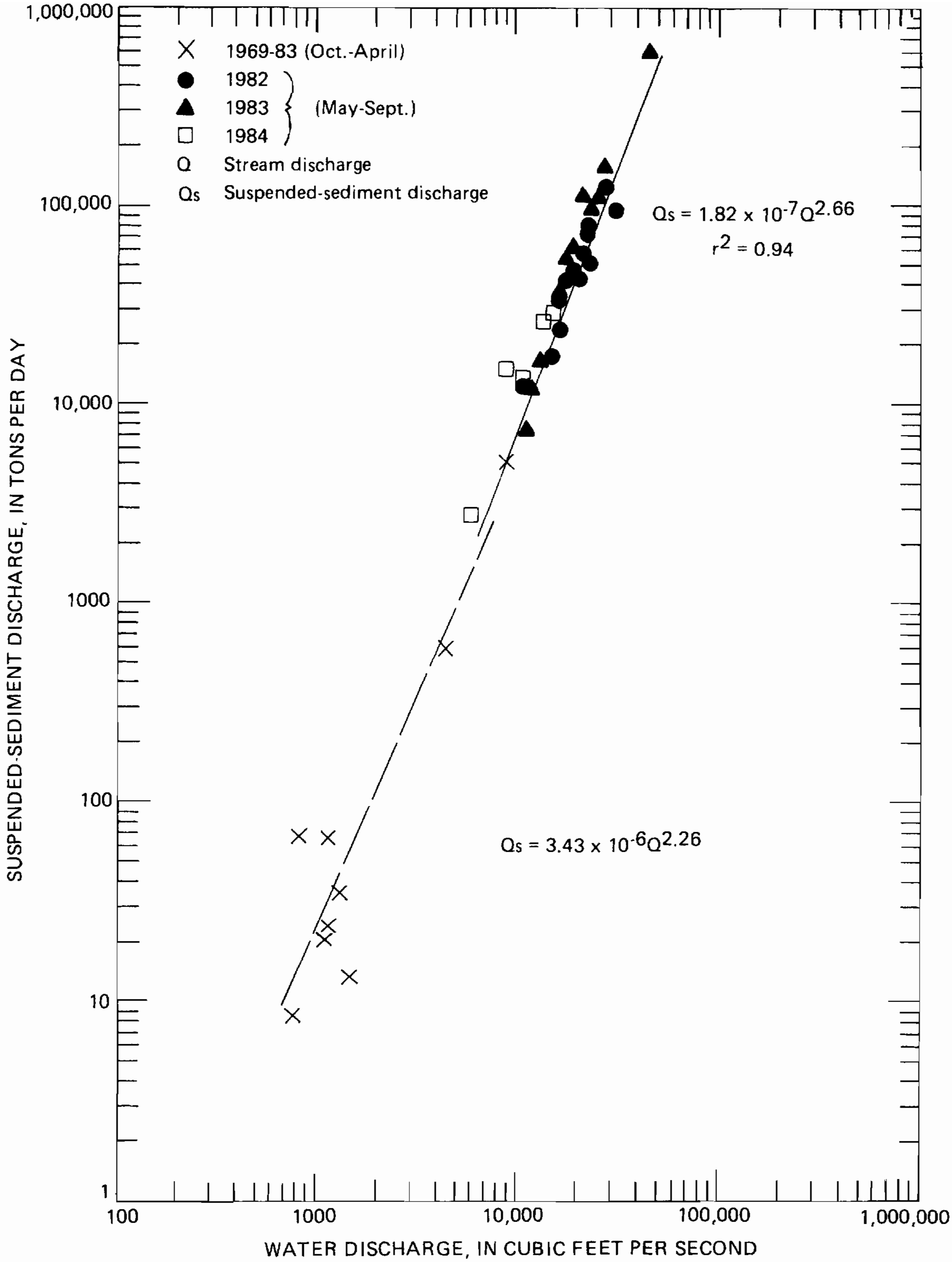

Figure 10.--Relation between suspended-sediment discharge and water discharge for Chulitna River below canyon near Talkeetna, May to September, 1982-84 and October to April, 1969-83. (Map number 8)

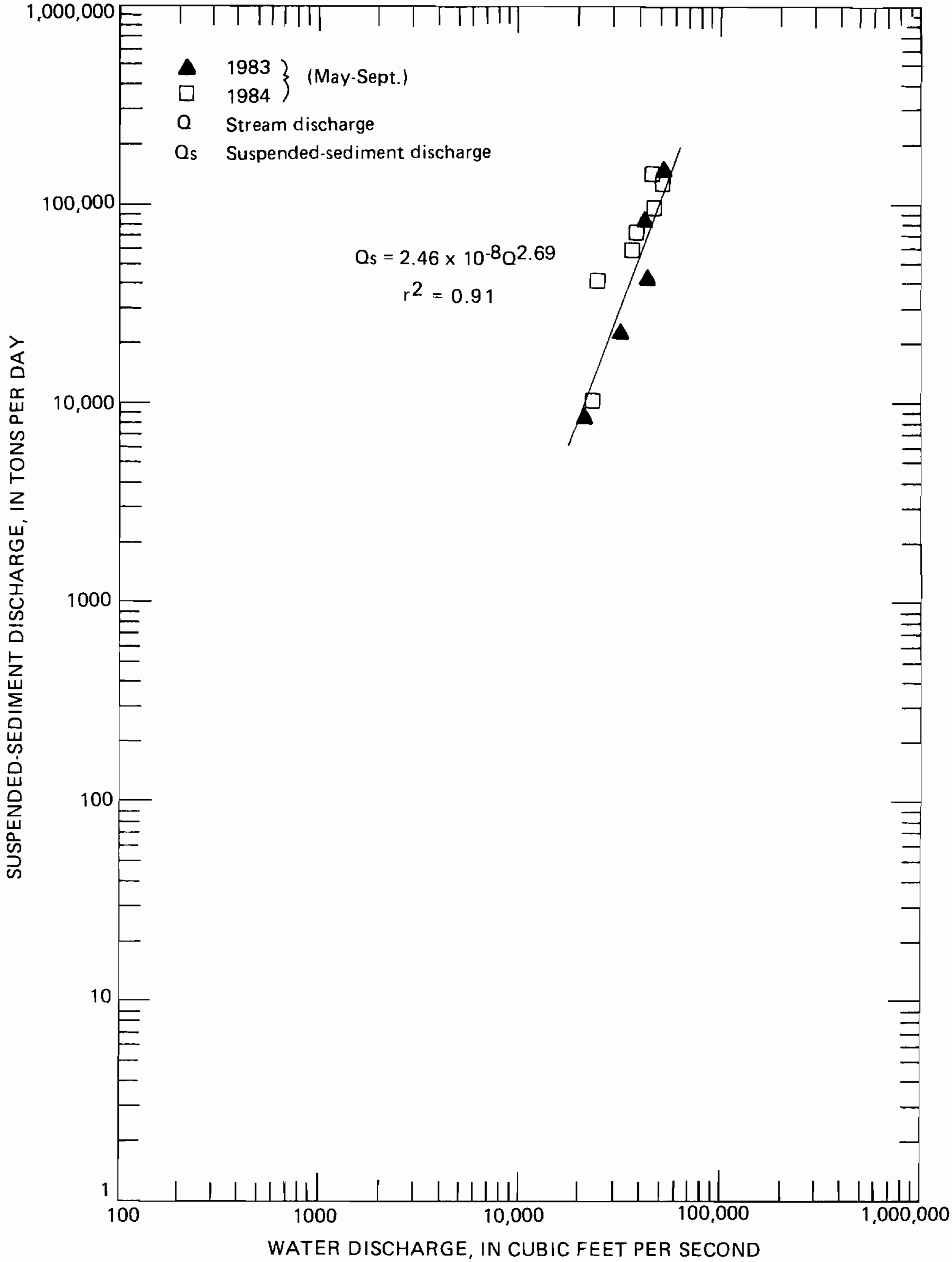

Figure 11.--Relation between suspended-sediment discharge and water discharge for Susitna River below Chulitna River near Talkeetna (sum of right and left channels), May to September, 1983 and 1984. (Map numbers 9 and 10)

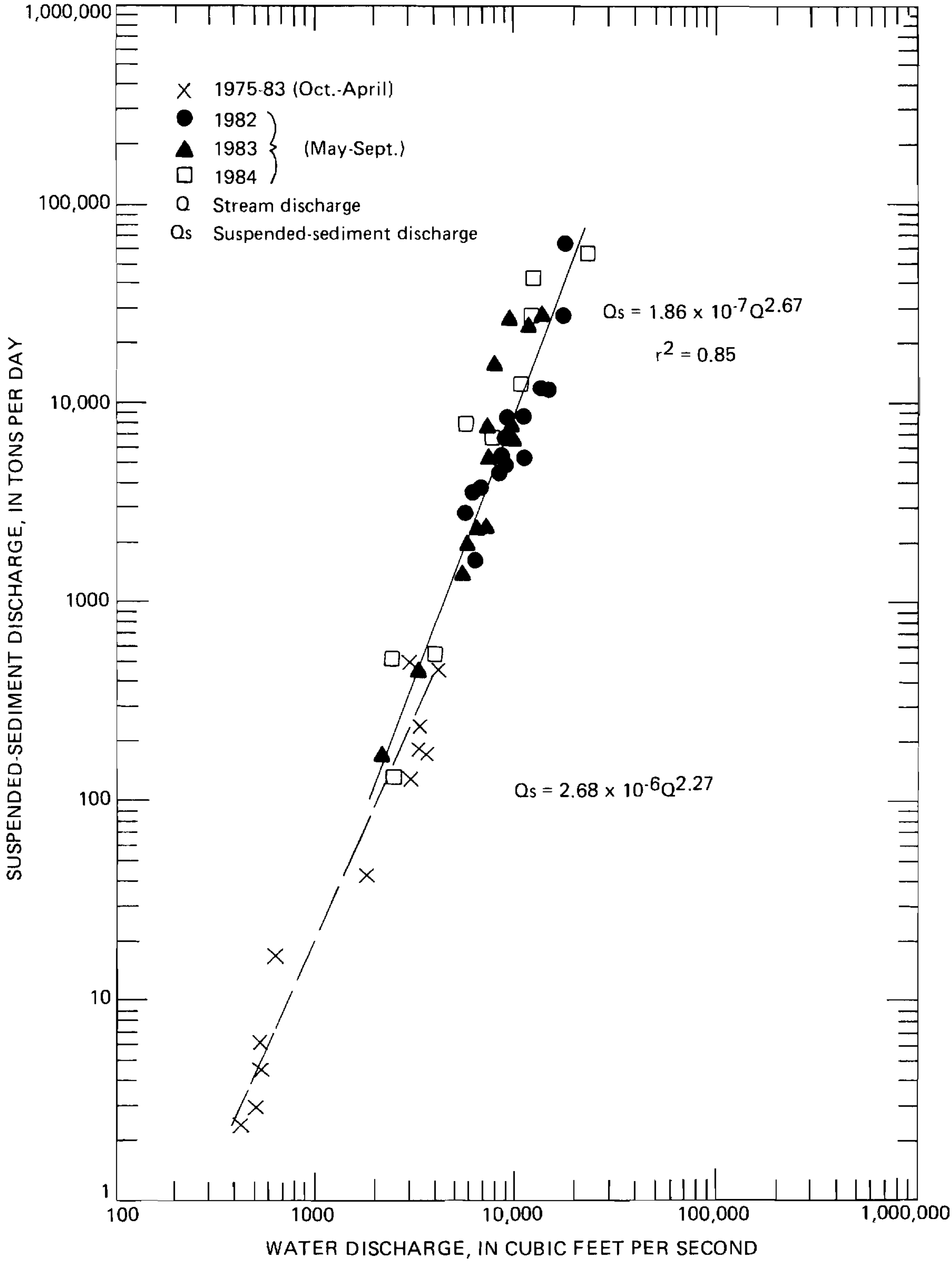

Figure 12.--Relation between suspended-sediment discharge and water discharge for Talkeetna River near Talkeetna, May to September, 1982-84 and October to April, 1975-83. (Map number 11)

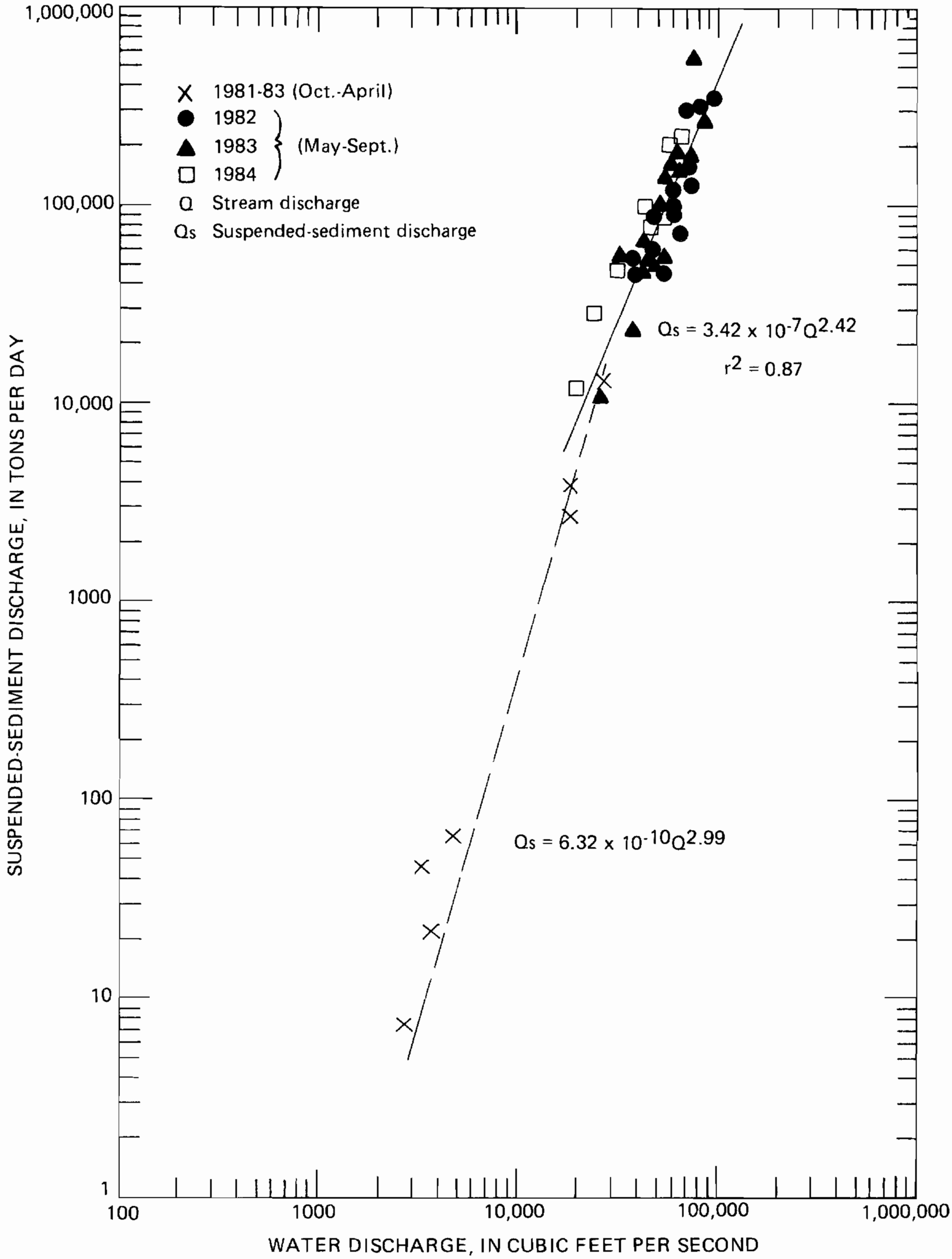

Figure 13.--Relation between suspended-sediment discharge and water discharge for Susitna River at Sunshine, May to September, 1982-84 and October to April, 1981-83. (Map number 12)

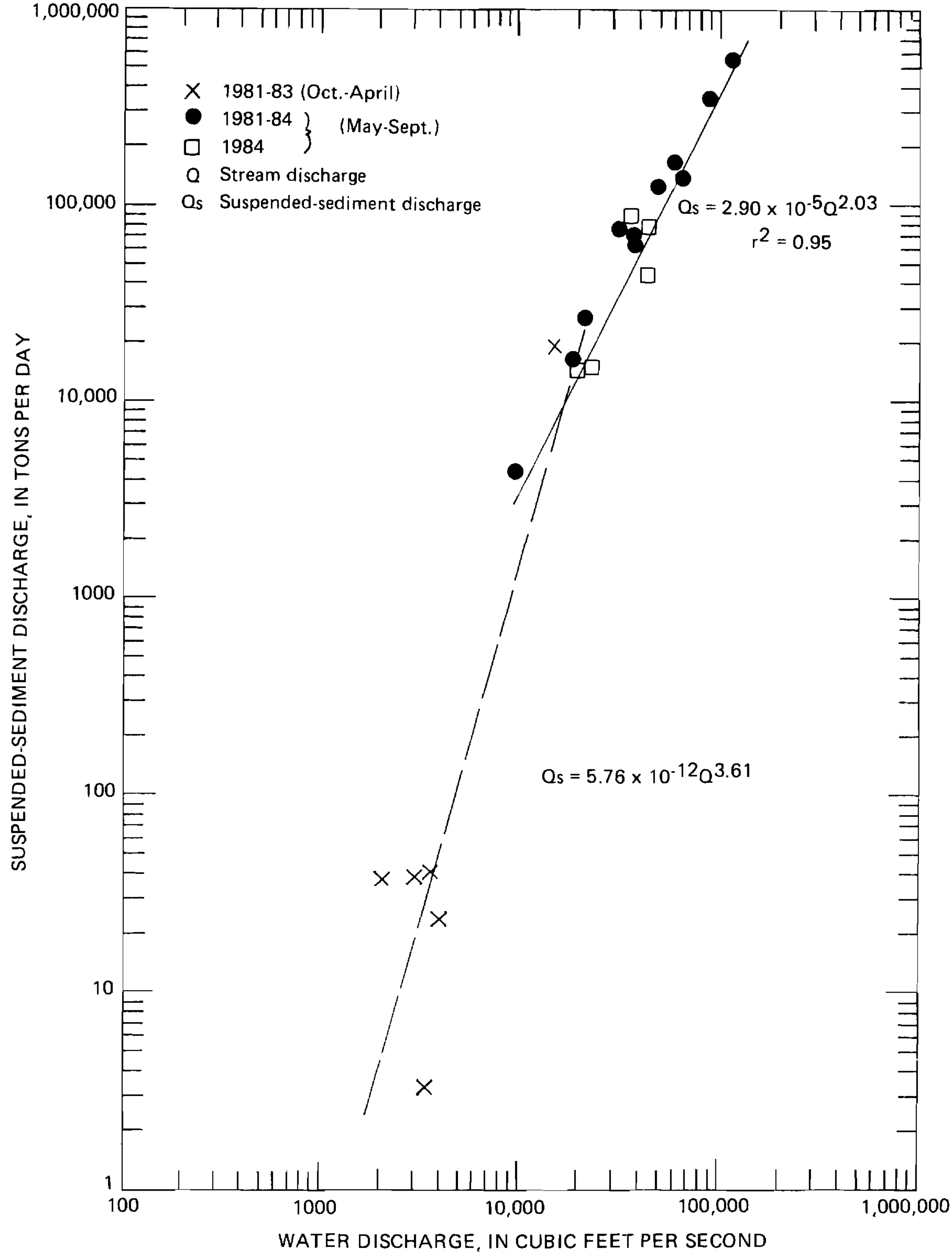

Figure 14.--Relation between suspended-sediment discharge and water discharge for Yentna River near Susitna Station, May to September, 1981-84 and October to April, 1981-83. (Map number 13)

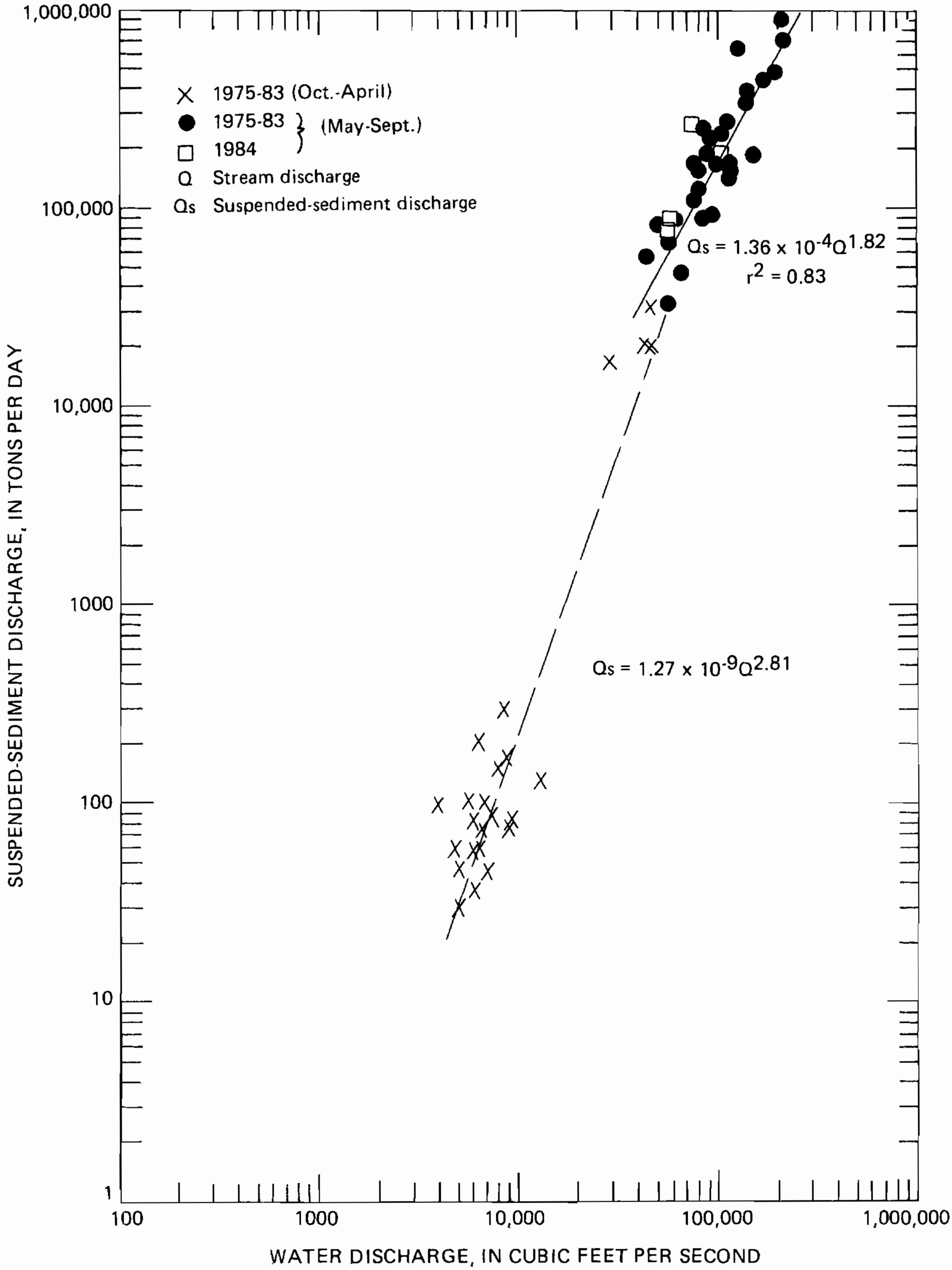

Figure 15.--Relation between suspended-sediment discharge and water discharge for Susitna River at Susitna Station, May to September, 1975-84 and October to April, 1981-83. (Map number 14)

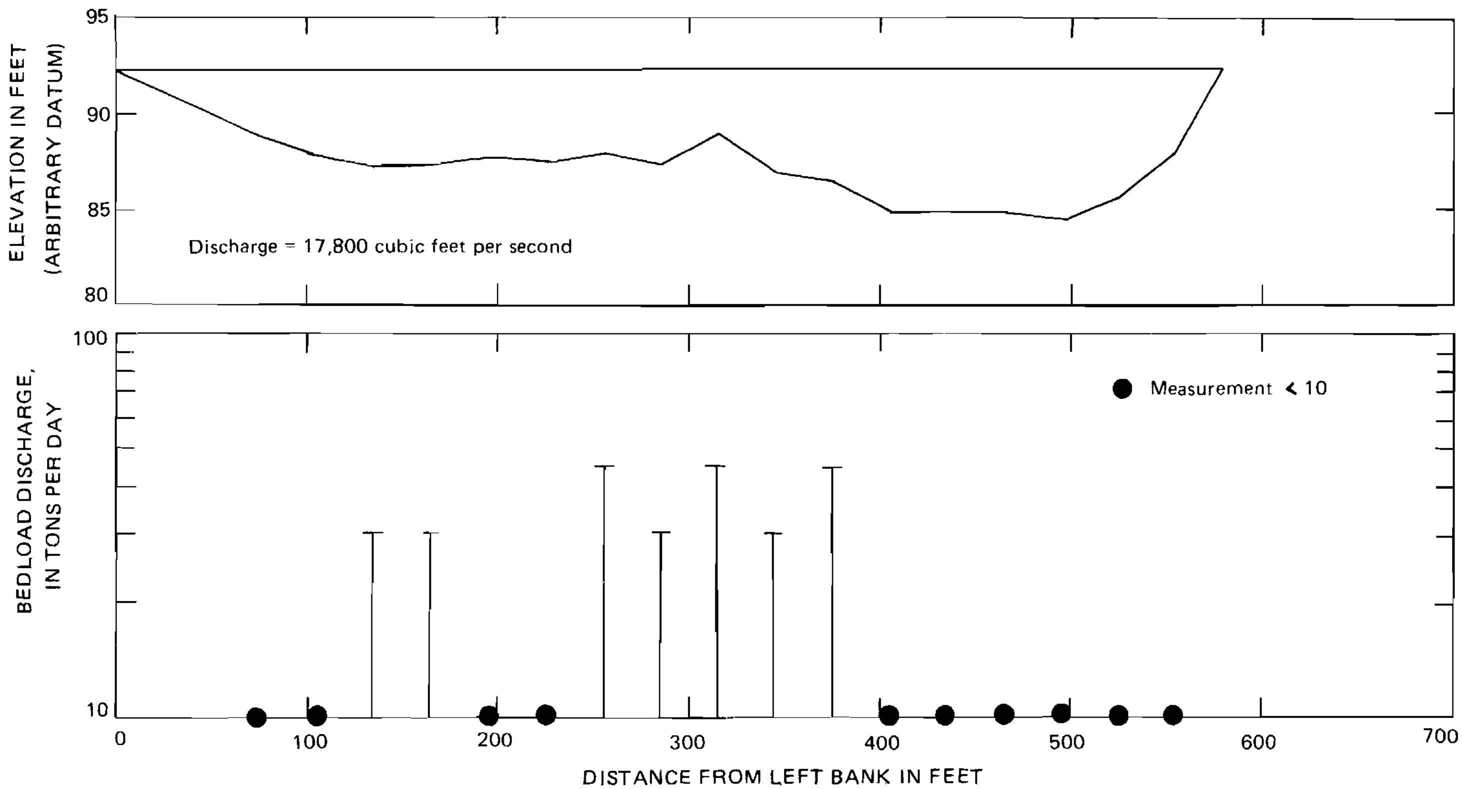

Figure 16a.--Cross section and distribution of bedload discharge, Susitna River near Talkeetna, May 17, 1984.
(Map number 6)

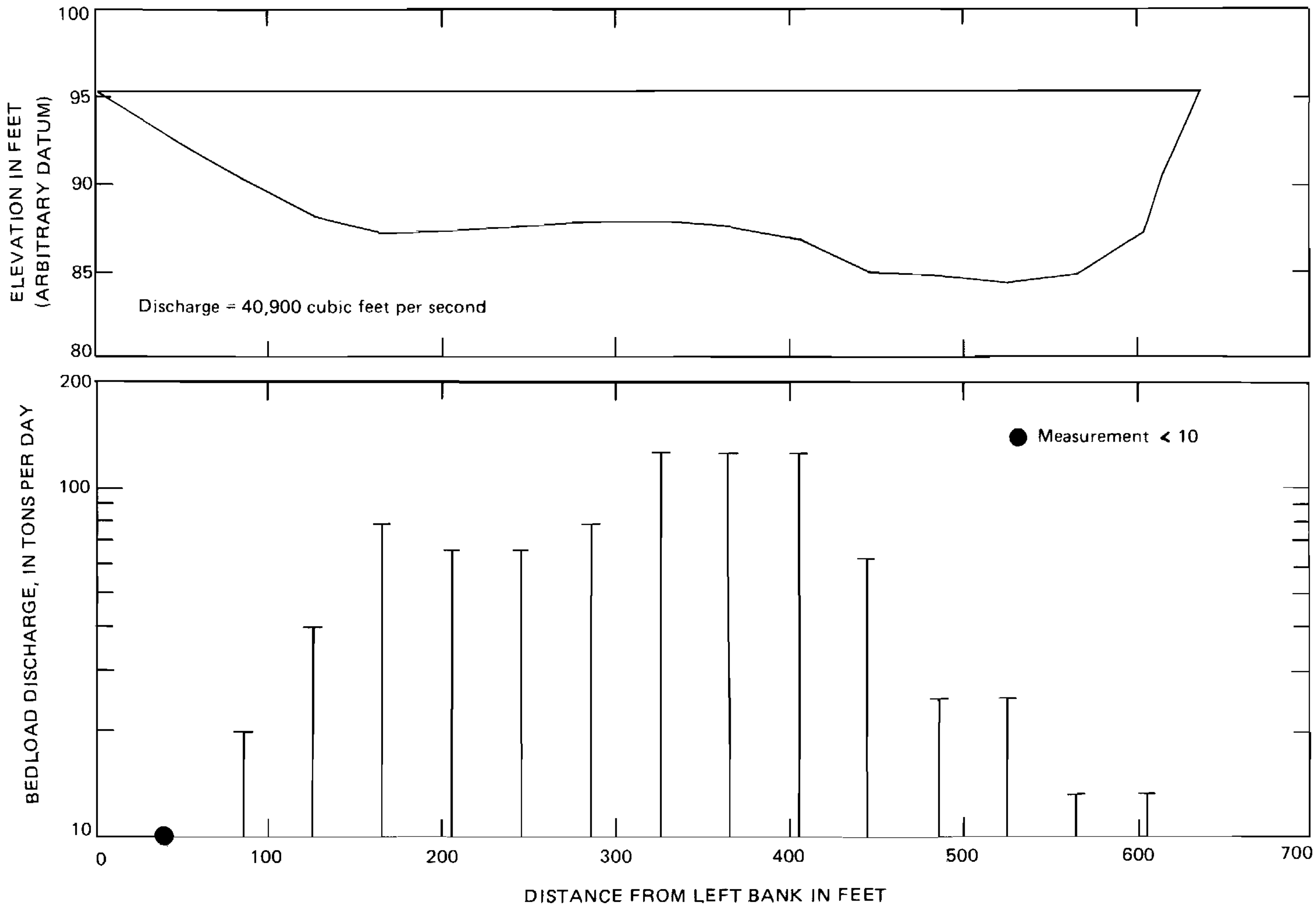

Figure 16b.--Cross section and distribution of bedload discharge, Susitna River near Talkeetna, August 26, 1984. (Map number 6)

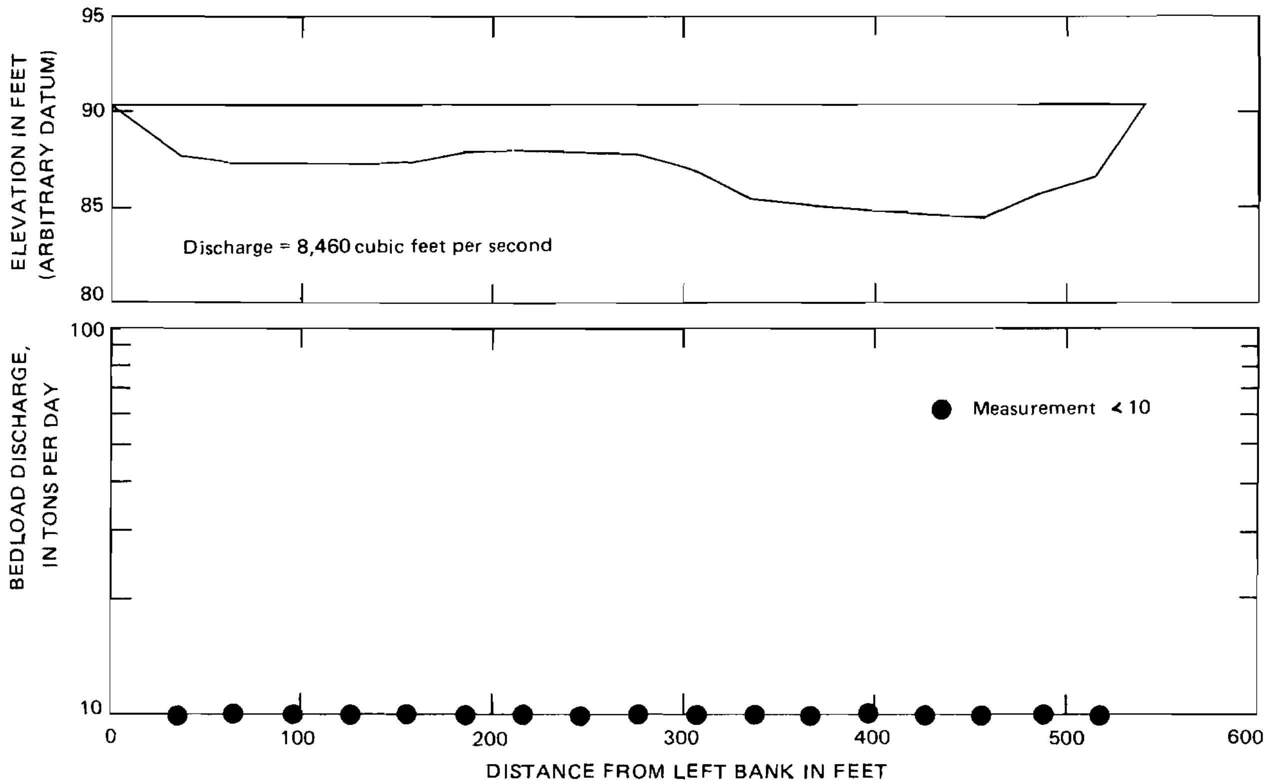

Figure 16c.--Cross section and distribution of bedload discharge, Susitna River near Talkeetna, September 25, 1984. (Map number 6)

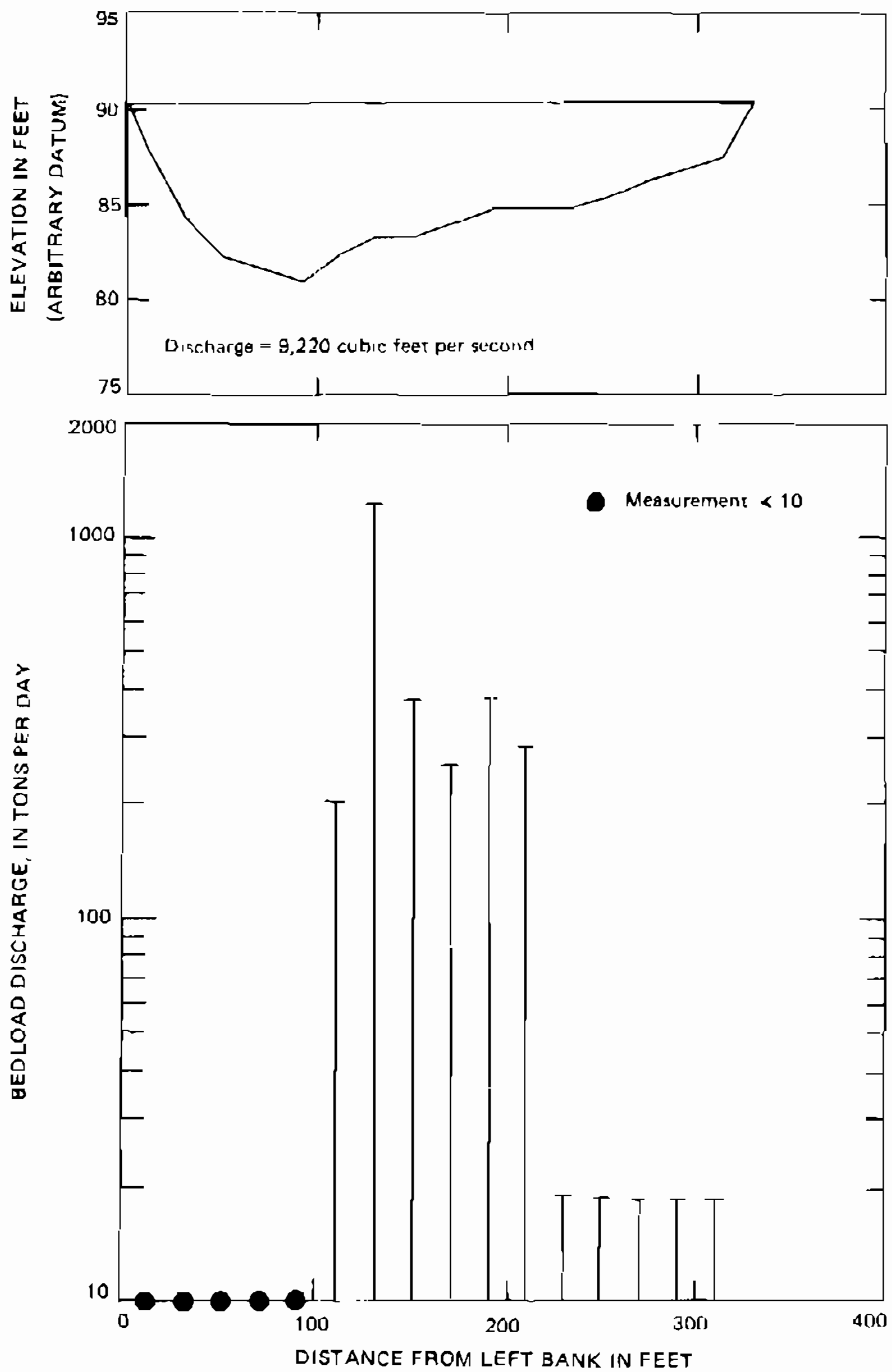

Figure 17a.--Cross section and distribution of bedload discharge, Chulitna River below canyon near Talkeetna, May 18, 1984. (Map number 8)

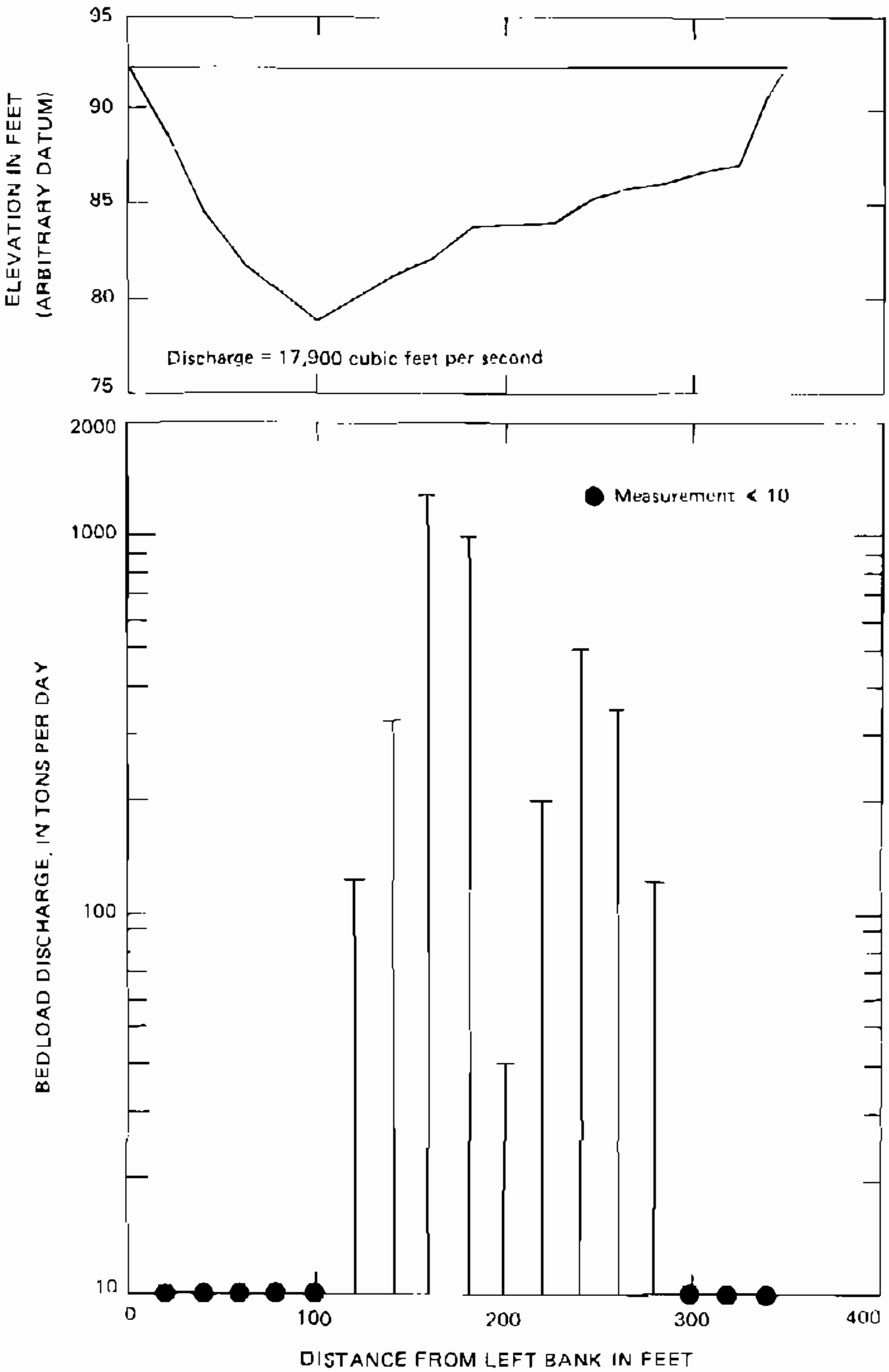

Figure 17b.--Cross section and distribution of bedload discharge, Chulitna River below canyon near Talkeetna, August 28, 1984. (Map number 8)

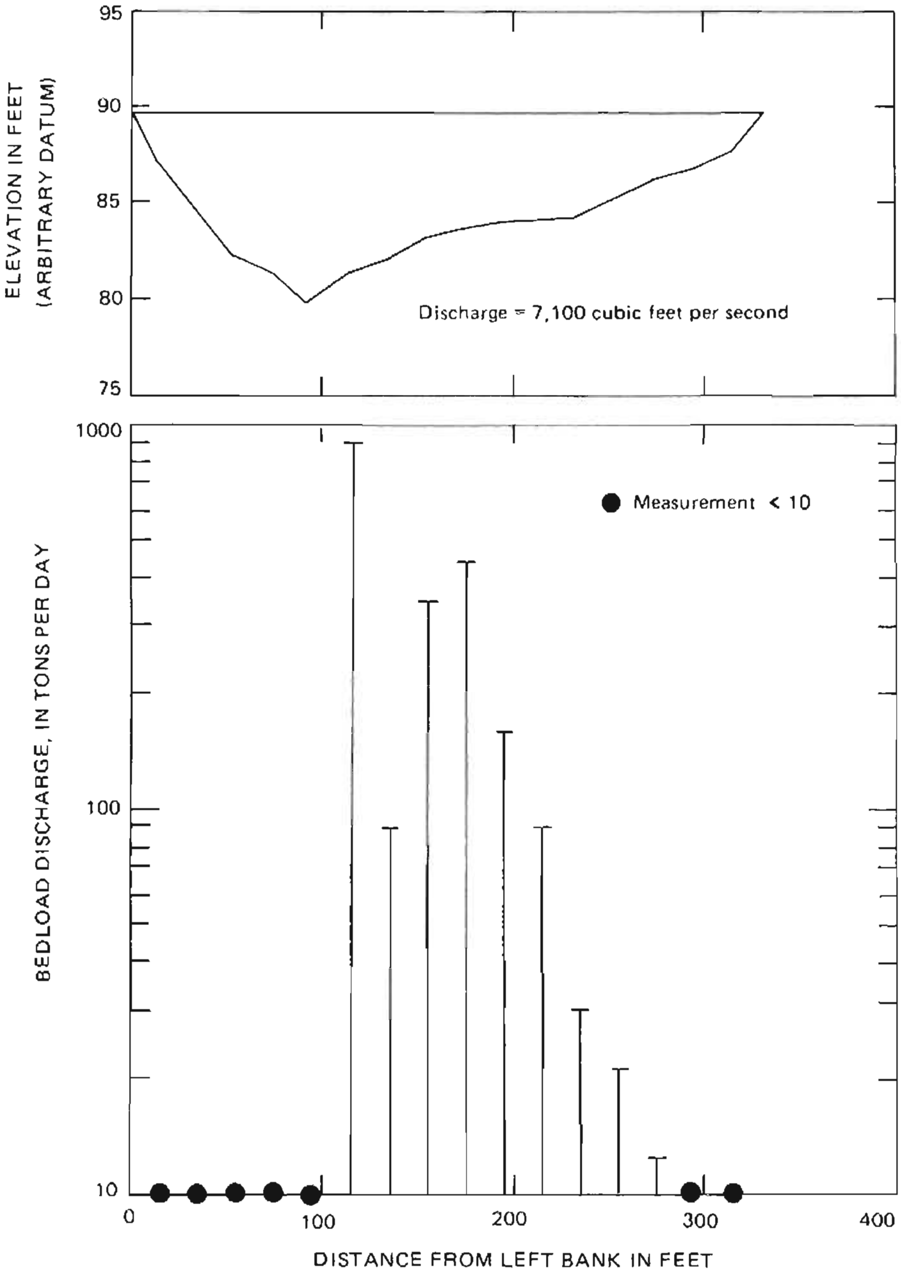

Figure 17c.--Cross section and distribution of bedload discharge, Chulitna River below canyon near Talkeetna, September 27, 1984. (Map number 8)

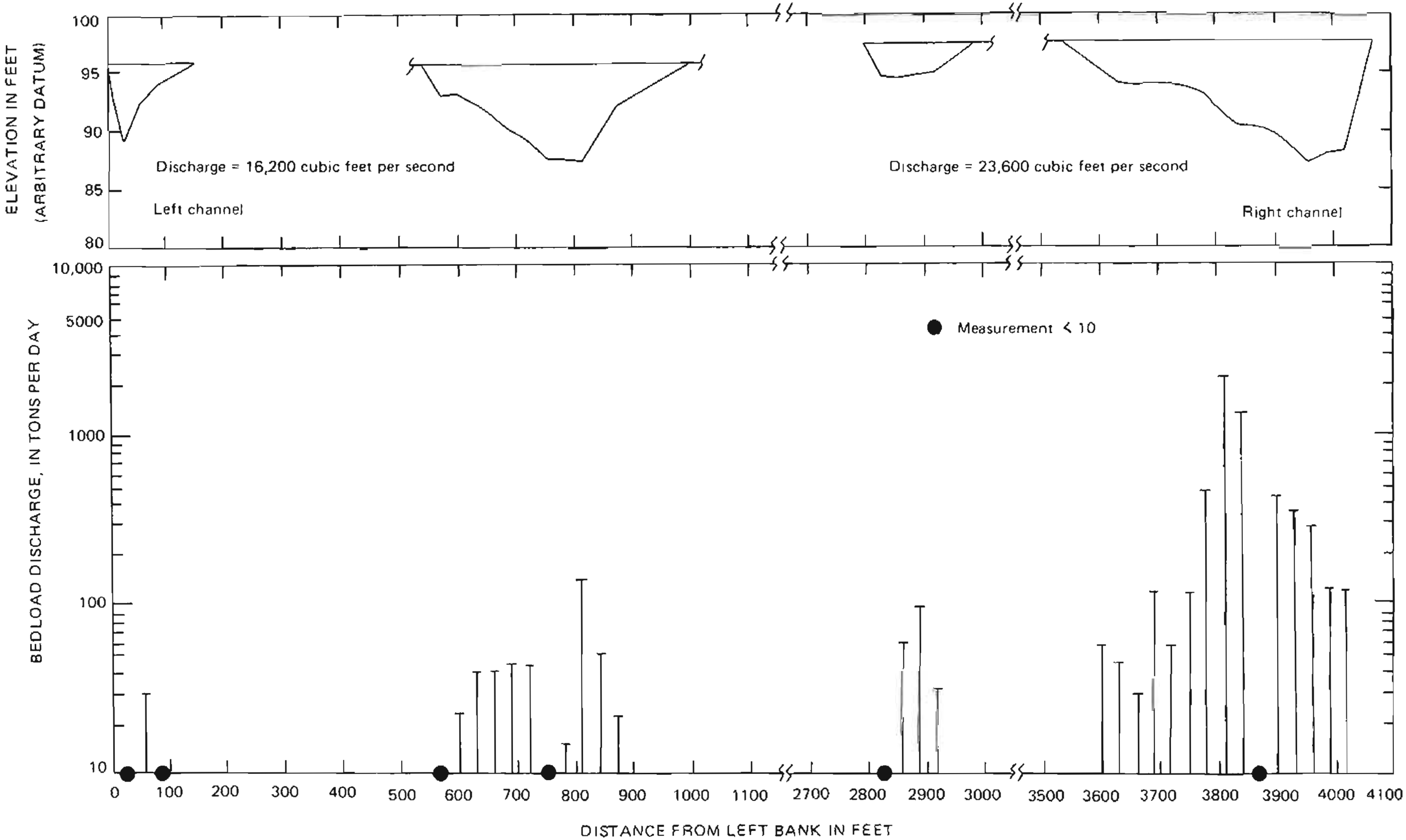

Figure 18a.--Cross section and distribution of bedload discharge, Susitna River below Chulitna River near Talkeetna, June 12, 1984 (Map numbers 9 and 10)

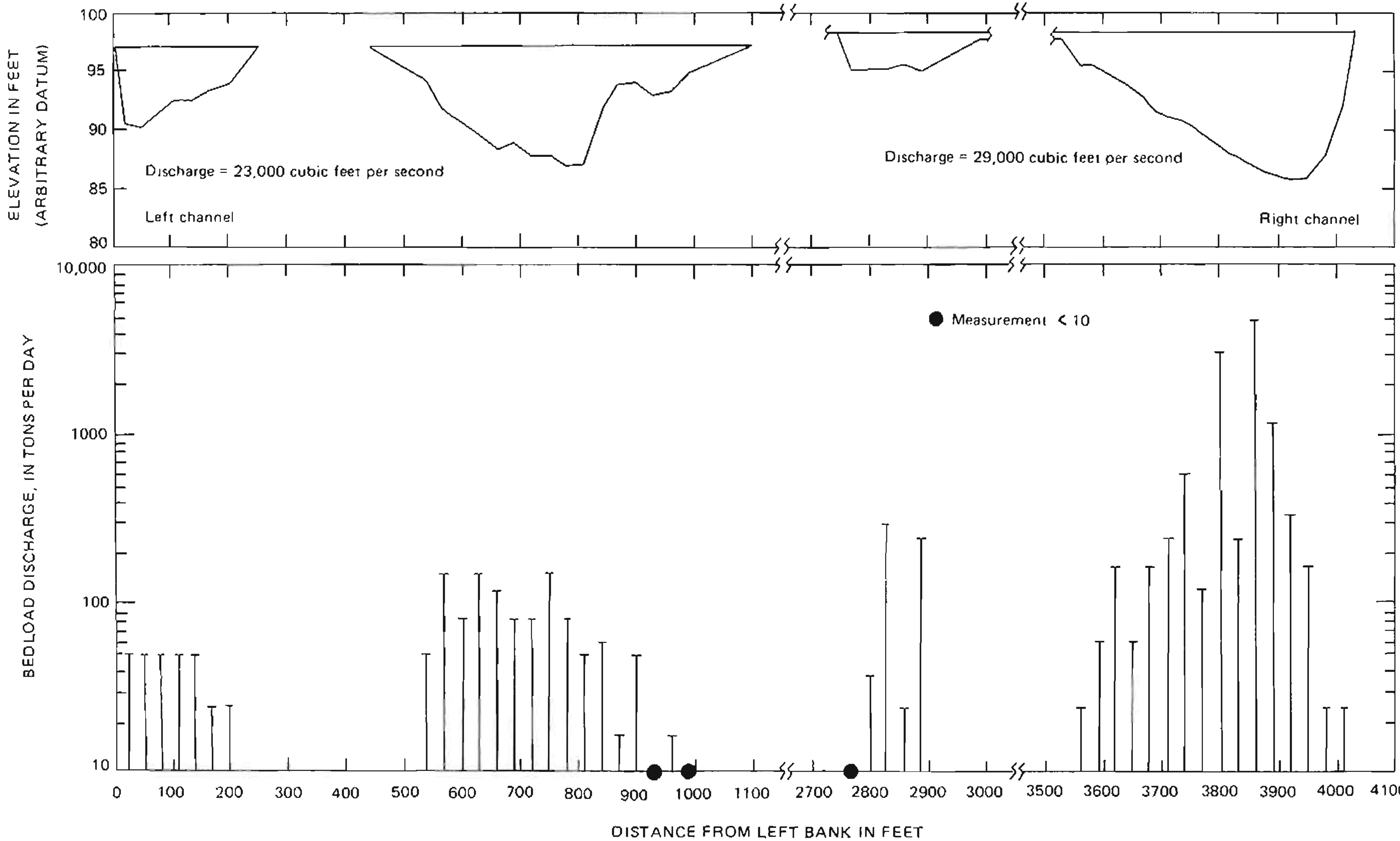

Figure 18b.--Cross section and distribution of bedload discharge, Susitna River below Chulitna River near Talkeetna, August 27, 1984. (Map numbers 9 and 10)

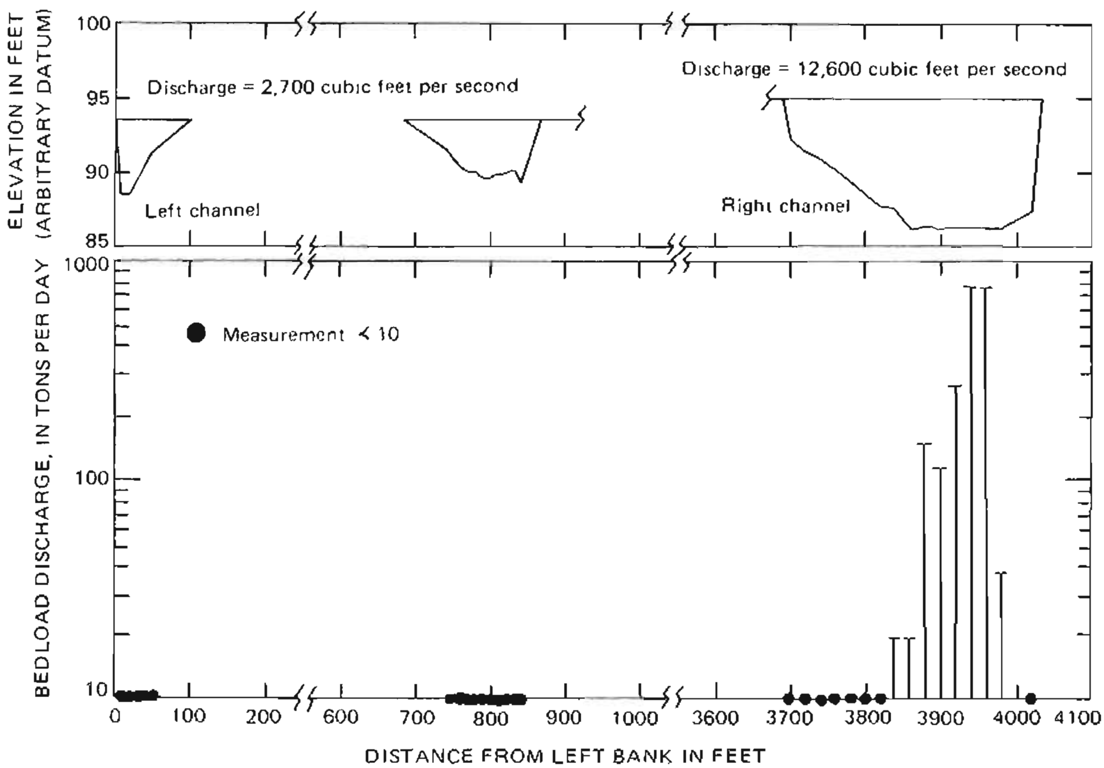

Figure 18c.--Cross section and distribution of bedload discharge, Susitna River below Chulitna River near Talkeetna, September 26, 1984. (Map numbers 9 and 10)

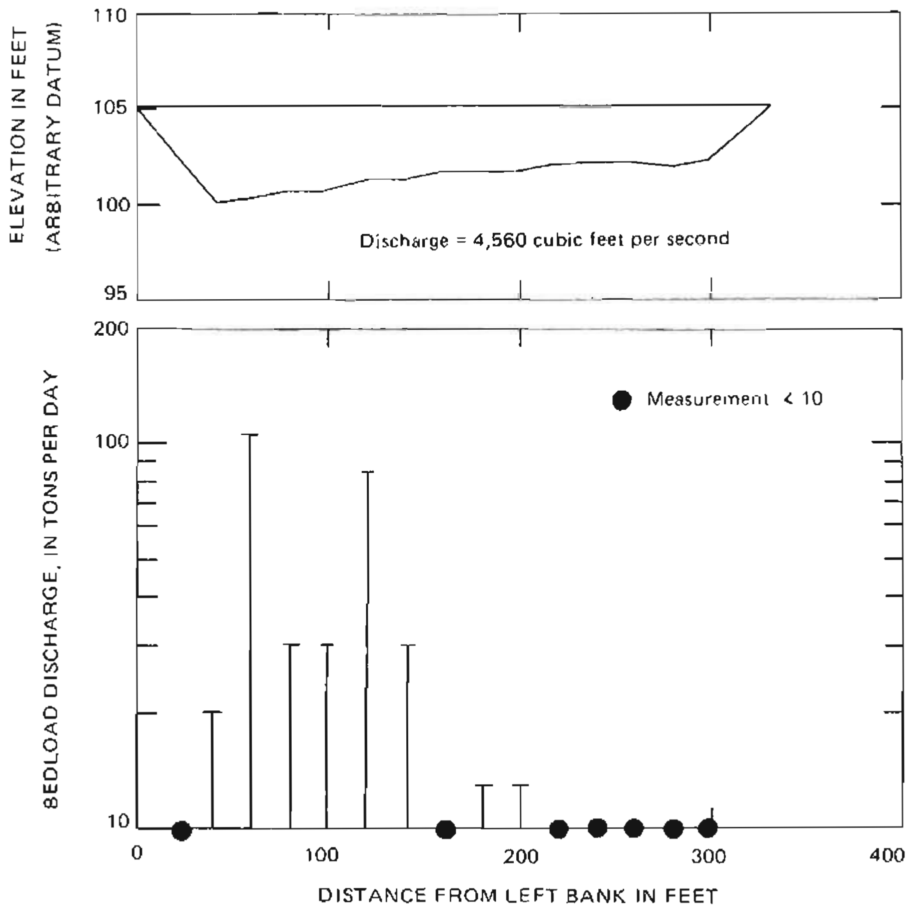

Figure 19a.--Cross section and distribution of bedload discharge, Talkeetna River near Talkeetna, May 18, 1984. (Map number 11)

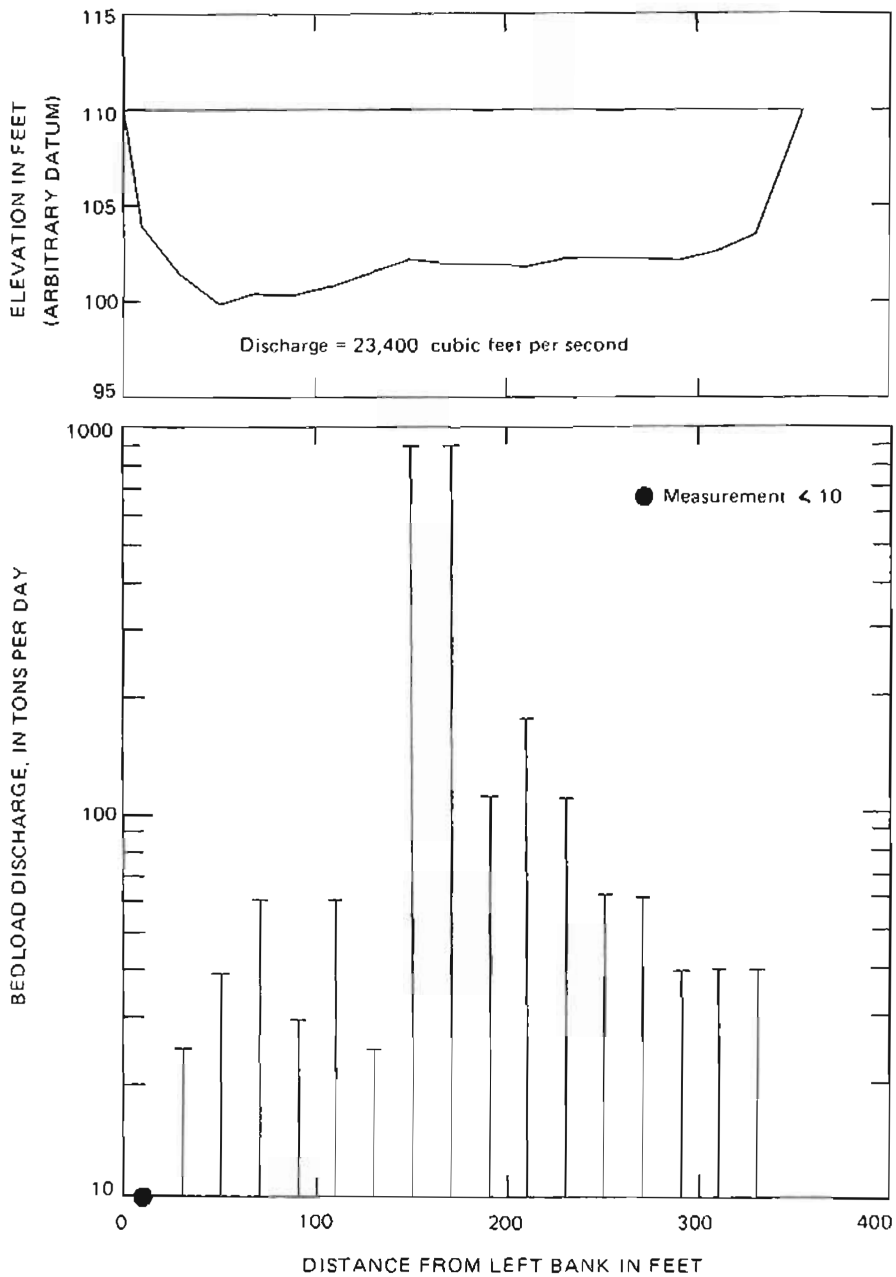

Figure 19b.--Cross section and distribution of bedload discharge, Talkeetna River near Talkeetna, August 26, 1984. (Map number 11)

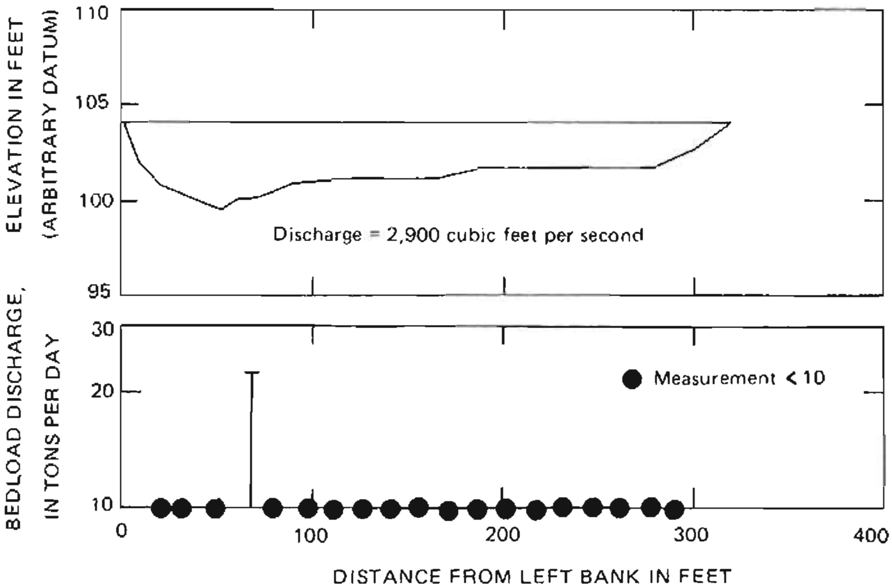

Figure 19c.--Cross section and distribution of bedload discharge, Talkeetna River near Talkeetna, September 26, 1984. (Map number 11)

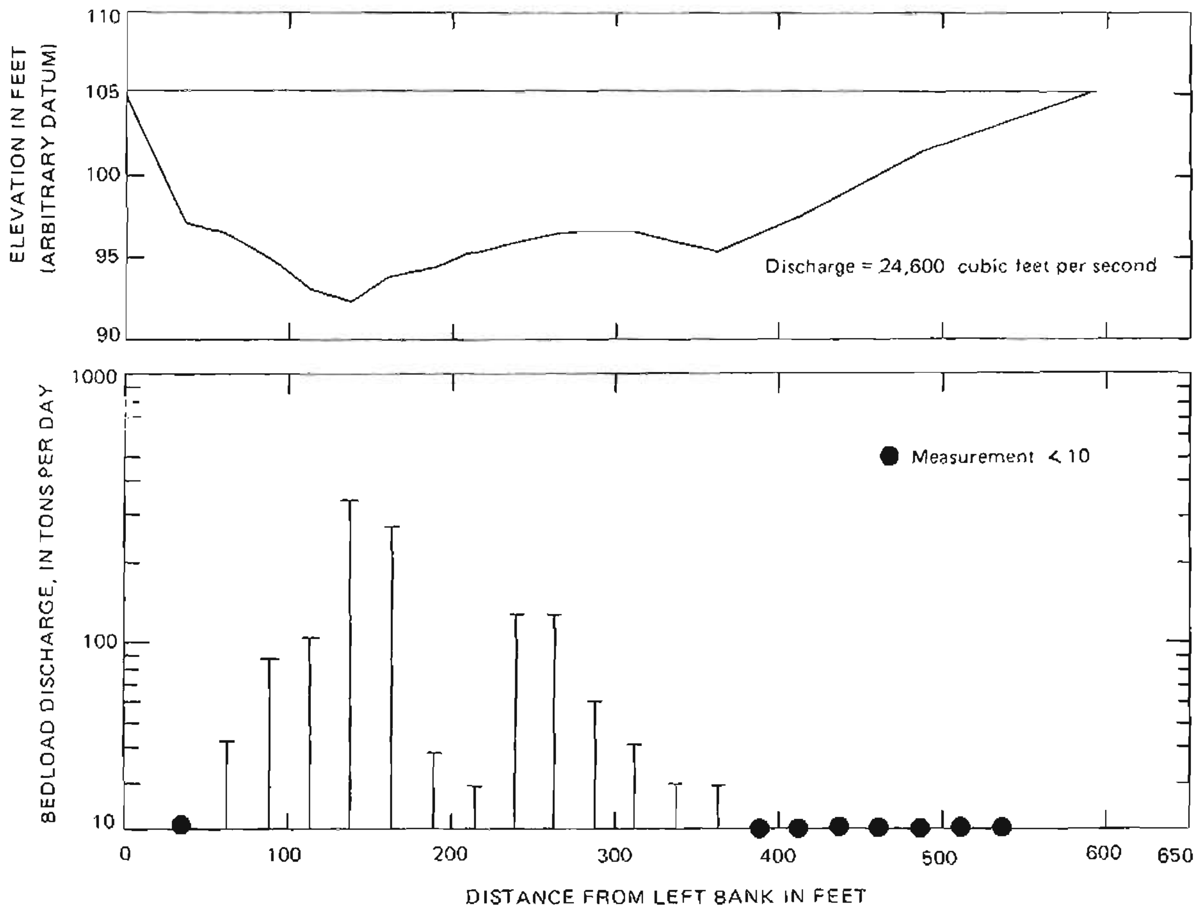

Figure 20a.--Cross section and distribution of bedload discharge, Susitna River at Sunshine, May 16, 1984. (Map number 12)

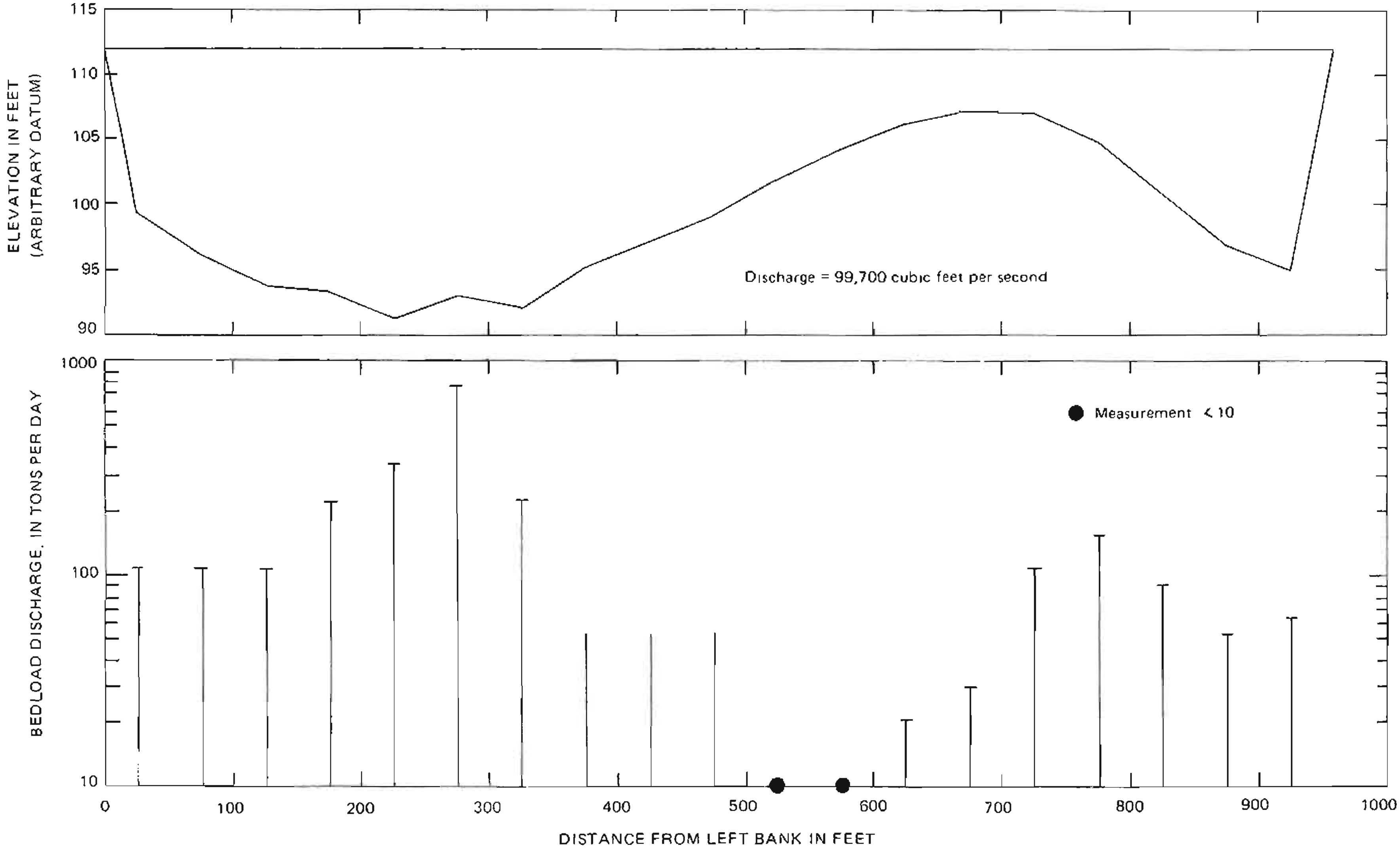

Figure 20b.--Cross section and distribution of bedload discharge, Susitna River at Sunshine, August 25, 1984.
(Map number 12)

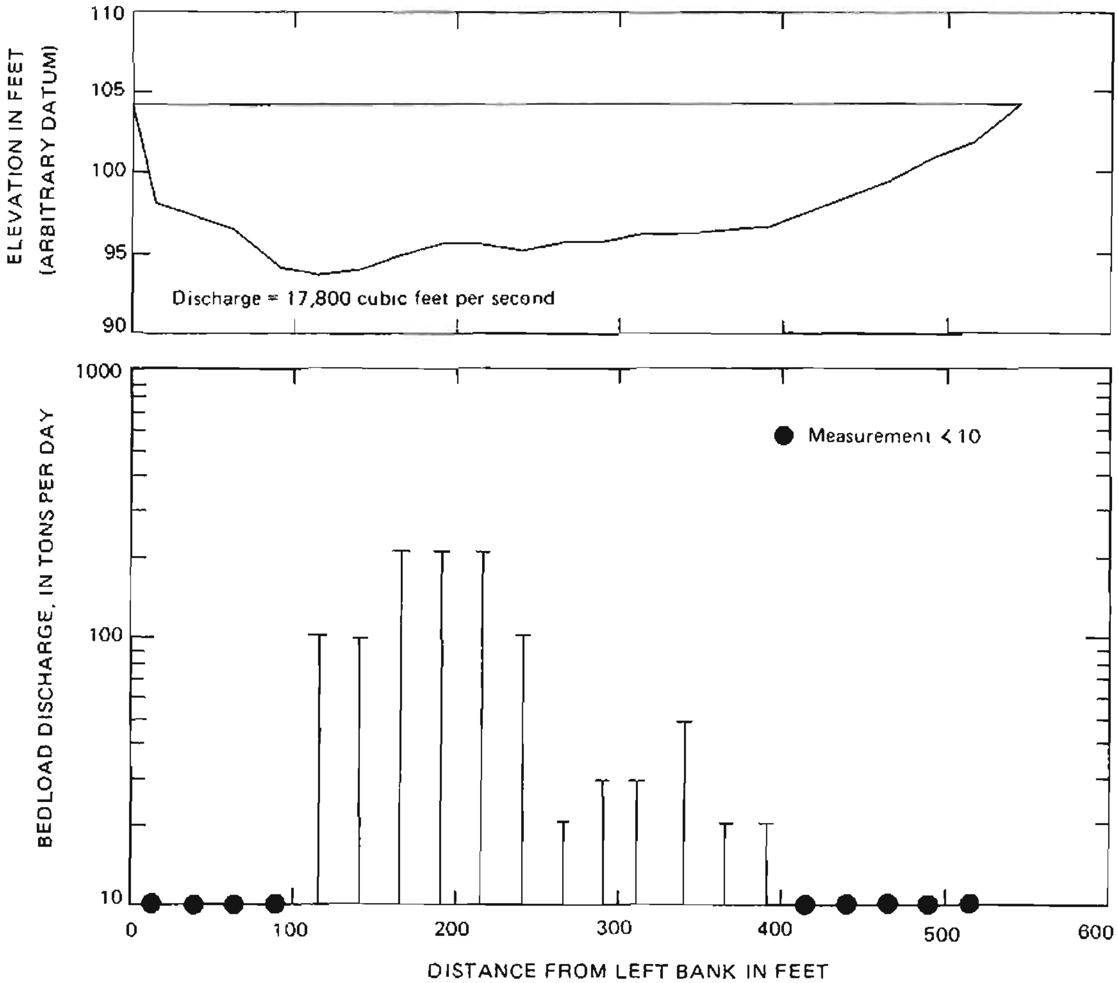

Figure 20c.--Cross section and distribution of bedload discharge, Susitna River at Sunshine, September 28, 1984. (Map number 12)

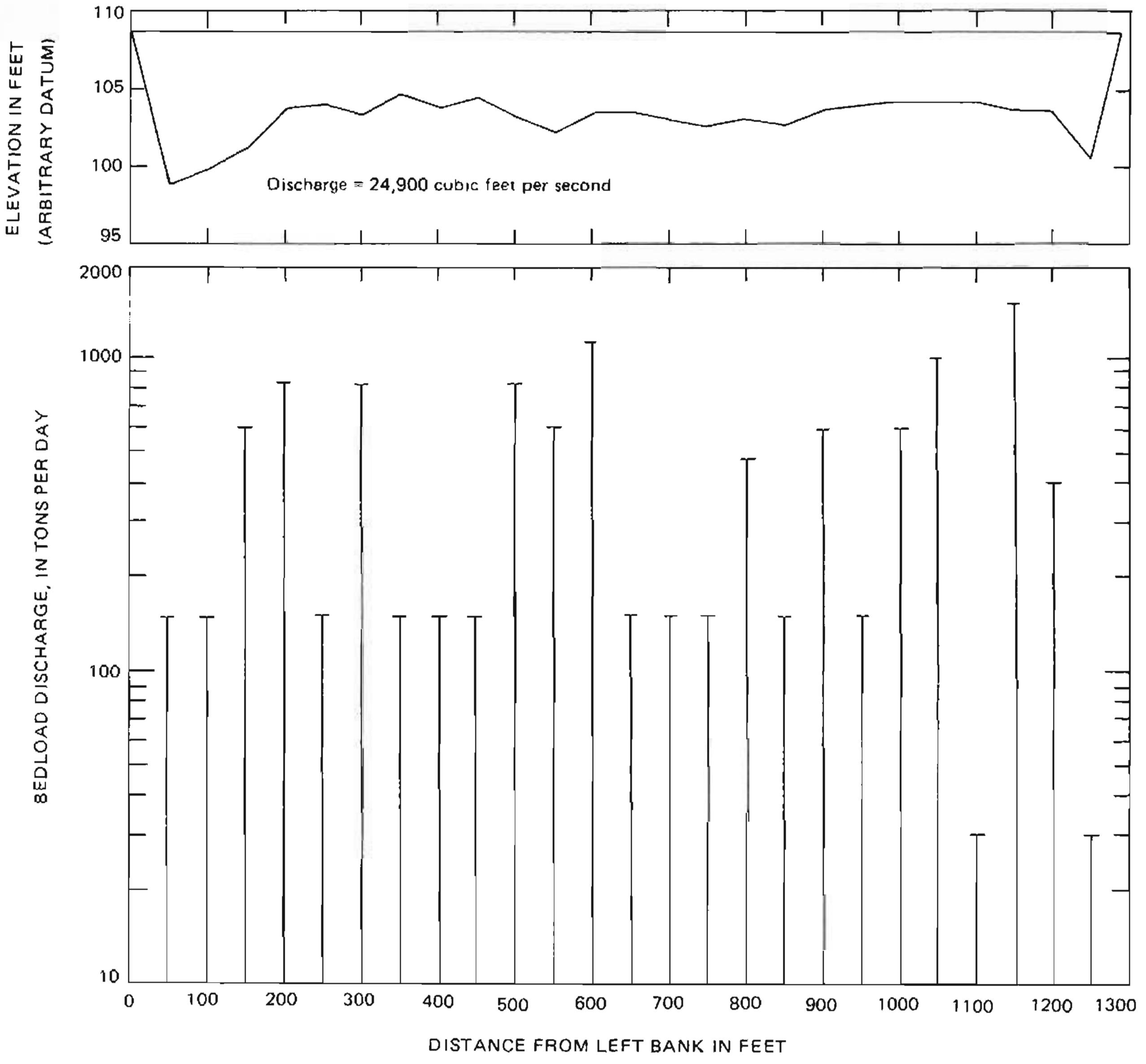

Figure 21a.--Cross section and distribution of bedload discharge, Yentna River near Susitna Station, May 14, 1984. (Map number 13)

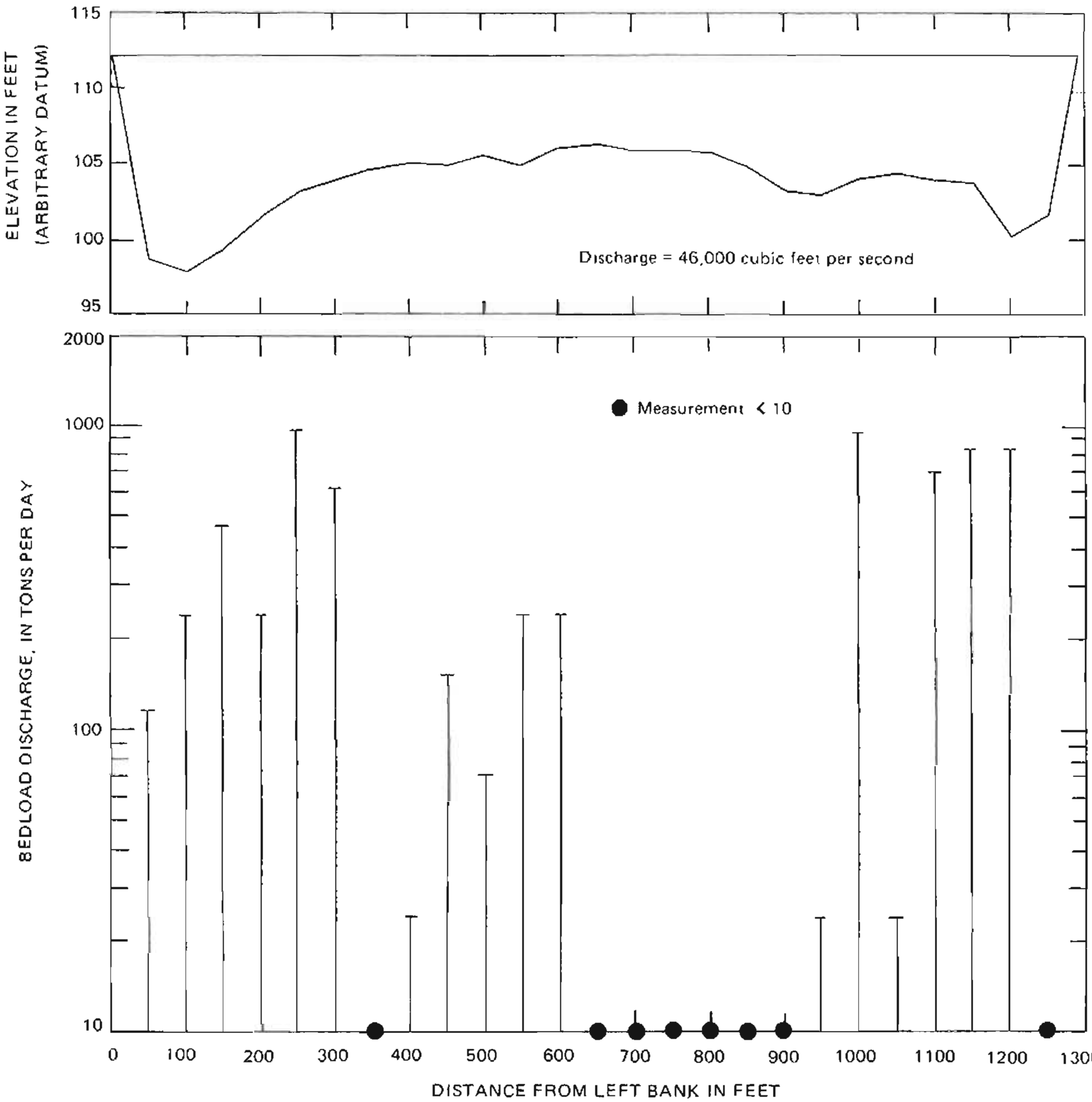

Figure 21b.--Cross section and distribution of bedload discharge, Yentna River near Susitna Station, July 17, 1984. (Map number 13)

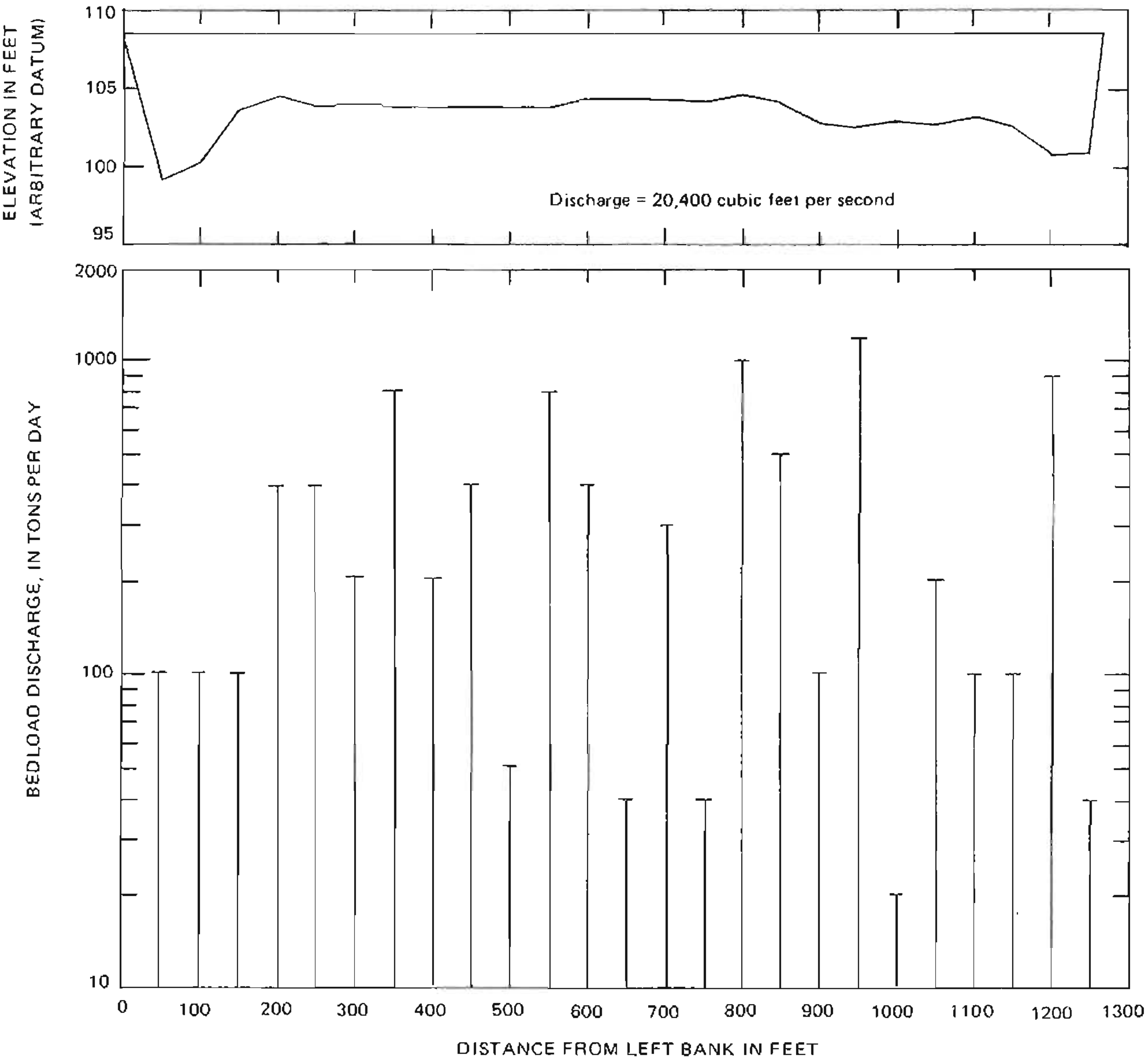

Figure 21c.--Cross section and distribution of bedload discharge, Yentna River near Susitna Station, September 19, 1984. (Map number 13)

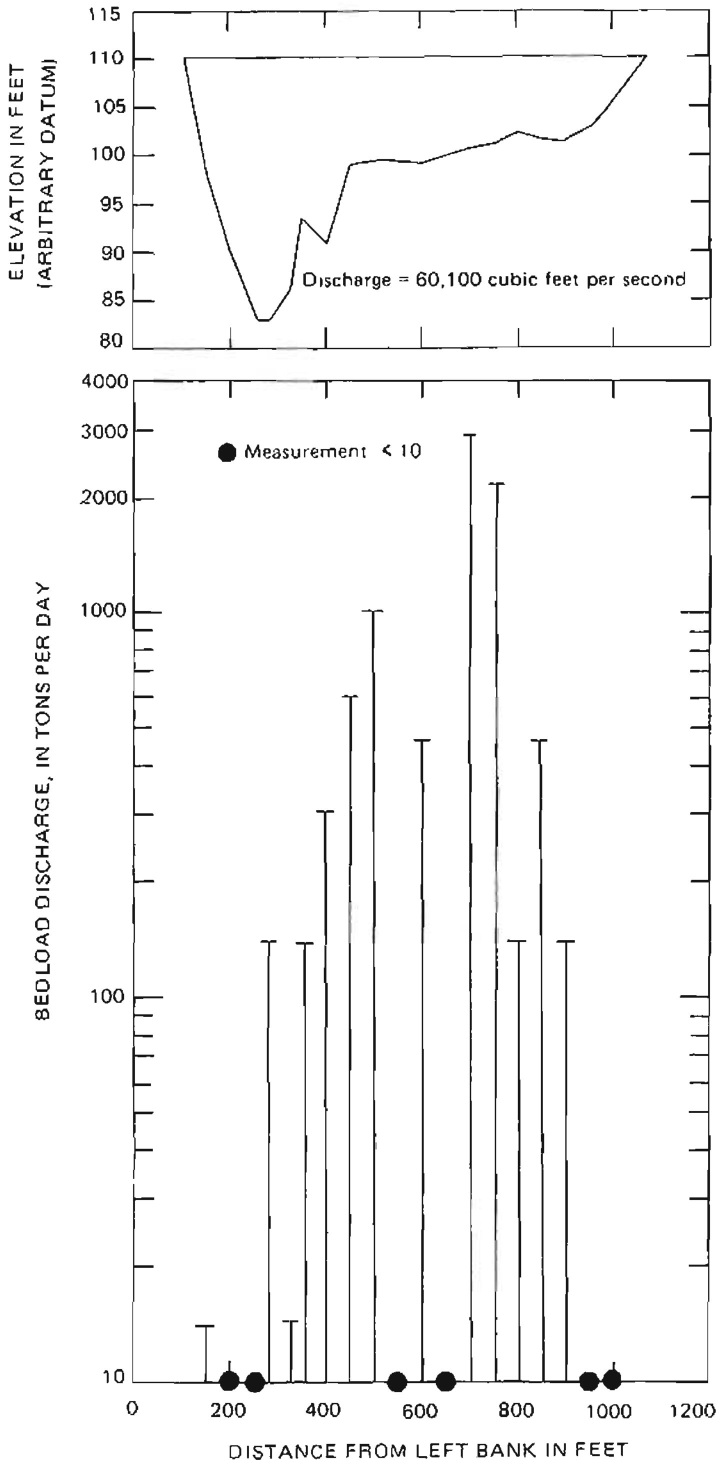

Figure 22a.--Cross section and distribution of bedload discharge, Susitna River at Susitna Station, May 17, 1984. (Map number 14)

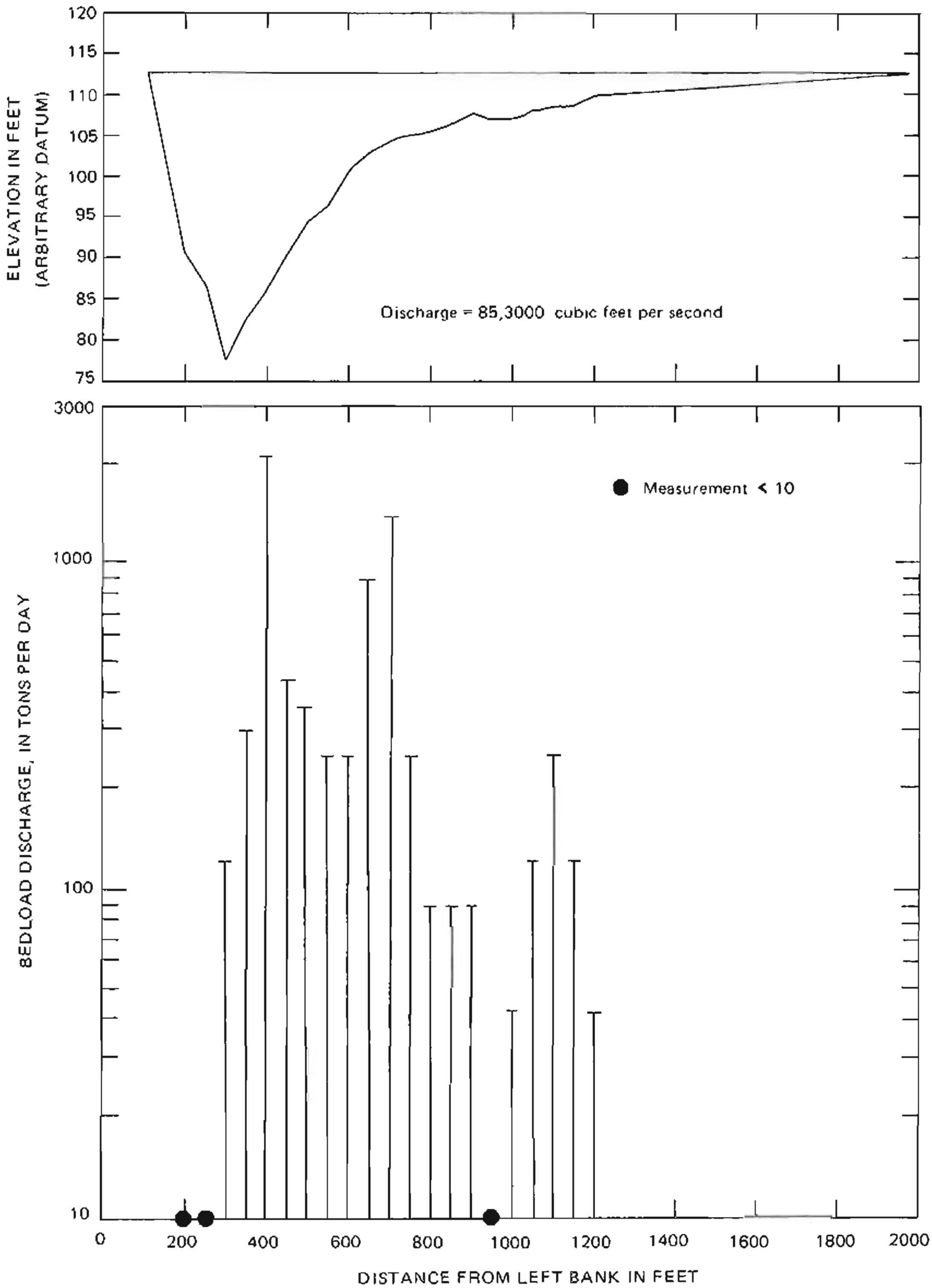

Figure 22b.--Cross section and distribution of bedload discharge, Susitna River at Susitna Station, August 15, 1984. (Map number 14)

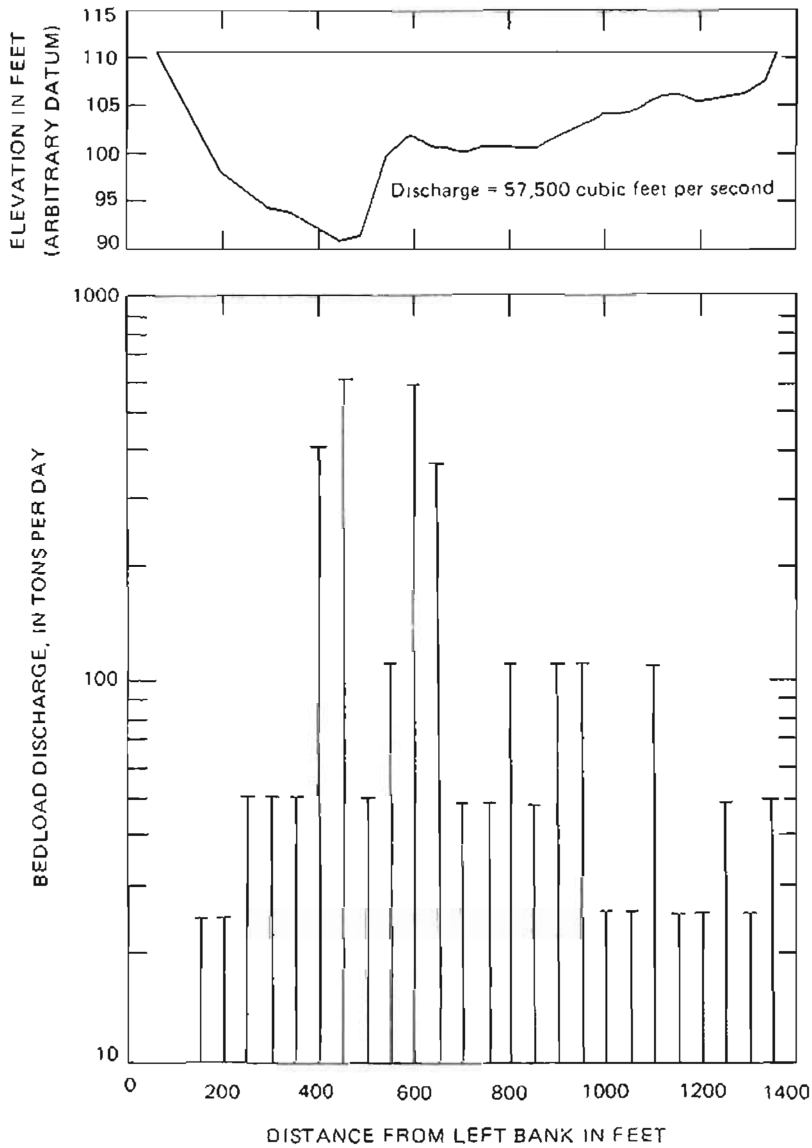

Figure 22c.--Cross section and distribution of bedload discharge, Susitna River at Susitna Station, September 20, 1984. (Map number 14)

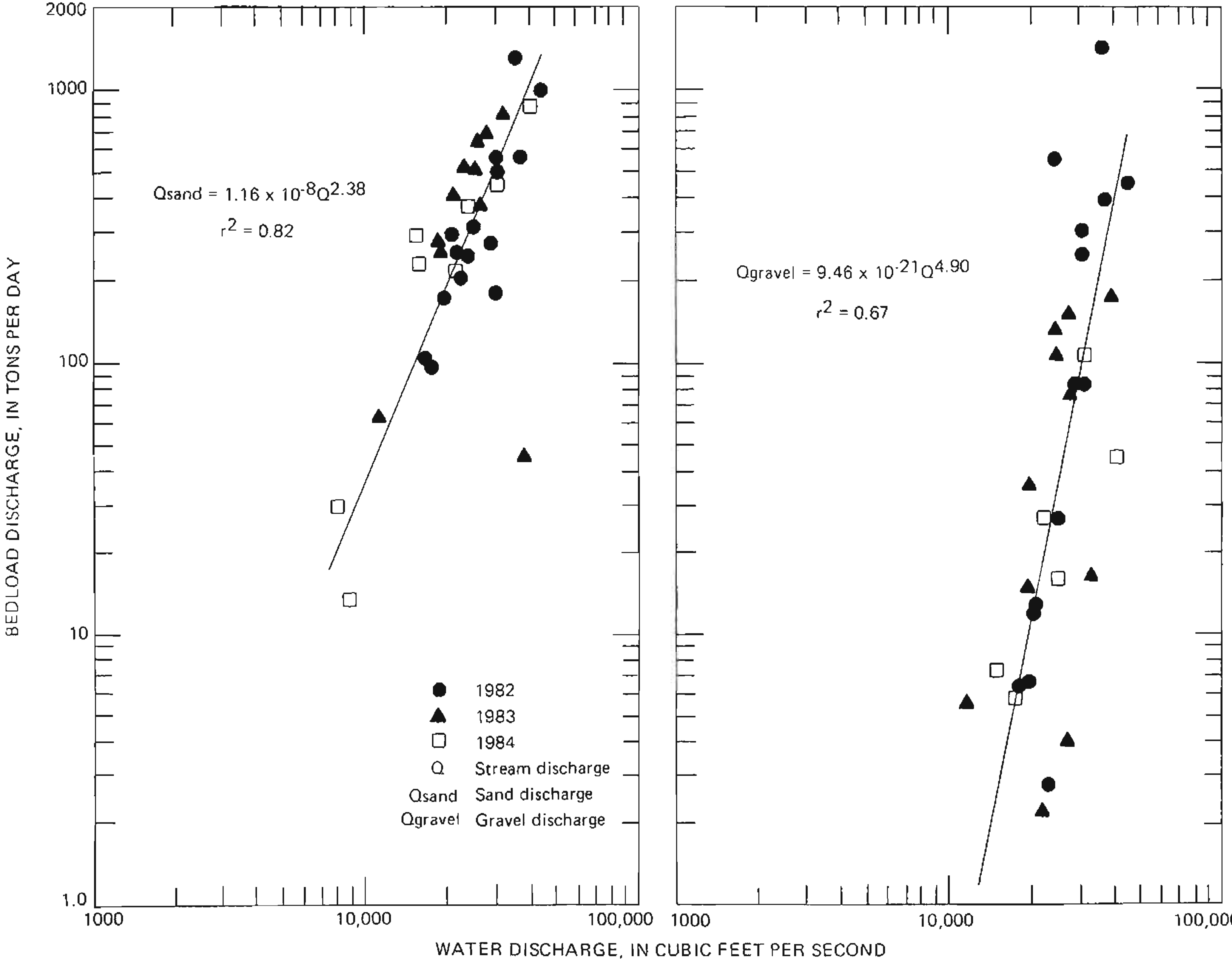

Figure 23.--Bedload-transport curves of sand and gravel for Susitna River near Talkeetna, May to September, 1982-84. (Map number 6)

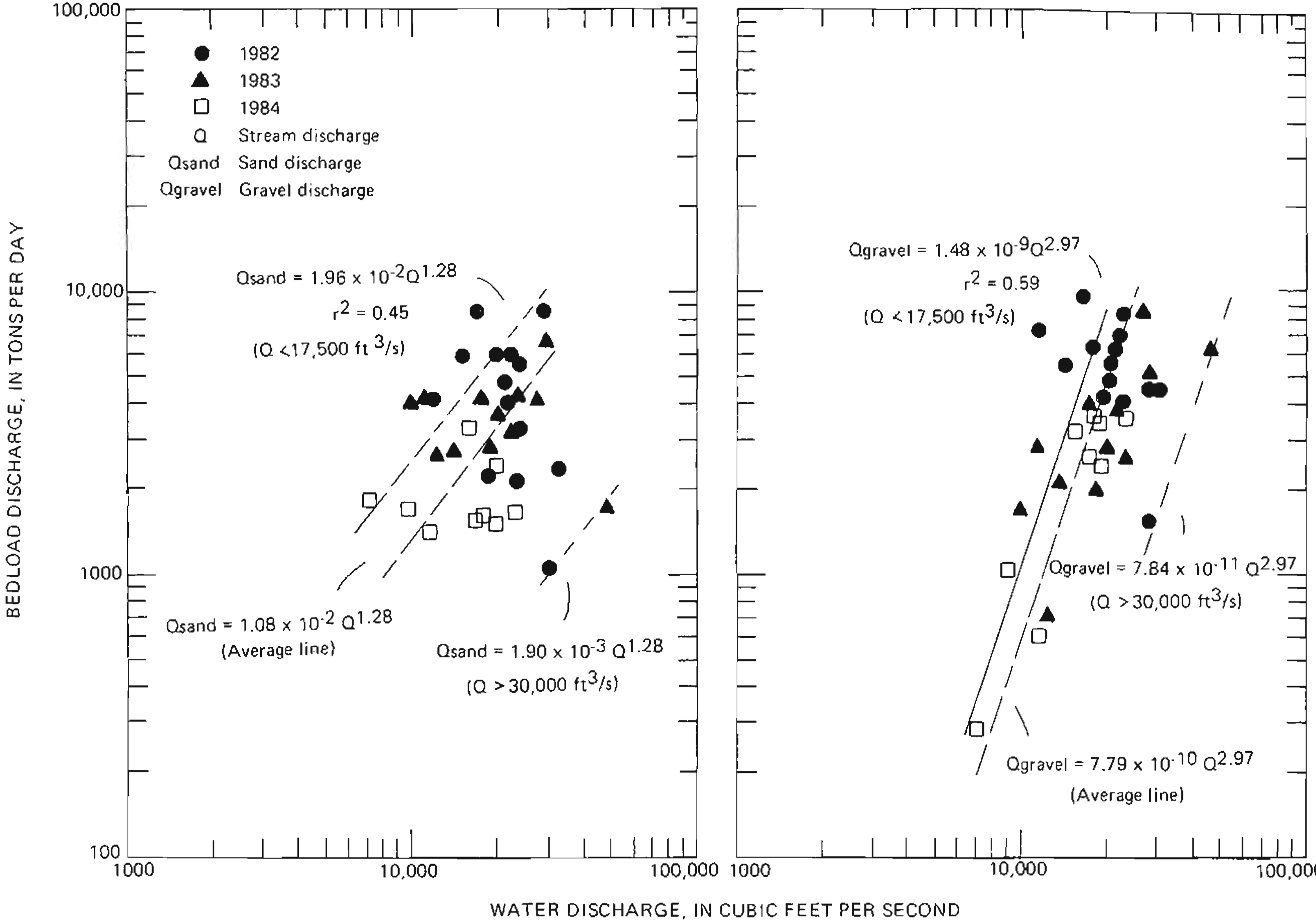

Figure 24.--Bedload transport curves of sand and gravel for Chulitna River below canyon near Talkeetna, May to September, 1982-84. (Map number 8)

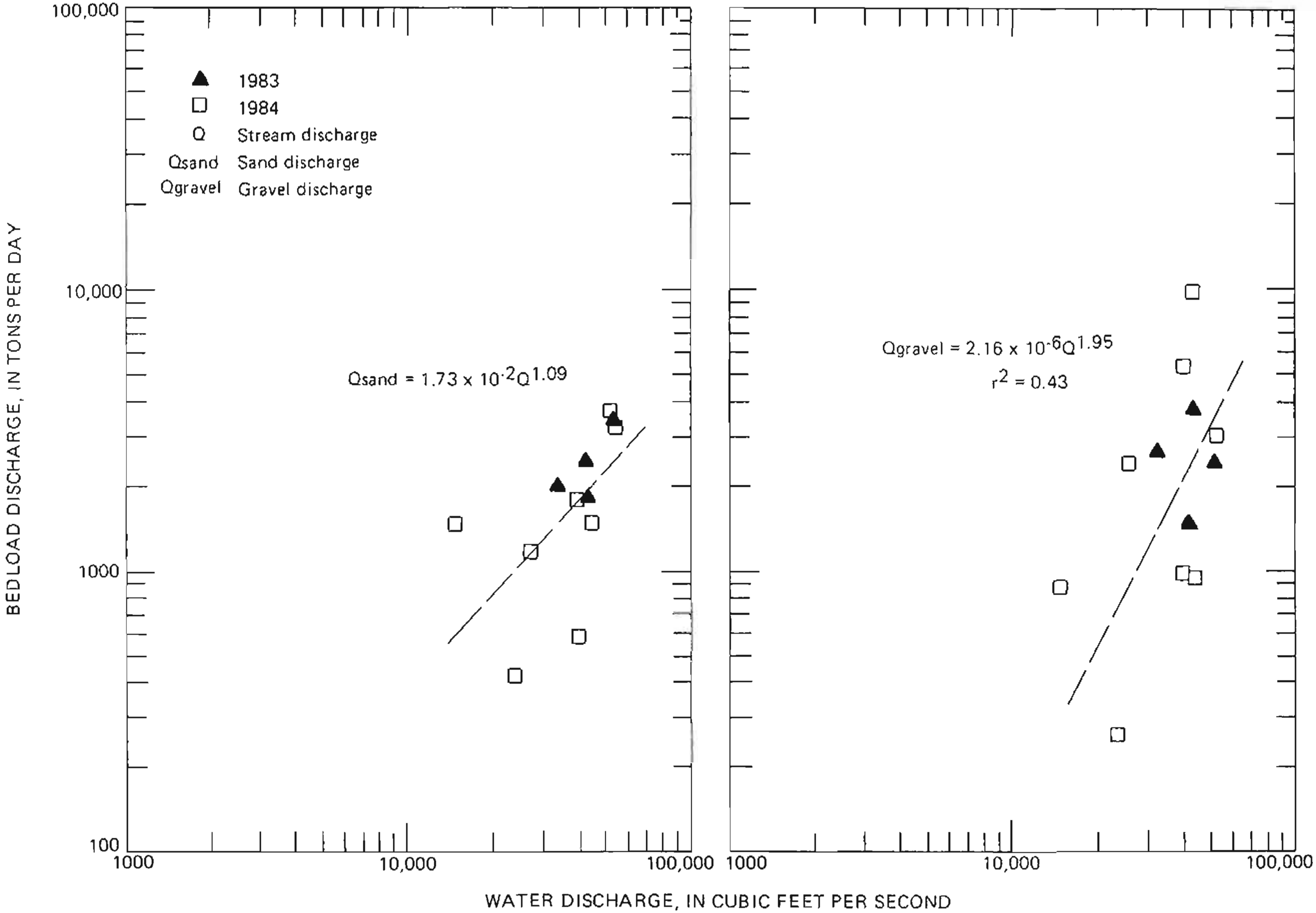

Figure 25.--Bedload-transport curves of sand and gravel for Susitna River below Chulitna River near Talkeetna (sum of right and left channels), May to September, 1983 and 1984. (Map numbers 9 and 10)

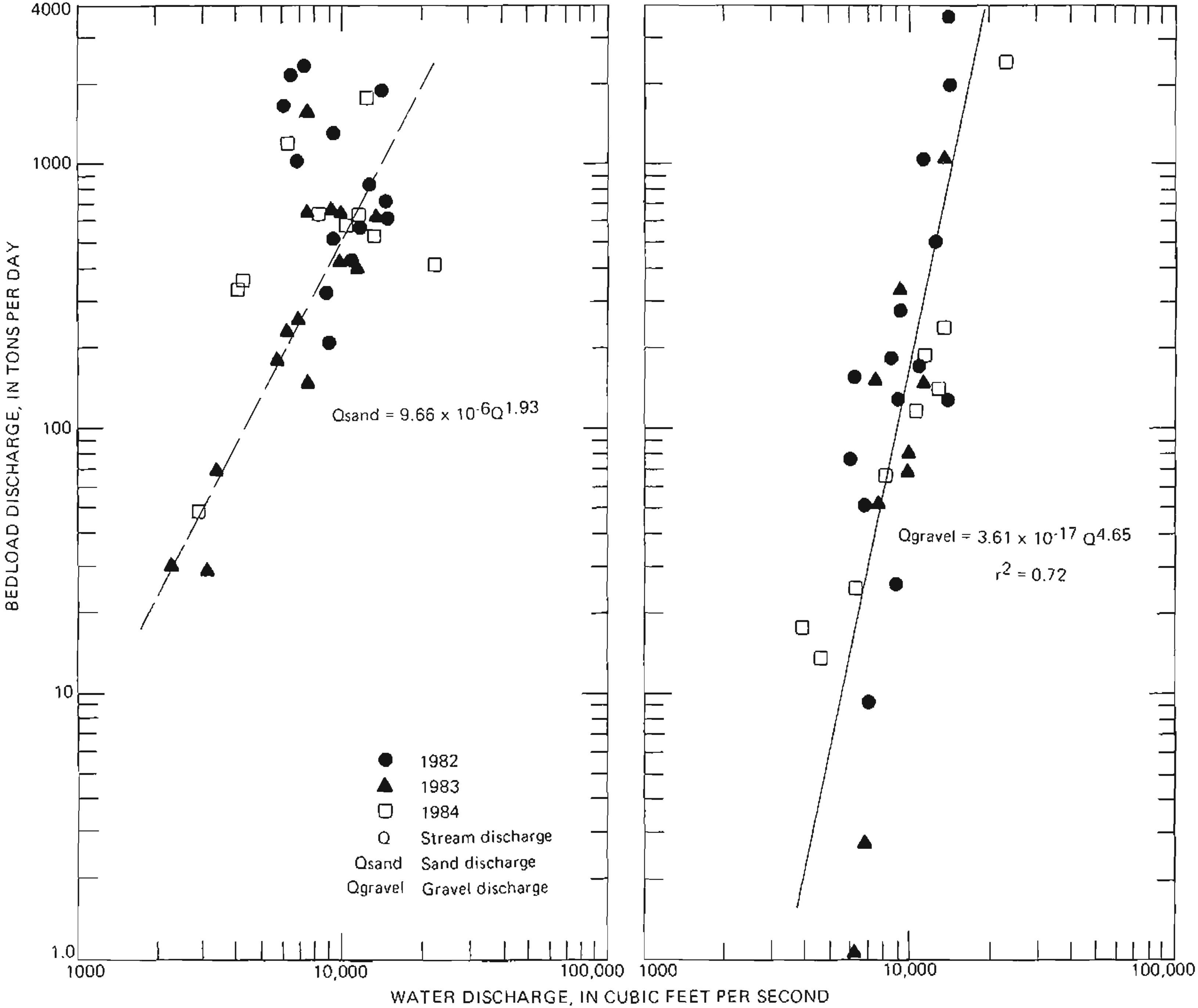

Figure 26.--Bedload-transport curves of sand and gravel for Talkeetna River near Talkeetna, May to September, 1982-84. (Map number 11) Transport curve of bedload sand was estimated by visual fit of a straight line to the data.

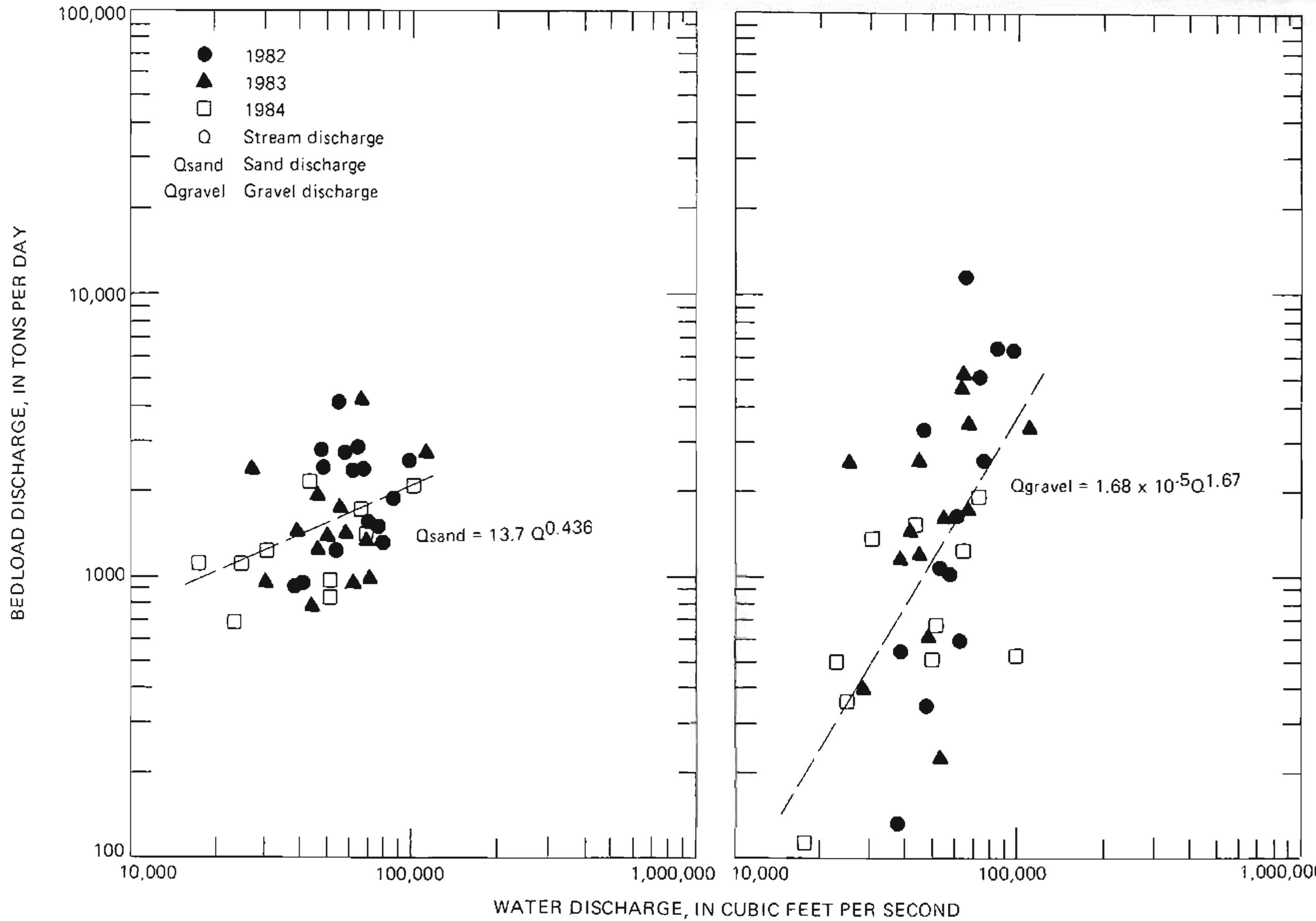

Figure 27.--Bedload-transport curves of sand and gravel for Susitna River at Sunshine, May to September, 1982-84. (Map number 12)

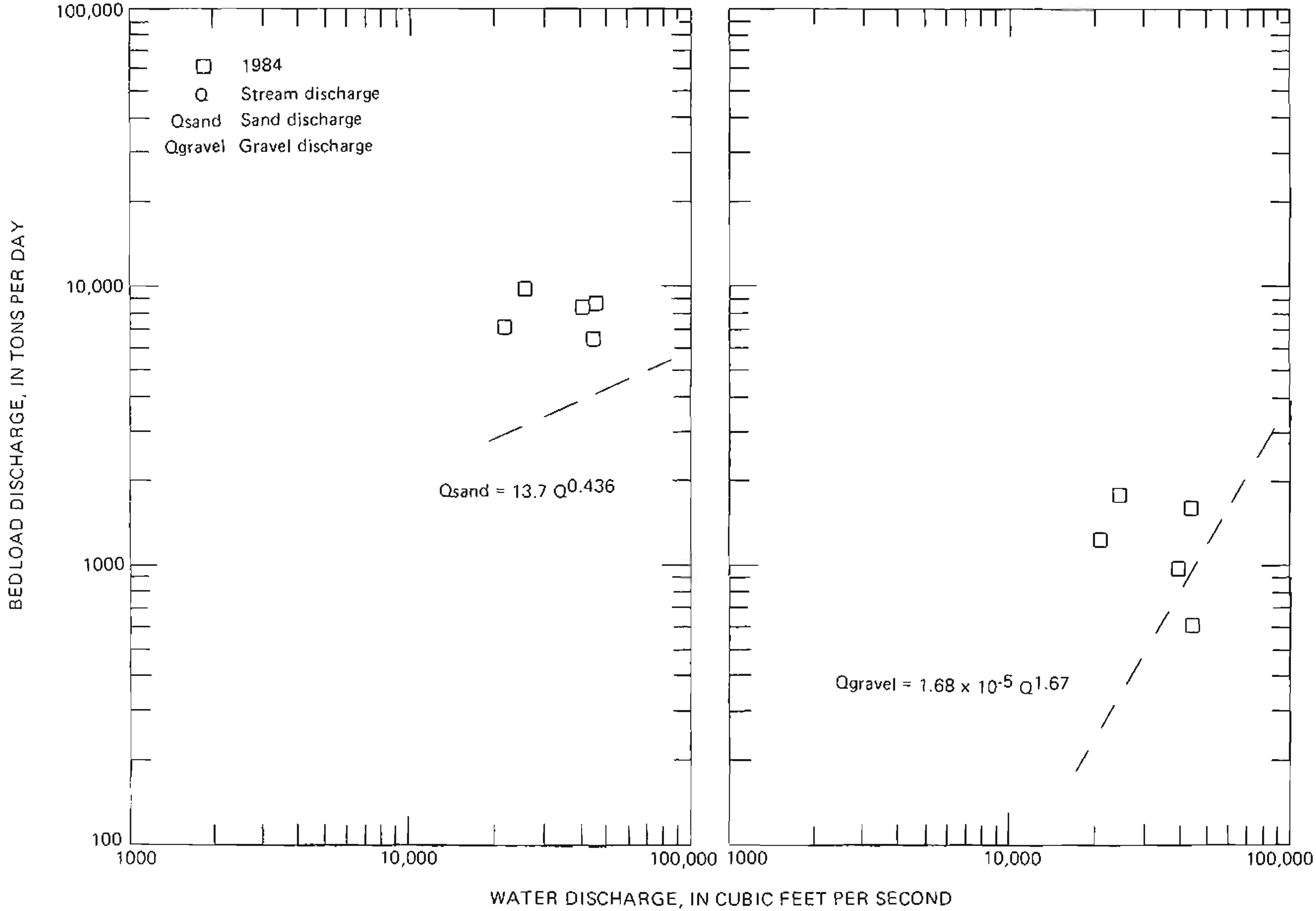

Figure 28.--Bedload discharge of sand and gravel versus water discharge for Yentna River near Susitna Station, May to September 1984. (Map number 13) Dashed lines correspond to transport curves for Susitna River at Sunshine, May to September, 1982-84. (Map number 12)

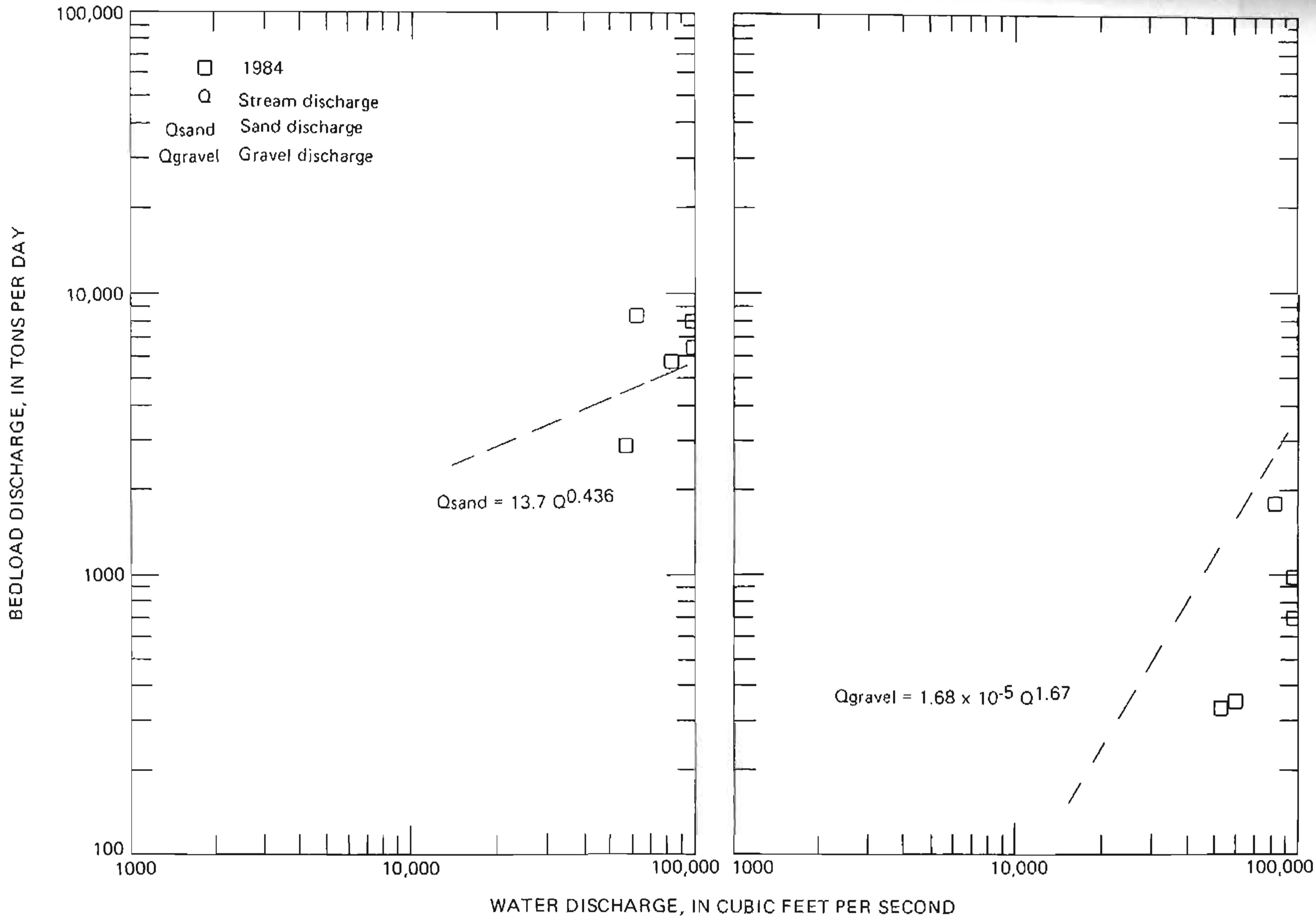

Figure 29.--Bedload discharge of sand and gravel versus water discharge for Susitna River at Susitna Station, May to September 1984. (Map number 14) Dashed lines correspond to transport curves for Susitna River at Sunshine, May to September, 1982-84. (Map number 12)

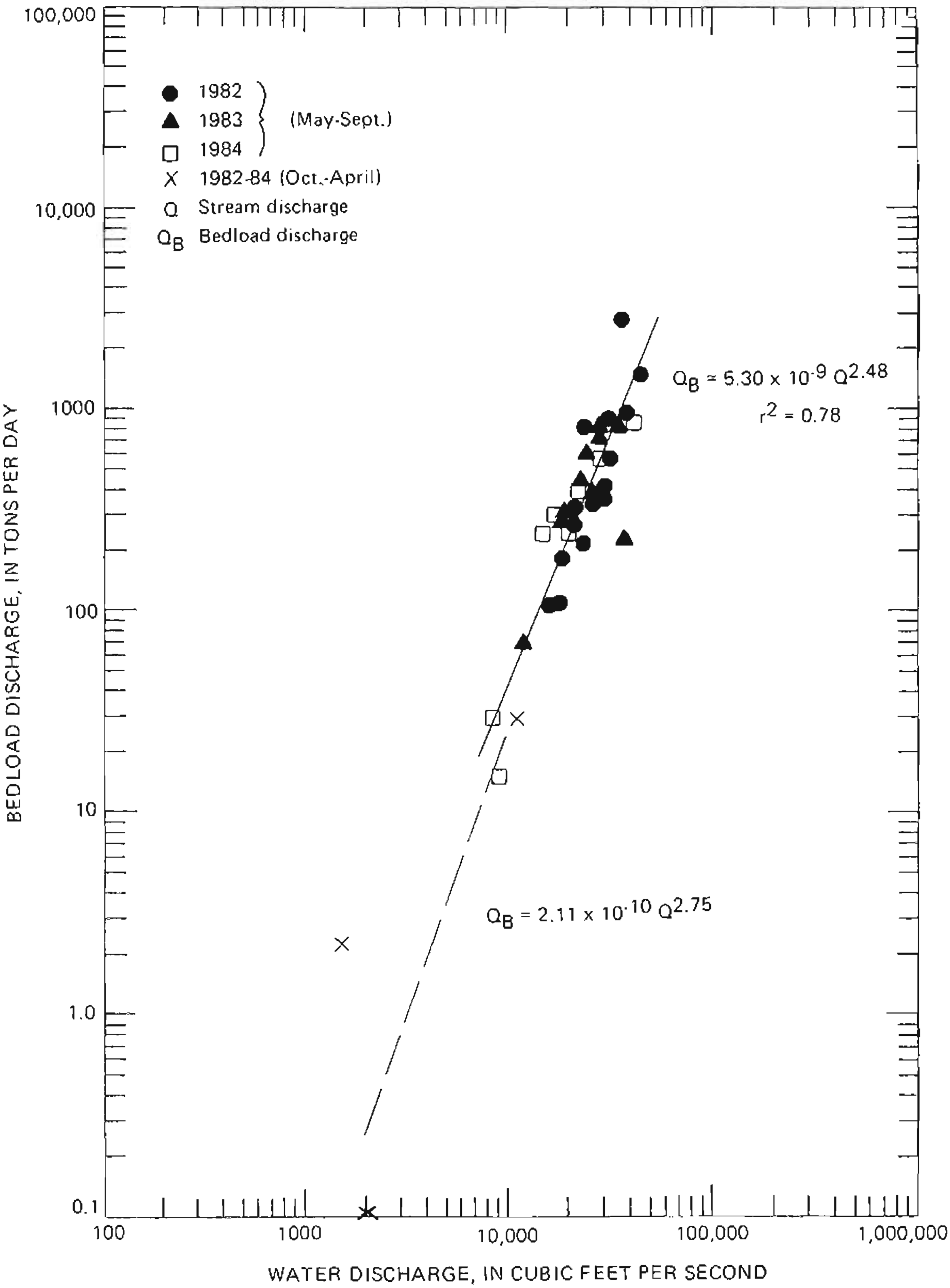

Figure 30.--Relation between bedload discharge and water discharge for Susitna River near Talkeetna, 1982-84. (Map number 6)

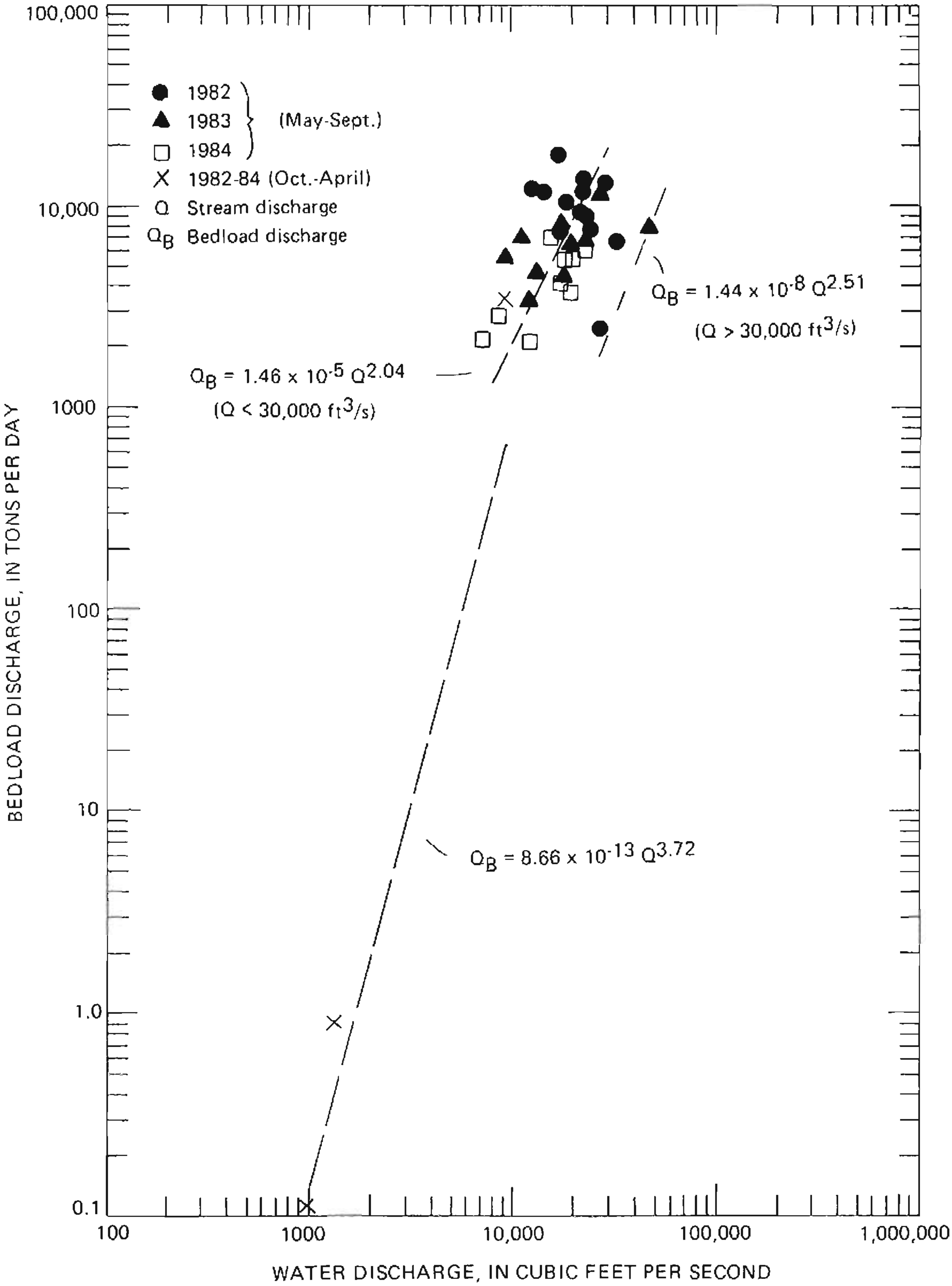

Figure 31.--Relation between bedload discharge and water discharge for Chulitna River below canyon near Talkeetna, 1982-84. (Map number 8)

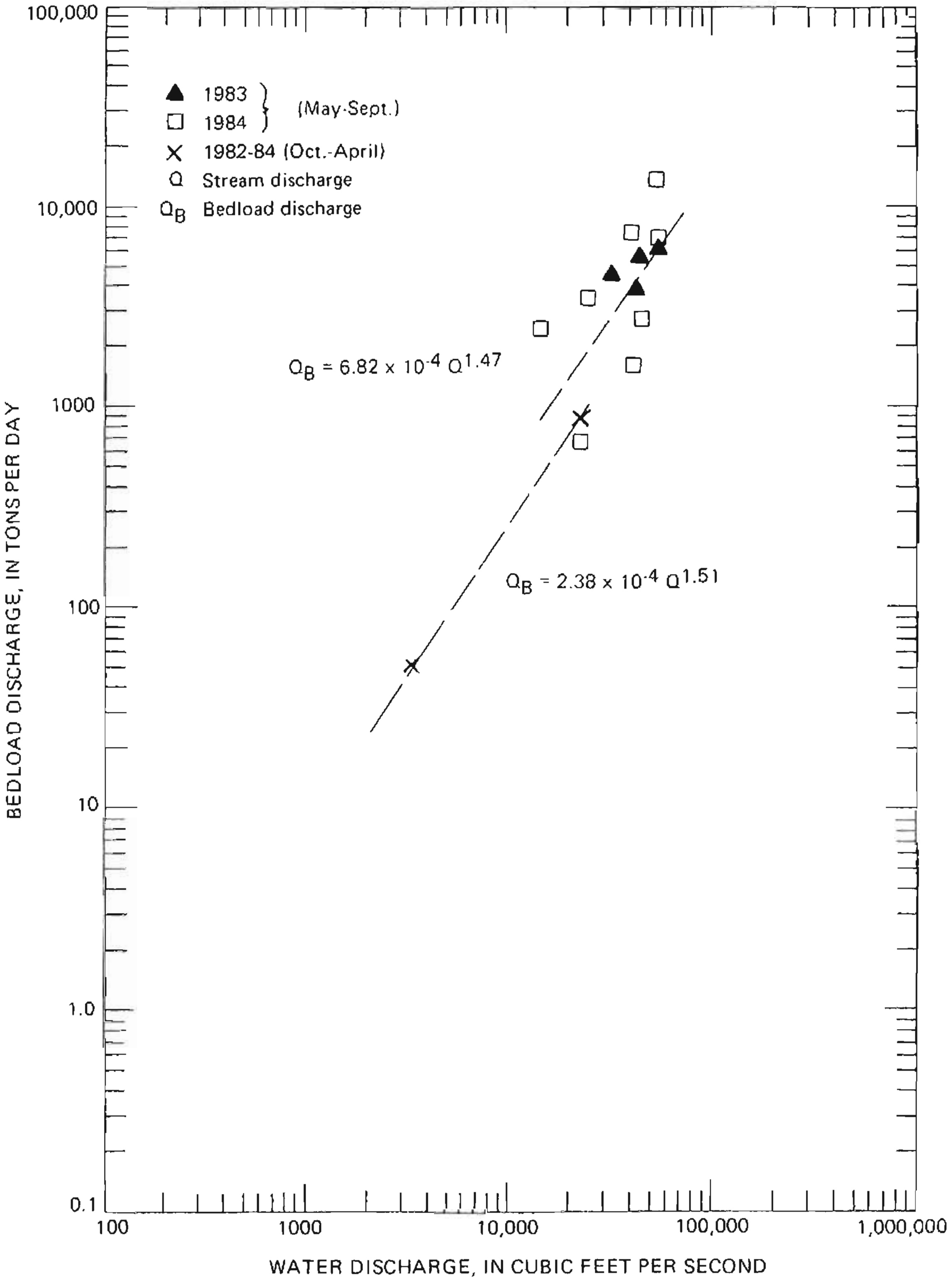

Figure 32.--Relation between bedload discharge and water discharge for Susitna River below Chulitna River near Talkeetna (sum of right and left channels), 1983 and 1984. (Map numbers 9 and 10)

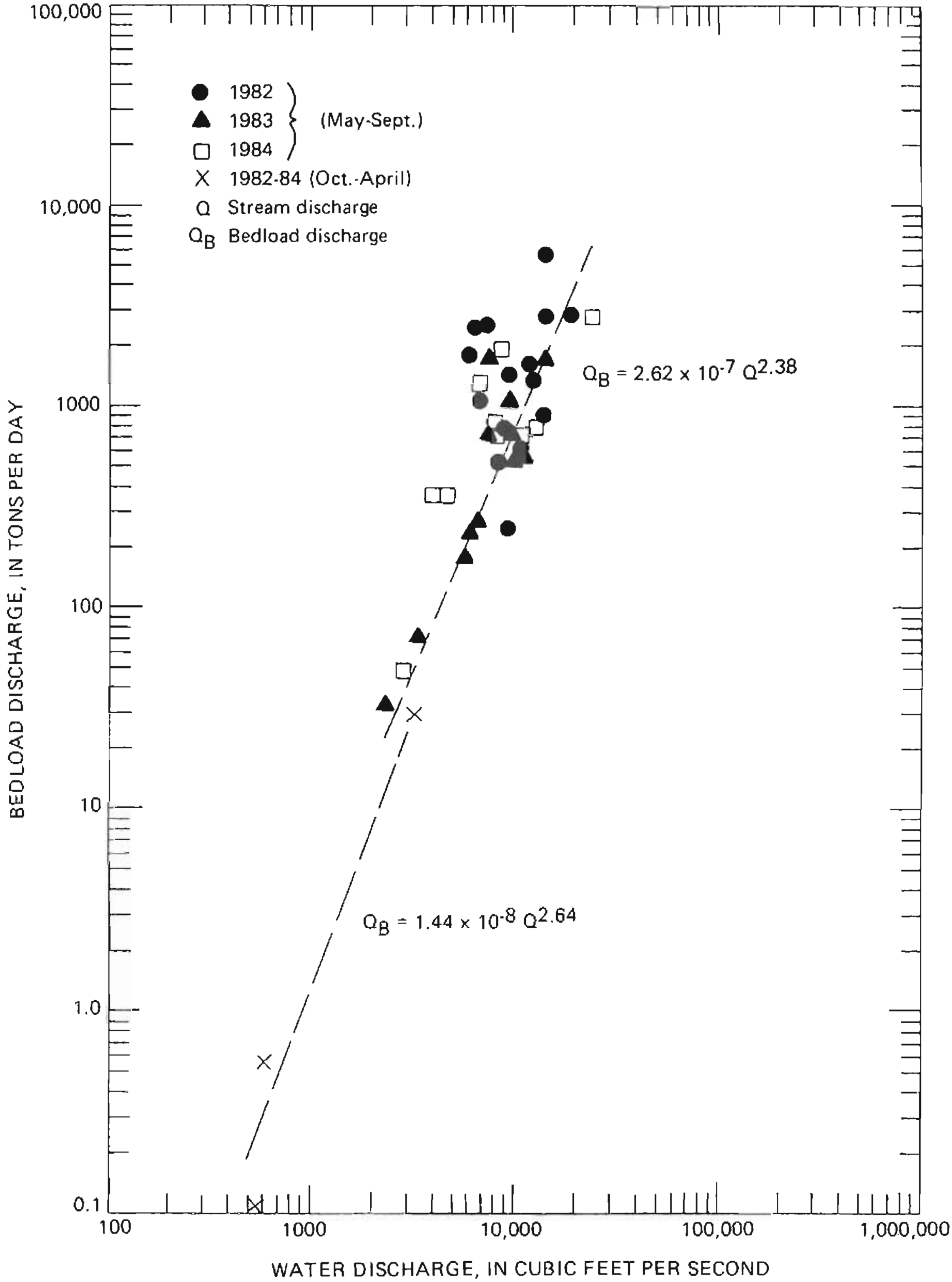

Figure 33.--Relation between bedload discharge and water discharge for Talkeetna River near Talkeetna, 1982-84. (Map number 11)

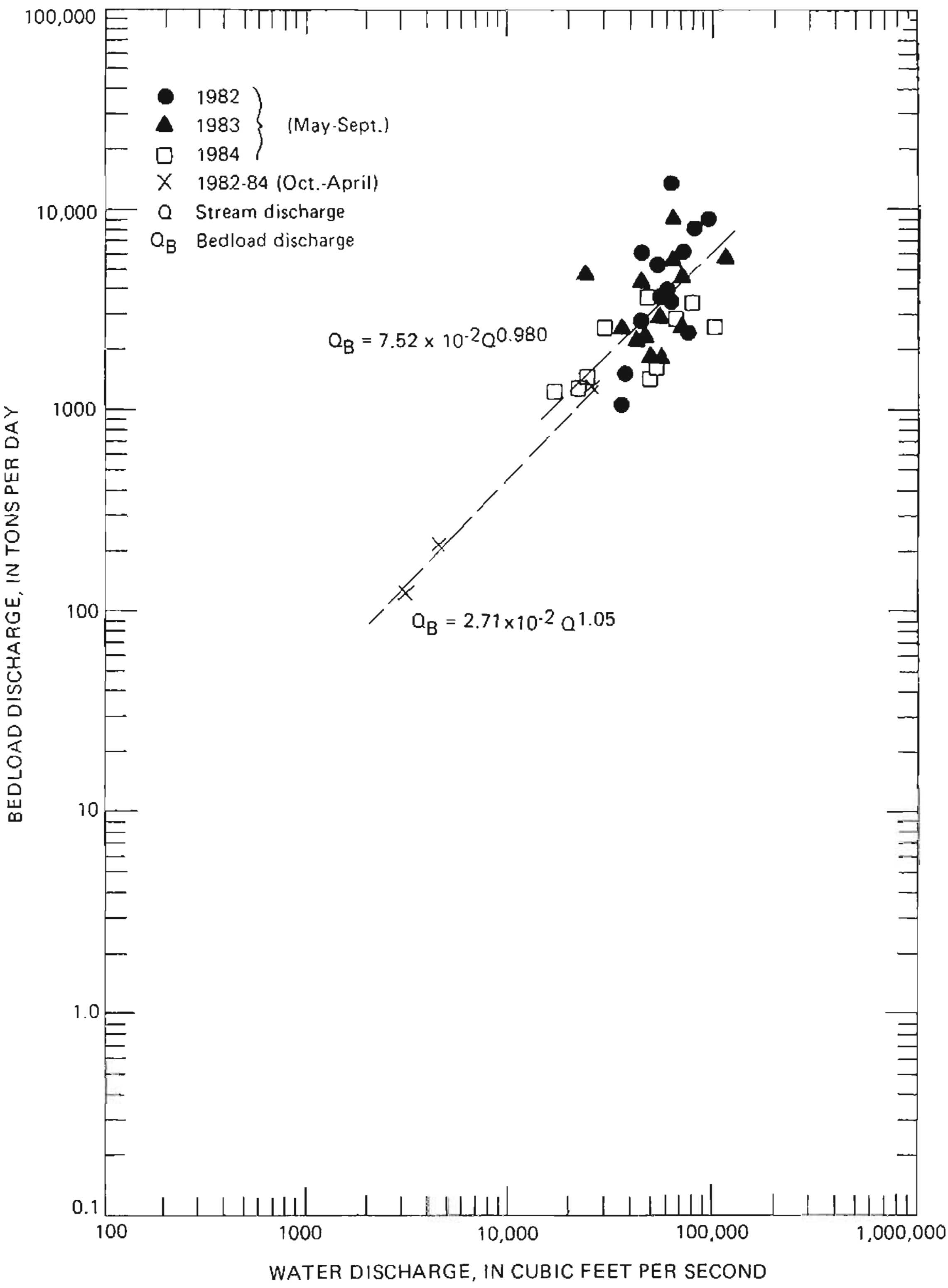

Figure 34.--Relation between bedload discharge and water discharge for Susitna River at Sunshine, 1982-84. (Map number 12)

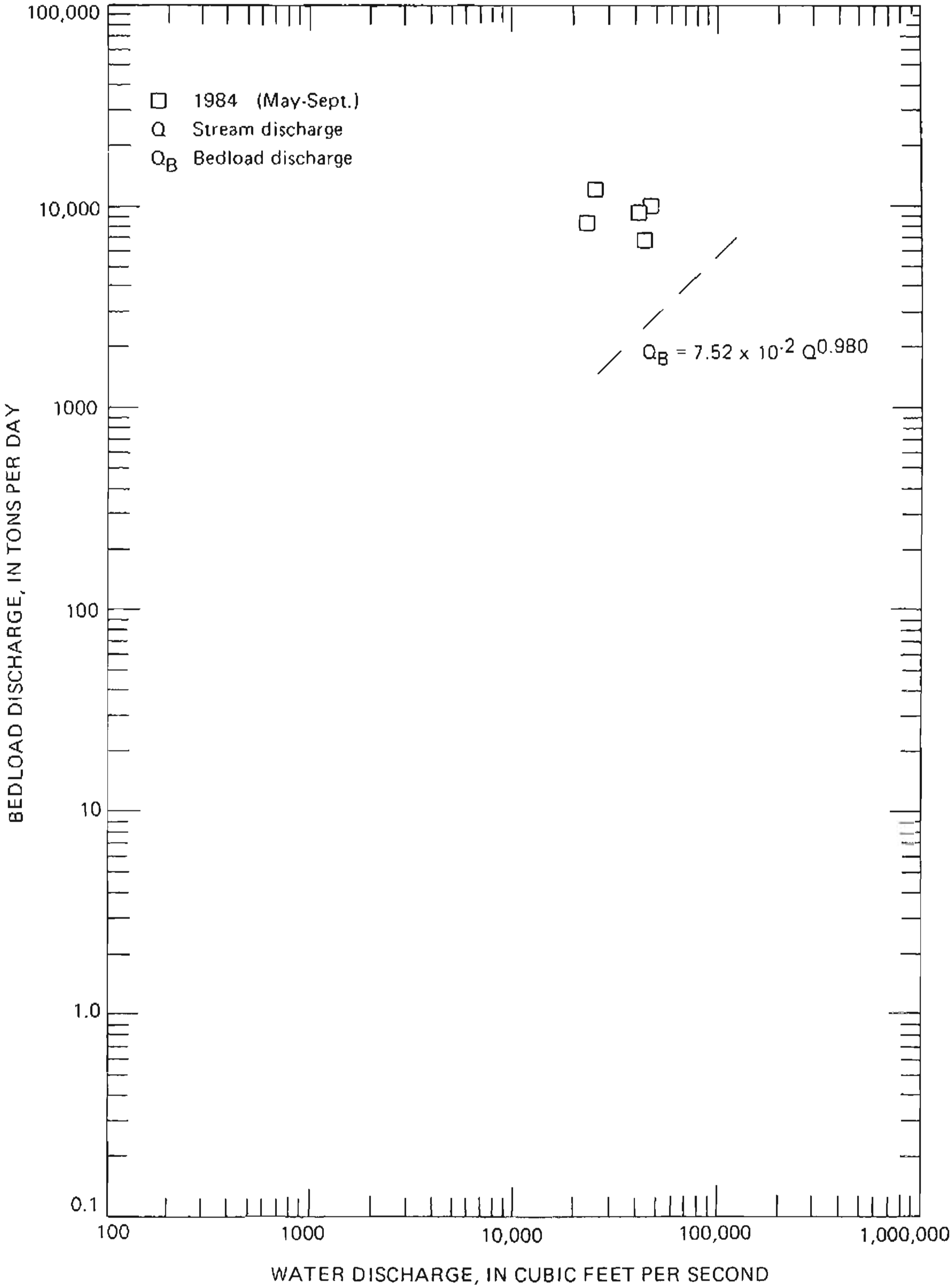

Figure 35.--Bedload discharge versus water discharge for Yentna River near Susitna Station, May to September 1984. (Map number 13) Dashed line corresponds to transport curve for Susitna River at Sunshine, May to September, 1982-84. (Map number 12)

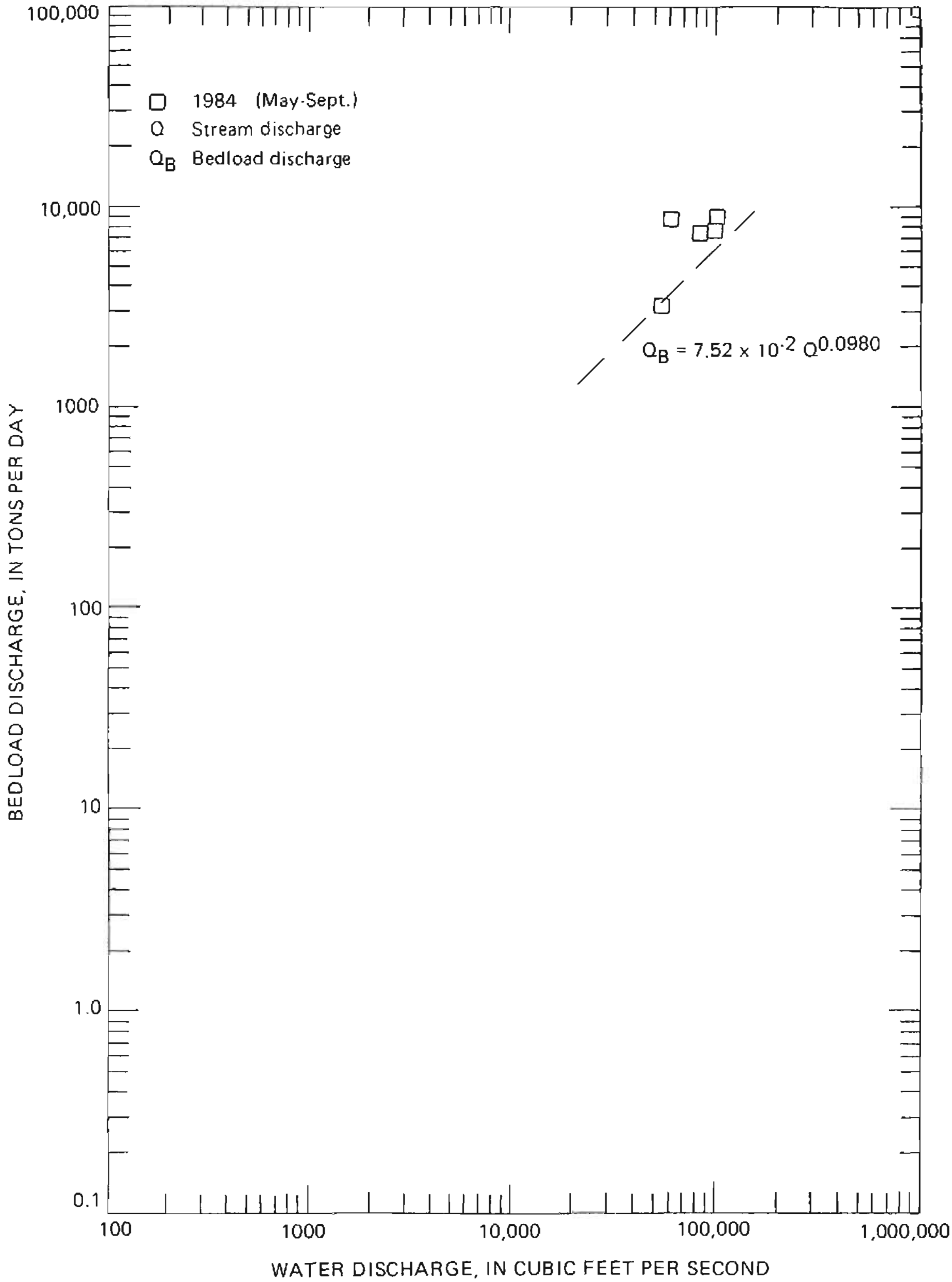

Figure 36.--Bedload discharge versus water discharge for Susitna River at Susitna Station, May to September 1984. (Map number 14) Dashed line corresponds to transport curve for Susitna River at Sunshine, May to September, 1982-84. (Map number 12)

Table 1.--Summary of streamflow and sediment data for selected stations in the Susitna River basin
[From Still and Jones, 1985 and U.S. Geological Survey, Alaska District files]

Map No. (fig. 1)	Station number	Station name	Drainage area (mi^2)	Data type	Period of record
1	625000149223500	Portage Creek near Gold Creek	--	Streamflow	1984
				Suspended sediment	1984
				Bed sediment	1984
2	624718149393600	Indian Creek near Gold Creek	--	Streamflow	1984
				Suspended sediment	1984
				Bed sediment	1984
3	15292000	Susitna River at Gold Creek	6,160	Streamflow	1949-84
				Suspended sediment	1952-57, 1962, 1967, 1974-84
				Bed sediment	1981
4	---	Susitna River at river mile 128.7 near Sherman Creek	--	Bed sediment	1984
5	---	Susitna River at river mile 125.6 near Skull Creek	--	Bed sediment	1984
6	15292100	Susitna River near Talkeetna	6,320	Streamflow	1982-84
				Suspended sediment	1982-84
				Bed sediment	1982-84
7	15292400	Chulitna River near Talkeetna	2,570	Streamflow	1958-77, 1979-84
				Suspended sediment	1967-72, 1980-84
				Bed sediment	1981
8	15292410	Chulitna River below canyon near Talkeetna	2,580	Streamflow	1982-84
				Suspended sediment	1982-84
				Bed sediment	1982-84
9 10	15292439 and 15292440	Susitna River below Chulitna River near Talkeetna	8,950	Streamflow	1983-84
				Suspended sediment	1983-84
				Bed sediment	1983-84
11	15292700	Talkeetna River near Talkeetna	2,006	Streamflow	1964-84
				Suspended sediment	1966-84
				Bed sediment	1981-84
12	15292780	Susitna River at Sunshine	11,100	Streamflow	1981-84
				Suspended sediment	1971, 1977, 1981-84
				Bed sediment	1981-84
13	15294345	Yentna River near Susitna Station	6,180	Streamflow	1980-84
				Suspended sediment	1981-84
				Bed sediment	1984
14	15294350	Susitna River at Susitna Station	19,400	Streamflow	1974-84
				Suspended sediment	1975-84
				Bed sediment	1984

Table 2.--Suspended-sediment data for selected stations in the Susitna River basin, October 1983 to September 1984
(Definition of units: ft^3/s, cubic feet per second; °C, degree Celsius; mg/L, milligrams per liter; ton/d, short ton per day)

Map No. (fig. 1)	Station name and number	Date of collection	Water discharge (ft^3/s)	Water temperature (°C)	Sediment concentration (mg/L)	Sediment discharge (ton/d)	Suspended sediment: Percent finer than size indicated, in millimeters 0.002	0.004	0.008	0.016	0.031	0.062	0.125	0.250	0.500	1.000	2.000
1	Portage Creek																
	near Gold Creek	May 30	597	--	4	6.4	--	--	--	--	--	68	--	--	--	--	--
	(625000149223500)	June 26	1,440	--	4	16	--	--	--	--	--	25	35	45	50	62	100
		July 24	782	--	3	6.3	--	--	--	--	--	75	88	93	99	100	--
		Sept.27	392	--	7	7.4	--	--	--	--	--	87	--	--	--	--	--
2	Indian Creek																
	near Gold Creek	May 30	339	--	3	2.7	--	--	--	--	--	67	--	--	--	--	--
	(624718149393600)	June 27	481	--	2	2.6	--	--	--	--	--	36	55	80	94	100	--
		July 25	388	--	3	3.1	--	--	--	--	--	56	74	88	100	--	--
		Sept.27	195	--	3	1.6	--	--	--	--	--	70	--	--	--	--	--
3	Susitna River																
	at Gold Creek	Oct. 3	12,400	--	74	2,480	--	--	--	--	--	43	--	--	--	--	--
	(15292000)	May 31	12,600	--	82	2,790	--	--	--	--	--	31	44	69	99	100	--
		June 27	29,200	--	476	37,500	24	29	32	40	47	58	68	86	98	100	--
		July 25	29,100	--	317	24,900	20	24	27	33	45	57	68	85	99	100	--
		Aug. 23	18,000	--	273	13,300	26	33	44	58	70	76	82	92	99	100	--
		Sept.28	7,140	5.0	17	328	--	--	--	--	--	79	85	92	100	--	--
6	Susitna River																
	near	Oct. 6	10,600	.5	23	658	--	--	--	--	--	32	36	53	98	100	--
	Talkeetna	May 16	15,800	2.0	460	19,600	11	14	--	23	--	48	61	83	100	--	--
	(15292100)	June 13	25,900	10.5	279	19,500	--	--	--	--	--	29	43	66	96	100	--
		July 9	22,400	12.5	323	19,500	31	37	--	55	--	74	80	91	100	--	--
		July 30	30,900	--	458	38,200	17	20	--	29	--	47	58	82	98	100	--
		Aug. 16	15,200	12.0	220	9,030	44	50	55	65	75	81	86	93	100	--	--
		Aug. 26	41,000	7.5	732	81,000	10	11	14	21	32	43	58	85	98	99	99
		Sept.13	9,380	7.5	27	684	--	--	--	--	--	71	76	89	100	--	--
		Sept.25	8,420	6.0	14	318	--	--	--	--	--	69	73	85	100	--	--
8	Chulitna River																
	below canyon	Oct. 5	9,170	1.5	200	4,950	18	21	--	30	--	39	48	67	99	100	--
	near	May 18	9,220	4.0	580	14,400	8	10	14	22	32	46	60	74	96	100	--
	Talkeetna	June 11	16,100	8.5	571	24,800	24	31	41	51	59	68	76	86	91	100	--
	(15292410)	June 14	19,200	6.5	895	46,400	23	27	34	42	49	56	69	78	96	99	100
		July 11	20,200	8.0	1,010	55,100	30	42	47	58	65	70	75	83	94	100	--
		July 31	22,900	6.0	921	56,900	29	35	41	49	58	64	71	82	98	100	--
		Aug. 17	20,300	6.0	931	51,000	30	35	42	52	63	70	77	87	97	100	--
		Aug. 28	18,100	4.0	556	27,200	20	22	29	37	46	56	64	80	94	97	100
		Sept.14	11,100	4.0	388	11,600	18	23	34	43	53	62	70	83	99	100	--
		Sept.27	7,480	4.0	133	2,690	32	38	44	50	60	66	69	77	98	100	--
9	Susitna River																
	below Chulitna	Oct. 5	16,000a	1.5	166	7,170	--	--	--	--	--	30	37	50	98	100	--
	River	May 18	18,000a	3.0	646	31,400	10	14	18	24	38	54	69	83	97	100	--
	(right channel)	June 12	23,600	10.5	707	45,100	18	25	33	40	46	52	60	73	97	100	--
	near Talkeetna	July 10	29,200	6.5	1,070	84,400	31	39	49	59	66	72	77	86	99	100	--
	(15292439)	July 30	35,500	6.5	975	93,500	--	--	--	--	--	57	--	--	--	--	--
		Aug. 15	27,000a	--	839	61,200	26	37	45	57	70	81	87	94	99	100	--
		Aug. 27	29,000	5.0	831	65,100	16	20	24	28	41	55	67	83	97	100	--
		Sept.12	16,700	6.5	209	9,420	27	30	38	45	53	60	64	75	97	100	--
		Sept.26	12,600	6.0	159	5,410	17	20	--	28	--	37	44	57	93	98	100
10	Susitna River																
	below	Oct. 5	6,200a	1.5	44	737	--	--	--	--	--	24	34	75	100	--	--
	Chulitna River	May 17	9,000a	5.0	339	8,240	--	--	--	--	--	48	65	87	100	--	--
	near Talkeetna	June 12	16,200	11.5	215	9,400	--	--	--	--	--	30	40	69	97	100	--
	(left channel)	July 10	16,000	12.0	314	13,600	33	41	--	56	--	74	80	90	99	100	--
	(15292440)	July 29	19,700	12.0	509	27,100	12	18	--	30	--	51	61	87	100	--	--
		Aug. 15	13,000a	--	270	9,480	40	45	55	71	80	82	88	94	100	--	--
		Aug. 27	22,000a	6.5	1,070	63,600	12	14	17	27	40	56	63	83	99	100	--
		Sept.12	6,070	8.0	36	590	--	--	--	--	--	67	74	84	99	100	--
		Sept.26	2,700	7.0	21	153	--	--	--	--	--	60	64	73	100	--	--

a Estimated

Table 2.--Suspended-sediment data for selected stations in the Susitna River basin, October 1983 to September 1984 --Continued

(Definition of units: ft^3/s, cubic feet per second; °C, degree Celsius; mg/L, milligrams per liter; ton/d, short ton per day)

Map No. (fig. 1)	Station name and number	Date of collection	Water discharge (ft^3/s)	Water temperature (°C)	Sediment concentration (mg/L)	Sediment discharge (ton/d)	Suspended sediment, Percent finer than size indicated, in millimeters 0.002	0.004	0.008	0.016	0.031	0.062	0.125	0.250	0.500	1.000	2.000
11	Talkeetna																
	River near	Oct. 4	4,250	1.5	41	470	--	--	--	--	--	17	--	--	--	--	--
	Talkeetna	Mar. 7	590	--	7	11	--	--	--	--	--	72	--	--	--	--	--
	(15292700)	May 15	2,440	7.0	79	520	--	--	--	--	--	31	53	90	100	--	--
		May 31	4,170	--	46	518	--	--	--	--	--	15	28	53	100	--	--
		June 13	12,000	7.5	1,310	42,400	8	9	12	19	31	46	71	89	99	100	--
		June 28	8,370	--	290	6,550	10	17	--	27	--	42	53	79	98	100	--
		July 26	13,200	--	764	27,200	16	19	25	36	50	61	76	92	99	100	--
		July 28	11,200	9.0	396	12,000	--	--	--	--	--	44	53	80	99	100	--
		Aug. 16	6,640	11.0	438	7,850	14	19	27	34	44	56	67	83	98	100	--
		Aug. 26	22,700	6.5	916	56,100	5	7	10	16	24	36	68	92	99	100	--
		Sept. 26	2,900	--	15	117	--	--	--	--	--	36	52	79	100	--	--
12	Susitna River																
	at Sunshine	Oct. 4	28,000	2.0	171	12,900	12	15	--	19	--	29	37	68	99	100	--
	(15292780)	May 16	24,600	5.0	440	29,200	10	13	--	22	--	43	56	72	99	100	--
		May 18	34,900	5.5	467	44,000	14	15	--	27	--	51	63	85	100		--
		June 14	68,300	--	999	184,000	15	17	20	26	34	48	70	87	99	100	--
		July 13	52,200	10.5	638	89,900	21	31	37	47	55	60	66	82	98	100	--
		July 19	49,900	--	569	76,700	24	32	45	54	65	69	75	87	99	100	--
		July 28	77,700	9.0	960	201,000	27	31	36	45	55	64	74	87	96	99	100
		Aug. 14	45,800	9.5	748	92,500	22	27	40	50	57	63	70	84	100	--	--
		Sept. 11	23,300	7.0	168	10,600	23	29	--	46	--	57	63	76	100	--	--
		Sept. 21	29,600	--	284	22,700	13	16	--	25	--	35	41	63	96	100	--
		Sept. 28	17,800	5.0	88	4,730	22	27	--	34	--	46	51	67	100	--	--
13	Yentna River																
	near	Feb. 23	2,240	0.0	4	24	--	--	--	--	--	--	--	--	--	--	--
	Susitna Station	Apr. 5	3,540	--	7	67	--	--	--	--		73					
	(15294345)	May 14	24,400	--	227	15,000	--	--	--	--	--	30	53	85	98	100	--
		June 12	44,300	--	363	43,400	20	23	27	32	42	50	64	91	100	--	--
		July 17	42,900	--	684	79,200	28	36	46	54	63	68	76	89	99	100	--
		Aug. 14	39,400	--	792	84,300	24	29	39	49	57	66	74	89	99	100	--
		Sept. 19	20,500	--	257	14,200	--	--	--	--	--	45	58	77	97	100	--
14	Susitna River																
	at	Apr. 6	9,090	--	185	4,540	--	--	--	--	--	93	--	--	--	--	--
	Susitna Station	May 18	61,200	--	523	86,400	9	10	--	17	--	31	44	66	90	100	--
	(15294350)	July 18	97,800	--	700	185,000	30	40	50	60	71	80	86	97	100	--	--
		Aug. 15	82,200	--	563a	125,000	--	--	--	--	--	76	--	--	--	--	--
		Sept. 20	55,100	--	543	80,800	10	15	24	31	38	67	61	90	100	--	--

a Estimated

Table 3.--Hydraulic and bedload data for selected stations in the Susitna River basin, October 1983 to September 1984 (Definition of units: ft^3/s, cubic feet per second; ft, foot; ft/s, foot per second; ft/ft, foot per foot; ton/d, short ton per day)

Map No. (fig. 1)	Station name and number	Date of collection	Water discharge (ft^3/s)	Average depth (ft)	Width (ft)	Average velocity (ft/s)	Water surface slope (ft/ft)	Bedload discharge (ton/d)	Particle-size distribution of bed sediment: Percentage, by weight, finer than size (mm) indicated											
									0.062	0.125	0.25	0.50	1.0	2.0	4.0	8.0	16.0	32.0	64.0	76.0
1	Portage Creek	May 30	597	1.9	108	3.1	0.0057	15	--	--	0	2	15	29	48	60	74	85	100	--
	near	June 26	1,440	2.6	111	4.9	--	80	--	--	0	4	19	32	48	59	64	76	100	--
	Gold Creek	July 24	782	2.2	110	3.3	--	47	--	--	0	1	5	15	25	36	46	56	88	100
	(6250001492 23500)	Sept.27	392	1.4	105	2.7	--	.1	--	--	--	--	--	--	--	--	--	--	--	--
2	Indian Creek	May 30	339	1.7	57	3.5	--	4.6	--	--	0	8	44	62	78	87	100	--	--	--
	near	June 27	481	1.5	78	4.2	--	34	--	--	0	3	15	24	33	44	52	68	100	--
	Gold Creek (624718149393600)	July 25	388	2.0	60	3.2	--	19	--	--	0	4	18	30	45	59	69	73	100	--
6	Susitna River	Oct. 6	10,700	3.9	545	5.0	.0014	27	--	--	0	84	98	99	99	99	100	--	--	--
	near	Feb. 17	2,000	--	--	--	--	0	--	--	--	--	--	--	--	--	--	--	--	--
	Talkeetna	May 17	17,800	5.0	578	6.1	.0014	296	--	0	1	68	97	98	99	100	--	--	--	--
	(15292100)	June 13	24,700	5.7	613	7.1	.0014	391	--	--	0	63	95	96	97	97	99	100	--	--
		July 9	22,300	5.5	604	6.7	.0014	238	--	0	1	67	88	89	90	90	91	94	100	--
		July 30	30,900	6.9	627	7.1	--	564	--	0	1	61	80	81	83	86	89	90	100	--
		Aug. 16	15,200	4.9	559	5.5	.0012	242	--	0	1	72	96	97	98	98	98	100	--	--
		Aug. 26	40,900	7.7	636	8.4	.0014	894	--	0	2	74	94	95	96	98	99	100	--	--
		Sept.13	9,340	4.1	551	4.1	.0011	14	--	--	0	73	95	95	98	99	100	--	--	--
		Sept.25	8,460	3.6	540	4.3	.0012	29	--	--	0	77	100	--	--	--	--	--	--	--
8	Chulitna	Oct. 5	9,170	5.8	330	4.8	.00044	3,380	--	0	1	30	57	61	68	81	90	98	100	--
	River below	Feb. 29	1,420	--	--	--	--	.88	0	1	2	49	73	79	79	84	100	--	--	--
	canyon near	May 18	9,220	5.7	329	4.9	.00074	2,850	--	0	1	26	54	63	74	84	91	98	100	--
	Talkeetna	June 11	16,100	7.3	346	6.4	.0010	6,590	--	0	1	13	42	48	55	66	83	94	100	--
	(15292410)	June 14	19,400	7.6	354	7.2	.0011	5,170	--	0	1	12	25	31	38	47	64	90	100	--
		July 11	20,200	8.3	357	6.8	.00098	3,860	--	0	1	12	35	38	42	53	69	86	100	--
		July 31	23,300	8.8	371	7.1	.0012	5,190	--	0	1	12	26	31	38	54	70	88	100	--
		Aug. 17	19,900	8.5	353	6.6	.0012	5,640	--	0	1	14	37	41	47	57	73	91	100	--
		Aug. 28	17,900	7.9	348	6.5	.00083	4,100	--	--	0	8	33	37	43	55	73	92	100	--
		Sept.14	11,200	6.2	337	5.4	.00057	2,090	--	0	1	24	61	71	78	84	92	98	100	--
		Sept.27	7,480	5.5	331	4.1	.00039	2,120	--	--	0	26	74	87	94	97	99	100	--	--
9	Susitna River	Oct. 5	16,000a	4.4	714	5.1	--	818	--	--	0	53	77	82	82	83	86	94	100	--
	below	Feb. 16	1,400a	--	--	--	--	52	--	--	0	50	99	100	--	--	--	--	--	--
	Chulitna	May 18	18,000a	--	--	--	--	3,170	--	--	0	17	27	34	39	47	61	89	100	--
	River	June 12	23,600	4.6	720	7.1	--	6,980	--	--	0	9	20	22	25	33	50	76	100	--
	(right	July 10	29,200	5.1	755	7.6	--	2,150	--	0	1	25	52	57	61	67	75	88	100	--
	channel) near	July 30	35,500	5.7	770	8.1	--	5,470	--	0	1	20	40	46	55	63	72	85	100	--
	Talkeetna	Aug. 15	27,000a	--	--	--	--	1,400	--	--	0	14	27	30	37	48	65	86	100	--
	(15292439)	Aug. 27	29,000	3.1	1,280	7.1	--	12,200	--	--	0	6	16	19	25	38	58	83	99	100
		Sept.12	16,700	3.9	677	6.3	--	652	--	--	0	32	62	64	67	73	80	92	100	--
		Sept.26	12,600	3.7	602	5.7	--	2,330	--	--	0	27	61	63	67	72	80	90	100	--
10	Susitna River	Oct. 5	6,200a	3.3	454	4.1	--	69	--	--	0	78	95	96	97	98	98	100	--	--
	below	Feb. 16	2,000a	--	--	--	--	0	--	--	--	--	--	--	--	--	--	--	--	--
	Chulitna	May 17	9,000a	--	--	--	--	272	--	0	1	36	36	37	38	39	42	53	100	--
	River	June 12	16,200	4.5	620	5.8	--	360	--	0	1	44	81	83	84	86	89	100	--	--
	(left channel)	July 10	15,000	4.4	580	5.9	--	319	--	0	1	64	94	94	95	95	97	100	--	--
	near	July 29	19,700	4.9	740	5.4	--	790	--	0	4	77	94	95	95	96	97	100	--	--
	Talkeetna	Aug. 15	13,000a	--	--	--	--	196	--	0	3	75	85	86	86	87	88	92	100	--
	(15292440)	Aug. 27	23,000a	4.3	910	5.5	--	1,430	--	0	5	65	85	86	86	87	88	93	100	--
		Sept.12	6,070	3.2	500	3.8	--	25	--	--	0	52	72	73	74	75	80	100	--	--
		Sept.26	2,700	2.4	292	3.8	--	18	--	0	1	46	82	83	85	85	90	100	--	--

a Estimated

Table 3.--Hydraulic and bedload data for selected stations in the Susitna River basin, October 1983 to September 1984 --Continued
(Definition of units: ft^3/s, cubic feet per second; ft, foot; ft/s, foot per second; ft/ft, foot per foot; ton/d, short ton per day)

Map No. (fig. 1)	Station name and number	Date of collection	Water discharge (ft^3/s)	Average depth (ft)	Width (ft)	Average velocity (ft/s)	Water surface slope (ft/ft)	Bedload discharge (ton/d)	Particle-size distribution of bed sediment: Percentage, by weight, finer than size (mm) indicated											
									0.062	0.125	0.25	0.50	1.0	2.0	4.0	8.0	16.0	32.0	64.0	76.0
11	Talkeetna	Oct. 7	3,070	3.0	323	3.2	--	29	--	--	0	79	98	100	--	--	--	--	--	--
	River near	Feb. 28	590	--	--	--	--	.56	0	1	3	48	97	100	--	--	--	--	--	--
	Talkeetna	May 18	4,560	3.3	328	4.2	--	358	--	0	2	33	88	96	99	100	--	--	--	--
	(15292700)	May 31	4,080	3.3	324	3.8	--	357	--	--	0	27	90	95	96	97	97	100	--	--
		June 13	12,000	5.7	336	6.2	--	771	0	1	4	30	76	81	83	85	87	90	100	--
		June 28	8,440	--	--	--	--	712	--	0	2	34	87	91	92	94	96	99	100	--
		July 26	13,200	5.9	345	6.5	--	762	--	0	1	23	66	70	72	75	80	97	100	--
		July 28	11,200	5.5	343	6.0	--	688	--	0	2	38	81	84	85	87	88	96	100	--
		Aug. 16	6,570	4.1	334	4.8	--	1,210	--	0	1	44	95	98	99	99	100	--	--	--
		Aug. 24	11,200	5.4	338	6.2	--	1,920	--	0	1	30	88	90	91	93	95	98	100	--
		Aug. 26	23,400	7.8	355	8.5	--	2,690	--	0	1	7	12	15	19	30	54	79	98	100
		Sept.26	2,900	2.8	320	3.2	--	48	--	0	3	58	99	99	100	--	--	--	--	--
12	Susitna	Oct. 4	28,200	7.9	610	5.9	.0014	1,320	--	0	1	40	66	71	72	77	85	96	100	--
	River at	Feb. 23	4,630	--	--	--	--	216	--	0	1	30	58	61	64	69	77	93	100	--
	Sunshine	May 16	24,600	7.5	593	5.5	--	1,360	--	0	2	46	80	82	83	86	90	96	100	--
	(15292780)	June 14	68,300	9.8	940	7.4	--	2,920	0	1	4	45	58	60	61	65	72	84	100	--
		July 13	52,200	8.3	945	6.6	--	1,620	--	0	1	28	55	58	60	65	71	82	100	--
		July 18	51,200	8.5	802	7.3	--	1,340	--	--	0	33	59	62	65	71	82	94	100	--
		July 28	77,900	10.8	954	7.6	--	3,320	--	0	1	32	41	43	45	52	65	79	100	--
		Aug. 14	45,800	8.8	852	6.1	--	3,590	--	0	2	33	56	58	60	63	72	88	100	--
		Aug. 25	99,700	12.7	960	8.2	--	2,580	0	3	14	63	79	80	81	83	88	94	100	--
		Sept.11	23,300	7.5	580	5.3	--	1,190	--	0	1	36	56	58	62	71	87	98	100	--
		Sept.21	29,600	8.1	595	6.2	--	2,590	--	0	2	28	45	47	53	64	78	92	100	--
		Sept.28	17,800	6.9	570	4.5	--	1,190	--	0	1	59	90	91	92	94	97	100	--	--
13	Yentna River	May 14	24,900	5.6	1,290	3.4	--	11,300	--	0	5	65	77	84	90	96	100	--	--	--
	Susitna	June 12	43,800	8.5	1,280	4.0	--	10,000	--	0	5	46	79	84	88	92	96	100	--	--
	Station	July 17	46,000	8.5	1,290	4.2	--	6,800	--	0	2	43	88	91	94	96	99	100	--	--
	(15294345)	Aug. 15	40,100	7.8	1,290	4.0	--	9,480	--	0	3	58	88	90	92	94	96	98	100	--
		Sept.19	20,400	5.3	1,270	3.1	--	8,220	--	0	2	48	82	85	90	93	97	100	--	--
14	Susitna River	May 17	60,100	12.2	975	5.0		8,550	--	0	6	80	95	96	97	98	99	100	--	--
	at Susitna	June 13	97,500	10.2	1,860	5.1	--	7,460	--	0	2	34	85	87	89	92	96	99	100	--
	Station	July 18	98,500	--	--	--	--	8,590	--	0	3	53	89	92	94	97	99	100	--	--
	(15294350)	Aug. 15	85,300	8.4	1,870	5.2	--	7,370	--	0	3	49	71	76	87	91	96	99	100	--
		Sept.20	57,500	8.8	1,520	4.3	--	3,250	--	0	8	84	90	90	91	92	93	96	100	--

Table 4.--Bed-material data for selected stations in the Susitna River basin May to September 1984 (Sampling point stationing from left bank)

Map No. (fig. 1)	Station name and number	Date of collection	Sampling point	Sample type	Bed material: Percent finer than size indicated, in millimeters 0.062	0.125	0.25	0.50	1.0	2.0	4.0	8.0	16.0	32.0	64.0	128.0	256.0
1	Portage Creek	Sept.13															
	near		30a	surface	--	--	--	--	--	--	--	0	5	57	100	--	--
	Gold Creek			sub-sur	--	--	--	--	--	--	--	0	18	48	71	100	--
			35a	surface	--	--	--	--	--	--	--	--	0	4	34	100	--
				sub-sur	--	0	1	5	11	12	19	34	53	69	81	100	--
			60a	surface	--	--	--	--	--	--	--	0	4	28	65	100	--
				sub-sur	--	--	--	0	2	3	8	23	55	86	100	--	--
2	Indian River	May 30															
	near		50a	surface	--	--	--	--	--	--	--	0	1	13	39	100	--
	Gold Creek			sub-sur	--	--	--	0	1	2	4	9	24	73	100	--	--
			100a	surface	--	0	1	2	3	4	8	18	47	93	100	--	--
				sub-sur	1	3	12	35	46	51	60	79	97	98	100	--	--
			150a	surface	--	--	0	1	1	2	2	3	6	36	71	100	--
				sub-sur	0	1	2	9	23	28	33	43	57	80	100	--	--
4	Susitna River	June 5	Left channel														
	at		110a	surface	13	31	68	99	100	--	--	--	--	--	--	--	--
	river mile		170a	surface	--	0	2	6	6	6	6	6	6	10	40	100	--
	128.7			sub-sur	0	1	8	20	21	22	24	27	33	47	84	100	--
	near		230a	surface	4	18	66	99	100	--	--	--	--	--	--	--	--
	Sherman Creek		290a	surface	0	1	2	2	3	3	3	4	6	17	66	100	--
				sub-sur	2	3	7	11	15	19	26	34	47	60	100	--	--
			Middle channel														
			100a	surface	--	0	8	77	100	--	--	--	--	--	--	--	--
			150a	surface	--	--	--	--	--	--	0	1	2	16	51	100	--
				sub-sur	0	1	2	6	7	7	8	12	25	70	100	--	--
			200a	surface	--	0	1	3	4	4	5	6	9	36	100	--	--
				sub-sur	1	2	5	16	22	26	32	41	62	79	100	--	--
			250a	surface	--	0	1	3	3	3	3	4	5	61	100	--	--
				sub-sur	2	4	13	20	25	28	33	44	59	78	100	--	--
			Right channel														
			50c	dredged	--	--	--	--	--	--	--	--	--	--	--	--	--
			100b	dredged	--	--	--	--	--	--	--	--	0	2	13	100	--
			150b	dredged	--	--	--	--	--	--	--	--	0	3	35	100	--
			200b	dredged	--	--	--	--	--	--	--	--	--	0	20	100	--
			250b	dredged	--	--	--	--	--	--	--	--	0	3	24	100	--
			300c	dredged	--	--	--	--	--	--	--	--	--	--	--	--	--
			350c	dredged	--	--	--	--	--	--	--	--	--	--	--	--	--
5	Susitna River	June 6	Left channel														
	at		50a	surface	0	1	1	1	1	1	1	1	1	5	39	100	--
	river mile			sub-sur	1	1	1	1	1	2	5	11	27	56	87	100	--
	125.6 near		100a	surface		0	1	3	3	3	3	4	11	24	100	--	--
	Skull Creek			sub-sur	1	3	7	13	15	15	16	18	24	37	73	100	--
			Middle channel														
			50a	dredged	--	--	--	--	--	--	--	--	--	0	11	100	--
			100b	dredged	--	--	--	--	--	--	--	--	--	0	16	100	--
			150a	surface	--	--	--	--	--	--	--	--	0	2	11	100	--
				sub-sur	0	1	4	8	10	11	15	21	31	52	100	--	--
			200a	surface	--	0	1	2	2	2	2	3	4	12	59	100	--
				sub-sur	2	6	13	14	16	16	17	19	23	34	82	100	--
			Right channel														
			50b	dredged	--	--	--	--	--	--	--	--	0	1	1	100	--
			100b	dredged	--	--	--	--	--	--	--	0	3	12	12	100	--
			150c	dredged	--	--	--	--	--	--		--	--	--	--	--	--
			200a	dredged	--	--	--	--	--	--	--	--	0	16	38	100	--
			250b	dredged	--	--	--	--	--	--	--	--		0	48	100	--
			325a	surface	0	1	1	1	1	1	1	1	2	6	23	100	--
				sub-sur	1	3	7	11	14	15	18	23	29	50	80	100	--
			375a	surface	--	--	0	1	1	1	1	2	5	25	81	100	--
				sub-sur	0	2	5	11	14	15	16	18	32	54	78	100	--
			500a	dredged	--	--	--	--	--	--	--	--	0	1	6	100	--
			550b	dredged	--	--	--	--	--	--	--	--		0	11	100	--
			600b	dredged	--	--	--	--	--	--	--	--	0	1	6	100	--
6	Susitna River	May 17															
	near Talkeetna		0a	surface	--	--	--	--	--	--	--	--	0	1	13	31	100
	(15292100)			sub-sur	0	2	4	10	11	12	13	20	29	44	52	100	--
			125b	dredged	--	--	--	--	--	--	--	0	1	1	12	100	--
			225b	dredged	--	--	--	--	--	--	0	1	3	8	39	100	--
			325b	dredged	--	--	--	--	--	--	--	--	--	0	13	100	--
			425b	dredged	--	--	--	--	--	--	--	--	0	1	9	100	--
			525b	dredged	--	--	--	--	--	--	--	--	--	--	0	100	--
			560a	surface	--	--	--	--	--	--	--	0	3	15	57	100	--
				sub-sur	2	5	8	14	17	18	22	29	42	60	78	100	--
8	Chulitna River	May 18															
	below canyon		30c	dredged	--	--	--	--	--	--	--	--	--	--	--	--	--
	near Talkeetna		80a	dredged	--	0	1	2	18	26	33	47	69	86	100	--	--
	(15292410)		120a	dredged	--	0	1	36	68	70	75	81	90	96	100	--	--
			200a	dredged	--	--	0	1	14	20	25	34	47	59	83	100	--
			280a	dredged	--	--	--	--	--	--	--	0	1	5	35	100	--

Table 4.--Bed-material data for selected stations in the Susitna River basin
May to September 1984 --Continued
(Sampling point stationing from left bank)

Map No. (fig. 1)	Station name and number	Date of collection	Sampling point	Sample type	Bed material: Percent finer than size indicated, in millimeters 0.062	0.125	0.25	0.50	1.0	2.0	4.0	8.0	16.0	32.0	64.0	128.0	256.0
9	Susitna River	May 17															
	below		3760ad	dredged	--	--	0	1	3	3	4	6	12	29	64	100	--
	Chulitna River		3860ad	dredged	--	--	--	--	--	--	0	1	2	15	15	100	--
	(right channel)		3960ad	dredged	--	--	0	2	3	9	29	48	72	87	100	--	--
	near Talkeetna		4060ad	dredged	--	--	--	--	--	--	--	--	--	0	25	100	--
	(15292439)																
10	Susitna River	May 17															
	below Chulitna		100ad	dredged	--	--	--	--	--	--	--	0	2	8	44	100	--
	River		600ad	dredged	--	--	--	--	--	--	0	1	4	18	65	100	--
	(left channel)		700ad	dredged	--	--	--	--	--	0	1	2	10	35	74	100	--
	near Talkeetna		800ad	dredged	--	--	--	--	--	--	--	--	0	6	16	100	--
	(15292440)		900ad	surface	0	1	2	3	3	3	3	4	7	35	100	--	--
				sub-sur	1	2	6	21	22	24	29	38	60	88	100	--	--
			1000ad	surface	--	--	--	--	--	--	0	1	5	28	60	100	--
				sub-sur	1	2	5	16	20	22	27	38	55	75	100	--	--
			2750ad	surface	1	2	3	5	5	5	5	6	10	29	100	--	--
				sub-sur	2	5	14	62	62	64	68	74	84	97	100	--	--
11	Talkeetna	May 15															
	River		30a	surface	--	--	--	--	--	--	--	0	2	24	100	--	--
	near Talkeetna			sub-sur	0	2	5	10	12	16	19	25	38	65	100	--	--
	(15292700)		80a	dredged	--	0	1	16	51	53	53	54	54	54	63	100	--
			130a	dredged	--	0	1	17	72	78	79	79	79	81	86	100	--
			180a	dredged	--	0	1	8	41	47	48	49	51	59	90	100	--
			230a	dredged	--	--	0	3	37	50	55	56	58	65	100	--	--
			340a	surface	--	--	--	--	--	--	--	--	--	0	11	50	100
				sub-sur	0	1	2	3	4	5	6	8	13	45	100	--	--
			350a	surface	--	--	0	1	1	1	1	1	2	6	22	100	--
				sub-sur	3	6	11	16	25	30	35	45	58	84	100	--	--
12	Susitna River	May 16															
	at Sunshine		100b	dredged	--	--	--	--	--	--	--	--	--	0	8	100	--
	(15292780)		200a	dredged	--	0	1	46	87	88	88	89	91	92	100	--	--
			300a	dredged	--	--	0	1	2	4	8	15	44	61	95	100	--
			400a	dredged	--	0	1	2	3	3	4	5	7	25	49	100	--
			500b	dredged	--	--	--	--	--	--	--	--	0	2	18	100	--
			675a	surface	--	0	2	5	5	5	6	6	9	23	100	--	--
				sub-sur	1	2	2	5	11	15	18	22	29	40	69	100	--
			725a	surface	1	4	19	94	100	--	--	--	--	--	--	--	--
				sub-sur	1	2	11	41	41	44	44	45	47	57	88	100	--
			800a	surface	41	76	97	100	--	--	--	--	--	--	--	--	--
13	Yentna River	May 14															
	near		100a	dredged	0	1	24	80	82	83	87	92	96	100	--	--	--
	Susitna Station		200a	dredged	0	1	11	56	70	76	80	84	90	99	100	--	--
	(15294345)		300a	dredged	0	1	15	89	89	89	89	91	94	98	100	--	--
			400a	dredged	0	1	15	83	85	85	85	85	86	89	100	--	--
			500a	dredged	0	1	18	79	83	83	84	85	86	94	100	--	--
			600a	dredged	0	1	16	91	95	95	96	98	99	100	--	--	--
			700a	dredged	0	1	17	97	98	99	99	99	100	--	--	--	--
			800a	dredged	0	1	9	82	89	92	95	98	99	100	--	--	--
			900a	dredged	--	0	4	83	83	85	87	90	96	100	--	--	--
			1000a	dredged	--	0	4	50	87	93	96	98	100	--	--	--	--
			1100a	dredged	--	0	2	46	56	68	82	95	100	--	--	--	--
			1200a	dredged	--	0	1	50	51	61	79	94	100	--	--	--	--
14	Susitna River	May 17															
	at		200a	dredged	--	0	6	89	94	94	95	95	97	100	--	--	--
	Sunshine Station		300a	dredged	--	0	5	58	86	88	91	93	95	98	100	--	--
	(15294350)		400a	dredged	--	0	4	47	91	93	94	95	98	100	--	--	--
			500a	dredged	--	0	5	69	99	99	99	99	100	--	--	--	--
			600a	dredged	--	0	7	93	99	99	99	99	100	--	--	--	--
			700a	dredged	--	0	14	99	100	--	--	--	--	--	--	--	--
			800a	dredged	0	1	27	93	98	98	98	99	100	--	--	--	--
			900a	dredged	0	1	7	32	38	39	44	52	65	90	100	--	--

a Representative sample obtained for particles finer than 128 mm
b Few particles obtained, non-representative sample
c Streambed too coarse for obtaining samples
d Stationing from left bank of Susitna River, left channel (15292440)

Table 5.--Water discharge and estimated total sediment loads at selected stations in the Susitna River basin, October 1983 to September 1984
(Definition of units: mi^2, square mile; acre-ft, acre-foot; tons, short tons)

Map No. (fig. 1)	Station name and number	Drainage area (mi^2)	Period	Water discharge (acre-ft)	Suspended sediment (tons) Silt-clay	Sand	Total	Bedload (tons) Sand	Gravel	Total	Total sediment (tons)
6	Susitna River near Talkeetna (15292100)	6,320	October	541,000a	--	--	12,000	540	43	583	12,600
			November	216,000a	--	--	1,300	42	2.5	44	1,340
			December	143,000a	--	--	600	12	.6	13	613
			January	127,000a	--	--	500	8.4	.4	8.8	509
			February	126,000a	--	--	400	9.1	.4	9.5	410
			March	137,000a	--	--	400	10	.5	10	410
			April	129,000a	--	--	400	9.3	.4	9.7	410
			May	837,000a	180,000	250,000	430,000	6,100	250	6,350	436,000
			June	1,720,000a	460,000	700,000	1,160,000	17,000	2,400	19,400	1,180,000
			July	1,560,000a	490,000	310,000	800,000	9,700	1,700	11,400	811,000
			August	1,390,000a	340,000	260,000	600,000	11,000	800	11,800	612,000
			September	606,000a	13,000	12,000	25,000	700	10	710	25,700
			October to April	1,420,000a	--	--	15,600	631	48	679	16,300
			May to September	6,110,000a	1,480,000	1,530,000	3,020,000	44,500	5,160	49,700	3,060,000
			Total	7,530,000a	--	--	3,030,000	45,100	5,210	50,400	3,080,000
8	Chulitna River below canyon near Talkeetna (15292410)	2,580	October	530,000	--	--	250,000	19,000	16,000	35,000	285,000
			November	174,000	--	--	7,200	140	85	225	7,420
			December	147,000	--	--	4,600	64	36	100	4,700
			January	126,000	--	--	3,300	38	21	59	3,360
			February	86,700	--	--	1,500	12	6.1	18	1,520
			March	77,400	--	--	1,100	6.2	3.1	9.3	1,110
			April	81,900	--	--	1,300	6.0	4.6	11	1,310
			May	450,000	170,000	120,000	290,000	40,000	27,000	67,000	357,000
			June	1,110,000	810,000	620,000	1,430,000	64,000	91,000	155,000	1,580,000
			July	1,370,000	1,500,000	640,000	2,140,000	51,000	100,000	151,000	2,290,000
			August	1,400,000	1,500,000	700,000	2,200,000	63,000	100,000	163,000	2,360,000
			September	590,000	130,000	90,000	220,000	46,000	16,000	62,000	282,000
			October to April	1,230,000	--	--	269,000	19,300	16,200	35,400	304,000
			May to September	4,920,000	4,110,000	2,170,000	6,280,000	264,000	334,000	598,000	6,880,000
			Total	6,140,000	--	--	6,550,000	283,000	350,000	633,000	7,180,000
9 10	Susitna River below Chulitna River near Talkeetna (15292439 and 15292440)	8,950	October	1,070,000b	--	--	--	12,000	3,800	15,800	--
			November	390,000b	--	--	--	4,100	64	4,160	--
			December	290,000b	--	--	--	2,700	17	2,720	--
			January	253,000b	--	--	--	2,200	10	2,210	--
			February	213,000b	--	--	--	1,800	6.5	1,810	--
			March	214,000b	--	--	--	1,700	5.5	1,710	--
			April	211,000b	--	--	--	1,700	5.8	1,710	--
			May	1,290,000b	410,000	350,000	760,000	28,000	53,000	81,000	841,000
			June	2,830,000b	1,400,000	1,300,000	2,700,000	63,000	120,000	183,000	2,880,000
			July	2,930,000b	2,100,000	1,000,000	3,100,000	61,000	51,000	111,000	3,210,000
			August	2,790,000b	1,900,000	960,000	2,860,000	58,000	78,000	136,000	3,000,000
			September	1,200,000b	130,000	110,000	240,000	23,000	15,000	38,000	278,000
			October to April	2,640,000b	--	--	285,000b	26,200	3,910	30,100	315,000
			May to September	11,000,000b	5,940,000	3,720,000	9,660,000	233,000	317,000	549,000	10,200,000
			Total	13,700,000b	--	--	9,940,000	259,000	321,000	579,000	10,500,000
11	Talkeetna River near Talkeetna (15292700)	2,006	October	202,000	--	--	17,000	1,100	150	1,150	18,200
			November	65,300	--	--	690	50	1.9	52	742
			December	48,000	--	--	310	19	.5	20	330
			January	42,400	--	--	230	14	.3	14	244
			February	36,000	--	--	170	10	.2	10	180
			March	36,900	--	--	170	9.7	.2	9.9	180
			April	33,000	--	--	140	7.7	.1	7.8	148
			May	246,000	12,000	32,000	44,000	11,000	1,600	12,600	56,600
			June	555,000	200,000	250,000	450,000	17,000	4,100	21,100	471,000
			July	547,000	160,000	140,000	300,000	19,000	2,400	21,400	321,000
			August	600,000	140,000	200,000	340,000	25,000	7,700	32,700	373,000
			September	227,000	3,100	7,100	10,200	1,500	40	1,540	11,700
			October to April	464,000	--	--	18,700	1,210	153	1,260	20,000
			May to September	2,180,000	515,000	629,000	1,140,000	73,500	15,800	89,300	1,230,000
			Total	2,640,000	--	--	1,160,000	74,700	16,000	90,600	1,250,000

a Estimated
b Sum of Susitna and Chulitna Rivers near Talkeetna

Table 5.--Water discharge and estimated total sediment loads at selected stations in the Susitna River basin, October 1983 to September 1984 --Continued

(Definition of units: mi^2, square mile; acre-ft, acre-foot; tons, short tons)

Map No. (Fig. 1)	Station name and number	Drainage area (mi^2)	Period	Water discharge (acre-ft)	Suspended sediment (tons)			Bedload (tons)			Total sediment (tons)
					Silt-clay	Sand	Total	Sand	Gravel	Total	
12	Susitna River at Sunshine (15292780)	11,100	October	1,310,000	--	--	290,000	15,000	6,900	21,900	312,000
			November	492,000	--	--	12,000	6,700	1,800	8,500	20,500
			December	342,000	--	--	3,100	5,000	1,000	6,000	9,100
			January	301,000	--	--	2,100	4,500	870	5,370	7,470
			February	265,000	--	--	1,600	4,000	740	4,740	6,340
			March	276,000	--	--	1,600	4,200	770	4,970	6,570
			April	271,000	--	--	1,700	4,100	760	4,860	6,560
			May	1,590,000	440,000	440,000	880,000	34,000	10,000	44,000	924,000
			June	3,530,000	1,700,000	1,400,000	3,100,000	46,000	29,000	75,000	3,180,000
			July	3,640,000	2,200,000	1,300,000	3,500,000	35,000	30,000	65,000	3,560,000
			August	3,610,000	2,500,000	1,400,000	3,900,000	58,000	67,000	125,000	4,020,000
			September	1,420,000	170,000	190,000	360,000	27,000	19,000	46,000	406,000
			October to April	3,260,000	--	--	312,000	43,500	12,800	56,300	368,000
			May to September	13,800,000	7,010,000	4,730,000	11,700,000	200,000	155,000	355,000	12,100,000
			Total	17,000,000	--	--	12,100,000	244,000	168,000	411,000	12,500,000
13	Yentna River near Susitna Station (15294345)	6,180	October	660,000	--	--	91,000	--	--	--	--
			November	324,000	--	--	5,600	--	--	--	--
			December	220,000	--	--	1,400	--	--	--	--
			January	162,000	--	--	400	--	--	--	--
			February	133,000	--	--	230	--	--	--	--
			March	140,000	--	--	250	--	--	--	--
			April	342,000	--	--	16,000	--	--	--	--
			May	1,900,000	540,000	610,000	1,150,000	--	--	--	--
			June	2,980,000	1,700,000	1,300,000	3,000,000	--	--	--	--
			July	3,230,000	1,900,000	1,400,000	3,300,000	--	--	--	--
			August	3,280,000	2,200,000	1,500,000	3,700,000	--	--	--	--
			September	1,130,000	160,000	270,000	430,000	--	--	--	--
			October to April	1,980,000	--	--	115,000	10,000c	10,000c	20,000	135,000
			May to September	12,500,000	6,500,000	5,080,000	11,600,000	1,000,000c	200,000c	1,200,000	12,800,000
			Total	14,500,000	--	--	11,700,000	1,000,000	210,000	1,220,000	12,900,000
14	Susitna River at Susitna Station (15294350)	19,400	October	2,420,000	--	--	410,000	--	--	--	--
			November	1,130,000	--	--	42,000	--	--	--	--
			December	706,000	--	--	11,000	--	--	--	--
			January	457,000	--	--	3,000	--	--	--	--
			February	386,000	--	--	2,200	--	--	--	--
			March	400,000	--	--	2,000	--	--	--	--
			April	775,000	--	--	20,000	--	--	--	--
			May	3,720,000	1,000,000	1,200,000	2,200,000	--	--	--	--
			June	6,370,000	3,700,000	2,600,000	6,300,000	--	--	--	--
			July	6,720,000	3,900,000	2,700,000	6,600,000	--	--	--	--
			August	6,820,000	4,200,000	2,800,000	7,000,000	--	--	--	--
			September	3,040,000	620,000	940,000	1,560,000	--	--	--	--
			October to April	6,270,000	--	--	490,000	6,000c	700c	6,700	497,000
			May to September	26,700,000	13,400,000	10,200,000	23,700,000	1,000,000c	100,000c	1,100,000	24,800,000
			Total	32,900,000	--	--	24,200,000	1,000,000	100,000	1,110,000	25,300,000

c Estimated from average bedload measurements.

GPO 791-317/60006