COMPARISON OF TWO POTENTIAL STREAMGAGE LOCATIONS ON SCOTT CREEK AT SWANTON PACIFIC RANCH, CALIFORNIA

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ABSTRACT

Comparison of two potential streamgage locations on
Scott Creek at Swanton Pacific Ranch, California

Matthew Charles Scrudato

Two locations on Scott Creek, located 12 miles north of Santa Cruz California, are being considered for the installation of a streamgage to measure discharge. Each location offers unique considerations and challenges in gage construction and discharge measurement capabilities. A detailed flood frequency analysis was completed using a direct watershed comparison, direct equations developed by Waananen and Crippen, a Log Pearson Type III Frequency Distribution, a regional analysis, and two-station comparisons. Final results indicate a 100-year recurrence interval of 6,310 ft^3/s at the Upper Scott Creek location and 6,520 ft^3/s at the lower location. A detailed indirect measurement revealed that the Lower Scott Creek gage location can only maintain a discharge of 2,500 ft^3/s, or a 10-year frequency event, before bank overflow. Therefore, a cableway spanning the width of the design flow cannot be constructed and stage readings at extreme peak events will not accurately represent the true hydrograph. A bridge at the Upper Scott Creek gage location will provide a means for measuring high flow events; however, the channel is in a state of disequilibrium due to debris jams within the 140 foot reach above the bridge. This site is also problematic due to the occurrence of channel avulsion which is scouring and incising a new channel which threatens to undermine the left bank wingwall of the bridge. Remediation measures have been proposed, including the installation of a cross-vane and wing-deflectors, to mitigate negative effects of erosion and reestablish a natural channel condition. The upstream location has been selected as the preferred alternative given the remediation measures are successful.

Keywords: Scott Creek, flood frequency, Log Pearson Type III frequency distribution, regional frequency analysis, two-station comparison, Indirect measurement, Manning's *n* value, slope area, streamgage, incised channel, cableway, reference reach, instream structure, cross-vane, wing deflector, design flow

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CONVERSION FACTORS

Multiple	By	To obtain
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.590	square kilometer (ki^2)
cubic foot (ft^3)	0.0283	cubic meter (m^3)
cubic foot per second (ft^3/s)	0.0283	cubic meter per second (m^3/s)

CHAPTER I: INTRODUCTION

California Polytechnic State University is considering working in cooperation with the United States Geological Survey (USGS) in the construction of a streamgage on Scott Creek, locally known as Scotts Creek, on Swanton Pacific Ranch. Two locations are being considered on Scott Creek. One location is in the vicinity of the road ford downstream of Archibald Creek at 37^{o}03’06”N, 122^{o}13’34”W. The other location is at the Edgar J. Carnegie Railroad Bridge and downstream of discontinued USGS streamgage Scott Creek above Little Creek near Davenport (station number 11161900) at 37^{o}03’45”N, 122^{o}13’39”W (Figure 1). The ability to make discharge measurements during peak flow events, when wading measurements are impractical, is an integral part of the streamgage construction. The watershed characteristics and channel at the location of interest will be studied to develop possibilities for stream crossing and discharge measurements during flood conditions, particularly a design flow with a 100-year recurrence interval. The use of an existing bridge, a bank operated cableway and a manned cableway will all be considered.

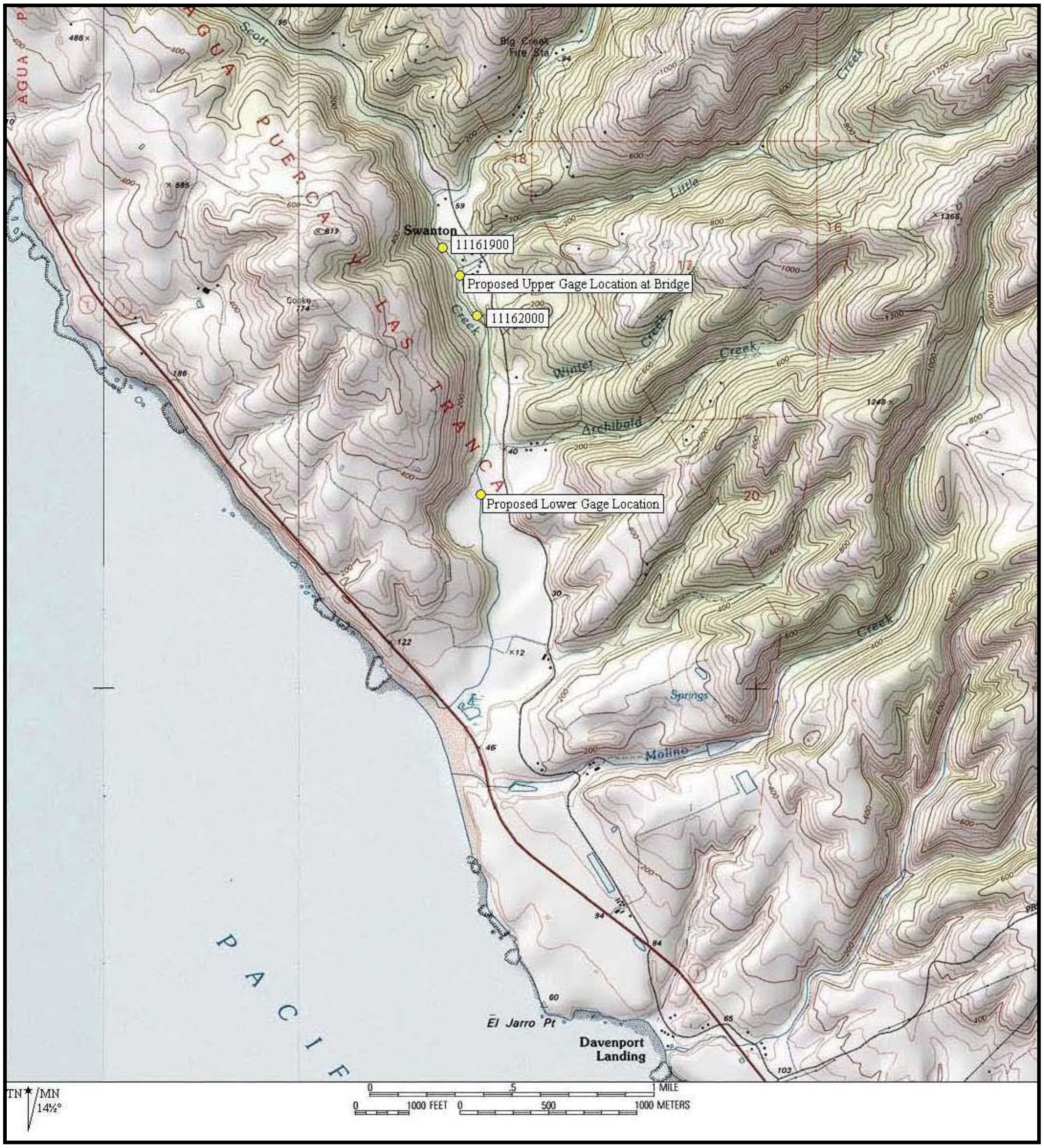

FIGURE 1. The location of two potential streamgages and discontinued USGS streamgages on Scott Creek.

Each location offers unique considerations and challenges in gage construction and discharge measurement capabilities. The downstream location will provide a more comprehensive view of the watershed runoff, as it would be located below all major drainages with the exception of Queseria Creek. There is a loss of channel slope however, and a significant widening of the channel

floodplain on both right and left banks directly upstream of the proposed gage location. Additional consideration needs to be given to the National Oceanic and Atmospheric Administration (NOAA) fish study activities which may frequently alter the channel control and flow pattern. Detailed plans for a realtime, continuously recording streamgage will be prepared for this location meeting U.S. Geological Survey specifications. This will include gage location and construction, a cableway, and recording and transmission equipment.

The upstream location has the benefit of the existing railroad bridge which could be used for high flow discharge measurements. It is located above the smaller drainages of Winter, Archibald, and Queseria Creeks. Large wood debris jams from fallen trees and the additional accumulation of woody debris during higher flow discharge events has altered channel geometry above and below the bridge. The channel had widened, eroded and undercut its banks, abandoned its original channel and has incised along the left bank. This has created significant damage to the bridge wingwalls and threatens to undermine the integrity and stability of the bridge. Measures to mitigate further erosion and incision with the use of instream structures will be investigated. Similar to the lower Scott Creek gage location, plans for a realtime, continuously recording streamgage will be prepared. This will include gage location and construction, as well as recording and transmission equipment.

Project Importance

University faculty, staff and students have been actively researching and analyzing the effects of various land management practices being implemented

at Swanton Pacific Ranch and the Scott Creek watershed. These studies include the monitoring of benthic macroinvertebrates, water quality, including temperature and suspended sediment, as well as monitoring changes in stream channel geometry. These long-term studies have tracked the changes caused by various land-use practices, such as timber harvesting, livestock, and agriculture in the watershed. The Scott Creek watershed provides students and researchers an excellent opportunity to study and experience the natural system in an interdisciplinary environment.

The Salmon Ecology Team at the Santa Cruz NOAA Fisheries Laboratory is currently studying anadromous fish populations at Scott Creek. Scott Creek is inhabited by steelhead (*Oncorhynchus mykiss*) and considered to represent the southernmost population of coho salmon (*Oncorhynchus kisutch*). Both of these species are listed under the Endangered Species Act. The steelhead population was listed as Threatened in 1997, whereas the coho salmon population was listed as Threatened in 1997 and upgraded to Endangered in 2005. Fish migration is actively being monitored seasonally by a bottom fish camera (BotCam) at the downstream road ford and potential streamgage location. Additionally, an adult weir fish trap located downstream of the camera, has been installed in the Fall of 2003 on Scott Creek between Queseria and Archibald Creeks, to count, tag and sample returning adult coho and salmon.

The ability to work in cooperation with the U.S. Geological Survey to construct a gage to monitor all stages of discharge near the outlet of Scott Creek would provide invaluable data and an additional resource to the overall management

and understanding of the watershed and current land use practices. It would be necessary to make high-flow measurements at or near the gage location when wading is impossible. This is essential to the overall functionality of a streamgage, especially where indirect measurements are impractical due to channel limitations.

The data that a streamgage would provide will serve multiple uses. These include monitoring the duration of low-flow periods, and a better understanding of the frequency and magnitude of peak flow events, and water availability. Streamgage data can be used to monitor environmental conditions and protect aquatic habitat. The data provided are essential for making water quality assessments of chemical and biological constituents. The continuous discharge data are needed to monitor water quality parameters and compute contaminant and sediment loads. These data will also provide a better understanding of the relationships between the timing and magnitude of discharge events, and how this affects the returning adult fish populations. Additionally, streamgages are needed to understand and study the hydrologic trends and changes in the natural process, and can be used to model the interactions between the physical and natural system. The value of stream discharge data increase with time. Long periods of systematic record provide indispensable data, and create a baseline to predict future changes.

Historic Discharge Data

The U.S. Geological Survey has historically operated two streamgages along Scott Creek. Scott Creek near Davenport, CA (station number 11162000) was in

operation for four years in 1937, and 1939-1941. Scott Creek above Little Creek, near Davenport, CA (station number 11161900) was in operation for 15-years from 1959-1973 (Appendix A and B). The four peak discharge values from streamgage 11162000 were adjusted by U.S. Geological Survey personnel for streamgage 11161900. How this adjustment was made, and by whom is unknown. Additionally, during the course of this study, a USGS published peak discharge value of 4,220 ft^3/s, occurring on January 4, 1982, was located in *Landslides, Floods, and Marine Effects of the Storm of January 3-5, 1982, in the San Francisco Bay Region, CA, 1988* (Ellen and Wieczorek, 1988). This peak value was not originally part of the published peak file. It has since been added to the peak file data base and used in the flood frequency evaluation for Scott Creek.

The published peak discharge values for 1937, 1939-1941, and 1982 were computed using indirect methods. The earlier adjusted values from 1937, and 1939-1941 have been labeled as estimated values for Scott Creek above Little Creek, near Davenport. All peak discharge values however, were used directly in the flood frequency analysis completed for this study.

Published discharge and peak data can be located in the corresponding year's *Water-Data Report, Volume 2, Pacific Slope Basins from Arroyo Grande to Oregon State Line except Central Valley*. The USGS also maintains a database of USGS streamgage records and annual peak discharge values available for public viewing in the National Water Information System (NWIS) data base. This data base contains peak information observed during the period of USGS data

collection, as well as historic peaks observed by the USGS outside the period of record. Peak values are often coded according to data quality. These data can be located at http://waterdata.usgs.gov/ca/nwis/sw.

Fisheries staff working with the National Oceanic and Atmospheric Administration (NOAA) have measured instantaneous discharge rates at the lower Scott Creek ford. These instantaneous measured discharge values have not been referenced to a surveyed datum, and therefore cannot be referenced to other USGS data sets used in this analysis. Additionally, discharge measurements were completed during lower flow regimes, and were not considered relevant to this analysis.

Description of Study Area

The Scott Creek watershed totals 30.0 square miles and is located 12 miles north of Santa Cruz, California, and 4 miles north of Davenport. The Santa Cruz Mountain Range is located to the east, with the Ben Lomond Mountains bordering the eastern portion of the watershed. The watershed elevation reaches a maximum of 2,650 feet, and drains into the Pacific Ocean at sea level.

A dominating factor in the weather of the region is the semi-permanent high pressure area of the North Pacific Ocean. This pressure center moves northward in summer, holding storm tracks well to the north. The result is very little precipitation during the summer months of May through October. In winter, between the months of November and April, the Pacific high pressure system retreats southward allowing storm centers to enter the area. When changes in this circulation pattern occur, large southwesterly storms approach the coast

bringing abundant amounts of moisture carried by the northeastward air mass. This results in heavy rains which may produce widespread flooding during the winter months. The average annual precipitation recorded in Santa Cruz from 1961-1990 ranges from 40-60 inches (NOAA), with an annual precipitation in the Scott Creek location of 47.7 inches. Additionally, published rainfall depth and frequency analysis indicate that this area of the Santa Cruz Mountains receive close to the highest rainfall intensities in the area.

Scott Creek is a perennial stream with a dendritic pattern. Primary perennial tributaries which feed Scott Creek include Mill Creek (drainage area 3.8 mi^2), Big Creek (11.2 mi^2), and Little Creek (2.0 mi^2). In addition, Queseria Creek (drainage area 0.6 mi^2) will also maintain perennial flow, except during extreme drought periods. Other intermittent tributaries include Winter Creek (drainage area 0.24 mi^2) and Archibald Creek (0.66 mi^2), which will maintain sustained flow only after significant rainfall.

The lower portion of Scott Creek, in the location of this study, is classified as a B4c according to Level II classification system developed by David Rosgen (Rosgen, 1994). It is a moderately entrenched system located in Valley Type II and formed in colluvial deposits. The channel substrate is dominated by cobble materials and exhibits a step-pool configuration. Step pools normally form in channels with slopes greater than 2 percent and bed material size ranging from gravel to boulders (Montgomery and Buffington, 1997). Formation, such as these, adjusts the energy expenditure through changes in boundary roughness in the vertical dimension (Chin, 2002).

General Approach

A major factor in the design criteria which will influence the general understanding of the Scott Creek watershed and the potential construction of a manned cableway installation to span this type of discharge event is the volume and elevation of the 100-year peak flow event. The river elevation at this design flood should be 10 to 15 feet below the bottom of the cable car on a loaded cable (Wagner, 1995). Various methods were used to determine the recurrence intervals on 2-, 5-, 10-, 25-, 50-, and 100-year (Q_2-Q_{100}) intervals, with the 100-year interval being the primary value of interest. These methods included direct equations developed by Waananen and Crippen (1977) for Central and North Coast Basins, a direct watershed comparison with a nearby streamgage, Log-Pearson Type III frequency distribution using measured peak discharge events at Scott Creek, a regional analysis using Log-Pearson Type III frequency distribution, and two-station comparisons. The results of these methods, as well as those computed in earlier studies (Rumann *et al*., 2002), were compared to determine a final 100-year peak discharge value. Unit runoff from the final frequency computation for a drainage area of 25.1 mi^2 was adjusted for drainage areas of the Upper and Lower Scott Creek locations of interest.

Indirect methods of computing discharge were then used in an attempt to compute the elevation of the design flow (Q_{100}) at the Lower Scott Creek location, and determine discharge before main channel bank overflow occurs. A detailed transit-stadia survey was first completed to measure channel characteristics, such as slope and cross-sectional elevations. Manning's roughness coefficients

were also determined by photographic comparisons with other known published stream channel roughness values. These coefficients were applied to cross-section subsections using the Manning's Equation to predict the effects on flow velocities. A basic slope conveyance and more detailed slope area were performed.

A proposal for a streamgage at Lower Scott Creek was developed, including the required monitoring equipment and options for a cableway system. Consideration was given to the stage of the 100-year discharge and ability for the channel to sustain this type of event.

A comparison study was completed for the Upper Scott Creek bridge location to determine the suitability of constructing a streamgage. The bridge at this location spans the entire high-flow channel and will provide the capability of completing the full range of discharge measurements. However, the channel is adversely impacted by large debris jams which are currently undermining the left abutment of the bridge. A reference reach study was completed at an undisturbed reach to use as a comparison with the altered reach at the bridge. Data collected at the reference reach was then extrapolated to the bridge and used as a representative guide of the channel in a stable condition. A channel stability study (Pfankuch, 1975, Rosgen 1996) was then completed at both reaches to further document and highlight areas of concern. Various scenarios were then developed, such as the installation of instream structures, to mitigate the negative effects of the channel in its current condition.

Alternatives for a streamgage at Upper Scott Creek, including monitoring equipment and instream structures, were developed with consideration given to the channel in its current and potentially modified state.

CHAPTER II: LITERATURE REVIEW

Flood Frequency

A flood frequency is the relation of the magnitude of the peak discharge to its expected frequency of occurrence. Flood frequency analyses are used to predict the discharge of design floods at specific recurrence intervals for sites along a watercourse. Different techniques and procedures can be used to determine recurrence intervals. One technique often used for ungaged locations involve the use of direct equations. Equations, such as these, have been developed using regression analysis for six regions in California which provide frequency intervals and the corresponding discharges based on drainage area, mean annual precipitation, and the altitude index. Other techniques for gaged locations, such as the Log-Pearson Type III frequency distribution, involve using observed annual peak flow discharge data to calculate statistical information, such as mean values, standard deviations, skewness, and recurrence intervals. These statistical data are then used to construct frequency distributions of various discharges as a function of exceedance probability. A two-station comparison is another procedure used to determine recurrence intervals. Peak flow data of a streamgage with limited data is adjusted by regression with concurrent peak flows at another longer term gaging station.

Many studies have been completed intended to determine the most accurate method for computing recurrence intervals of rivers. One comparison of flood-frequency studies for Coastal Basins in California was completed by Cruff and Rantz (1965). This study compared the results obtained using various regional

flood frequency methods to appraise the reliability of each method. The objective was to compare similar methods used in two very different regions of California. The six methods analyzed for use in the subhumid region of San Diego and the more humid region of coastal northwestern California included the index flood method, multiple correlation, logarithmic normal distribution, extreme-value probability distribution (Gumbel distribution), Pearson Type III distribution (now commonly referred to as the Log-Pearson Type III), and gamma distribution. The analysis show that all methods give better results in the coastal northwestern basins than in the San Diego Region basins. If historical data is available outside the systematic peak record, the multiple-correlation method is preferred. When flood peak frequencies are analyzed using solely the period of annual peak record, the Pearson Type III is the most desirable, as it is more flexible and will better fit the data set.

Regional peak flow equations (Waananen and Crippen, 1977) which were used for this Scott Creek frequency study were analyzed as part of a larger study to assess frequency techniques used by the California State Water Resources Control Board (SWRCB) (Mann *et al*., 2004). This publication can be located at http://pubs.usgs.gov/sir/2004/5068/pdf/CA-3096_text.pdf. Results indicate that errors are greatest in the 2-, 5-, and 10-year recurrence intervals when used for North Coastal California basins. Errors for the higher recurrence intervals, including the 25-, 50-, and 100-year events, were not as large. Peak discharge was generally underestimated when using these equations, with a standard error of about 50 percent. The relative bias ranged from -24.3 percent for the 2-year

peak flows to -5.7 percent for the 100-year peak flows. It is noted in the study that these equations should be updated using the larger peak data sets available, however, overall performance was reasonable.

The Log-Pearson Type III frequency analysis is a statistical flood frequency investigation of the annual-maximum peak discharge events. The logarithms of annual peaks events are statistically treated as a sequence of random events and are assumed to be independent random variables which follow a Log-Pearson Type III probability distribution. It is assumed in this method that the peak sample set is representative of all recorded and unrecorded annual peak discharge events at the station. The frequency curve is calculated based on the mean, standard deviation, and skew coefficient of the logarithms of annual instantaneous peak events. The mean is a measure of the central tendency of the distribution, the standard deviation is a measure of the dispersion of the distribution about the mean, and the skew coefficient is a measure of the asymmetry of the distribution. Adjustments are made based on zero-flow years, peaks below base, regional skew values, low outliers, high outliers, and historic information.

The Log-Pearson Type III distribution is widely used in the United States to calculate flood recurrences because it has been recommended by the U.S. Interagency Advisory Committee on Water Data. It is the standard method used by the U.S. Geological Survey for flood studies, and therefore was used to analyze peak recurrence intervals for Scott Creek. Details and procedures are outlined in *Guidelines for Determining Flood Flow Frequency, Bulletin 17B*

(Interagency Advisory Committee on Water Data, 1982).The publication can be located at http://water.usgs.gov/osw/bulletin17b/bulletin_17B.html. The publication is referenced many times throughout this study, and will hereafter be referred to as “Bulletin 17B”.

An important consideration in a frequency analysis of this type is the sample population of peak discharge events. Confidence in the final result is severely affected by sample size, as a small population may not represent the true fluctuations in peak discharges experienced when a longer period of record is available. If the resulting probabilities are derived from a small sample set, the result may not be reliable. Synthetic data series were used to extrapolate frequency estimates to determine the population size (number of systematic peak events) required to estimate floods on 10-, 50-, and 100-year intervals within a 95 percent confidence limit (Linsley *et al*., 1958). Results of this study indicate that a minimum of 48 years of systematic peak data are required to estimate the 100-year peak with an acceptable error of 25 percent. A larger data set of 115 peak values would be needed for an acceptable error of 10 percent. Results are presented below in Table 1.

TABLE 1. Length of record in years required to estimate floods of various probabilities with a 95% confidence limit (Linsley *et al*., 1958).

DESIGN PROBABLITY	ACCEPTABLE ERROR	
	10%	**25%**
10-year	90	18
50-year	110	39
100-year	115	48

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Flood frequency relations that are developed by fitting the logarithms of annual peak discharge events to a Log-Pearson Type III distribution are sensitive to skew coefficients. The skew coefficient used in Log-Pearson Type III frequency analysis is a numerical measure of the lack of symmetry in a frequency distribution. A distribution with a skew coefficient of zero (0.0) is considered symmetrical. Both generalized and station skew coefficients are required for flood frequency analyses using Bulletin 17B procedures. Generalized skew values are computed on a regional basis. Many gages with long periods of systematic record are used to compute the generalized skew values which represent pooled skew coefficient data from nearby stations. These skew coefficients are estimated from unbiased skew coefficients from nearby stations through regression, mapping, or averaging methods. A generalized skew map for the United States can be located in Plate I of Bulletin 17B (Appendix E). It was developed with data from watersheds smaller than 3,000 square miles and with unregulated peak discharges. Station skew values were plotted at the latitude and longitude of the gaging station, and isolines created to develop generalized skew values for designated regions with a standardized error of 0.55. An additional generalized skew map created by the USGS by Richard M. Bloyd for six hydrologic regions in California (Appendix F) is currently being used by the U.S. Geological Survey, California Water Science Center. No standardized error was computed for these values (Richard A. Hunrichs, USGS California Water Science Center, personal communication). This skew map is based on a study of the magnitude and frequency of floods in California (Waananen and Crippen,

1977), and is now the accepted alternative to the nationwide generalized skew map published in Bulletin 17B.

The station skew coefficients are calculated from the annual peak discharge population recorded at one specific gaging station. The skew is sensitive to large discharge events and cannot be accurately defined at stations with a short period of record (Hunrichs *et al*. 1998). The station skew coefficient as outlined in Bulletin 17B is computed as follows:

$$Gs = (N / (N-1)(N-2)S^3) \sum_{i=1}^{N} \left(Xi - \overline{X}\right)^3 \quad (1)$$

Where

Gs = station's skew coefficient
Xi = station's log-transformed annual peak discharge for year i
$\overline{X}$ = station's log-transformed mean annual peak discharges
S = station's log-transformed standard deviation of annual peak discharges
N = station's number of years of peak discharge record

To improve the accuracy of station skew coefficients for a limited peak data set, the stations skew coefficients are weighted with generalized skew coefficients according to procedures outlined in Bulletin 17B. Greater weight is applied to the station skew of a gage when a longer period of peak flow data is available for that specific station. Conversely, more weight will be given to the generalized skew when a station has a shorter period of peak record. The weighting is based on the relative mean-square errors of the station and generalized skew, and is

given by the following equation:

$$Gw = \frac{MSEg(Gs) + MSEs(Gg)}{MSEg + MSEs} \qquad (2)$$

Where

Gw = station's weighted skew coefficient
Gs = station skew coefficient
Gg = station's unbiased generalized skew coefficient
MSEg = mean square error of the unbiased generalized skew coefficient
MSEs =mean square error of the station's skew coefficient

Recent publications, including a magnitude and frequency analysis of northern and central California floods in 1997 (Hunrichs *et al*., 1998), use the generalized skews developed by Bloyd and the standardized error from Bulletin 17B. In this study, flood frequencies were computed using Log-Pearson Type III frequency distribution and the PEAKFQ program for 292 streamflow gaging stations for annual peaks through 1996, and compared with a similar analysis using data which included the 1997 events. Results show that the storms of December 1996 located in northern and central California were the largest on record at 106 stations, and recurrence intervals were greater than 100-years at 32 stations.

Low outlier peak flow data are another integral part of the Log-Pearson Type III frequency analysis. These low outlier values are data which depart significantly from the normal trend of peak discharges when plotted on a magnitude versus frequency graph. The low outliers create a strong downward curvature of the lower tail of the frequency curve and distort the fit of these data in the upper part of the curve, which are the data which represent the significant flood events. Unless these low outliers are censored, the fit of the Log-Pearson

Type III distribution is compromised, with the upper end of the distribution poorly defined and often overestimated (Lumia and Baevsky, 2000). It is therefore necessary to logically remove these data from the analysis in order to obtain a more realistic and defensible station skew coefficient. These data are removed using a conditional probability adjustment, the Grubbs-Beck test, outlined in Bulletin 17B. The equation used to detect these low outliers is as follows:

$$XL = M - KNS \tag{3}$$

Where

XL = low outlier threshold in log units

M= mean logarithm of systematic peaks (x's) excluding zero flood events, peaks below gage base, and outliers previously detected

KN = K value from Appendix 4 of Bulletin 17B for sample size N.

S = standard deviation of X's

This threshold can then be adjusted based on a visual inspection of the annual peaks on a frequency plot. Annual peak values that did not meet the previously mentioned low outlier criteria, but still appeared to plot off the obvious trend in a "stair-step" pattern, are removed from the record. Similar procedures for the determination of low outlier thresholds were followed by Hunrichs *et al*., (1998) and Mann *et al.,* (2004). This visual inspection and removal of low outliers which depart from the trend will further adjusted the station skew by giving more weight to the larger peak values.

Studies by Tasker and Stedinger (1986) have shown that the station's skew coefficient is a biased estimator of the population's skew coefficient. If biased estimators of the station skew coefficients are used, the resultant generalized skew coefficient will exhibit a similar bias. Station skews should therefore be

adjusted to remove bias. A bias-correction factor based on years of peak flow record is computed as:

$$Cb = (1 + (6/N)) \tag{4}$$

Where

Cb = station's bias correction factor

N = station's number of years of peak discharge data

This bias correction factor (Tasker and Stedinger, 1986) was used by Lumia and Baevsky (2000) to obtain unbiased station skews for 226 gaging stations in New York State. These skew values were then used to create a statewide contour map of unbiased, generalized skew coefficients. An error analysis of the final map showed a lower mean standard error than the nationwide skew coefficient map located in Bulletin 17B.

A regional analysis was completed to develop a more specific and defensible generalized skew, when compared with Plate 1 of Bulletin 17B and Central Coast values developed for California, to be weighted with the station skew of Scott Creek. Procedures outlined in Bulletin 17B recommend that when developing generalized skew coefficients, 40 gaging stations within a 100-mile radius should be used (U.S. Interagency Advisory Committee on Water Data, 1982). These stations should have a minimum of 25 years of record. Station skews for these stations should be computed, and an isoline map created with these station skews plotted at the centroid of the drainage basin to determine if a pattern is evident. If no pattern is evident, the arithmetic mean of the station skew coefficients should be computed. If the variability in the runoff regime is too large to use 40 stations with reasonable homogeneous hydrology, 20 stations may be used to estimate the generalized skew coefficient. The mean square error (MSE)

should be computed for both the isolines (if present) and the arithmetic mean value. If the newly developed generalized skew coefficient has a MSE error less than the MSE of generalized skew provided in Bulletin 17B, the new regional skew coefficient should be used. The MSE is used to appraise the accuracy of the final generalized skew coefficient value.

The two-station comparison is a method for determining recurrence intervals for a short-term streamgage such as Scott Creek, using a nearby long-term streamgage with significantly more data. The logarithmic mean and standard deviation of the peak flows for the short term gage are adjusted by regression with peak flows during a concurrent period for a long-term gage. The variances of the estimated logarithmic mean and standard deviation for the short-term gage are compared to the variances of the adjusted long-term record. If the correlation is high enough, the adjustment based on the long-term record with a larger population of peak values may reduce the possibility of bias as a result of limited data at the short-term gage.

A similar study used the two-station comparison method to improve flood-frequency estimates for seven USGS gaging stations, with ten or fewer years of peak data, in Salmon and Clearwater River Basins located in Central Idaho (Berenbrock, 2003). This publication can be located at http://id.water.usgs.gov/PDF/wri034001/TwoStation3.pdf. Results of this report indicate that unadjusted flood frequency estimates differ from the adjusted values by 10 percent when the range of systematic peak events for the short record

represents a large range of flow conditions. This value rises to 30 percent when the short term record is unrepresentative of the true range of flows.

A two-station comparison was also used as part of a larger study to evaluate streamflow statistics and flood frequencies for 30 stations located in small North Coastal California basins (Mann *et al*., 2004). A spreadsheet program developed by Robert W. Meyer of the USGS California Water Science was used for this study as well as the Scott Creek analysis. For this analysis, the long-term index station had a minimum of double the period of record, and R^2 values were greater than 0.8. Generalized skews developed for California by the USGS were used and station skews were computed using USGS program PEAKFQ. The slope of the regression line (b) was computed using the Program for Robust Regression (PROGRESS) (Rousseeuw and Leroy, 1987).

Localized Channel Incision and River Reach Characteristics

In order to develop a better understand the current channel condition at the proposed streamgage location at the Edgar J. Carnegie Railroad Bridge, it was necessary to determine the geomorphic condition and general stability of the channel reach. Large debris jams in this vicinity have obstructed the natural flow pattern which has scoured a new channel and continues to incise on the left bank. The incision evident at the Upper Scott Creek location is localized, affecting a reach only 240 feet in length. A typical incised channel is deep and broad, and lacks a defined or stable low-flow channel (Rosgen, 1996). The banks are steep and subject to mass-wasting. Pool habitat for aquatic species is lacking and riparian vegetation is often rare or completely absent (Hupp, 1999). The

historic floodplains of these channels have essentially been abandoned and hydrologically disconnected from the system, with all flows now contained in a similar width channel (Schumm *et al*., 1984). Incised channels range in size from small alluvial rills, to enormous bedrock canyons many kilometers in depth. The five types of incised channels include rills, valley-side gullies, valley-floor gullies, entrenched channels and drainage network rejuvenation (Harvey *et al.,* 1985).

All incised channels however, will undergo a predictable evolutionary sequence as the channel characteristics change in an attempt to find a condition of stable equilibrium (Schumm *et al*., 1984). The precise causes of channel instability however, are system-specific, varying with climate, land management practices, topography and earth materials. At Scott Creek above Little Creek near the Edgar J. Carnegie Railroad Bridge, the cause was initially the artificial widening of the channel when the original bridge was destroyed by high flow on February 11, 1998. Most recently, there is a narrowing of the channel width, a direct result of severe debris jams and natural vegetation encroachment upstream of the bridge. This erosive progression of an incised channel is illustrated in the Channel Evolution Model (CEM) (Figure 2) These five stages of CEM, developed by Schumm *et al.* (1984), will follow a spatial sequence, in which the changes are distributed throughout a watershed (Figure 3) when occurring on a large scale. Due to the episodic nature of stream channel adjustments, this process may take years, if not decades to reach a final state of stable equilibrium (Harvey *et al*., 1985). The evolution process will proceed in the following manner:

1. Channel depth increases and then decreases.
2. Channel top width increases.
3. Width-depth ratio increases
4. Maximum depth of the sediment stored in the channel increases.
5. Channel slope decreases.
6. Unit stream power decreases.
7. Mean velocity of the flow at bankfull discharge decreases.

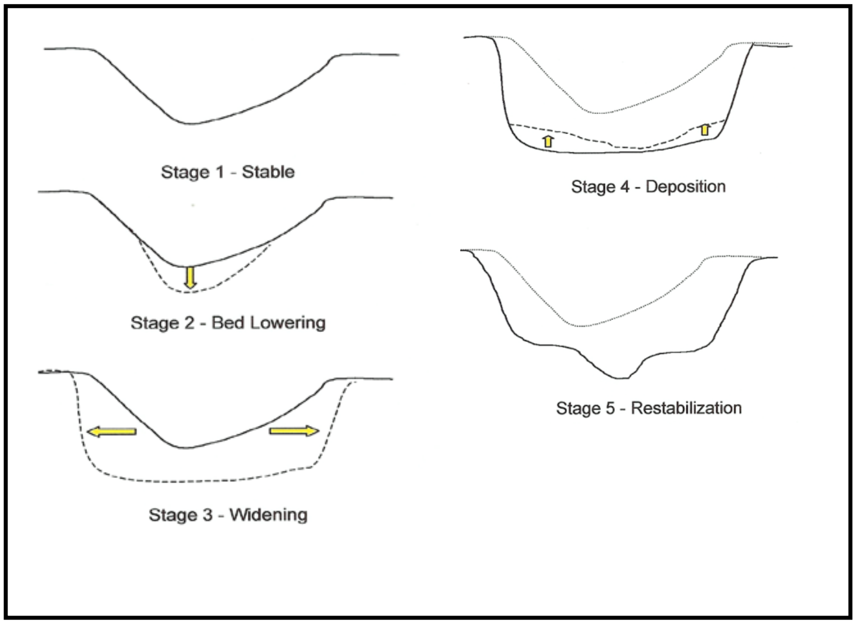

Figure 2. Stages in the channel incision. A temporal view of CEM (Schumm *et al*, 1984).

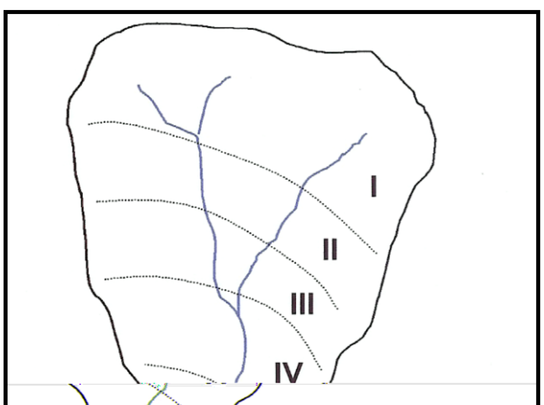

Figure 3. Stage in channel incision. A spatial view of CEM (Schumm *et al*, 1984).

Stage 1 (stable) is an undisturbed condition of stability prior to channel incision. The channel is in a stable state of dynamic equilibrium. The channel

slope and geometry during this stage can support natural hydraulic conditions and sediment loads.

Stage II (incision) will occur when the channel begins to incise and downcut due to varying factors in the channel or watershed. The channel banks during the second stage are stable, as the critical bank height for mass failure is greater than that of the bank height itself (Thorne, 1999).

Stage III (widening) of channel incision will undergo the failure of channel banks which will erode into the waterway. The critical bank height and bank angle for mass failure under gravity is reached (Thorne, 1999). Influential factors determining the mass-failures during this phase include the height and profile of the bank geometry, and the composition of bank materials. Bank failures of this type are usually episodic, often triggered during periods of bank saturation, when the bank material strength is minimized and their weight maximized. The rapid drawdown of flow may also promote bank failures, generating positive pore water pressures in the soil, essentially reducing the effective soil strength (Thorne, 1999).

Stage IV (stabilizing) characteristics of the evolution process exhibit the beginning of channel bed aggradation and a slowed rate of width increase. The flow is unable to continue to erode the banks and entrain failed bank material. These sediments and debris which cannot be removed with flow forces are accumulated at the toe of the bank, reinforcing the bank against further failure. The banks, now supported with this material, will lie back at a flatter, more stable angle of repose.

Stage V (stable) will occur when the channel slowly aggrades and the channel banks stabilize. Riparian vegetation will increase and substrate degradation is arrested. The stability of substrate materials will be a direct effect of a new channel slope, channel armoring or bedrock protection (Schumm *et al*., 1984). A new floodplain is formed below the terrace with a well defined flow channel. The system has reached a stable state of equilibrium, capable of supporting the adjusted flows and sediment loads.

The localized incision at Upper Scott Creek is likely in Stage II of CEM. It is important to understand the progression of events which have, and soon will transpire at this location in order to better mitigate potential hazards. If left undisturbed to follow the natural progression towards a state of stable equilibrium, severe consequences may occur with the stability of the bridge, as the channel widens and enters Stage 3 of CEM.

Reference Reach

Rosgen's (1994) stream channel classification system attempts to organize and categorize natural rivers using a variety of easily identifiable geomorphic and morphological features. The foundation of the system was developed considering hydraulic geometry, a product of channel adjustments and energy distribution (Leopold and Maddock, 1953). Three descriptive stages of classification are used, leading to a detailed inventory and depiction of a specific channel reach. Geomorphic variables required for the seven major stream types, *A* through *G*, include channel entrenchment, width/depth ratios, sinuosity, and gradient. The

addition of localized median particle size substrate data, and slope, will further refine the major channel type to one of 94 possibilities.

Entrenchment Ratio

Entrenchment describes the relationship of the river to the valley and landform features. It is qualitatively defined as the vertical containment of a river and the degree to which it is incised in the valley floor. The ratio is a computed index value, which is used to describe the degree of vertical containment of a river channel (width of the flood prone area at an elevation twice the maximum bankfull depth/bankfull width). To obtain the entrenchment ratio, the bankfull width must first be calculated (see *width/depth ratio*). The floodprone width is then measured at an elevation twice the maximum bankfull channel depth. This value is computed using the following equation:

ER = (Floodprone Width) / (Bankfull Width) (5)

Width/Depth Ratio

The width/depth ratio is the ratio of the bankfull surface width to the mean depth of the bankfull channel. This is an index value, which indicates the shape of the channel cross-section. The ratio value aids in the understanding of channel energy distribution, sediment movement and shape. To obtain the width/depth ratio value, bankfull elevation must first be determined on both the left and right banks. One good bankfull elevation from one bank can also be used when bankfull indicators are sparse. The additional unknown bankfull elevation value can then be interpolated. A cross-sectional profile, with values at all break-points, will then provide bankfull water depth data and distances along the cross-section.

The mean bankfull depth along this profile will then be used to calculate the ratio value. This value is computed using the following equation:

W/D = (Bankfull Width) / (Mean Bankfull Depth) (6)

Sinuosity

Sinuosity is the ratio of stream length to valley length. It can be described as the ratio of valley slope to channel slope. Sinuosity relates directly to channel meander geometry. This value can be obtained using direct channel measurements or aerial photography measurements. This value is computed using the following equation:

S = (Stream Length) / (Valley Length) (7)

Longitudinal Profile (gradient)

The slope of the water surface is a major determinant of river channel morphology, and of the related sediment, hydraulic, and biological functions. Slope measurements should be taken through a channel reach that is a minimum of 20 channel widths in length or for a distance equal to two meander lengths. This value is obtained with the use of an automatic level by taking the difference in elevation from one bed feature to the same bed feature either upstream or downstream.

Bed and Bank Material Characterization

A selected particle size index value, the D_{50}, represents the most prevalent of one of six channel material types or size categories, as determined from a channel material size distribution analysis. While channel bed and bank material influence the cross-sectional form, plan-view and longitudinal profile of rivers;

they also determine the extent of sediment transport and provide the means or resistance to hydraulic stress.

The modified Wolman method for determining bed material (pebble-count), proportionally adjusts the sample locations to acquire a more representative sample of the channel reach. The original method developed by Wolman (1954) was modified by David Rosgen (1994) to better account for bank materials and the frequency of riffle/pool and step/pool occurrences. The combined lengths of all pools and the combined lengths of all riffles are first calculated to determine the total percent of each habitat in the reach. Sampling location for ten cross-sections was then based on the frequency of pools and riffles in the reach.

Natural Channel Design

Using these data collected at a reference reach as baseline for an undisturbed channel, restoration plans can be developed for disturbed reaches by replicating the conditions described above at the reference reach. Rosgen refers to this as “natural channel design” (NCD). The NCD concept was developed from nearly 40 years of research and river restoration projects (Rosgen, 1996). The procedures involved in NCD include the implementation of fluvial geomorphological relationships to assess channel stability, in addition to the application of sedimentological, hydraulic, and morphological relationships. The methodology, as described by Rosgen (1996) includes eight major phases.

These phases are defined as follows:

(1) Define restoration objectives.
(2) Develop regional and localized information of geomorphological characterizations, hydrology, and hydraulics.
(3) Conduct a detailed watershed and river assessment
(4) Consider non-evasive means of restoration as opposed to mechanical restorations.
(5) Initiate NCD if passive measures are not adequate.
(6) Select and develop design for restoration to maintain or construct the dimension, pattern and profile of the objective stated in phase 1.
(7) Implement proposed design.
(8) Design a monitoring plan.

Literature shows conflicting views of the NCD Design Methods. There are both positive and negative feedback regarding these procedures and their functionality. Rosgen mentions that a comprehensive approach to river restoration would require a team of professionals from many disciplines in the design and development of restorative measures. Critics of the approach, in Rosgen's opinion, come from professionals with little experience and training.

A study conducted to evaluate the natural channel design theory (Simon *et al.*, 2007), concluded that this system ignores many critical components in open channel systems that adjust for inputs of energy and materials. Problems are often encountered with identifying bankfull, especially in incised river systems. The natural channel design ignores many processes controlled by force and resistance, as well as the imbalance between sediment supply and transporting energy. This was proven with the analysis of a C5 channel that adjusted differently and to different equilibrium morphologies in response to a similar disturbance, therefore contradicting the concept of natural channel design and the approach of a reference reach. The conclusion of this research was that the

Rosgen classification is best used as a communication tool, and not means of mitigating channel instability or to predict equilibrium morphologies.

CHAPTER III: OBJECTIVE

The objective of this study is to determine the most suitable location for a streamgaging station on Scott Creek. Two potential locations are being considered. The streamgage will record instantaneous stage values which will be used to compute discharge on a continuous basis. On a natural channel such as this, control conditions and flow patterns will frequently change. The continued manual measurement of flow will therefore be crucial to determine, verify, and adjust the stage-discharge rating curve used for the final computation of discharge. It will be necessary to have the capability to measure discharge during the full range of flow conditions. Additionally, the channel configuration would ideally support the full range of flow conditions and runoff events in the watershed. Knowledge of the probability of recurrence peak discharge events, particularly the 100-year discharge, will be an integral part in choosing a streamgage location and in the development of the streamgage.

CHAPTER IV: METHODS

Regional Equations

Equations developed for the Central and North Coast Regions (Waananen and Crippen, 1977) were used to compute recurrence intervals for Scott Creek. These equations can be located in Table 3. A direct watershed comparison with Corralitos Creek at Freedom (station 111592000) was compared to results computed using the regional equations. Corralitos Creek was chosen due to its close proximity to Scott Creek and similarities in drainage area size. Additionally, drainage basin adjustment equations (Waananen and Crippen, 1977) were used to compute recurrence intervals for Scott Creek using known recurrence interval results from eleven gaged streams within a 26.0 mile radius. This drainage area adjustment is computed by using the following formula:

$$Q_u = Q_g \, (A_u/A_g)^b \tag{8}$$

Where

Q_u = the discharge at the ungaged location on Scott Creek
Q_g = the discharge at the gaged location
A_u =the ungaged drainage area
A_g = the gaged drainage area
b = an exponent selected from the exponents associated with drainage area for the direct equations located in Table 1

The final results from the direct equations, direct watershed comparison, and drainage area adjustments were compared.

Log-Pearson Type III Frequency Distribution

Recurrence intervals for Scott Creek were also computed using a Log-Pearson Type III frequency distribution. Scott Creek above Little Creek near Davenport (station 11161900) has 20 years of peak data for use in this type of frequency analysis. Four of these peak discharge values were removed as low

outliers for some of the computations, leaving a population of 16 values for the frequency analysis. The removal of these data will be discussed in more detail in *Low Outlier Thresholds* and *Flood Frequency Results for Scott Creek*. A generalized skew coefficient of -0.3 with a standardized error of 0.55 was used. These values were obtained from Bulletin 17B and can be located in Plate 1 of that publication (Appendix E). Additionally, recurrence intervals were computed using a generalized skew coefficient of -0.5 as determined by the USGS (Appendix F) and a standardized error of 0.55 as determined by Bulletin 17B. No standardized error has been computed for the generalized skew map created for California, therefore the Bulletin 17B value was used. The limited peak data for Scott Creek above Little Creek near Davenport cannot provide results within a safe confidence limit as determined by Linsley *et al*. (1958).

Regional Analysis

To develop a more localized generalized skew coefficient for Scott Creek, a regional frequency analysis was performed using current and discontinued gages located within 50-miles of Scott Creek with 14 years of published peak data. Procedures outlined in Bulletin 17B recommend using gages with 25 years of peak data located within a 100-mile radius of the location of interest. A 50-mile radius was chosen to limit gages outside the influence of coastal weather patterns east of the Diablo Range. Additionally, strictly following Bulletin 17B procedures by using gages with a minimum of 25 years of data would have limited the regional analysis data set to 25 gages. A minimum limit of 14 peak discharge events was therefore chosen to expand and attempt to improve the

regional data set, increasing the number of usable gages to 34. Outliers were removed and station skews were computed using the USGS program PEAKFQ. A bias-correction factor based on record length (Tasker and Stedinger, 1986) was then used for each of the 34 stations to obtain an unbiased station skew value. The median of these station skew values was then used with a new MSE computed for the data set to develop an unbiased generalized skew value to be used with Scott Creek. The median was used, as opposed to the mean, as it is considered a more robust value. The final frequency was completed using a station skew of 0.82 for Scott Creek that was unadjusted for bias. Adjusting the peak data skew value for bias increased the station skew to 1.128 and was considered exceptionally large when compared with the regional data set. The bias adjusted skew value for Scott Creek was the largest adjusted skew value of the 34 regional stations which averaged -0.172. Twenty-five of the 34 stations have negative skew coefficient values, with the second largest value only half that of Scott Creek (0.561 at station 11153900).

Low Outlier Threshold

Procedures for the Grubbs-Beck test, outlined in Bulletin 17B, were first used to ascertain if any low outlier peak values for Scott Creek and the regional gages should be removed (Appendix H). Oftentimes, low peak discharges will fall below the general trend and the statistical test will not identify these low outliers although they will adversely affect the fit of the Log-Pearson Type III distribution. In these instances, a visual inspection of the log-probability plot of the fitted distribution and the observed peak discharges is necessary. An example of this

visual inspection procedure is illustrated below in Figure 4 for Carmel River near Carmel (station number 11143250) which was used in the regional analysis completed for this study (Chapter V, *Regional Analysis*). Bulletin 17B criterion computes a low outlier threshold of 93 ft^3/s resulting in a station skew of -0.870. A visual inspection of the frequency plot reveals additional low outliers and a "stair-step" pattern in 11 lower peak values. These peak values were removed by setting the low outlier threshold to 1,000 ft^3/s, resulting in a final station skew coefficient of -0.124, and a more accurate trendline. The final visual inspection and determination of the low outlier threshold value is subjective, as opposed to the more objective results obtained when using the direct equation provided in Bulletin 17B. The procedures for treating these outliers however, ultimately require judgment involving both mathematical and hydrologic considerations (Interagency Advisory Committee on Water Data, 1982).

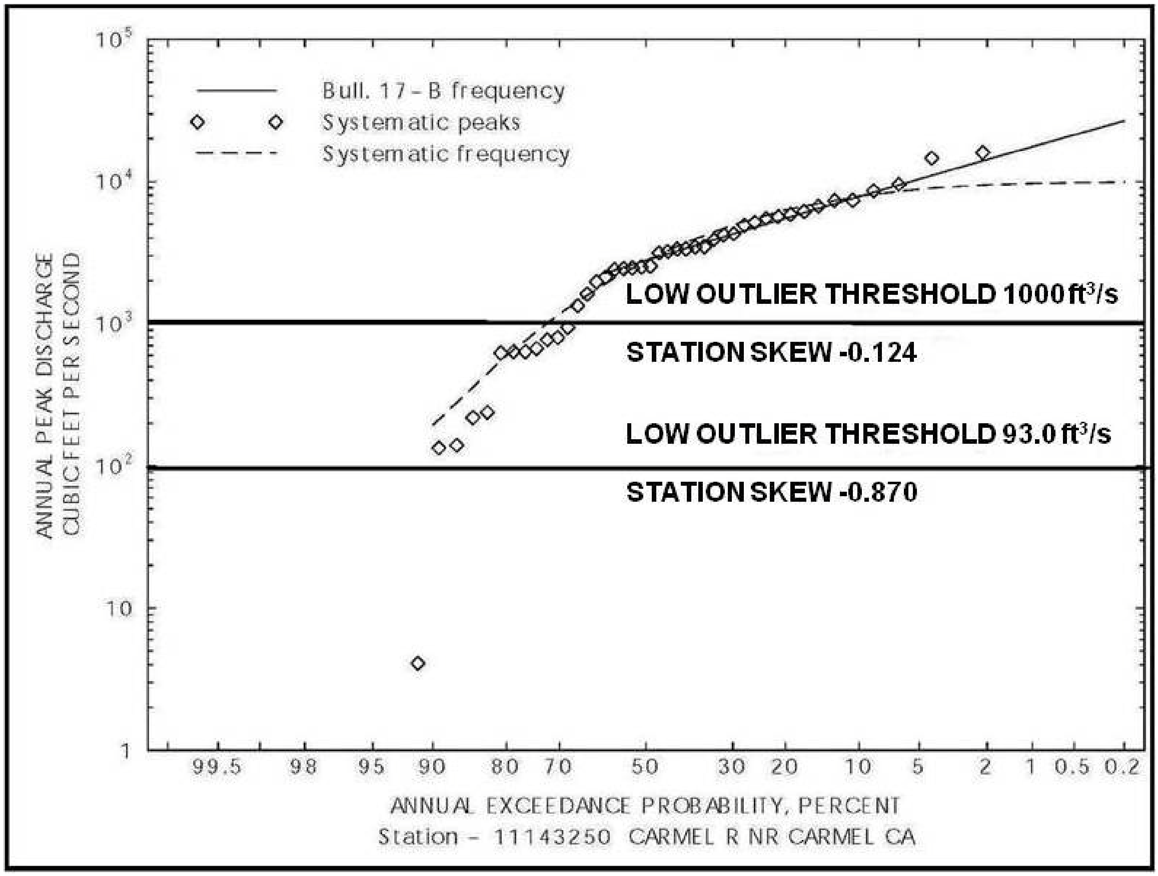

FIGURE 4. Comparison of low outlier threshold obtained using Bulletin 17B procedures and a visual inspection of the data trends.

Two-Station Comparison

The two-station comparison method was used to determine recurrence intervals on Scott Creek with the spreadsheet program developed by Robert W. Meyer. The description with the necessary equations needed to complete a two-station comparison can be located at the end of Appendix J. This attachment is from Appendix 7 of Bulletin 17B. Scott Creek was compared to seven long-term gages with a minimum of 53 years of peak discharge record. Values for R^2 were poor, ranging from 0.03 to 0.61. The slope of the regression line was computed

manually using the following equation provided in Bulletin 17B:

$$b = \frac{\Sigma X_1 Y_1 - \Sigma X_1 \Sigma Y_1 / N_1}{\Sigma X_1^2 - (\Sigma X_1)^2 / N_1} \qquad (9)$$

Where

X_1 = Logarithms of flows from long record during concurrent period
Y_1 = Logarithms of flows from short record during concurrent period
N_1 = Number of years when flows were concurrently observed at the two sites

Indirect Measurements of Discharge

Indirect measurements of discharge make use of the energy equation for computing streamflow. The specific equations vary for different types of flow. Consideration needs to be given to the physical characteristics of the channel, the water surface elevation at the time of peak stage, and additional hydraulic factors.

Manning's Equation

The Manning's equation was developed for conditions of uniform flow, assuming the energy gradient, water-surface profile and bed profile are parallel. It is also assumed that the hydraulic radius and depth are constant throughout the reach, and is valid in a natural channel if the energy gradient reflects only losses due to boundary friction. The equation is as follows:

$$Q = (1.486/n)AR^{2/3}S^{1/2} \qquad (10)$$

Where

Q = discharge
n = roughness coefficient
A = area
R = hydraulic radius
S = friction slope

Slope Area

The slope-area method (Dalrymple and Benson, 1967) is an indirect measurement used to compute peak discharge events from measurements of high-water marks and channel geometry. The method is based on one-dimensional gradually varied, steady flow equations. Flow in a natural channel however, will rarely achieve a steady flow condition, and are spatially and temporarily varied during conditions of significant discharge. The slope-area method uses the conservation of energy (Bernoulli equation) and the mass (continuity equation) and the normal-flow equation (Manning's equation) to determine discharge at a particular stage and roughness. The computation is based on channel characteristics, water-surface profiles, and a roughness or retardation coefficient. The drop in water-surface profile for a uniform reach of channel represents energy losses caused by bed and bank roughness.

Determination of Manning's n value

The roughness coefficient, or Manning's *n* value, was determined for subdivided sections of channel cross-sections along the Lower Scott Creek reach. The factors that exert the greatest influence on the coefficient of roughness are the character of the streambed material, cross section irregularity, the presence of vegetation, the alignment of the channel, and the depth of flow over each of these features. Additionally, roughness coefficient values based on vegetation density will change seasonally.

Roughness coefficients were selected during the field survey completed on October 15, 2008. These values and ranged from 0.032 to 0.036 for the main

channel. The coefficients were selected by reference to Water Supply Papers 1849 (Barnes, 1967), 2441 (Coon, 1998), 2339 (Arcement and Schneider, 1989) and *Roughness Characteristics of New Zealand Rivers* (Hicks and Mason, 1991). A final value of 0.035 was used for the unvegetated channel. A significantly larger value of 0.21 was used for the densely vegetated upper banks. Photos of Scott Creek illustrated below in Figures 5 and 6, were taken on February 12, 2009, during the height of the rain season These photos compare very well with Figure 7 from Water Supply Papers 2339 (Arcement and Schneider, 1989). Figure 7 is that of a previously computed Manning's *n* value of 0.20. The Scott Creek value is slightly larger due to a larger percentage of vegetation.

FIGURE 5. Upper banks of Lower Scott Creek on February 12, 2009.

FIGURE 6. Additional photo of the upper banks of Lower Scott Creek on February 12, 2009.

Computed roughness coefficient: Manning's n=0.20
Date of flood: March 3, 1971
Date of photograph: March 29, 1979
Depth of flow on flood plain: 2.9 ft
Description of flood plain: The vegetation of the flood plain is large and small trees, including oak, gum, and ironwood. The base is firm soil and has minor surface irregularities. Obstructions are minor (some downed trees and limbs). Ground cover is medium, and the large amount of undergrowth includes vines and palmettos. Veg_d=0.0115, and C_*=22.7. The selected values are n_1=0.025, n_2=0.005, n_3=0.010, n_4'=0.015, and n_0=0.055.

FIGURE 7. Comparison photo from Water-Supply Paper 2339 with a Manning's *n* value of 0.20.

Oftentimes, roughness coefficients are underestimated for dense riparian vegetation of this magnitude, resulting in larger indirect measurement discharge value computations (Robert Meyer, USGS California Water Science Center, personal communication). This was taken into consideration during the final analysis.

A detailed transit-stadia survey, combining vertical and horizontal control surveys in one operation, was completed at the Lower Scott Creek gage location to evaluate channel slope, roughness coefficients, flow pattern, and topography (Figure 8 and Appendix K). Knowing a reasonable estimate of the 100-year design flow event, attempts were made to indirectly replicate this discharge and determine a surface water profile and channel width at this peak event. Usually, indirect discharge computations require high-water marks to verify surface water slope and flow pattern, which are then used to determine a discharge at multiple cross-sections throughout the reach. In this instance however, an attempt was made to reverse this approach by using a known discharge (Q_{100}) to calculate water surface elevations and channel width at three cross-sections throughout the reach. These efforts however proved inconclusive as a result of the uncertainty in the flow pattern during overbank discharge events.

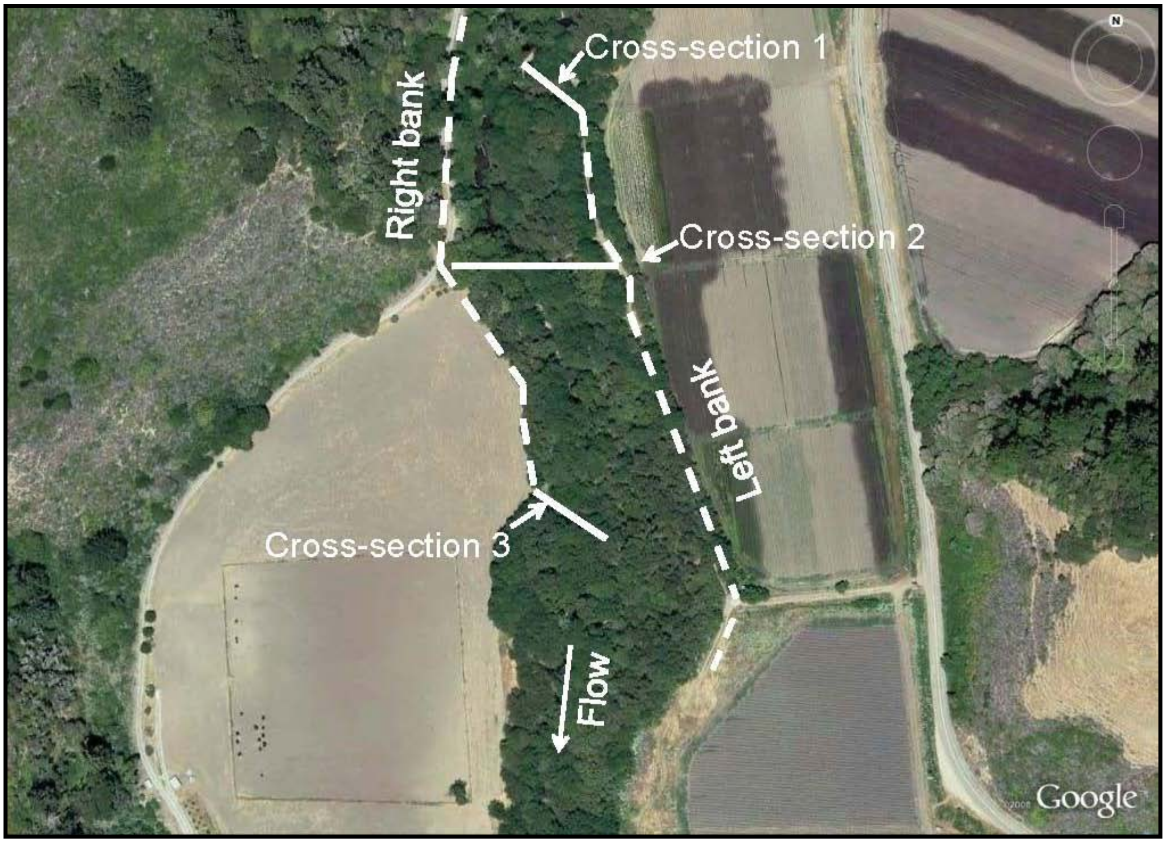

FIGURE 8. Transit-stadia survey at the proposed gage location on Lower Scott Creek indicating cross-section locations and upper bank level locations.

Due to the dynamic nature of the channel and flow at extreme discharge events, it was impossible to compute discharge once the channel's flow topped the upper levee at cross-section 1. The levee, which varies in height throughout the survey reach, will allow overbank flow to renter the channel at many locations downstream. Flow will also pool in the agricultural fields. Photos taken in 1982 (computed peak flow 4,220 ft^3/s Jan. 4, 1982) and 1998, illustrate the overflow pattern and pooled water on the left bank of Scott Creek (Figures 9 and 11). Additionally, Figure 10 shows the severe scour along the left bank of Lower Scott Creek after the 1982 peak event.

FIGURE 9. Overflow of left bank at Lower Scott Creek evident following the January 1982 flood flows.

FIGURE 10. Left bank scour of Lower Scott Creek after 1982 storm event.

FIGURE 11. Overflow of left bank at Lower Scott Creek in 1998.

Using the elevation data acquired during the survey, a reasonable slope was obtained between each cross-section. Indirect methods were used to compute maximum discharge within the confined channel system, before bank overflow and uncertainty. The maximum elevation of the confined channel at cross-section 1 was used. This elevation was then adjusted accordingly based on slope for cross-sections 2 and 3 located downstream. The resultant discharge was then compared to the 100-year design flow event to determine if the construction of cableway was feasible at this location.

Procedures for Analysis of Upper Scott Creek

The Upper Scott Creek river reach is in a state of disequilibrium and instability. This is direct result of multiple debris jams in a 240 foot section directly

above the bridge, which has caused channel avulsion and the creation of a newly incised channel along the left bank. The erosive force of this channel and corresponding flow threatens the stability of the bridge. The reach and local channel characteristics were therefore studied to determine potential methods for channel rehabilitation and ultimately bridge stability.

Stability Analysis

Data was collected along an undisturbed reference reach 370 feet downstream of the bridge. These data were analyzed to determine a Rosgen channel classification for the reach as a comparison with the disturbed reach located at the Edgar J. Carnegie Railroad Bridge. Additionally, a stream reach inventory and channel stability survey, developed by Pfankuch (1975), was completed at the reference reach and at the bridge location. A copy of this survey form is located in Appendix N. As described by Pfankuck in *Stream Reach Inventory and Channel Stability Evaluation, A Watershed Management Procedure,* the purpose of the survey is to develop systematic “measurements and evaluations of the resistive capacity of mountain streams channels to the detachment of bed and bank materials and to provide information about the capacity of streams to adjust and recover from potential changes in flow and/or increases in sediment production.” The survey scores various measureable and visual indicators of the upper banks, lower banks and streambed. Areas of evaluation include mass wasting potential adjacent to the channel, detachability of bank and bed materials, channel capacity and evidence of excessive erosion or deposition. The sum of the scores then provides a numerical evaluation of the

reach's stability, ranging from excellent to poor. The procedure has been used for 25 years by the USDA Forest Service and other Federal Agencies (Pfankuch, 1975). Although not as widely used today, the Pfankuch Rating is still part of many stability studies throughout the country (Eric Schroder, Arapaho/Roosevelt National Forests and Pawnee National Grasslands, personal communication). This stability rating was further refined by Rosgen (1996), who delineated scores and categorized these scores by stream channel classification. The results of two surveys, one completed by the author and another completed by E.R. Houston (USGS Hydrologist), were averaged for the final result and can be located in Appendix N. The evaluation and scoring is subjective, and require judgment and experience. Results have shown however, that scoring values obtained by inexperienced and experienced individuals are similar (Pfankuck, 1978).

Topographic Sketch of Impacted Reach

An attempt was made to create a detailed topographic map of the impacted reach of concern at the bridge. A Leica Total Station Model TCR307 was used to collect 160 elevation points using an arbitrary datum, and their corresponding azimuth, on February 12, 2009. Field verification of the final computer generated map conducted on April 29, 2009, show significant discrepancies in the final product. Original plans were to use the topographic representation to create a 3-dimensional image to aid in the planning of instream stability structures. Using the data points and their corresponding elevations, and visually comparing these elevations to channel features at the reach, a rough sketch was created representing the true configuration of the channel. There is a large margin of

error in the final version, especially when compared to true computer generated output. With the aid of the topographic representation, channel geometry was studied and compared to reference reach data to develop possible solutions for rehabilitation and channel stability options, including a cross-vane, and single and double wing deflectors.

CHAPTER V: FLOOD FREQUENCY RESULTS FOR SCOTT CREEK ABOVE LITTLE CREEK NEAR DAVENPORT (STATION 11161900)

Previous Frequency Analysis

A frequency analysis was completed for the Scott Creek Watershed (Rumann *et al*., 2002). Details of this study can be located in *Hydrologic Evaluation for the Scott Creek Watershed, Santa Cruz County, California*. The 2-, 5-, 10-, 25-, 50-, and 100-year (Q_2-Q_{100}) recurrence intervals were computed using the U.S. Army Corps of Engineer Hydrologic Engineering Center (HEC) Flood Hydrograph Package (USCOE, 1987) and compared with direct regression equations developed by Cruff and Young in 1967. These equations can be located in *Pacific Slope Basins in California, Part 11, Vol. 2, of Magnitude and frequency of floods in the United States: U.S. Geological Survey Water-Supply Paper 1686*. The regression equations were developed for a maximum 50-year discharge. The 100-year discharge value was therefore extrapolated by extending the regression line plot on a log extreme value graph. The results of the HEC-1 model and regression equations were then compared with 100-year discharge events for similar watershed sizes calculated by the Federal Emergency Management Agency (FEMA, 1986) Flood Insurance Study (FIS). Results, using a drainage area of 30 square miles, are illustrated in Table 2.

TABLE 2. Frequency results for Scott Creek from Hydrologic Evaluation for the Scott Creek Watershed (Rumann *et al*., 2002).

Return Interval	HEC-1 (Q in ft^3/s)	Regression Equation (Q in ft^3/s)	FIS (Q in ft^3/s)
Q_2	2,500	2,400	
Q_5	5,600	4,500	
Q_{10}	7,900	6,000	
Q_{25}	11,400	8,700	
Q_{50}	14,300	12,600	
Q_{100}	17,200	18,000	12,300

Both HEC-1 model and extrapolated regression equation results are similar, with a 4.5 percent difference for the 100-year value. It was therefore determined that an average value of 17,600 ft^3/s was the 100-year design flow at the outlet of Scott Creek Watershed. FIS discharge for the 100-year recurrence interval however, is dramatically smaller, resulting in a -35.4 percent difference when compared with the final discharge value of 17,600 ft^3/s. Although this difference is noted, it was determined that results are within an acceptable range, considering the excellent comparison of HEC model and equation values.

Direct Equations

The most recent equations were used for estimating peak flows at various recurrence intervals, including the 2-, 5-, 10-, 25-, 50-, and 100-year discharge events for watersheds located in California. These equations were developed by Waananen and Crippen (1977). The regression equations were developed from a regional multiple-regression flood-frequency analysis of peak-discharge records of 10 years or longer, available as of 1975, at 705 gaging stations located throughout California, and can be found in the publication *Magnitude and*

Frequency of Floods in California, U. S. Geological Survey Water-Resources Investigations 77-21.

Two sets of regional equations were used directly, including the Central Coast Region developed from 98 gaging stations, and the North Coast Region developed from 141 gaging stations, to estimate recurrence intervals and bracket the 100-year flood event. The Scott Creek watershed is located in the northern portion of the Central Coast Region (Appendix C); therefore North Coast Region results were used as a comparison. Watershed characteristics necessary for these computations include drainage area (A), mean annual precipitation (P), and the altitude index (H), which is computed as the average altitude at 10 and 85 percent of the distance from the location of interest on the main channel to the basin divide. A drainage area of 25.1 square miles was used, representing the contributing watershed area at the upper Scott Creek location, to provide results which can be better compared with additional analyses conducted for this study. All parameters were obtained using *California StreamStats*, a USGS internal computer program, and compared with USGS topographic maps for an additional reference and verification. A minor difference of 0.1 square miles in drainage area was noted between the published record and *California StreamStats* output. The published drainage area of 25.1 was therefore used to maintain consistency. Output from *California StreamStats* can be viewed in Appendix C. Results for the 100-year recurrence interval, illustrated in Tables 3 and 4, and Figure 12, are 11,770 ft^3/s for the Central Coast Region and 7,430 ft^3/s for the North Coast Region.

It should be noted that the frequency analyses performed for this study were completed for Scott Creek above Little Creek near Davenport (station 11161900) with a drainage area of 25.1 mi^2. The Rumann *et al*., (2002) study accounted for the entire drainage basin with a drainage area of 30.0 mi^2. To provide a better comparison of these results with the earlier study completed by Rumann *et al*. (2002), the HEC-1 model and extrapolated regression result of 17,600 ft^3/s was adjusted from 30 mi^2 to 25.1 mi^2. The unit discharge per square mile with a drainage area of 30 mi^2 is 587 ft^3/s. It can therefore be assumed that when using a drainage area of 25.1 mi^2, the design flow would be 14,700 ft^3/s. Even after adjustment, this value is significantly larger than those computed using Central Coast Region and North Coast Region equations, resulting in percent differences of 81.3 and 40.3 respectively.

TABLE 3. Frequency results computed from direct equations for the Central Coast Region.

CENTRAL COAST REGION Recurrence intervals using regional flood frequency equation directly				
		Recurrence Interval	Equation	Discharge ft^3/s
Drainage Area (A)=	25.1	Q2	$0.0061A^{0.92}P^{2.54}H^{-1.10}$	**4,690**
Mean Precipitation (P)=	49.1	Q5	$0.118A^{0.91}P^{1.95}H^{-0.79}$	**7,490**
Altitude Index (H)=	0.59	Q10	$0.583A^{0.90}P^{1.61}H^{-0.64}$	**8,830**
		Q25	$2.91A^{0.89}P^{1.26}H^{-0.50}$	**10,090**
		Q50	$8.2A^{0.89}P^{1.03}H^{-0.41}$	**11,080**
		Q100	$19.7A^{0.88}P^{0.84}H^{-0.33}$	**11,770**

TABLE 4. Frequency results computed from direct equations for the North Coast Region.

NORTH COAST REGION Recurrence intervals using regional flood frequency equation directly				
		Recurrence Interval	Equation	Discharge ft^3/s
Drainage Area (A)=	25.1	Q2	$3.52A^{0.90}P^{0.89}H^{-0.47}$	**2,940**
Mean Precipitation (P)=	49.1	Q5	$5.04A^{0.89}P^{0.91}H^{-0.35}$	**4,130**
Altitude Index (H)=	0.59	Q10	$6.21A^{0.88}P^{0.93}H^{-0.27}$	**5,100**
		Q25	$7.64A^{0.87}P^{0.94}H^{-0.17}$	**5,990**
		Q50	$8.57A^{0.87}P^{0.96}H^{-0.08}$	**6,930**
		Q100	$9.23A^{0.87}P^{0.97}$	**7,430**

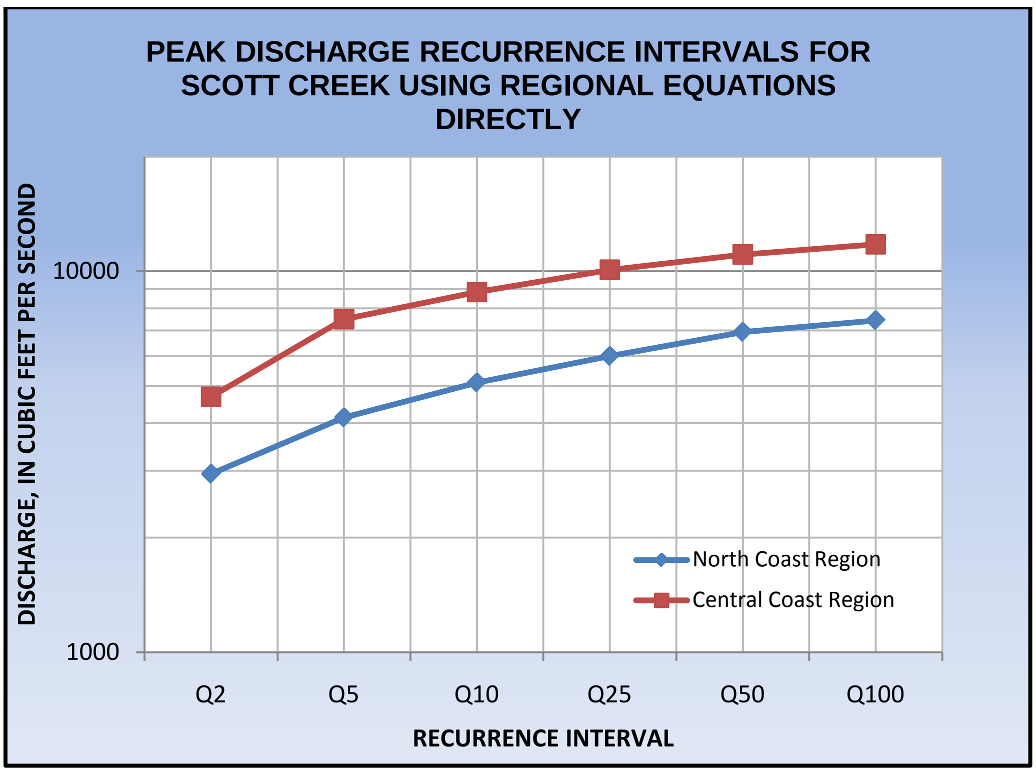

FIGURE 12. Comparison graph of Central and North Coast Region frequency results. Drainage area of 25.1 mi^2.

Direct Watershed Comparison

Waananen and Crippen recommend the use of an existing record, at a nearby river with similar attributes, for determining recurrence intervals. Gaged data from

USGS gaging station Corralitos Creek at Freedom, CA (station 11159200) was therefore used as a direct comparison to determine recurrence intervals and the design flow for Scott Creek. Recurrence intervals were previously computed for Corralitos Creek and can be located in *Magnitude and Frequency of Floods in California*. As noted by Waananen and Crippen, a comparison is plausible if the drainage-area difference is less than 5 percent and there is a long, historic discharge record available. In this instance, the drainage area difference is 2.3 percent and the recurrence intervals were developed for Corralitos Creek using 20 years of historic data and a maximum peak discharge of 3,620 ft^3/s (12/22/1955). This gaging station is located 26 miles southeast of the proposed Scott Creek gage (Appendix D). Gaging station comparison data and frequency results are located in Tables 5 and 6 respectively. A graph comparing regional equation results and direct watershed comparison values is located in Figure 13.

TABLE 5. Watershed comparison parameters for Scott Creek and Corralitos Creek

	Drainage Area (A) (square miles)	Mean Precip (P) (inches)	Channel Length (L) (miles)	Alt Index (H) (thousands of ft)
Scott	25.1	49.1	10.0	0.59
Corralitos	27.8	35.0	11.7	0.50

TABLE 6. Frequency results from direct watershed comparison.

CORRALITOS CREEK AT FREEDOM, CA Recurrence intervals using a direct comparison			
Q2	1,030	Q25	5,390
Q5	2,450	Q50	6,780
Q10	3,660	Q100	8,230

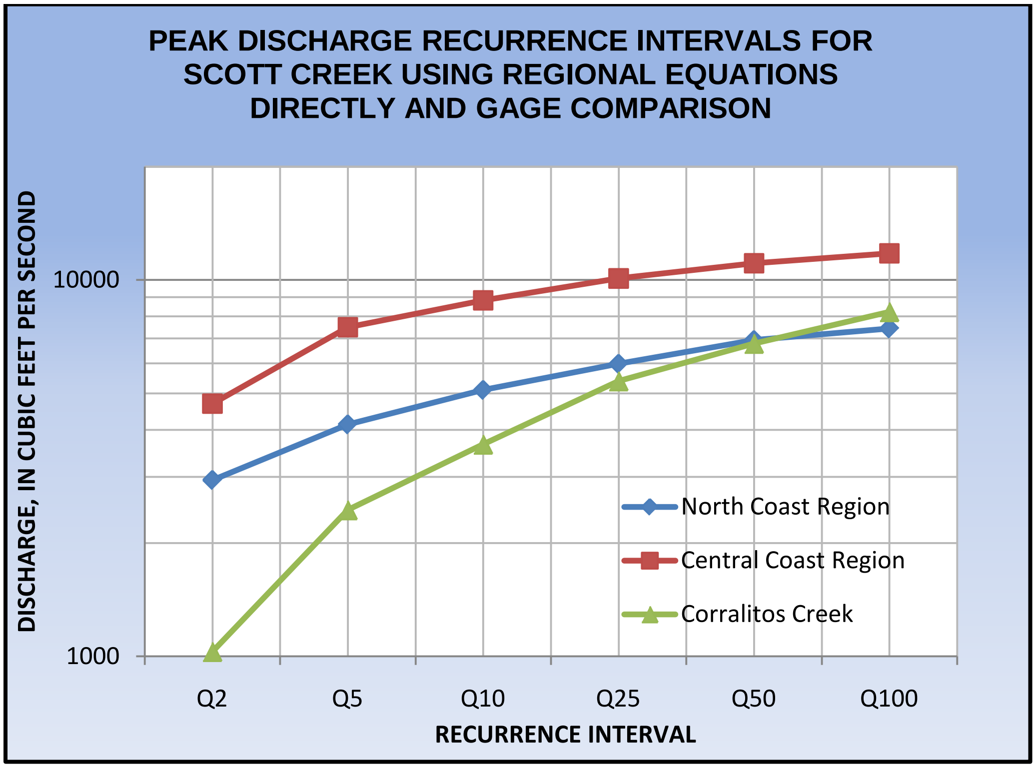

FIGURE 13. Comparison graph of Central and North Coast Region and direct watershed comparison frequency results.

Drainage Area Adjustment

Recurrence intervals and design flow were also computed for Scott Creek by adjusting the peak discharge for the difference in drainage area of eleven locally gaged streams with previously computed frequencies found in *Magnitude and Frequency of Floods in California.* More detailed information related to these eleven stream gages, including annual peak streamflow, is located in Appendix D. Results of the drainage area adjustments can be located in Table 7 and Figure 14.

TABLE 7. Frequency results computed with drainage area adjustment using Central Coast Region exponents.

	Station No.	Yrs Record	DA		Q2	Q5	Q10	Q25	Q50	Q100
Corralitos Creek at Freedom	11159200	20	27.8	Q_g	1,030	2,450	3,660	5,390	6,780	8,230
Scott Ck Adjustment			25.1	Q_u	**938**	**2,230**	**3,340**	**4,920**	**6,190**	**7,520**
Aptos Crk at Aptos	11159700	14	12.3	Q_g	402	1,200	1,980	3,230	4,320	5,510
Scott Ck Adjustment			25.1	Q_u	**775**	**2,300**	**3,760**	**6,090**	**8,150**	**10,320**
WB Soquel Crk nr Soquel	11159800	14	12.2	Q_g	1,010	2,580	3,990	6,070	7,800	9,620
Scott Ck Adjustment			25.1	Q_u	**1,960**	**4,970**	**7,640**	**11,540**	**14,820**	**18,150**
Soquel Crk at Soquel	11160000	25	40.2	Q_g	2,550	5,850	8,580	12,400	15,500	18,600
Scott Ck Adjustment			25.1	Q_u	**1,650**	**3,810**	**5,620**	**8,150**	**10,190**	**12,290**
San Lorenzo River Trib nr Boulder	11160030	12	0.26	Q_g	14	45	77	129	176	228
Scott Ck Adjustment			25.1	Q_u	**938**	**2,880**	**4,710**	**7,530**	**10,280**	**12,720**
Zayante Crk at Zayante	11160300	18	11.1	Q_g	865	2,500	4,070	6,540	8,660	11,000
Scott Ck Adjustment			25.1	Q_u	**1,830**	**5,250**	**8,480**	**13,520**	**17,900**	**22,550**
San Lorenzo River at Big Trees	11160500	39	111	Q_g	5,970	13,100	18,800	26,700	32,800	39,200
Scott Ck Adjustment			25.1	Q_u	**1,520**	**3,390**	**4,930**	**7,110**	**8,740**	**10,600**
Branciforte Crk at Santa Cruz	11161500	19	17.3	Q_g	1,620	3,180	4,330	5,850	7,000	8,140
Scott Ck Adjustment			25.1	Q_u	**2,280**	**4,460**	**6,050**	**8,150**	**9,750**	**11,290**
Pescadero Crk Trib nr La Honda	11162470	13	0.22	Q_g	6	15	24	36	47	58
Scott Ck Adjustment			25.1	Q_u	**469**	**1,120**	**1,700**	**2,440**	**3,180**	**3,750**
Pescadero Crk nr Pescadero	11162500	24	45.9	Q_g	1,960	4,490	6,580	9,540	11,900	14,300
Scott Ck Adjustment			25.1	Q_u	**1,120**	**2,590**	**3,820**	**5,580**	**6,950**	**8,410**
Butano Crk at Pescadero	11162540	14	18.3	Q_g	925	1,380	1,660	1,990	2,210	2,420
Scott Ck Adjustment			25.1	Q_u	**1,240**	**1,840**	**2,210**	**2,640**	**2,930**	**3,200**

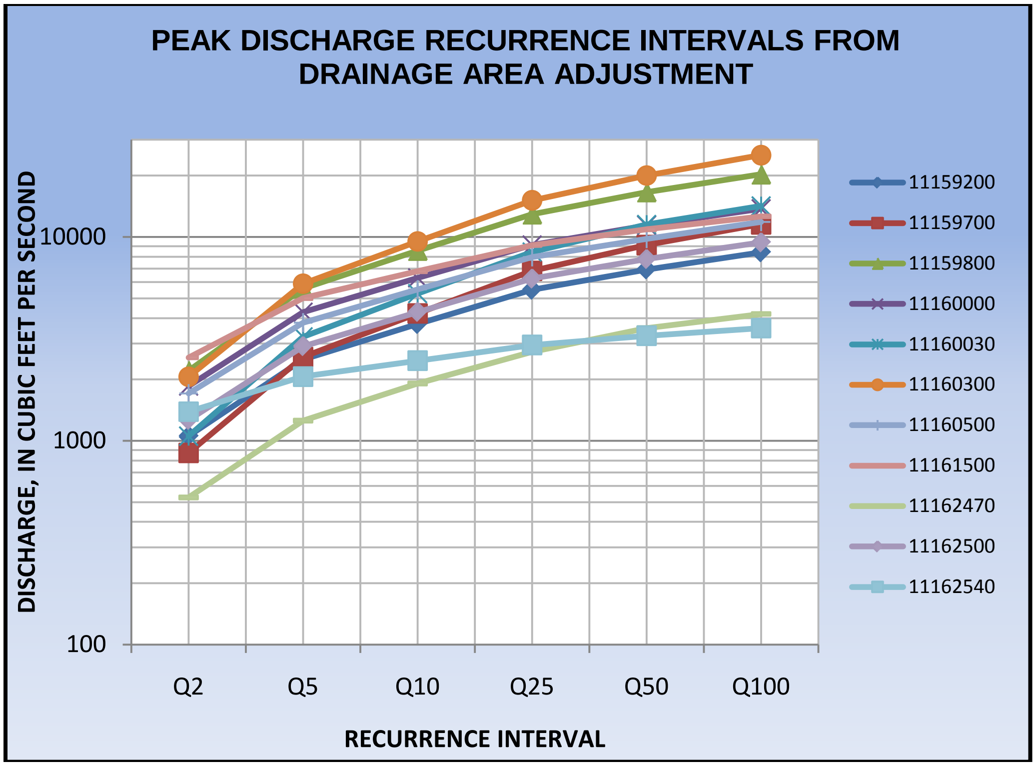

FIGURE 14. Comparison graph of frequency results computed with drainage area adjustment.

Summary of Direct Equations and Watershed Comparisons

Regression equation results for the Central and North Coast regions and a direct watershed comparison with Corralitos Creek at Freedom vary significantly. The Central Coast Region equations calculate a larger peak discharge for all recurrence intervals. Corralitos Creek values however, compare well with North Coast Region equations for 25-, 50-, and 100-year recurrence intervals, with percent differences of 11, 2 and 10 respectively. Additionally, when using the drainage area adjustment formula, the North Coast Region peak discharge recurrence values are similar to those of Corralitos Creek, resulting in a 9 percent difference. Overall, the direct drainage area adjustment results vary significantly, ranging from 100-year peak discharge of 22,500 ft^3/s when adjusted to Zayante Creek at Zayante, to 3,200 ft^3/s when adjusted to Butano Creek at Pescadero.

This poor correlation may be a direct result of the wide range of drainage areas used for this adjustment, which range from 111 to 0.22 square miles. These results however, can be used to provide an envelope curve to identify boundary limits for Scott Creek recurrence intervals

Log-Pearson Type III Frequency Distribution

A flood-frequency analysis was conducted using program J407 PEAKFQ, a U.S. Geological Survey program, to determine flood magnitude and recurrence intervals on a 1.5 (bankfull) to 500-year basis at USGS Streamgage 11161900 Scott Creek above Little Creek near Davenport, CA. The PEAKFQ program performs statistical flood-frequency analysis of annual-maximum peak flow events following procedures recommended in Bulletin 17B. The flood-frequency curve and tabular data output produced by the program illustrate the magnitude of discharge to the frequency of occurrence.

Initial default results used a regional (or generalized) skew value of -0.3 which was chosen from the national skew map (see Appendix E). This skew value was developed with data from watersheds smaller than 3,000 square miles and with unregulated peak discharges. The national skew map depicts the generalized skew coefficients of annual maximum streamflows in the United States, and was developed with data from 2,972 gaging stations through 1973. Twenty systematic peaks at Scott Creek were used for this analysis. Of the twenty peak discharge values, four were estimated historic peaks adjusted from values obtained at Scott Creek near Davenport for years 1937, 1939-1941, and one historic peak for

1982. For a more detailed discussion regarding these peak discharge values, please refer to the discussion in *Historic Discharge Data*.

Output results from the Log-Pearson Type III frequency curve compute a 100-year discharge of 8,360 ft^3/s and can be viewed below in Figures 15 and 16. Tabular data output can be located in Appendix E. A station skew value of -0.393 indicate asymmetrical data, with a median peak discharge value greater than the mean. The tail of this frequency distribution is therefore skewed to the left, and longer on the left side than the right.

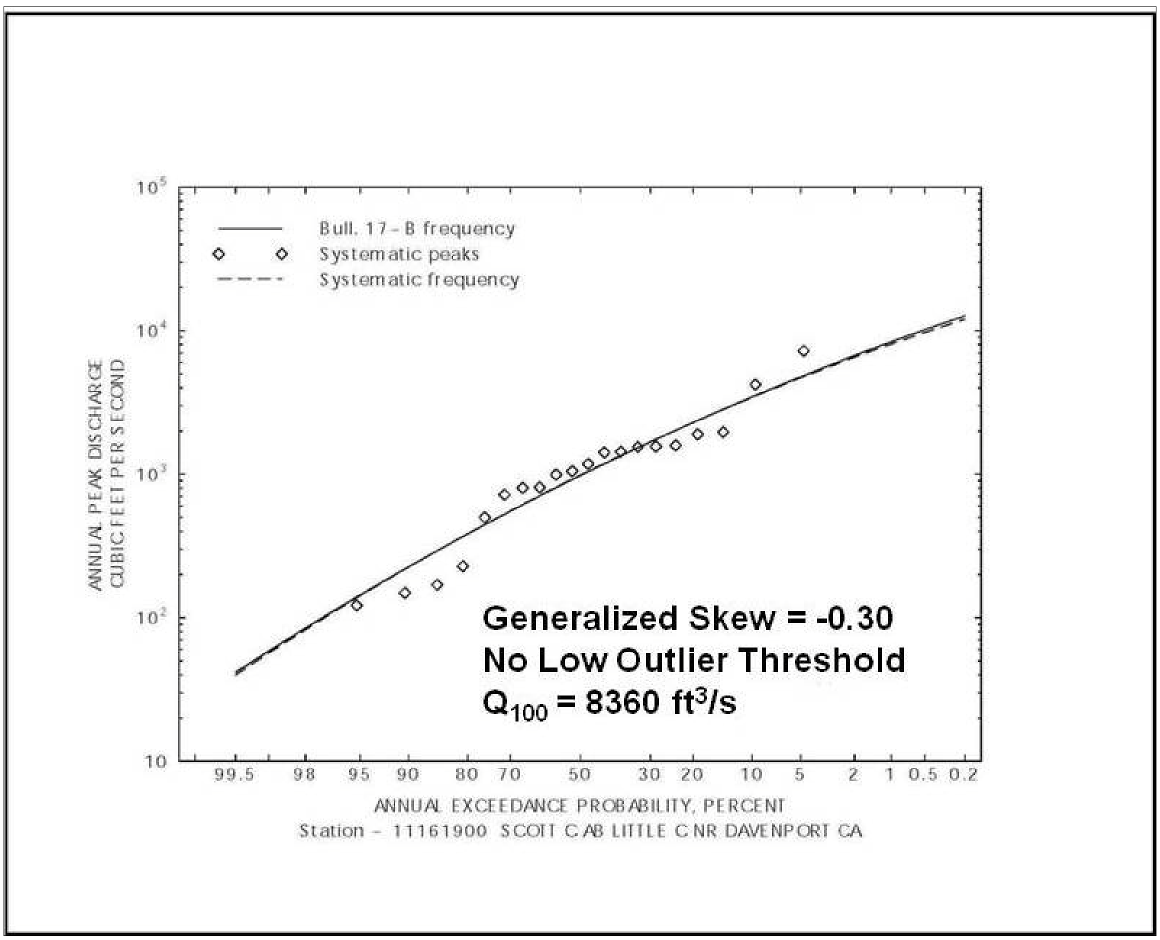

FIGURE 15. Log-Pearson Type III frequency curve using a generalized skew of -0.30 and no low outliers.

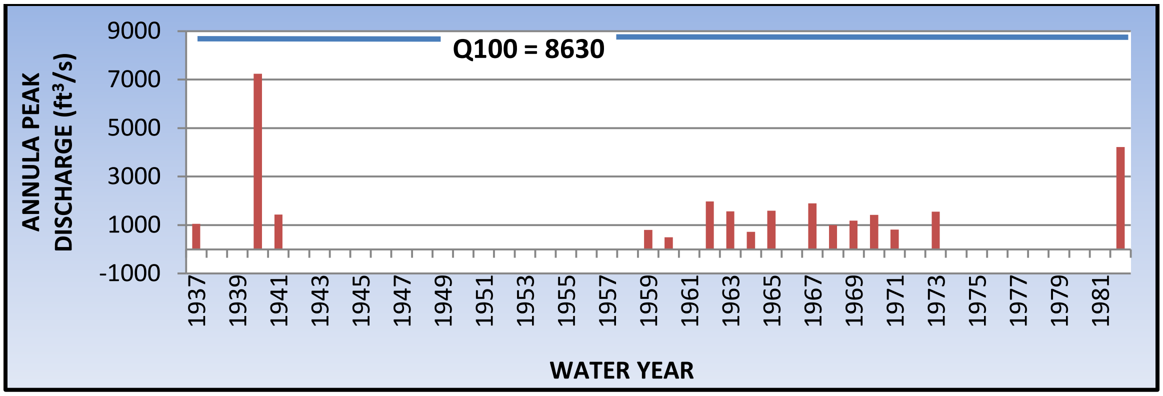

FIGURE 16. Log-Pearson Type III frequency output using a generalized skew of -0.30 and no low outliers and compared to peak discharge data used for the analysis.

Outliers, especially in a small sample such as this, can significantly affect the statistical parameters computed from these data. A low outlier threshold of 250 ft^3/s was therefore used in an attempt to straighten the frequency curve, giving more emphasis to the larger peak flow events. Setting this threshold at 250 ft^3/s removed four of the smallest peak events from the analysis. These peak discharge values include 229 ft^3/s in 1966, 170 ft^3/s in 1972, 149 ft^3/s in 1939 and 122 ft^3/s in 1961. Sixteen peak discharge events were therefore used with a regional skew of -0.30. Output results from the Log-Pearson Type III frequency curve compute a 100-year discharge of 7,080 ft^3/s and can be viewed below in Figures 17 and 18. The result of this frequency computation is a 20 percent difference when compared to values obtained before the removal of low outlier data. A station skew value of 0.820 indicates asymmetrical data, with a median peak discharge value less than the mean. The tail of this frequency distribution is therefore skewed to the right, and longer on the right side than the left.

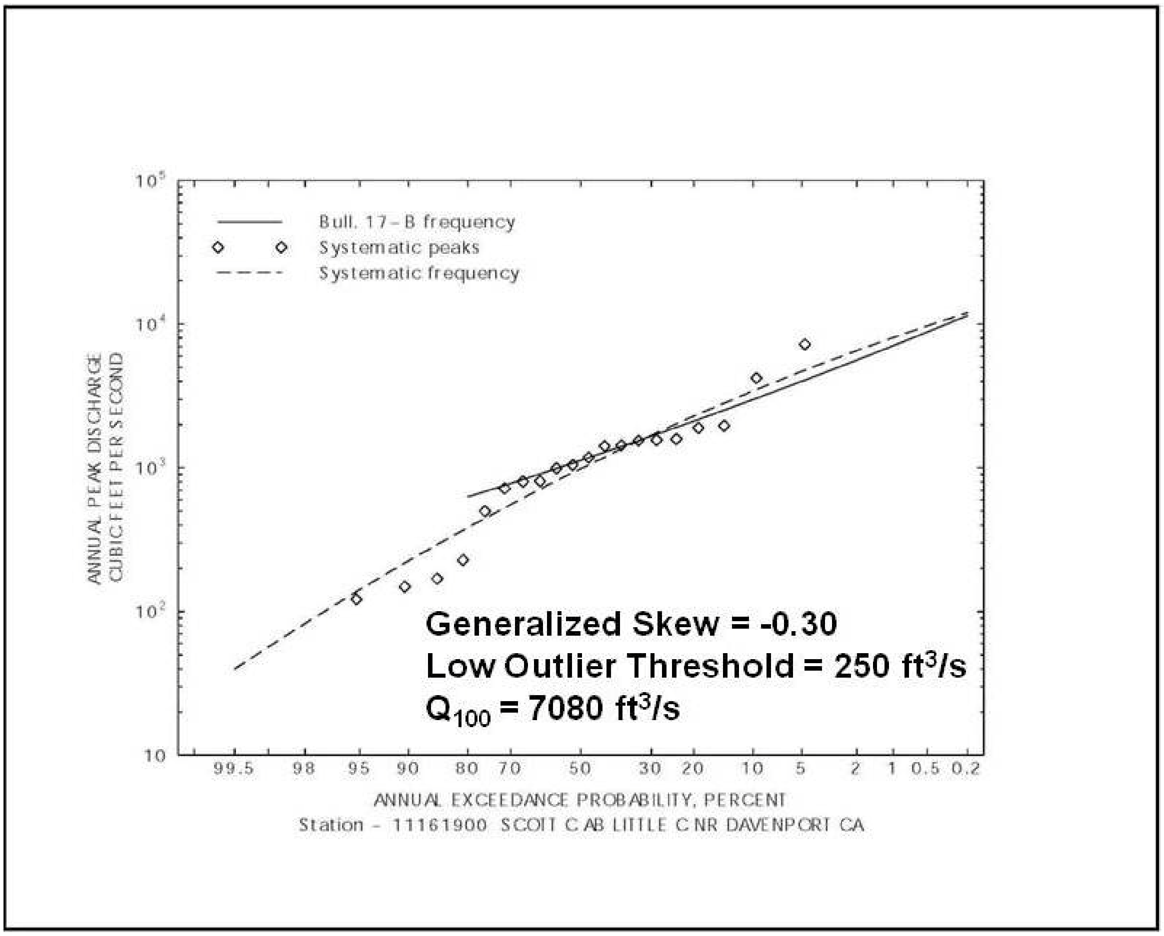

FIGURE 17. Log-Pearson Type III frequency curve using a generalized skew of -0.30 and a low outlier threshold of 250 ft^3/s.

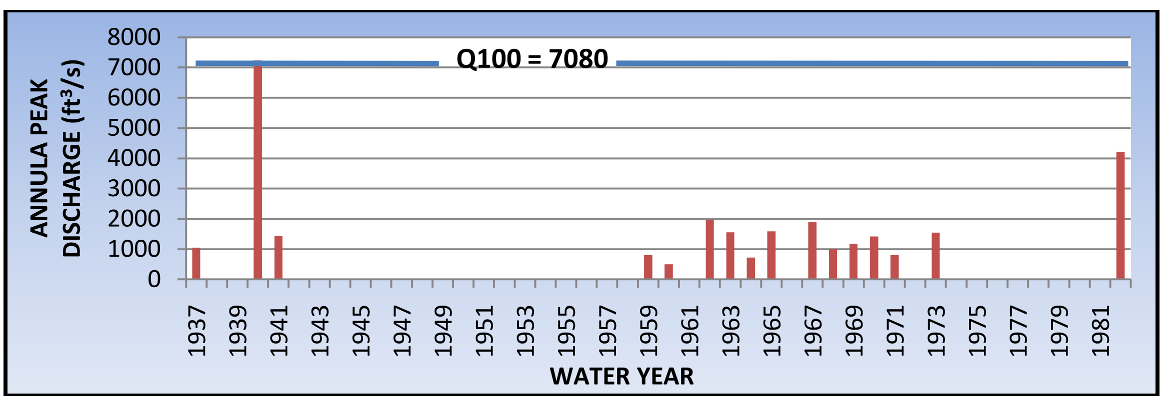

FIGURE 18. Log-Pearson Type III frequency output using a generalized skew of -0.30 and a low outlier threshold of 250 ft^3/s and compared to peak discharge data used for the analysis.

As an alternative to the national generalized skew published in Bulletin 17B, median skew values for six hydrologic regions specific to California were

developed by Richard M. Bloyd in 1979 (see Appendix F). These skew values were developed from a statewide study of the magnitude and frequency of floods in California (Waananen and Crippen, 1977). The values have recently replaced earlier skew values in California, and are widely used for frequency analysis with the U.S. Geological Survey. As mentioned earlier, the standard error of the generalized skew (MSE), used as a measure of appraising the accuracy, has not been determined for the hydrologic regions. MSE values from Bulletin 17B are therefore being used as a default parameter and may affect the precision of the frequency output.

Based on the map developed by Bloyd, the generalized skew was adjusted to -0.50. Similar to the previous analysis, twenty published peak discharge events were used. Output results from the Log-Pearson Type III frequency curve compute a 100-year discharge of 7,740 ft^3/s and can be viewed below in Figures 19 and 20. Tabular data output can be located in Appendix F.

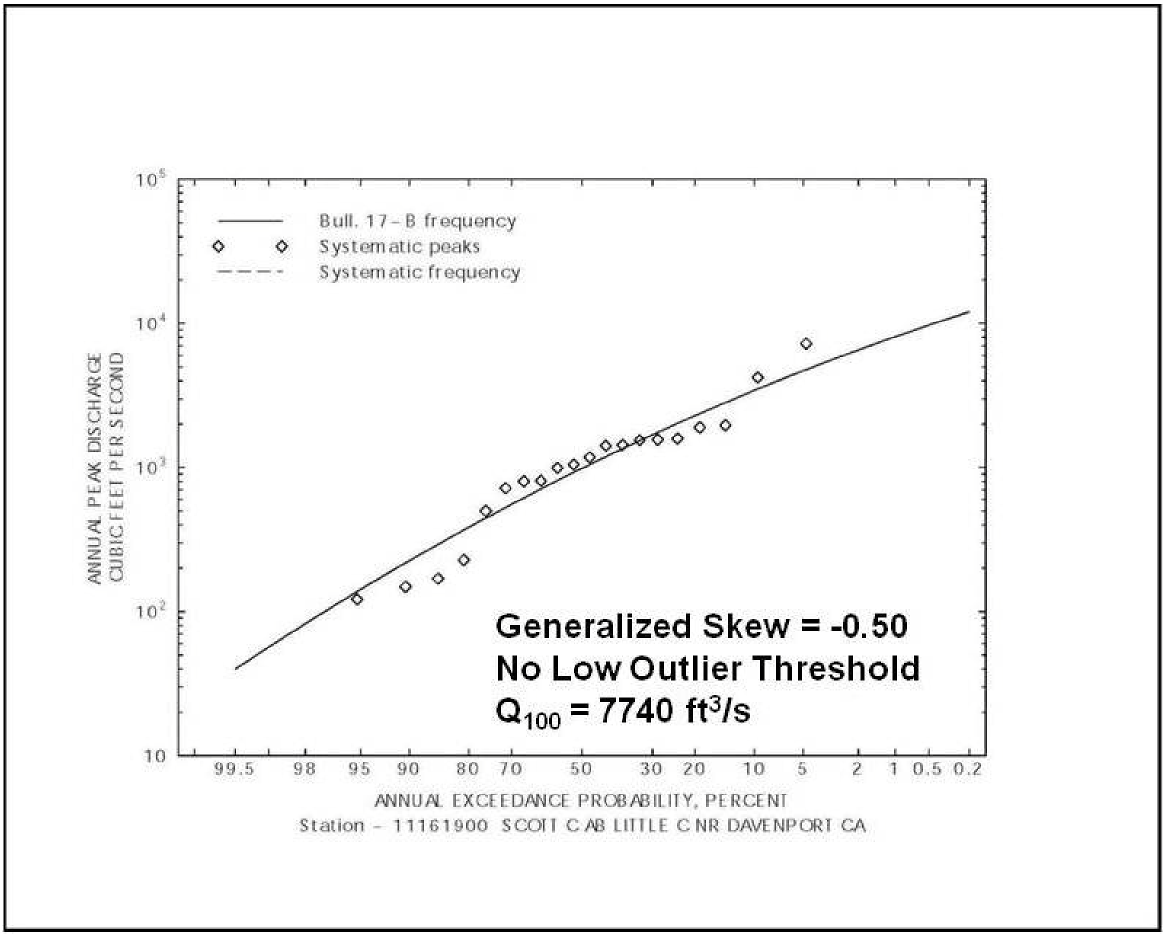

FIGURE 19. Log-Pearson Type III frequency curve using a generalized skew of -0.50 and no low outliers.

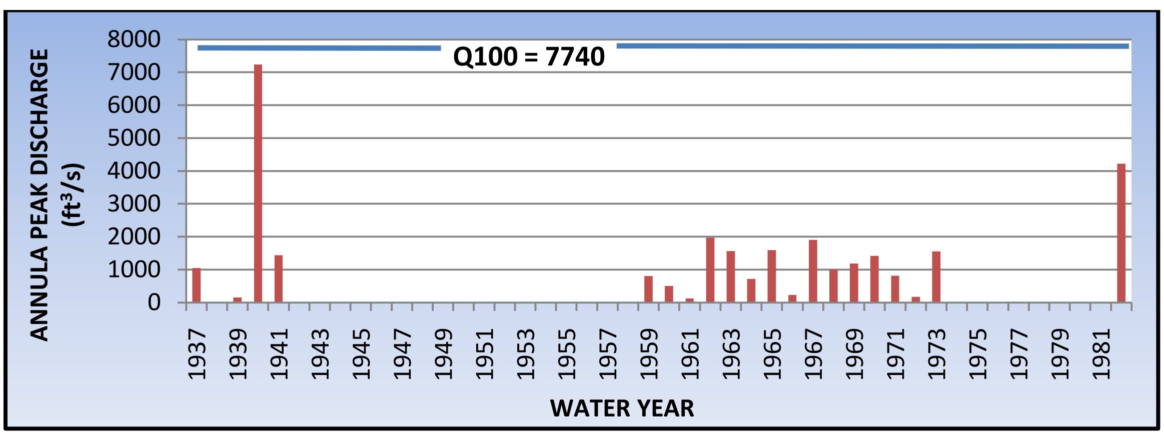

FIGURE 20. Log-Pearson Type III frequency output using a generalized skew of -0.50 and no low outliers and compared to peak discharge data used for the analysis.

Again, a low outlier threshold of 250 ft^3/s was used in an attempt to straighten the frequency curve, giving more emphasis to the larger peak flow events. Output

results from the Log-Pearson Type III frequency curve compute a 100-year discharge of 6,700 ft^3/s and can be viewed below in Figures 21 and 22. Tabular data output can be located in Appendix F. The outcome is a -14 percent difference when compared to values obtained before the removal of low outlier data.

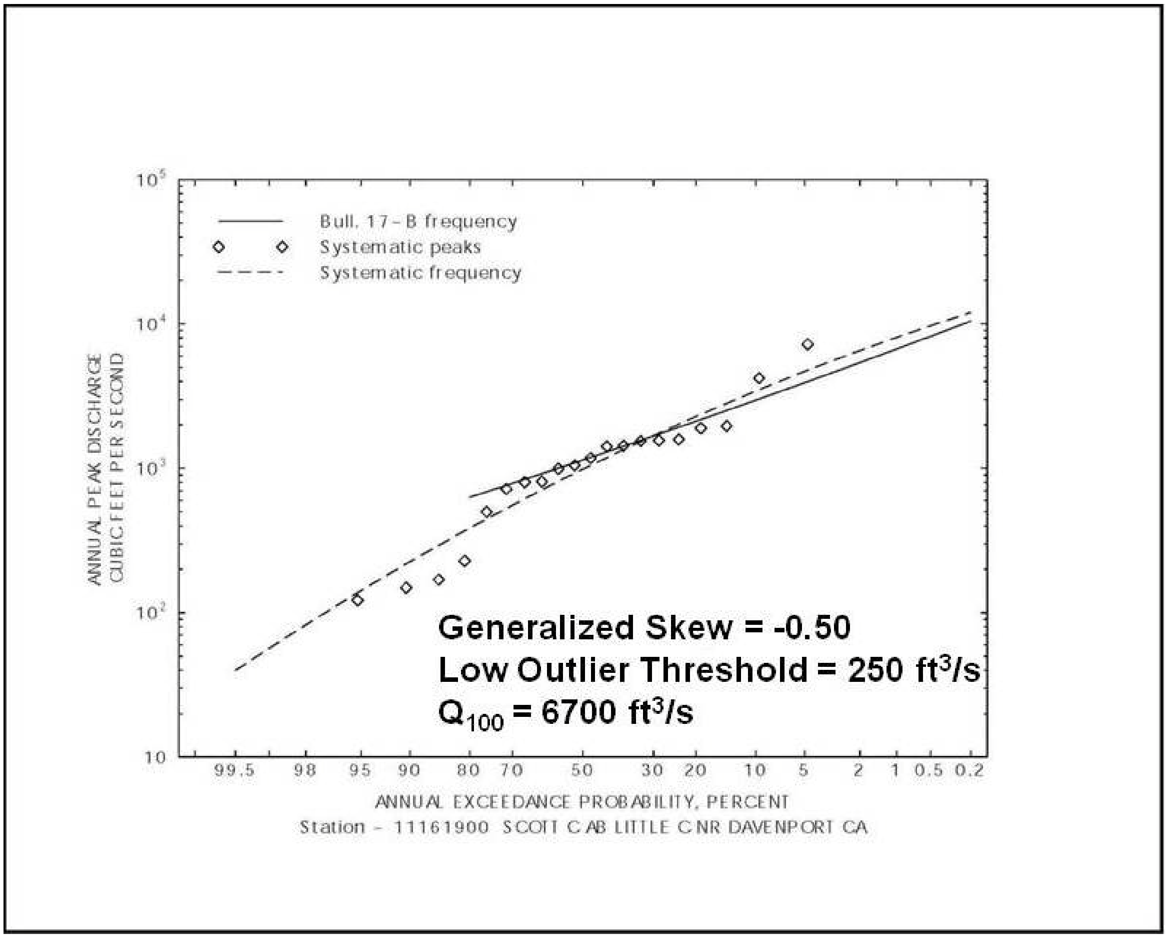

FIGURE 21. Log-Pearson Type III frequency curve using a generalized skew of -0.50 and a low outlier threshold of 250 ft^3/s.

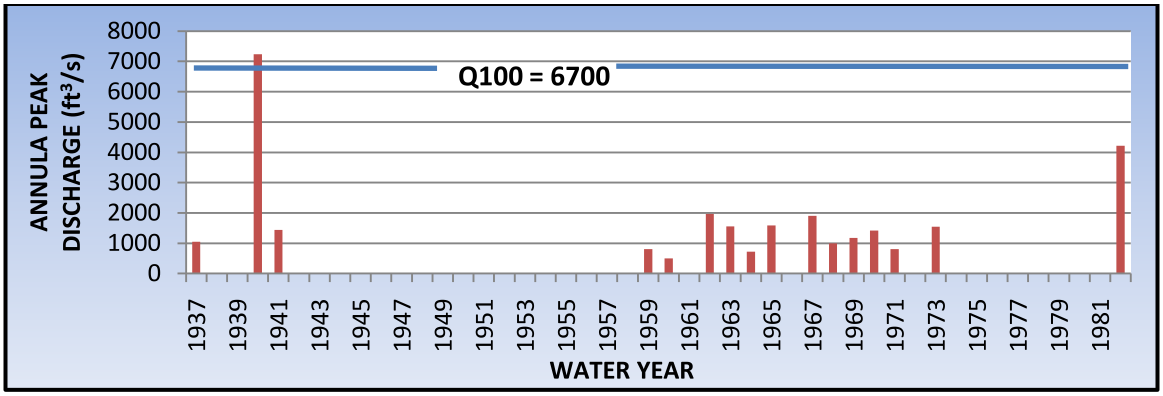

FIGURE 22. Log-Pearson Type III frequency output using a generalized skew of -0.50 and a low outlier threshold of 250 ft^3/s and compared to peak discharge data used for the analysis.

Regional Analysis

To develop a more localized generalized skew coefficient for Scott Creek, a regional frequency analysis was performed using current and discontinued gages located within a 50 mile radius of Scott Creek. As a start, 43 gages with a minimum of 10 published peak discharge values were located in the NWIS database. Peak values affected by regulation, urbanization and diversion were removed from the data set. Low outliers were then removed following procedures recommended in Bulletin 17B. The output frequency curves were then visually inspected for additional low outliers, which were removed accordingly (see *Low Outlier Threshold*). No high-outliers met the criteria for removal and all historic peaks were used in the final computation. Frequency curves exhibiting poor linearity, or a continuous “stair-step” pattern, were removed from the analysis. These gages include the following:

Cedar Creek Near Bell Station (11152900)
Uvas Creek near Morgan Hill (11154000)
Bean Creek at Scotts Valley (11160430)
Coyote Creek near Edenvale (11171500)
Alameda Creek at Union City (11180750)

To further improve data quality, a minimum limit of 14 peak discharge events was used. Gages not meeting these criteria, which were removed from the analysis, include the following:

Aptos Creek near Aptos (11159690)
Aptos Creek at Aptos (11159700)
Butano Creek near Pescadero (11162540)
Sharon Creek near Menlo Park (11162900)

Thirty-four gages were found which met the final criteria and used to develop the regional skew coefficient (Appendix H). Detailed peak values for these gages can be located in Appendices D and G. Of these gages, peak numbers used in the final analysis ranged from 14 for San Vicente Creek near Davenport (station 11161800) to 70 for Saratoga Creek near Saratoga (station 11169500).

The station skew coefficients which were computed after all low outliers had been removed from each of the 34 stations were multiplied by the bias-correction factor developed by Tasker and Stedinger (1986) to obtain an unbiased value. The median of these final values was then used as the generalized skew to be weighted with the station skew for the Scott Creek frequency curve which was not adjusted for bias. A new mean square error (MSE) was computed for these data, which is used in the frequency computation to appraise the accuracy of the data. The MSE was computed following guidelines recommended in Bulletin 17B. The sum of the squared differences between the true and estimated values of the skews were therefore divided by the number of observations to obtain the value.

This is shown in the following equation:

$$\text{MSE} = \sum_{i=0}^{N}(\text{Gs} - \text{Gg}) / \text{N} \qquad (11)$$

Where

MSE = mean square error

Gs = station skew for gaging station *i*

Gg = generalized skew for gaging station *i*

N = number of stations

Adjusted station skew values ranging from 1.128 for Scott Creek above Little Creek (station 11161900) with a low outlier threshold set at 250 ft^3/s, to -0.848 for Dry Creek at Union City (station 11180500). When no low outlier thresholds are used for Scott Creek, the maximum station skew coefficient is 0.561 for Uvas Creek above Uvas Reservoir, near Morgan Hill (station 11153900).

Output results from the Log-Pearson Type III frequency curve, using a regional generalized skew of -0.24 and an MSE of 0.040, result in a 100-year discharge of 8,970 ft^3/s and can be viewed below in Figure 23. Tabular data output can be located in Appendix I.

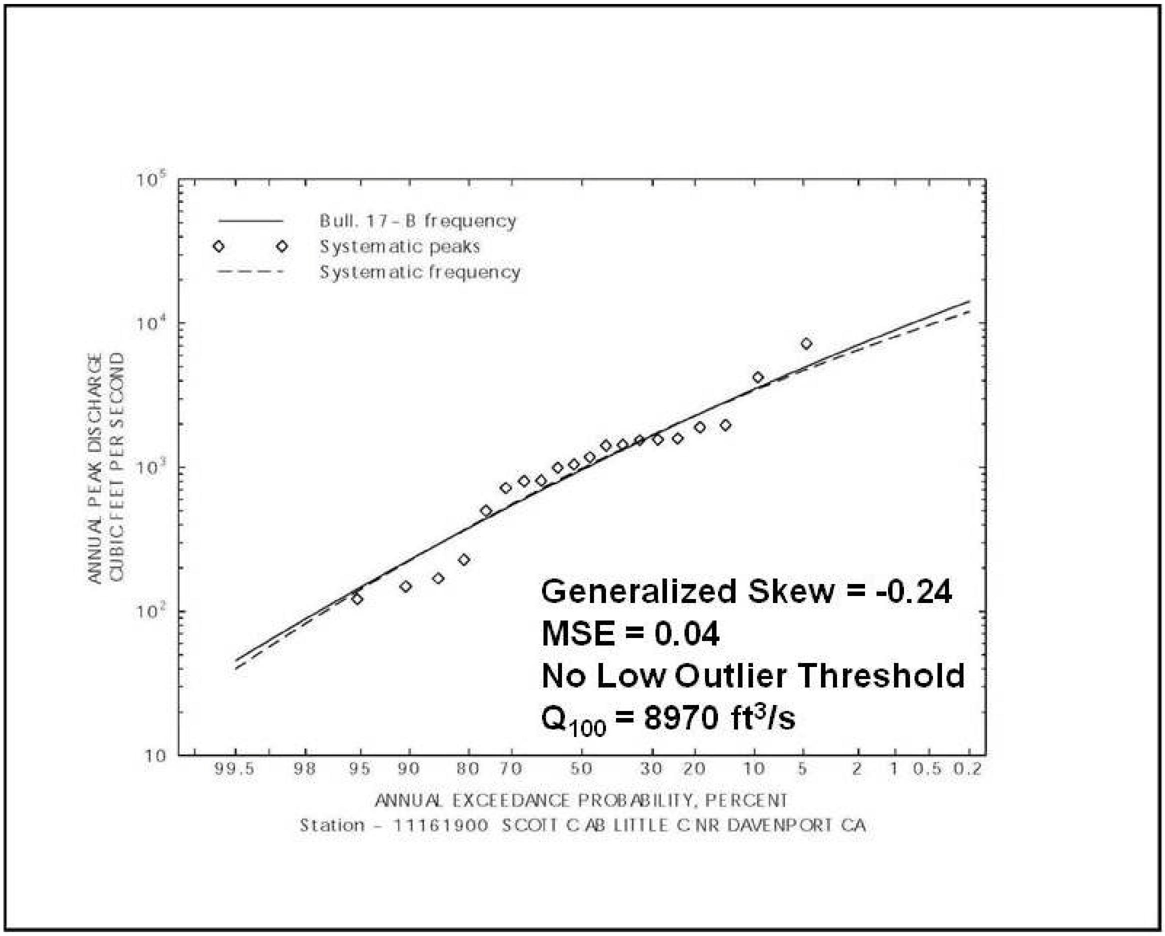

FIGURE 23. Log-Pearson Type III frequency curve using a generalized skew of -0.50 and no low outliers.

Output results from the Log-Pearson Type III frequency curve, using the regional generalized skew values and a low outlier threshold of 250 ft^3/s, result in a 100-year discharge of 5,840 ft^3/s and can be viewed below in Figure 24. Tabular data output can be located in Appendix I. The outcome is a -42 percent difference when compared to values obtained before the removal of low outlier data.

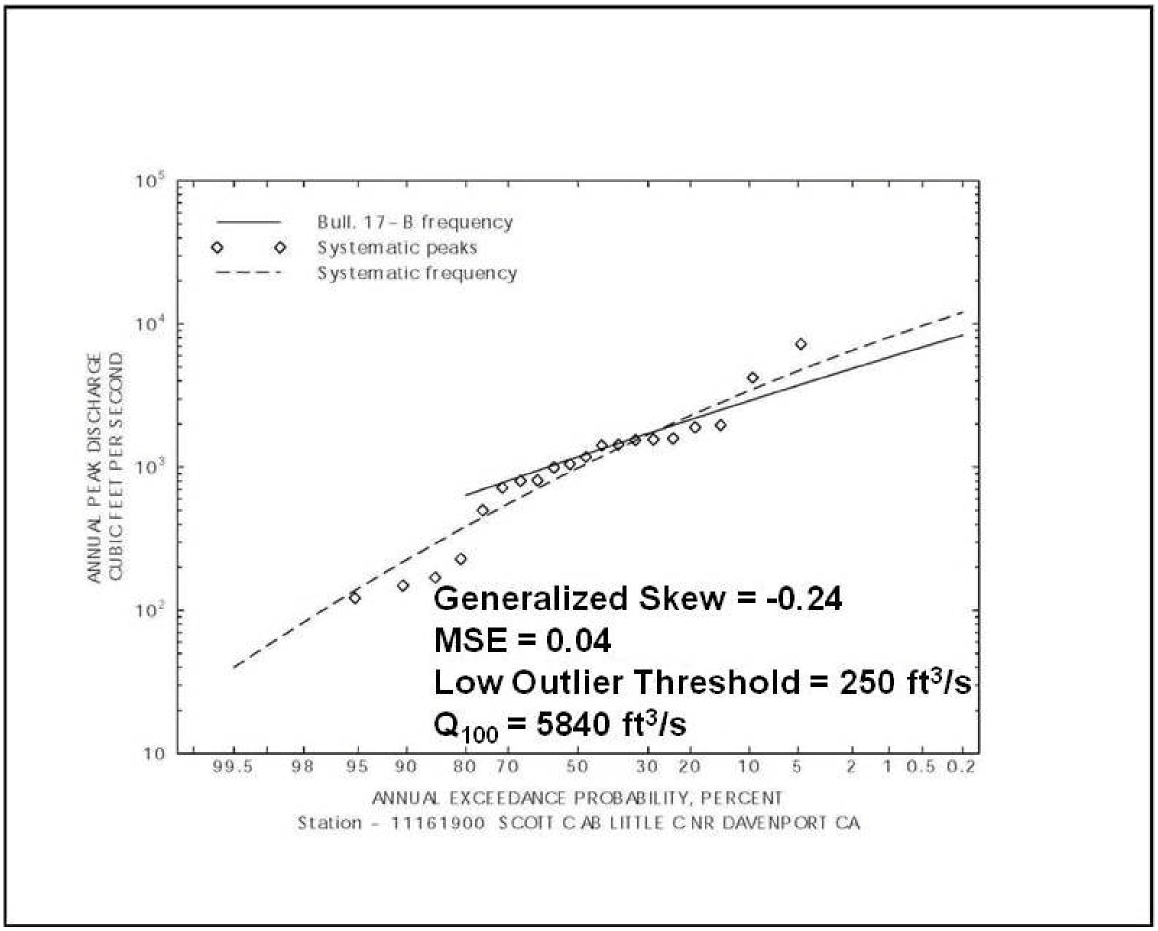

FIGURE 24. Log-Pearson Type III frequency curve using a generalized skew of -0.24 and a low outlier threshold of 250 ft^3/s.

Two-Station Comparison

Using a spreadsheet developed by Robert Meyer (retired USGS Hydrologist, California Water Science Center), seven two-station comparisons were completed to determine recurrence intervals for Scott Creek. As a criterion, gages selected for comparison with Scott Creek above Little Creek near Davenport contained a minimum of 50 years of peak discharge data after the removal of low outliers, and were located within the 50 mile radius previously determined for the regional frequency analysis. These gages, including the

number of years of peak discharge record and general distance to Scott Creek, are shown in Table 8.

TABLE 8. Streamgages used for two-station comparison.

Station Name	Station No.	Years of Peak Data	Rough Distance to 11161900 (miles)
Tres Pinos Ck nr Tres Pinos	11157500	53	50.0
Pajaro R at Chittenden	11159000	60	36.0
Soquel Ck at Soquel	11160000	55	15.5
San Lorenzo R at Big Trees	11160500	58	9.0
Pescadero Ck nr Pescadero	11162500	53	15.0
San Francisquito Ck at Stanford Univ.	11164500	58	25.0
Saratoga Ck at Saratoga	11169500	70	16.5

To maintain consistency and adhere to frequency analysis procedures and protocol, low outliers below a set threshold of 250 ft^3/s were removed from the 20 Scott Creek peak values. The generalized skew computed for the regional analysis was used for the two-station comparisons, with a station skew for Scott Creek unadjusted for bias. Direct peak correlation is poor when comparing the long-term gage peak values with those of Scott Creek as illustrated below in Figures 25-27. The best fit peak comparison R^2 values are for gaging stations Pescadero Creek near Pescadero, Soquel Creek at Soquel, and San Lorenzo River at Big Trees with values of 0.61, 0.59, and 0.57 respectively. The remaining R^2 values for San Francisquito Creek at Stanford University, Pajaro

River at Chittenden, Saratoga Creek at Saratoga, and Tres Pinos Creek near Tres Pinos result in 0.27, 0.12, 0.05, and 0.03 respectively.

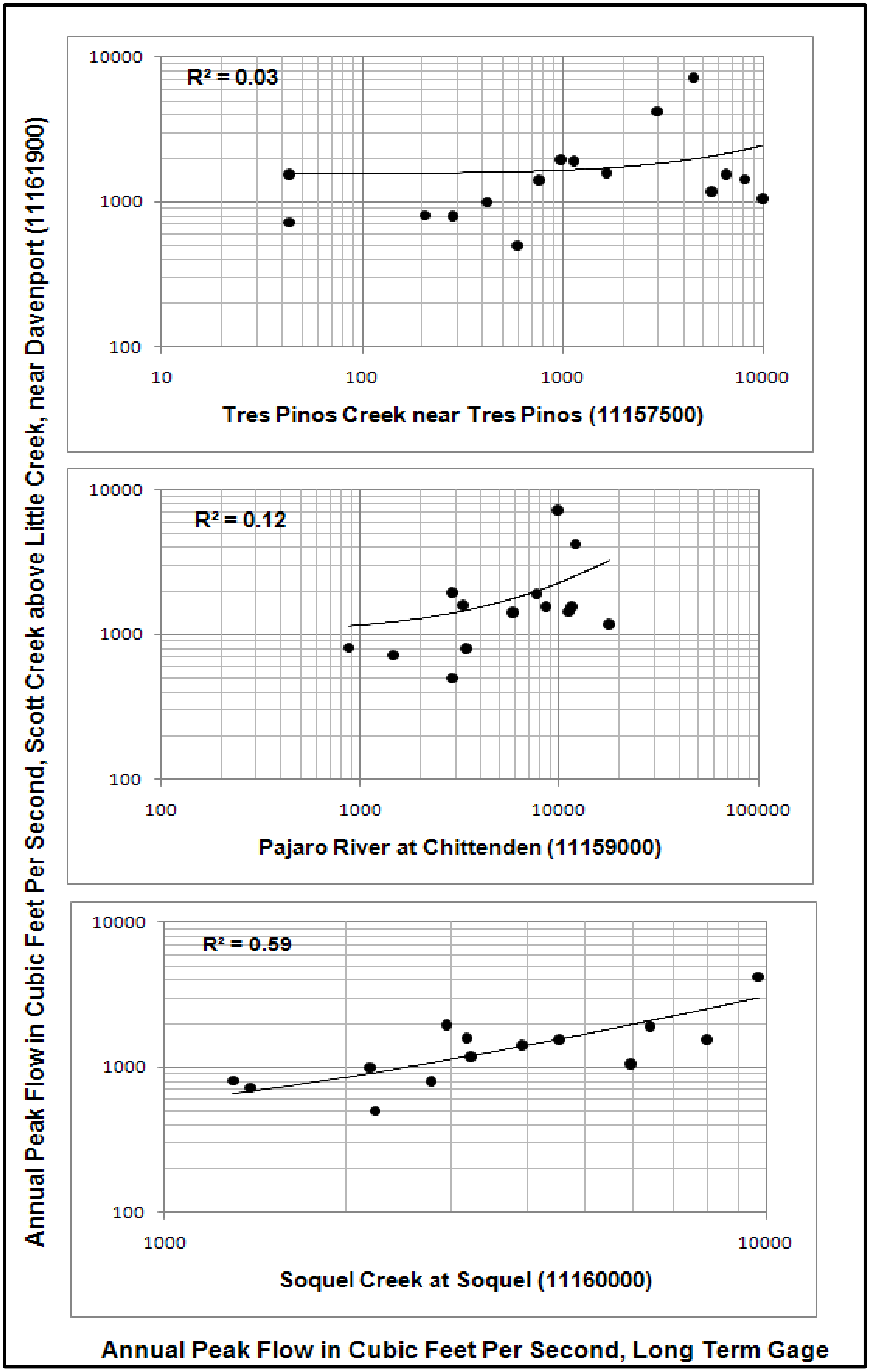

FIGURE 25. Peak correlation with stations 11157500, 11159000, and 1116000.

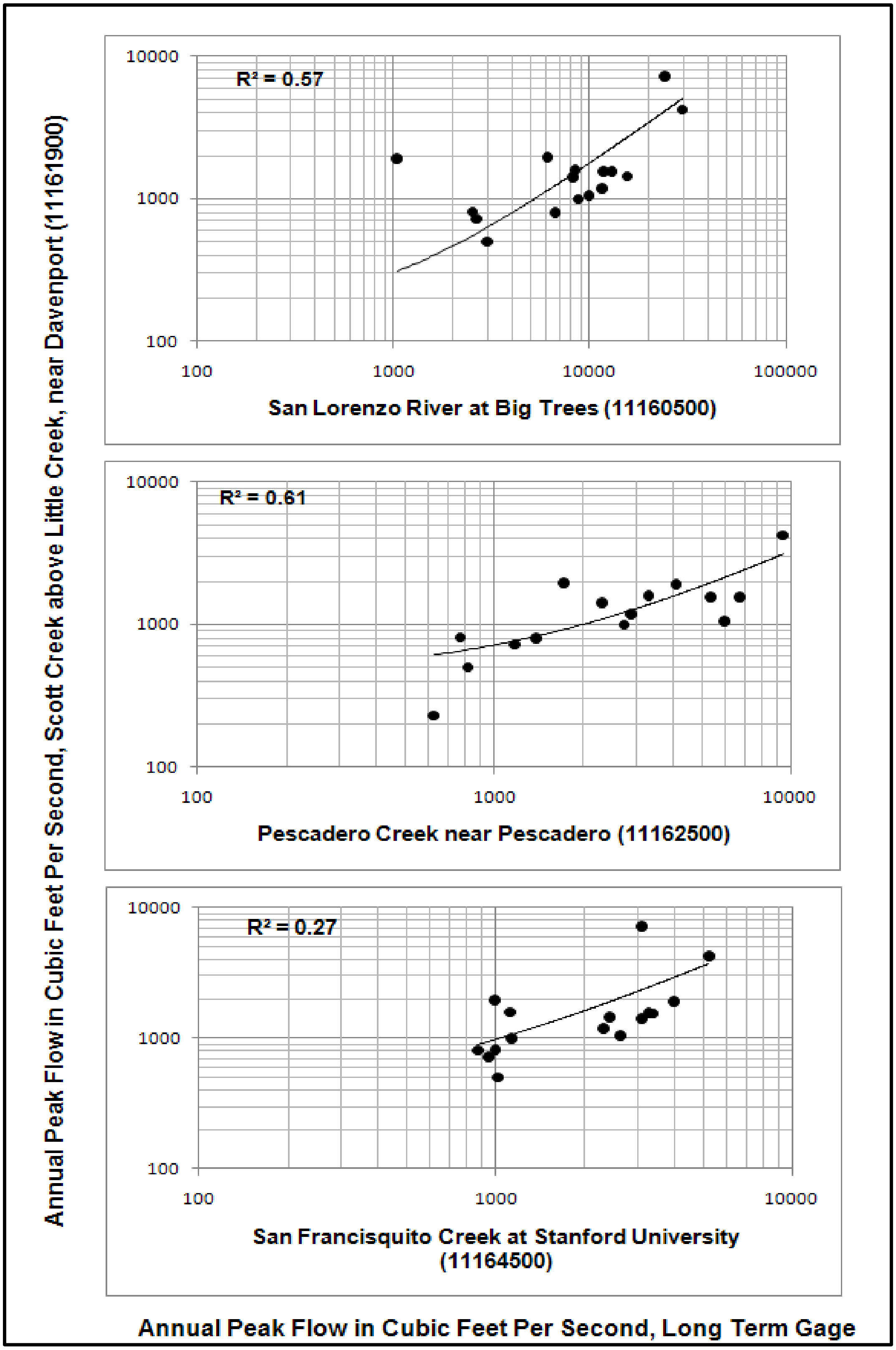

FIGURE 26. Peak correlation with stations 11160500, 11162500, and 11164500.

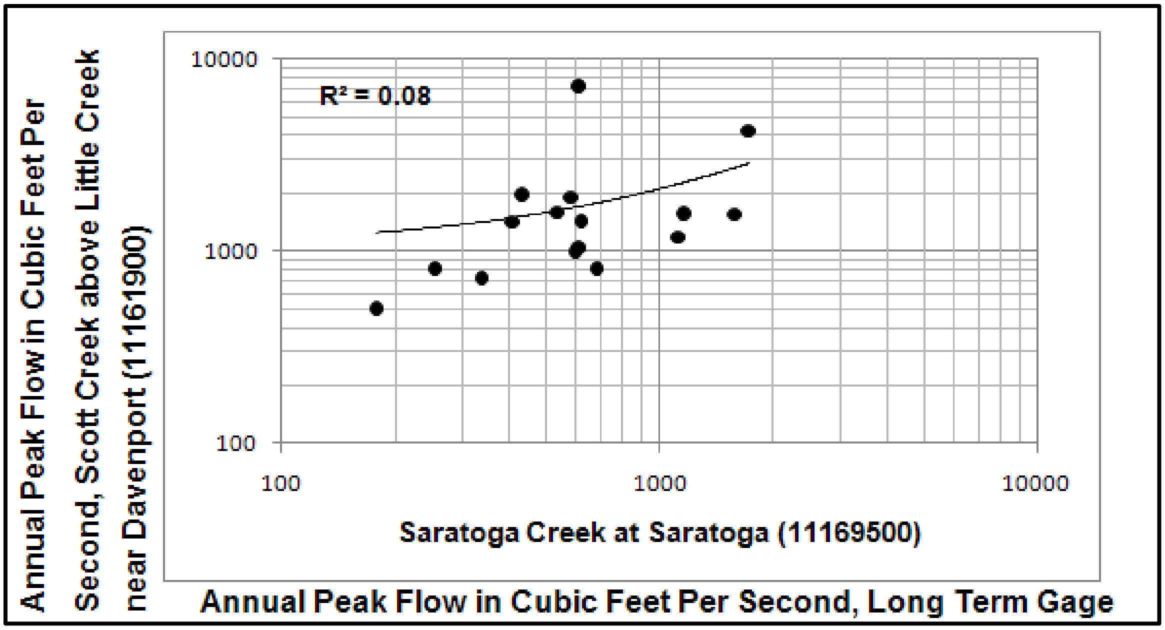

FIGURE 27. Peak correlation with station 11169500.

Recurrence interval results for the seven, two-station computations are illustrated in Tables 9-12.

TABLE 9. Recurrence intervals and peak values obtained from two-station comparison with stations 11157500 Tres Pinos Creek near Tres Pinos and 11159000 Pajaro River at Chittenden.

11157500

Probability	R.I.	Q
0.9950	1.01	363
0.9900	1.01	408
0.9500	1.05	570
0.9000	1.11	686
0.8000	1.25	864
0.5000	2	1371
0.4296	2.33	1516
0.2000	5	2233
0.1000	10	2913
0.0400	25	3899
0.0200	50	4729
0.0100	100	**5643**
0.0050	200	6651
0.0020	500	8143

11159000

Probability	R.I.	Q
0.9950	1.01	275
0.9900	1.01	316
0.9500	1.05	467
0.9000	1.11	579
0.8000	1.25	758
0.5000	2.00	1297
0.4296	2.33	1459
0.2000	5.00	2291
0.1000	10.00	3123
0.0400	25.00	4387
0.0200	50.00	5494
0.0100	100.00	**6751**
0.0050	200.00	8176
0.0020	500.00	10352

TABLE 10. Recurrence intervals and peak values obtained from two-station comparison with stations 11160000 Soquel Creek at Soquel and 11160500 San Lorenzo River at Big Trees.

11160000

Probability	R.I.	Q
0.9950	1.01	215
0.9900	1.01	247
0.9500	1.05	366
0.9000	1.11	455
0.8000	1.25	597
0.5000	2.00	1028
0.4296	2.33	1157
0.2000	5.00	1826
0.1000	10.00	2497
0.0400	25.00	3520
0.0200	50.00	4419
0.0100	100.00	**5441**
0.0050	200.00	6603
0.0020	500.00	8381

11160500

Probability	R.I.	Q
0.9950	1.01	335
0.9900	1.01	380
0.9500	1.05	543
0.9000	1.11	662
0.8000	1.25	846
0.5000	2.00	1382
0.4296	2.33	1539
0.2000	5.00	2324
0.1000	10.00	3085
0.0400	25.00	4209
0.0200	50.00	5170
0.0100	100.00	**6241**
0.0050	200.00	7435
0.0020	500.00	9225

TABLE 11. Recurrence intervals and peak values obtained from two-station comparison with stations 11162500 Pescadero Creek near Pescadero and 11164500 San Francisquito Creek at Stanford University.

11162500

Probability	R.I.	Q
0.9950	1.01	212
0.9900	1.01	245
0.9500	1.05	368
0.9000	1.11	462
0.8000	1.25	612
0.5000	2.00	1074
0.4296	2.33	1214
0.2000	5.00	1948
0.1000	10.00	2694
0.0400	25.00	3846
0.0200	50.00	4867
0.0100	100.00	**6039**
0.0050	200.00	7379
0.0020	500.00	9447

11164500

Probability	R.I.	Q
0.9950	1.01	208
0.9900	1.01	243
0.9500	1.05	380
0.9000	1.11	489
0.8000	1.25	672
0.5000	2.00	1290
0.4296	2.33	1490
0.2000	5.00	2622
0.1000	10.00	3889
0.0400	25.00	6030
0.0200	50.00	8086
0.0100	100.00	**10600**
0.0050	200.00	13658
0.0020	500.00	18706

TABLE 12. Recurrence intervals and peak values obtained from two-station comparison with station 11169500 Saratoga Creek at Saratoga.

11169500

Probability	R.I.	Q
0.9950	1.01	217
0.9900	1.01	253
0.9500	1.05	387
0.9000	1.11	490
0.8000	1.25	657
0.5000	2.00	1181
0.4296	2.33	1342
0.2000	5.00	2197
0.1000	10.00	3081
0.0400	25.00	4466
0.0200	50.00	5709
0.0100	100.00	**7149**
0.0050	200.00	8811
0.0020	500.00	11400

Results of Two-Station Comparisons

Peak discharge values computed using the seven two-station comparisons for the 100-year design flow at Scott Creek above Little Creek near Davenport range from a maximum of 10,600 ft^3/s when compared with San Francisquito Creek at Stanford University, to 5,440 ft^3/s when compared with Soquel Creek at Soquel. The maximum value of 10,600 ft^3/s appears to be an outlier, and is much larger when compared to the other six discharge values. This peak event is followed by a second largest peak discharge value of 7,150 ft^3/s, the result of the comparison with Saratoga Creek at Saratoga. Comparison of the three best fit data sets (station numbers 11160000, 11160500, 11162500) result in values which are in close proximity of each other, ranging from 5,440 ft^3/s to 6,240 ft3/s. An average value of these three peak discharge results gives a 100-year design flow of 5,900 ft^3/s.

Summary of 100-Year Frequency Results and Method Comparison

Computed peak discharge at the 100-year recurrence interval varies greatly with each method used in this analysis (Table 13). Direct equations developed by Cruss and Young, as well as HEC-1 modeling, compute peak flow values significantly larger than other equations and methods used for this investigation. It is important to note that the Rumann *et al*. computations were based on a drainage area of 30.0 square miles, as compared to the drainage area of 25.1 square miles used during this study. Central and North Coast equations developed by Waananen and Crippen compare well with each other, while the North Coast equation result correlates well with a direct watershed comparison to Corralitos Creek. The drainage adjustment values vary significantly, and can only provide a general idea of the possible recurrence value. All equations however, use regional generalizations and will not be as accurate as computations which use actual peak data from Scott Creek. Waananen and Crippen noted in *Magnitude and Frequency of Floods in California* that the wide ranges of climatic and topographic conditions in California produce large variations in the watershed response to precipitation. This can only provide an added degree of uncertainty when computing peak frequency events.

Results of the Log-Pearson Type III analysis show the different effects and importance of choosing the proper generalized skew coefficient and low outlier threshold. Output from the regional analysis is therefore a better indicator of the true 100-year recurrence discharge. This result is further verified by the excellent comparison of the average peak flow of the three best-fit two-station

computations. The outcome is a 1.0 percent difference when comparing a regional frequency value of 5,840 ft^3/s to an average two-station computation value of 5,900 ft^3/s.

Analyses of these data indicate that a final 100-year design flow peak discharge for Scott Creek above Little Creek near Davenport is 5,840 ft^3/s. The unit discharge per square mile, with a drainage area of 25.1 mi^2 at this location is 233 ft^3/s. It can therefore be assumed that when using a unit discharge of 233 ft^3/s at the downstream bridge location, and a drainage area of 27.1mi^2, a 100-year design flow of 6,310 ft^3/s can be expected. Using the same assumption, the design flow at the lower gage, with a drainage area of 28.5 mi^2, would adjust to 6,520 ft^3/s.

TABLE 13. Peak discharge results for Scott Creek from various methods.

Method (Furnished data represented with "*****" based on drainage area of 30.0 mi^2. All other methods based on drainage area of 25.1 mi^2.)	**Peak Discharge (ft^3/s)**
*HEC-1	17,200
*Regression Equation (Cruss and Young)	18,000
*FIS	12,300
Central Coast Equation	11,700
North Coast Equation	7,430
Direct Comparison	8,230
Drainage Area Adjustment	22,550 – 3,200
LP III (-0.3 skew), no outlier	8,360
LP III (-0.3 skew), low outlier 250 ft^3/s	7,080
LP III (-0.5 skew), no outlier	7,740
LP III (-0.5 skew), low outlier 250 ft^3/s	6,700
Regional Analysis, no outlier	8,970
Regional Analysis, low outlier 250 ft^3/s	5,840
Two-Station Comp (7 comps)	10,600 – 5,440
Two-Station Comp (best fit, 3 comps)	5,440 – 6,240
Average Two-Station Comp (best fit, 3 comps)	5,900

CHAPTER VI: LOWER SCOTT CREEK GAGE

Indirect Measurement of Discharge

Indirect methods were used to determine discharge in the confined channel at Lower Scott Creek before overbank flows occur. It is assumed that extremely high velocities are present at the channel's center, significantly slowing in the dense vegetation present on the right and left banks. The retarded flow in the upper vegetated banks will most likely create a backwater effect with an elevated water surface.

Survey of Site

The lower Scott Creek channel and upper banks were surveyed by the author and Ernest R. Houston (USGS Hydrologist) on October 15 and 16, 2008, using a Zeiss Ni-2 level #W252537. The two peg test completed on October 15 indicated that there was no error in the line of collimation, and no instrument adjustments were required. The reference point (Hub 1) for this survey is a wooden spike with a nail, driven into the downstream, upper left bank at the road pull-out. The survey was run to an arbitrary datum of 99.99 feet monumented by Hub 1. The survey reach is 322 feet above the river ford, and 318 feet below the river ford, with additional elevations along the road on the left bank for about 450 feet downstream of cross-section 3 (Appendix K).

Conditions at this site are poor for an indirect measurement. The reach is densely overgrown, with a majority of the cross-sectional area filled by dense stands of mature trees, and thick growths of vines and bushes. Only the central portion of the channel over the perennial flowing thalweg is clear of vegetation.

This made it impossible to locate the levee system and find an adequate number of cross-sections for a more detailed analysis. Upper bank elevations, as illustrated below in Figure 28, clearly show that overbank discharge will first occur on the left bank, and is not subject to overflow on the steeper right bank. This location of main channel overflow would most likely be found above this reach and below the confluence with Archibald Creek. For detailed photographs of the cross-sections and channel reach, please refer to Appendix K.

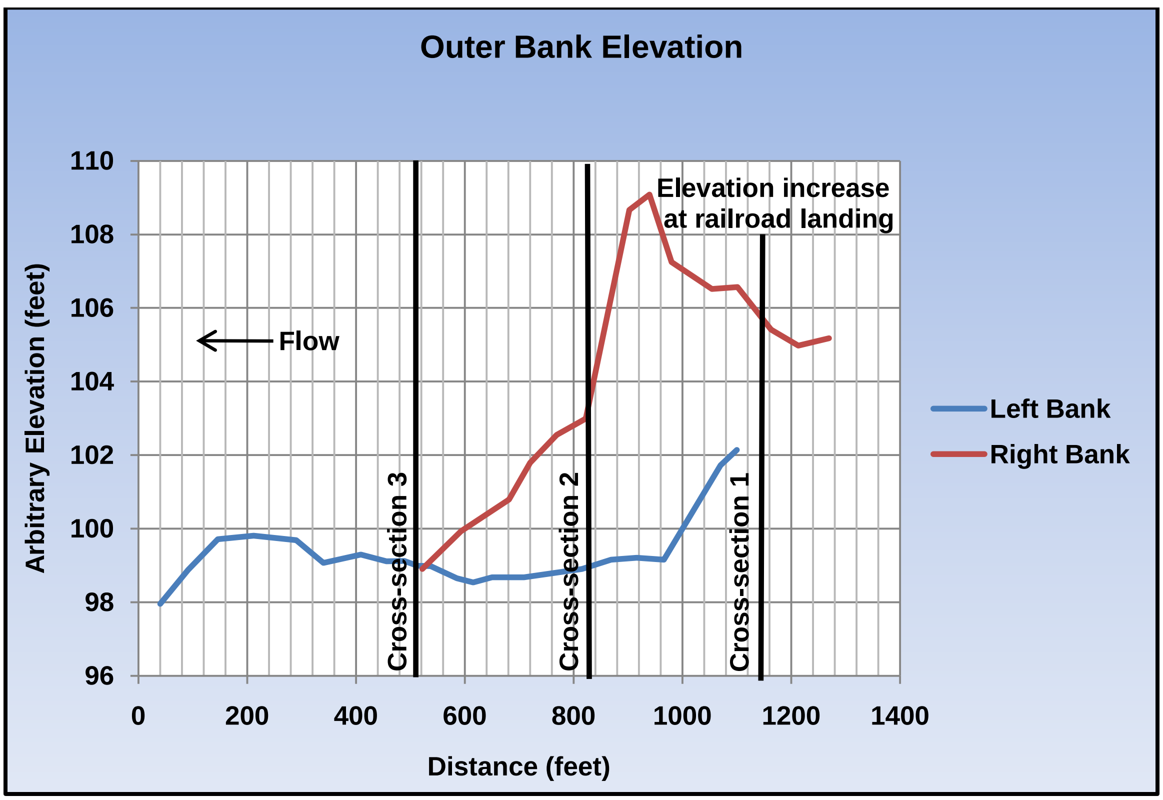

FIGURE 28. Comparison of right and left bank outer bank elevations along Lower Scott Creek, with cross-section locations.

Cross-section 1, illustrated in Figure 29, is located 322 feet above the river ford. The left bank is steep and not subject to overflow. The levee on the right bank however, is subject to overflow during extreme events. The highest

elevation at this cross-section was used as an indicator to determine the maximum cross-sectional area before breaching the levee on the left bank.

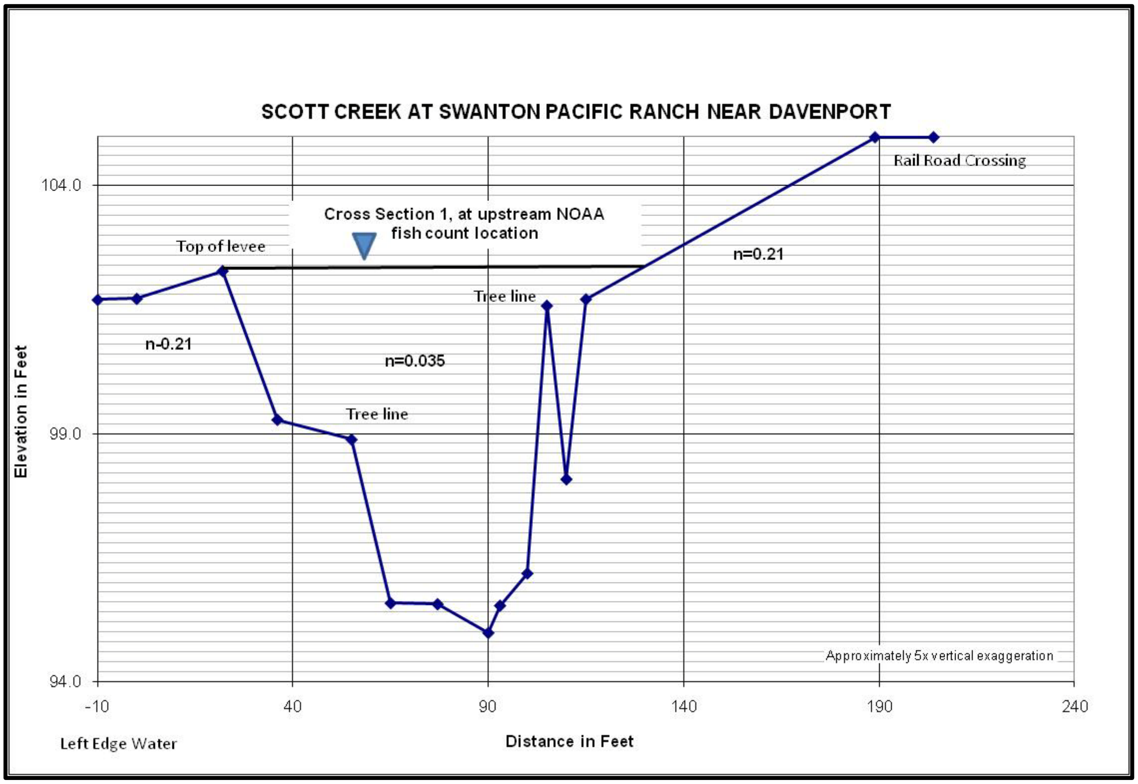

FIGURE 29. Cross-section 1 located at upper section of the reach.

Cross-section 2, illustrated in Figure 30, is located at the river ford and potential gaging station 322 feet downstream of cross-section 1. A change in vertical height of 1.03 feet was measured between cross-sections 1 and 2 during the transit-stadia survey. This was used to determine the water's elevation and profile at this location by dropping the maximum confined channel elevation of cross-section 1 a total of 1.03 feet to cross-section 2.

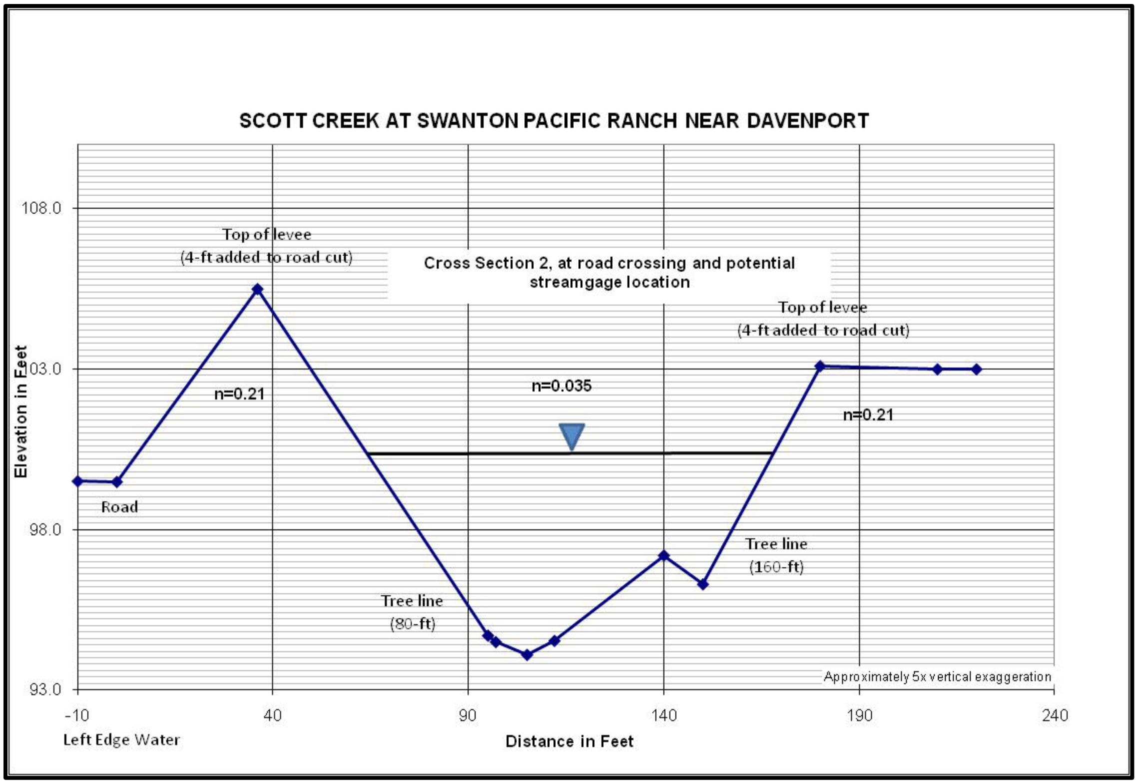

FIGURE 30. Cross-section 2 located at river ford.

Cross-section 3, illustrated in Figure 31, is located 318 feet below the river ford and about 100 feet above the NOAA fish capture weir. A channel slope of 0.83 feet was measured between cross-sections 2 and 3 during the transit-stadia survey was used to determine the water's elevation and profile at this site.

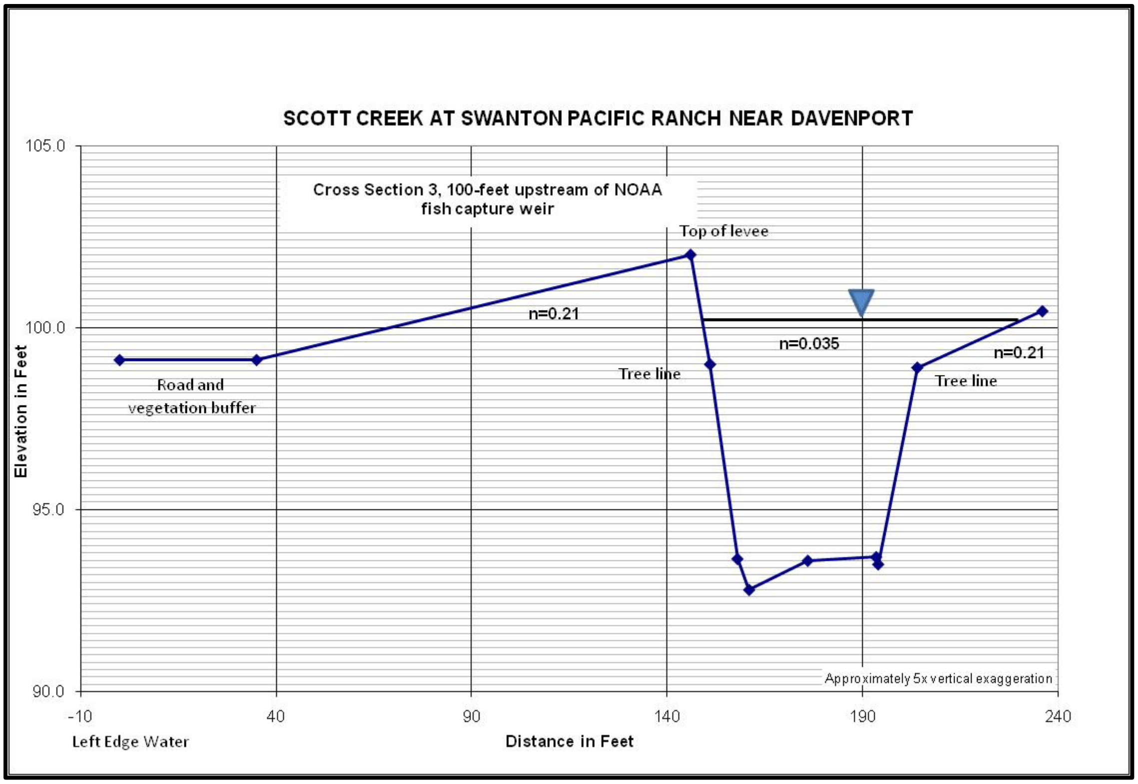

FIGURE 31. Cross-section 3 located at upper section of the reach.

Basic Cross-Sectional Discharge

The Manning's Equation was used directly at each cross-section to compute discharge. Manning's roughness coefficients, as described in *Methods*, were incorporated into this computation on a sectional basis, applying the required coefficients to each specific subdivided segment. Discharge values range from 2,230 ft^3/s at cross-section 3 to 2,780 ft^3/s at cross-section 2, with an average value of 2530 ft^3/s. Percent differences range from 7.0 to 22.0 percent when comparing these final values. Cross-sectional results, including specific sectional data are illustrated below in Tables 14-16.

TABLE 14. Output from direct use of the Manning's Equation showing sectional discharge distribution at cross-section 1.

SLOPE CONVEYANCE

Cross-section 1 at upstream NOAA fish count location

fall =	1.030
length =	322.00
S =	0.003
S1/2 =	0.057

Station	n	Distance	Water Surface	Elevation	Depth	Mean Depth	Area	WP	R	R2/3	Q
22	0.210	0	102.30	102.30							
36	0.210	14		99.30	3.00	1.50	21.0	14.3	1.4667	1.29	**10.8**
55	0.210	19		98.90	3.40	3.20	60.8	19.0	3.1993	2.17	**52.8**
65	0.035	10		95.60	6.70	5.05	50.5	10.5	4.7956	2.84	**344.8**
77	0.035	12		95.60	6.70	6.70	80.4	12.0	6.7000	3.55	**686.1**
90	0.035	13		95.00	7.30	7.00	91.0	13.0	6.9926	3.66	**799.0**
93	0.035	3		95.50	6.80	7.05	21.2	3.0	6.9541	3.64	**185.0**
100	0.035	7		96.20	6.10	6.45	45.2	7.0	6.4180	3.45	**374.4**
105	0.035	5		101.60	0.70	3.40	17.0	7.4	2.3100	1.75	**71.3**
110	0.035	5		98.10	4.20	2.45	12.3	6.1	2.0071	1.59	**46.8**
115	0.210	5		101.70	0.60	2.40	12.0	6.2	1.9477	1.56	**7.5**
139	0.210	24		102.30	0.00	0.30	7.2	24.0	0.2999	0.45	**1.3**
Totals		117					418.5	122.6	43.0909	25.96	**2,580**

TABLE 15. Output from direct use of the Manning's Equation showing sectional discharge distribution at cross-section 2.

Cross-section 2 at road crossing and potential streamgage location

fall =	0.830
length =	318.00
S =	0.003
S1/2 =	0.051

Station	n	Distance	Water Surface	Elevation	Depth	Mean Depth	Area	WP	R	R2/3	Q
59	0.210	0	101.27	101.27							
80	0.210	21		97.40	3.87	1.94	40.1	21.1	1.9020	1.54	**22.2**
95	0.035	15		94.70	6.57	5.22	78.3	15.2	5.1374	2.98	**505.7**
97	0.035	2		94.50	6.77	6.67	13.3	2.0	6.6369	3.53	**102.2**
105	0.035	8		94.10	7.17	6.97	55.8	8.0	6.9613	3.65	**441.0**
112	0.035	7		94.50	6.77	6.97	48.8	7.0	6.9586	3.64	**385.7**
140	0.035	28		97.20	4.07	5.42	151.8	28.1	5.3950	3.08	**1012.6**
150	0.035	10		96.30	4.97	4.52	45.2	10.0	4.5018	2.73	**267.3**
160	0.210	10		98.40	2.87	3.92	39.2	10.2	3.8363	2.45	**34.7**
173	0.210	13		101.27	0.00	1.44	17.9	12.8	1.3986	1.25	**8.1**
Totals		113					490.3	114.5	42.7280	24.84	**2,779**

TABLE 16. Output from direct use of the Manning's Equation showing sectional discharge distribution at cross-section 3.

Cross-section 3 located 100-feet upstream of NOAA capture weir

fall =	0.830
length =	318.00
S =	0.003
S1/2 =	0.051

Station	n	Distance	Water Surface	Elevation	Depth	Mean Depth	Area	WP	R	R2/3	Q
149	0.210	0	100.44	100.44							
151	0.210	2		99.00	1.44	0.72	1.4	2.5	0.5843	0.70	**0.4**
158	0.035	7		93.70	6.74	4.09	28.6	8.8	3.2608	2.20	**136.6**
161	0.035	3		92.80	7.64	7.19	21.6	3.1	6.8868	3.62	**169.4**
176	0.035	15		93.60	6.84	7.24	108.6	15.0	7.2297	3.74	**880.8**
194	0.035	18		93.70	6.74	6.79	122.2	18.0	6.7899	3.59	**950.6**
195	0.035	1		93.50	6.94	6.84	6.8	1.0	6.7072	3.56	**52.8**
204	0.210	9		98.90	1.54	4.24	38.2	10.5	3.6358	2.36	**32.6**
236	0.210	32		100.44	0.00	0.77	24.6	32.0	0.7691	0.84	**7.5**
Totals		87					352.1	91.0	35.8635	20.60	**2,230**

Slope Area

A three cross-section slope area with a channel length of 640 feet was computed using the *Slope Area Computation Program* (SAC). A link to the user's manual can be located at http://water.usgs.gov/software/SAC /code/doc/sacman.pdf. SAC follows USGS standardized procedures for computing discharge by the slope-area method and solves the 1-D steady-state energy and continuity equations for discharge given upstream and downstream water-surface elevations. Discharge values are therefore computed between sections providing three output possibilities. Output from this computation can be located in Appendix L. These outputs include a discharge value between cross-sections 1 and 2, cross-sections 2 and 3, and cross-section 1and 3. All subreaches are evaluated by the program, resulting in a final discharge value of 2,500 ft^3/s before bank overspill. Frequency results indicate that a discharge of 2,500 ft^3/s has a recurrence interval of about 7 years.

Evaluation of Slope Area Output

The change in velocity head (H_v) indicates that subreach 1-2 is hydraulically expanding, with a 28 percent spread. In expanding reaches, the conveyance procedure is questionable and should be avoided if possible. The CX ratio (computed discharge divided by the discharge computed with no expansion loss, K=0), is less than 1.0, indicating losses due to expansion. The conveyance ratio of 0.74 is within the required limits ($0.7 < K_u/K_d < 1.4$). Fall (ΔH) through the reach is less than the friction head (H_f), and the ratio of friction head to fall is 1.24. The downstream velocity head is less than that upstream. Values indicate non-uniform flow regime, and can be located in Table 17.

Subreach 2-3 is hydraulically contracting with full energy recovery. The drop in the water surface profile between these subreaches is not totally a result of friction loss (H_f), but includes acceleration between subsections. The CX ratio is equal to 1.0, indicating no losses due to expansion or contraction. The conveyance ratio is 1.28 and within the required limits. Fall through the reach is greater than the friction head, and the ratio of friction head to fall is 0.66. The downstream velocity head is greater than the upstream velocity head. Values indicate a uniform flow regime, and can be located in Table 18.

Subreach 1-3 is hydraulically contracting. The CX ratio is very close to 1.0, indicating limited losses due to expansion or contraction. The conveyance ratio is 0.95 and within the required limits. Fall through the reach is greater than the friction head, and the ratio of friction head to fall is 0.71. The downstream velocity

head is greater than the upstream velocity head. Values indicate a uniform flow regime, and can be located in Table 19.

Subreach Properties

TABLE 17. SAC output for subreach 1-2.

Subreach	1-2
Discharge	3100
Type	Expanding
Length	322
Fall (ΔH) (ft)	1.03
Friction Head (H_f)	1.279
K_u/K_d (conveyance ratio)	0.74
Hv (change in H_v)	0.32

TABLE 18. SAC output for subreach 2-3.

Subreach	2-3
Discharge	2100
Type	Contracting
Length	318
Fall (ΔH) (ft)	0.83
Friction Head (H_f)	0.552
K_u/K_d (conveyance ratio)	1.28
Hv (change in H_v)	-0.39

TABLE 19. SAC output for subreach 1-3.

Subreach	1-3
Discharge	2510
Type	Contracting
Length	640
Fall (ΔH) (ft)	1.86
Friction Head (H_f)	1.626
K_u/K_d (conveyance ratio)	0.95
Hv (change in H_v)	-0.07

The Froude number for all sections indicates that the flow is sub-critical. In this state, the role played by gravity forces is more pronounced and has a low velocity and tranquil flow. This is a result of the higher roughness values located in the densely vegetated banks. Cross-sectional information, including Froude

numbers can be located in Table 20.

Cross-Sectional Properties

TABLE 20. Cross-sectional information for all sections.

Section	1	2	3
Area (sq/ft)	418	492	352
Alpha	1.493	1.252	1.147
Froude No.	0.56	0.43	0.62
Velocity (f/s)	6.0	5.1	7.1
Velocity Head (Hv)	0.83	0.51	0.90
N Value SA 2	0.035	0.035	0.035
N Value SA 2	0.210	0.210	0.210

High Flow Measurement Capability

Cableway

A cableway located at cross-section 2, or anywhere along this reach, could not be constructed to span a design flow of the 100-year event. Flood frequency analyses have determined that a 100-year recurrence discharge of 6,520 ft^3/s is likely. Slope conveyance and slope area computations indicate that a discharge of this magnitude would certainly exit the main channel, flowing out past the riparian corridor through the agricultural fields on the left bank. The nearest upstream location with a confined channel to maintain all flow events is sited directly downstream of the confluence with Little Creek. This is illustrated in the terrain map below (Figure 32).

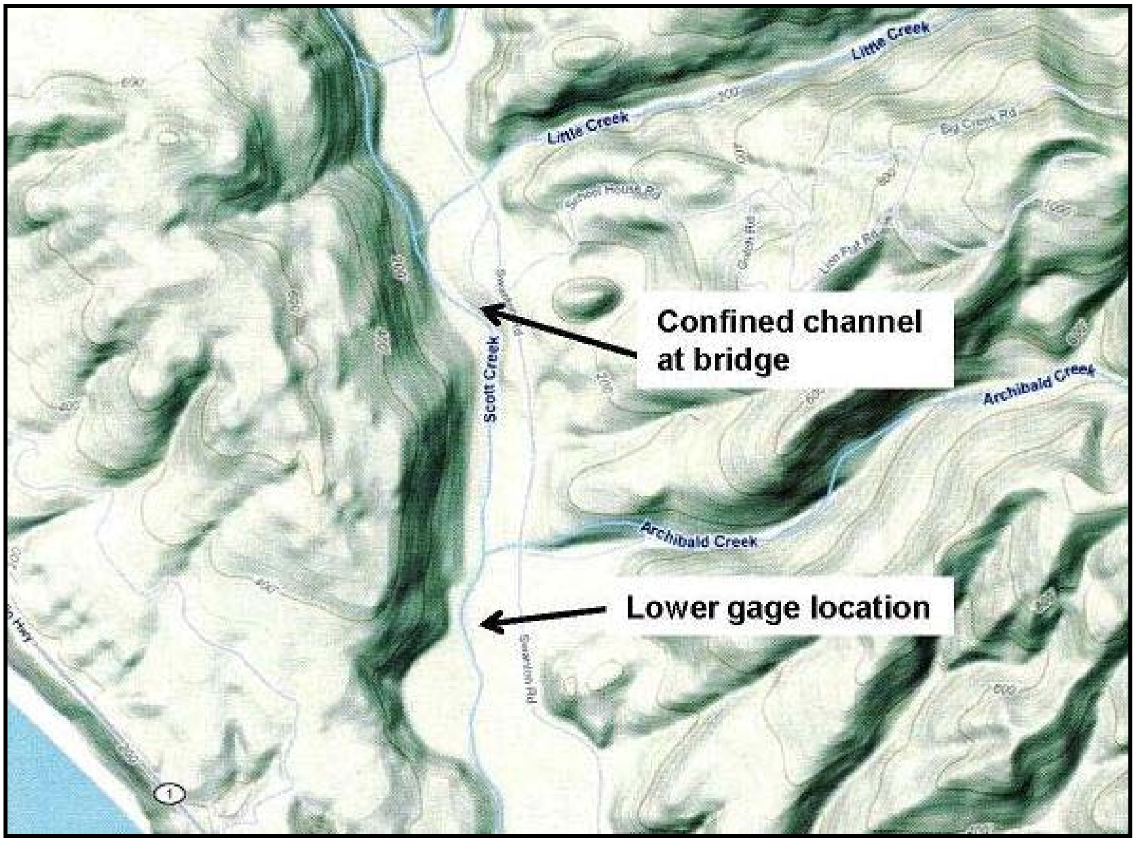

FIGURE 32. Terrain map of Scott Creek.

A standardized USGS A-frame manned cableway can be constructed spanning the reach at a length of 220 feet, with left and right bank installations positioned 40 feet from the levee system (Figure 33). This length will provide measurement and crossing capability for a design discharge greater than maximum channel overflow 2,500 ft^3/s, while still allowing 10 feet of freeboard below the bottom of the cable car on a loaded cable. Discharges greater than 2,500 ft^3/s are unpredictable, flowing outside the upper left-bank levee and flooding the agricultural fields adjacent to the span of the cableway. Design specifications for the construction of a cableway at this location can be found in Appendix M.

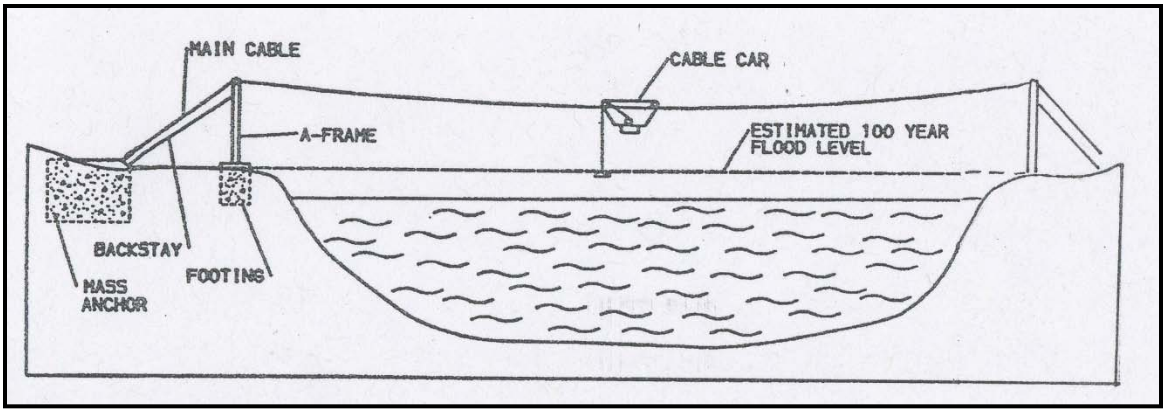

FIGURE 33. Standardized manned USGS cableway.

A bank operated cableway could be constructed to span the same distance and capture similar discharge events. Benefits of this type of system include cost savings and increased safety of field personnel. Various systems can be purchased directly from Rickly Hydrological Company, or can also be built in a well supplied shop. Systems can be operated manually, or with electric power which is currently installed at this location for NOAA fish monitoring. Information regarding bank operated cableways supplied by Rickly Hydrological Company can be found on at http://www.rickly.com/sgi/bank_operated_ cableways.htm and are also supplied in Appendix M. Instructions on how to build a bank operated cableway can be located at http://www.stream.fs.fed.us/news/ streamnt/pdf/SN_4_00.pdf, and are also supplied in Appendix M.

Existing Bridge

A possible measurement alternative to the construction of a cableway is the use of the existing Edgar J. Carnegie train bridge located 0.85 miles upstream of the proposed Lower Scott Creek gage site. Channel storage adjustments can be made to correlate the measured discharge obtained at the bridge to the

discharge occurring at the downstream gage (Rantz, 1982). The equation used is

$$Q_G = Q_m +/- WL (\Delta h/\Delta t) \qquad (12)$$

Where

Q_G = discharge passing the control at gage
Q_m = measured discharge (at bridge)
W = average width of stream between measurement section and control at gage
L = length of reach between measurement section and control at gage
Δh = average change in stage in the reach during the measurement
Δt = elapsed time during the measurement

This adjusted discharge could be added to the estimated discharges for the drainages of Winter and Archibald Creeks. Stage values obtained at a downstream gage however, may not be representative of the true condition during a bank overflow episode. Stage values will essentially reach the maximum elevation of the contained channel discharge only.

In order to measure peak discharge safely, the bridge would need to be retrofitted to adhere to U.S. Geological Survey standards. As stated in the USGS Safety Manual, SM 445-2-H CHAPTER 44**,** Fall Protection Program**,** exceptions to the standard Occupational Safety and Health Administration (OSHA) regulations can be followed. This includes:

> (3) *Working over Water.* When working over water on bridges, dams, pools, and boats, the preferred fall protection is a standard railing. When a standard railing is not available, the second choice is a personal fall arrest system, followed by a personal flotation device (PFD). In some cases, a PFD is required. However, methods to prevent the fall should be implemented whenever possible. It is therefore necessary to securely fasten the horizontal bridge cables to the vertical support beams. A harness and lanyard can then be used by field personnel, in conjunction with a personal floatation device, while making a measurement.

Measurement equipment including a 100 and 75 pound sounding weight, an

A and B-reel, Type A 3-wheel and/or Type A 4-wheel crane assembly should be stored on site for easy access. Additionally, safety equipment including two harnesses and lanyards should be stored at this gage if measurements are to be made from the bridge.

Currently, the railings at the Edgar J. Carnegie Railroad Bridge consist of two horizontal wire cables on the upstream and downstream sides of the bridge (Appendix O, Photo 7). These cables are fastened to the bridge supports with galvanized wire or plastic cable ties. These wire cables should be replaced with galvanized steel, or another strong material, which will withstand the forces exerted from the crane during high flow measurements. Additionally, it will provide the needed support for the use of 3-wheel crane assembly.

Gage Location and Recording Equipment

To avoid seasonal control modifications created by NOAA fish monitoring personnel upstream of the road crossing, the gage should be placed 40 feet downstream from the road crossing on the left bank. A stable boulder/riffle control is present 70 feet downstream of the road, creating a quiescent gage pool for monitoring changes in stage (Figure 34). The gage house should be placed

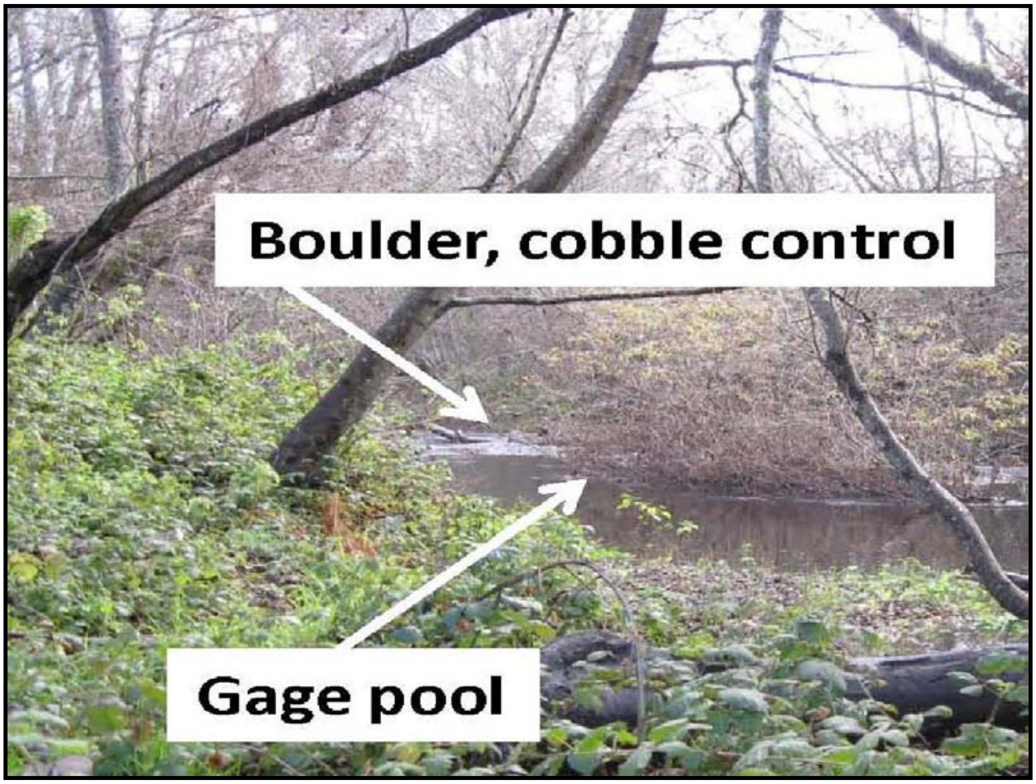

FIGURE 34. Recommended location for streamgage at Lower Scott Creek.

on the entry road, 36 feet from the levee and 100 feet from the left bank. Fastening a raised gage house 4.5 feet above a cement pad will allow extremely high flow events to pass below the gage house structure, while still providing ease of servicing the electronic monitoring equipment.

The monitoring equipment should consist of a pressure transducer and data logger to record at 15-minute intervals and transmit data on an hourly schedule. An orifice line should be encased in 1.5-inch galvanized piping at the river for a 30-foot span, and securely fastened to withstand extreme flow events. The remainder of the orifice length can be encased in 1.5-inch light flex non metallic conduit and buried in the riparian zone before entering the gage structure. A series of staff plates at the orifice tip location should be installed in a linear fashion and perpendicular to the channel. Crest-stage gages will also be required

to verify high flow peak stages. A basic illustration for a typical pressure transducer gage is located below in Figure 35.

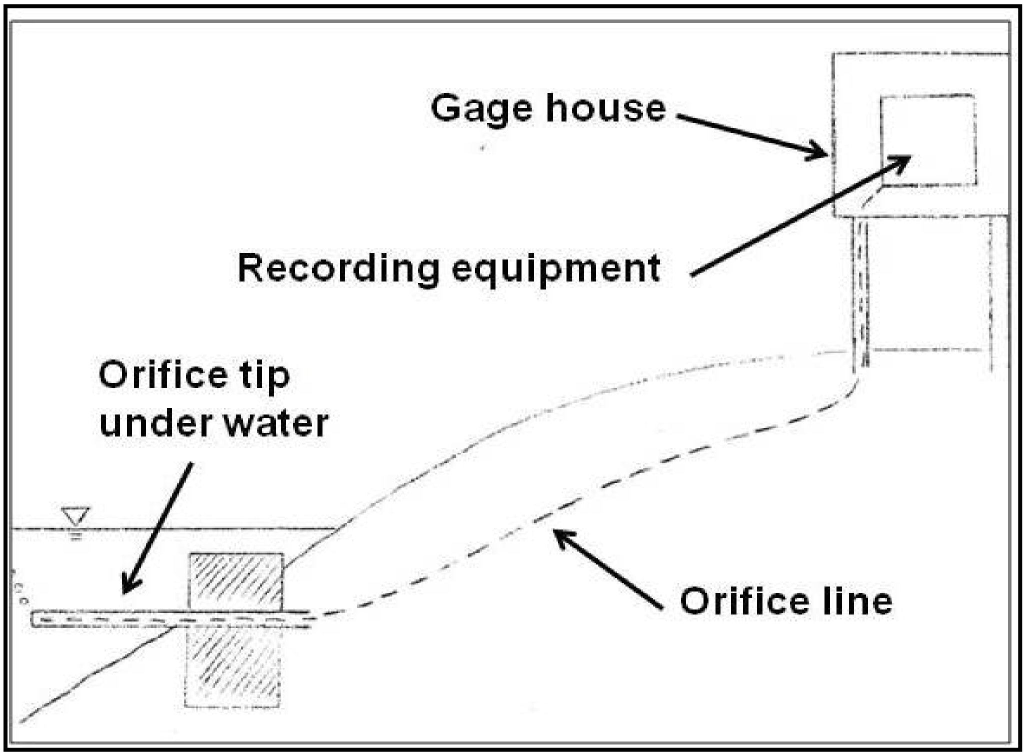

FIGURE 35. Typical streamgage.

Equipment to be installed in the gage structure could include a Design Analysis H-522+ Data Logger with integrated High Data Rate GOES transmitter. The system will allow sensor readings to be transmitted over the GOES Radio system. A H-3521 “Fluid” non-submersible pressure transducer will be required to measure the pressure (stage) of the water above the orifice tip. In addition, a H-355 “smart-gas” system could be used as the purge bubbler system. Other equipment required to finalize the installation include a solar panel, rechargeable battery, H-223 GOES satellite antenna and voltage regulator. For additional monitoring equipment specifications provided by Design Analysis, please refer to Appendix P.

CHAPTER VII: UPPER SCOTT CREEK GAGE

Field Conditions

Scott Creek is currently in an unstable state of change in the 250 foot reach directly above the bridge. This instability is a product of multiple debris jams within the reach, the most sizeable being located 140 feet above the bridge. This debris jam, which appears to grow in size after each significant peak event, spans a majority of the channel, and had blocked what was once the primary perennial channel in the center of the reach. This has caused channel avulsion, forcing flows into a narrow channel along the left bank along what appears to have once been an overflow channel. Evidence of this is a mature tree line of alders along the right bank of the current channel, which was once the left bank of the earlier undisturbed channel (Figure 36). Additional confirmation is verified by the channel width above the avulsion, which totals 54 feet before widening to 114 feet in the impacted reach. The channel width between the alders and far right bank, excluding the width of the new incised channel, totals 70 feet. Large deposits of coarse sand have deposited downstream of the debris jam due to loss of channel competence, which further results in a majority of flows being forced to the new left bank channel. Velocities have increased due to the narrow width of the current channel, creating localized channel incision at the reach. This localized channel incision has lowered its bed by degradation, and is in a condition of vertical disequilibrium (Knighton, 1984). Levels indicate a difference of 4 feet between the thalweg and top of recent depositional sand/gravel bars downstream of the primary upstream debris jam. The eroding forces applied by the concentrated flows in the confined channel exceed the resistance of the bed

and bank materials creating an entrenched system with a low width/depth ratio. The consequence of this process can create a system of positive feedback, where the concentrated flow in the narrow channel increase bank shear stress and toe erosion, resulting in further incision and downcutting until a stable base level is found. The unprotected upper and lower right bank adjacent to the upstream debris pile shows severe erosion and mass wasting directly into the channel. This is the result of higher discharges being forced around the debris in both directions. The steep left bank directly downstream of the bridge is also eroding rapidly; a result of the direction of concentrated flows and deflection by debris piles. Detailed photos can be located in Appendix O.

Figure 36. Newly formed channel above bridge at Upper Scott Creek.

If left undisturbed, the current channel would eventually widen as the channel banks erode and Stage III of the Channel Evolution Model is entered. Debris

jams appear to be a common occurrence along Scott Creek, and are often moved during higher flow events (Brian Dietterick, California Polytechnic State University, personal communication). The current circumstances however, have created a unique situation due to the locality and stability of the bridge. If left unabated, the increased velocities, which have scoured a hole at the base of the left bank bridge wingwall, will continue to undermine the bridge's structural integrity.

Field evidence suggests a backwater effect further upstream, caused by a narrowing of the channel at the avulsion locality, and an additional debris jam 250 feet upstream of the bridge and 100 feet above the primary debris jam. The channel along this reach is aggrading, dominated by sand-sized materials likely deposited due to a loss of channel competence in the backwater situation. This 100 foot channel section can be classified as a B5c, until it again returns to the prevailing B4c further upstream. A similar scenario which may be considered a prototype model is identical to the creation of the new left bank incised channel upstream of the bridge. This prototype is currently occurring at the upstream end of the B5c channel. Overbank flows are actively scouring a new channel along the right bank caused in part by a build-up of debris and possibly backwater downstream.

Site Survey

Methods developed Rosgen (1996), and described in *Methods*, were used to classify Scott Creek, and compare current channel conditions at the bridge with a stable reference reach. A reference reach was chosen 370 feet downstream of

the bridge in an unaffected location which appears to be representative of the local channel condition in its natural state. The left bank is steep with a slope greater than 100 percent. The right bank contains a terrace and is subject to overflow during extreme flow events. The landform results are shown in Table 21.

TABLE 21. Reference reach data.

Bankfull Width	60.50
Width/Depth Ratio	46.5
Entrenchment Ratio	1.13
Dominant Channel Materials	80 mm
Channel Slope	0.01 ft/ft (1.0 % gradient)
Sinuosity	1.1

The reference reach can be classified as a B4c stream type. As described by Rosgen, B4c stream types are moderately entrenched with gradients less than 2%. A sinuosity value of 1.1, which is lower than the recommended value of >1.2, was obtained using topographic maps, and may have a slight margin of error. The channel substrate is composed predominantly of gravel materials of colluvial deposition with a D_{50} of 64.0 mm (Figure 37).

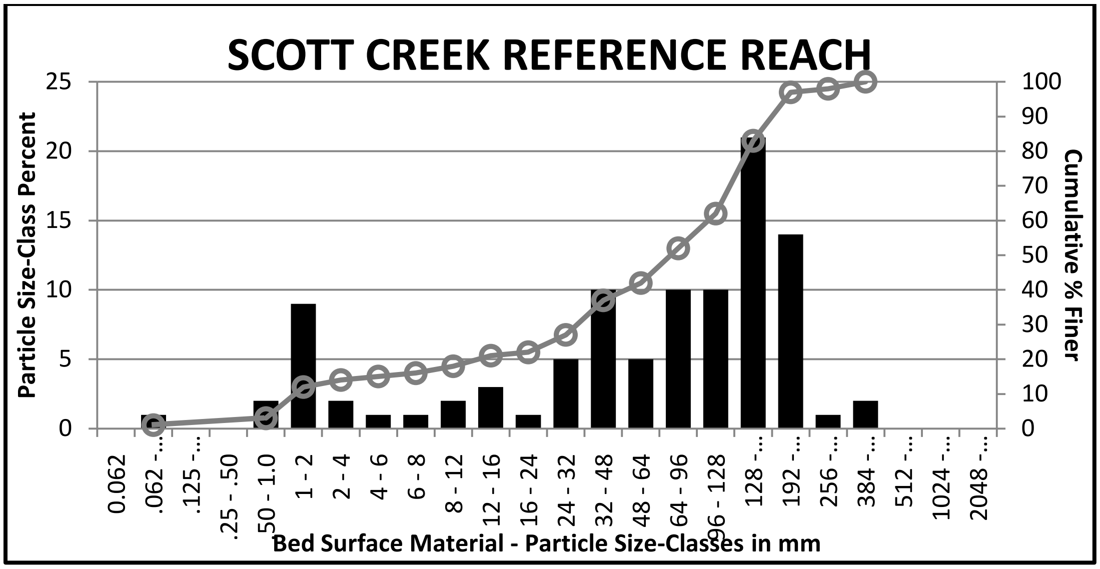

FIGURE 37. Reference reach pebble count data**.**

Pebble count results from the impacted reach upstream of the bridge illustrate a deviation from channel materials for undisturbed reaches which are normally composed of gravel as verified with the reference reach results obtained 370 feet downstream of the Edgar J. Carnegie Railroad Bridge. As expected, a larger quantity of fine material is present upstream of the bridge, with a measured D_{50} of 24 mm (Figure 38). This is a result of deposition of finer particles, once in suspension, due to the loss of sediment transport capacity in a majority of the channel along this reach.

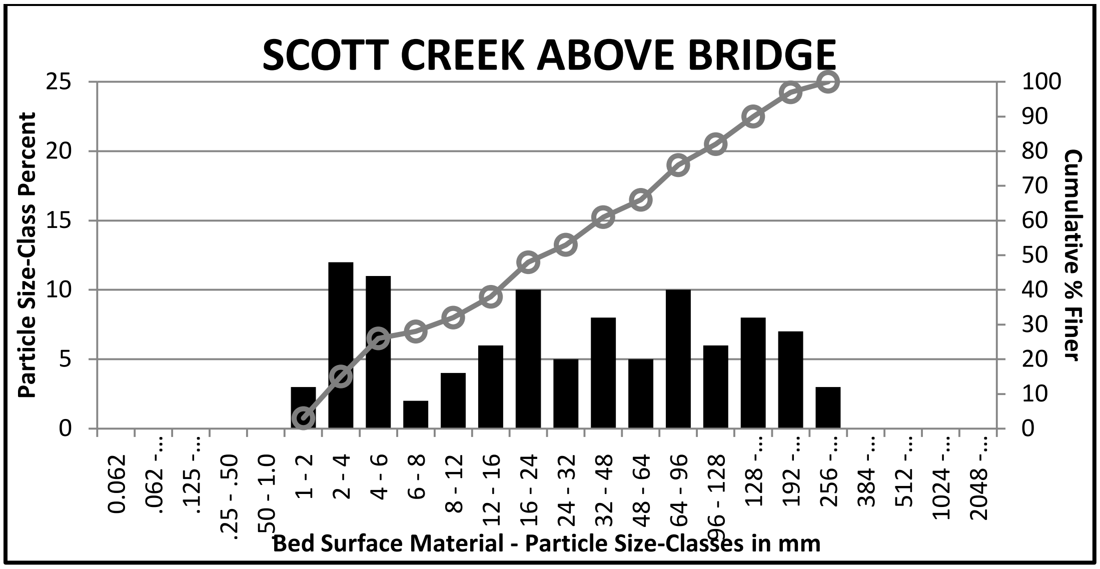

FIGURE 38. Impacted reach pebble count data**.**

A Stream Reach Inventory and Channel Stability Survey (Appendix N) was completed for the reference reach and bridge location. An average reference reach stability rating of 74 was obtained, resulting in a rating of *Good* on a scale of *Excellent* to *Poor* developed by D.J. Pfankuck. This reach condition stability value was then converted using Rosgen criteria for a B4c stream type. The result was a rating of *Fair*. A similar survey was completed at the bridge with an average reach stability rating of 112. This correlates to a fair stability rating on a Pfankuch scale and a *Poor* rating on a Rosgen scale. Field notes, with ratings and values, can be located in Appendix N. Parameters which significantly altered the results when comparing the reference reach to the bridge reach is debris jam potential of the upper banks, lower bank obstructions and undercutting, and scouring and deposition of the streambed.

Five cross-sectional profiles were completed in a 180 foot portion of the reach during the creation of the topographic map (Figure 39). These are illustrated below in Figures 40-44. Cross-section 1 was completed at the upper portion of

the reach, directly above the largest of the debris jams and below the point of channel avulsion. A new sand bar has deposited in the channel's center, splitting the flow into two separate channels (Figure 40).

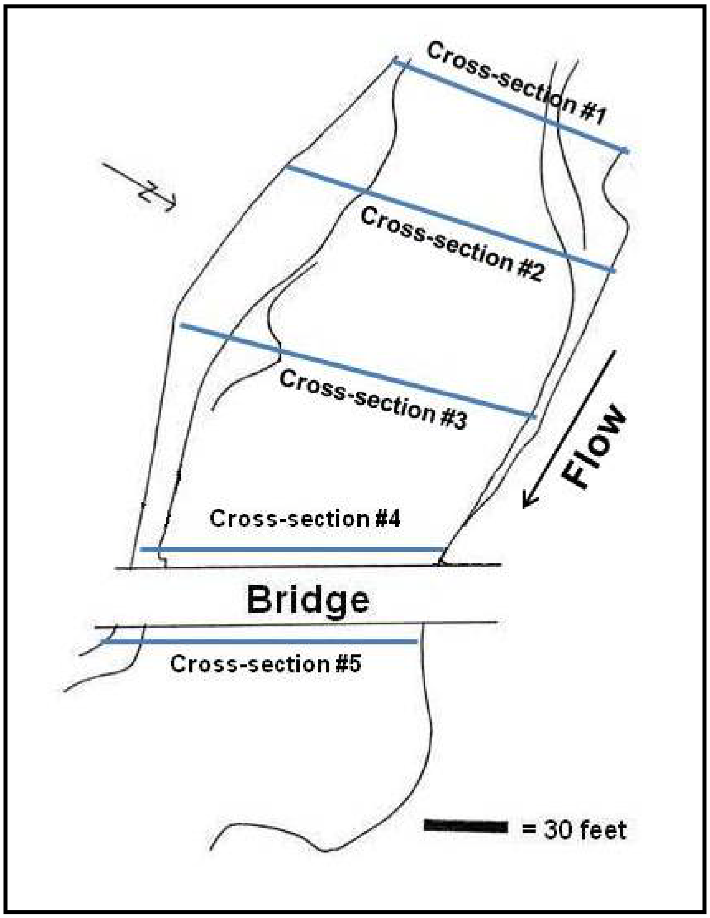

Figure 39. Locations of cross-sections at the proposed Upper Scott Creek gage location.

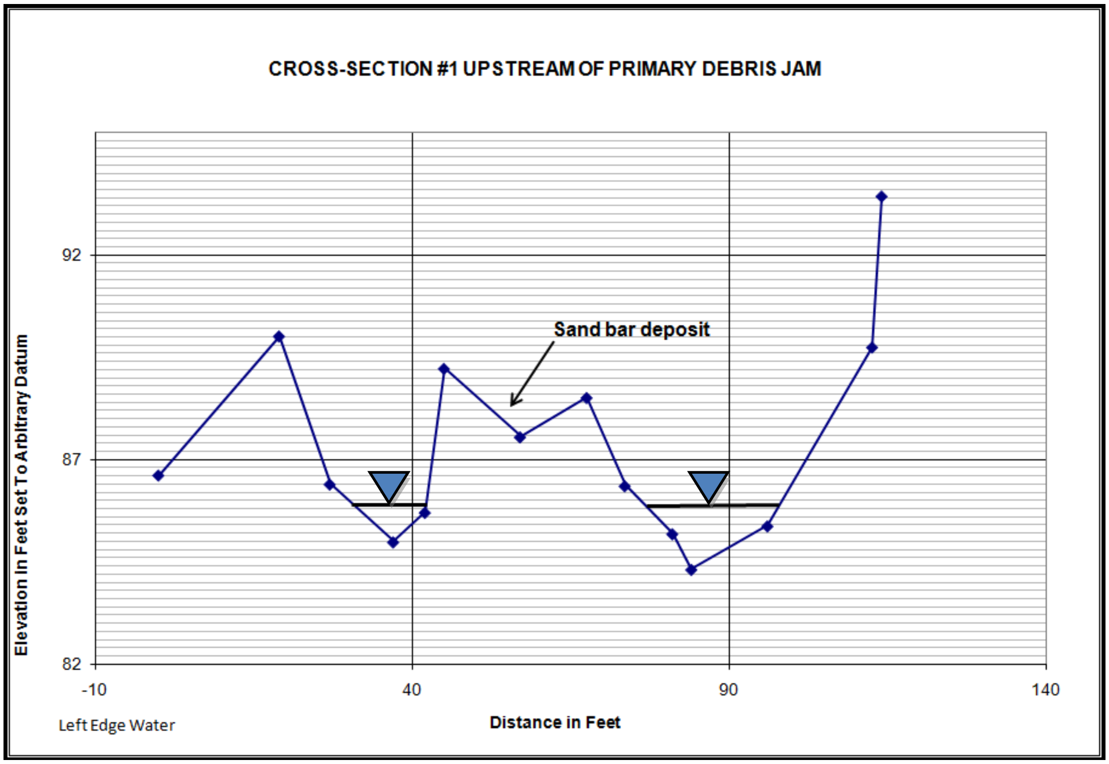

FIGURE 40. Cross-section #1 located upstream of the primary debris jam.

Cross-section 2 was completed directly downstream of the debris jam. All flow, unable to pass the obstruction, has been forced to the far left bank. Higher discharges are eroding the steep, unprotected banks directly behind the debris and forming a new channel adjacent to the right bank. Sand and gravel have accumulated behind the debris (Figure 41).

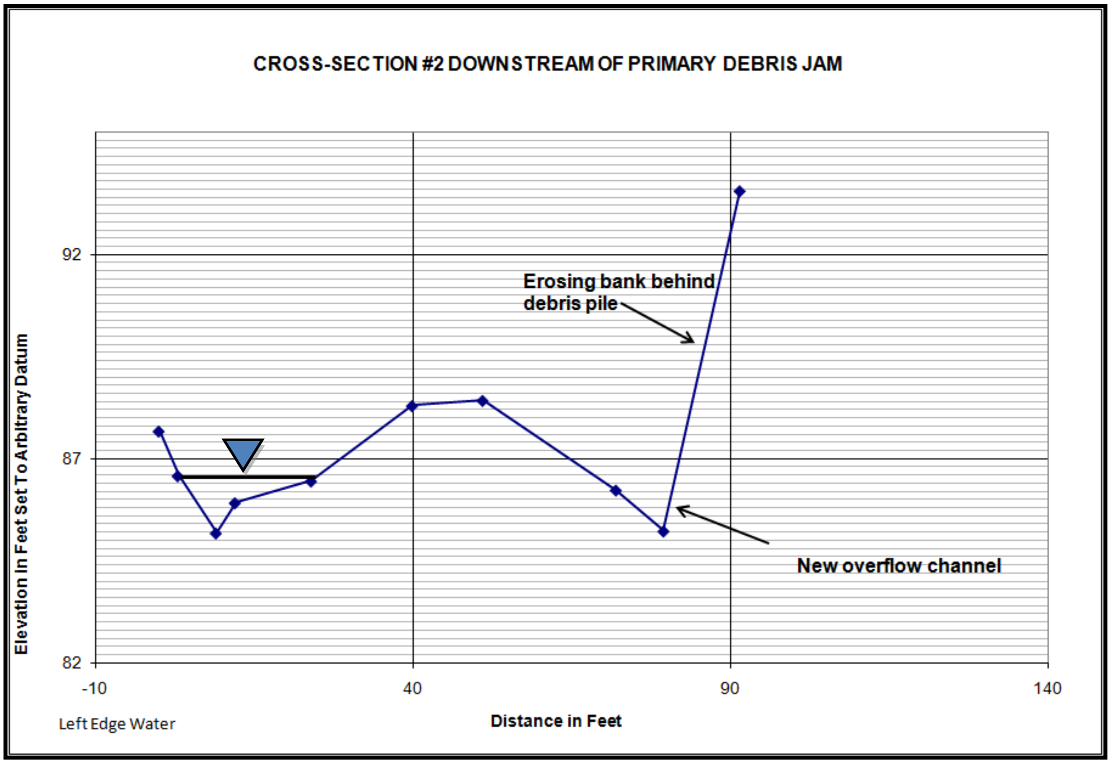

FIGURE 41. Cross-section #2 located directly downstream of the primary debris jam.

Cross-section 3 was completed in the center of the incise channel. Erosional forces are extreme in the active channel, incising the reach nearly one foot when compared to the abandoned channel and undercutting the unprotected banks. Smaller particles have deposited in remainder of the channel; a direct result of reduced velocities and limited carrying capacity caused by the debris blockage. An overflow is actively creating a new conduit on the far right bank (Figure 42).

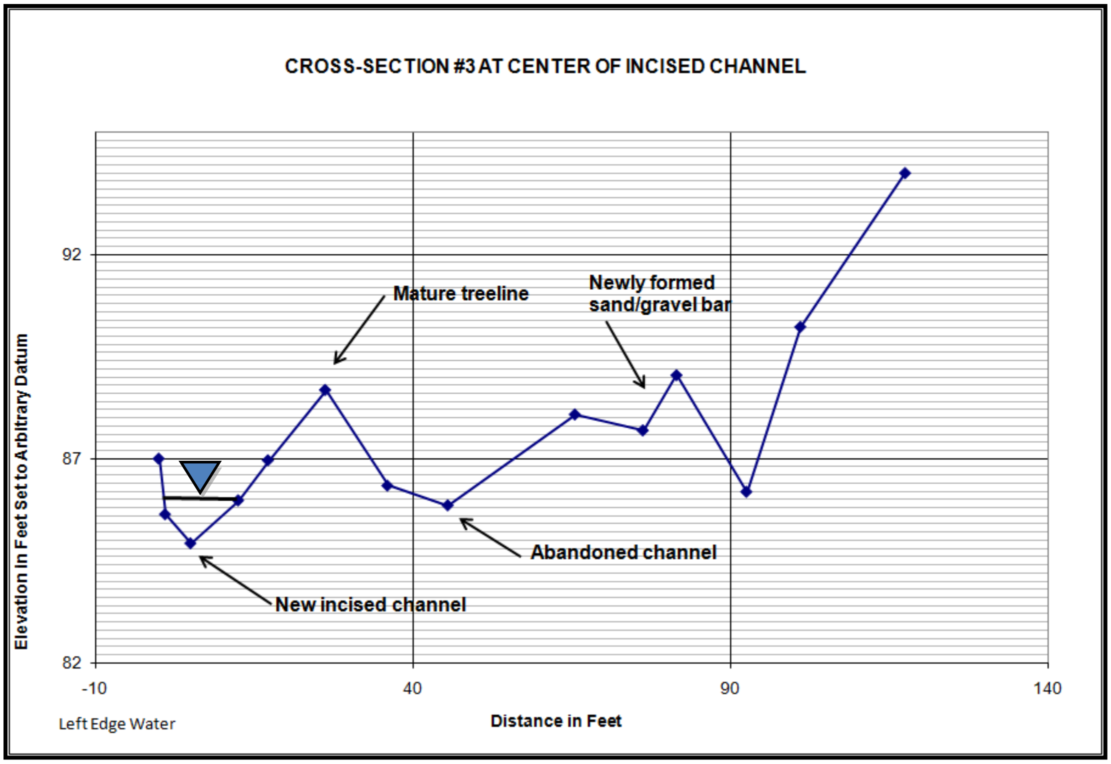

FIGURE 42. Cross-section #3 located at center of incised channel.

Cross-section 4 was completed directly above the bridge. The depth of the scour pool is 2.85 feet below the thalweg of the original channel. Debris piles in this location obstruct flows throughout the cross-section, further forcing the discharge into a narrow channel on the left bank (Figure 43).

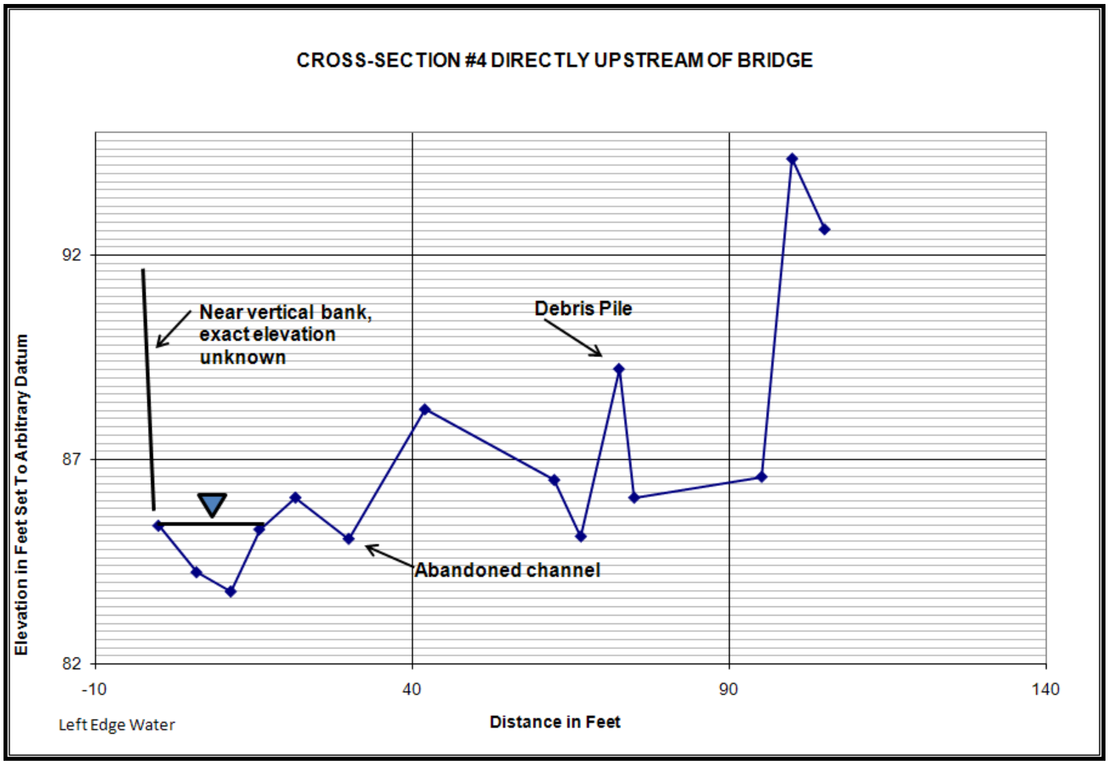

FIGURE 43. Cross-section #4 located directly upstream of the bridge.

Cross-section 5 was completed directly below the bridge and at the downstream end of the impacted reach. The channel once again returns to what appears to be a state of equilibrium 20 feet downstream. Two additional debris piles have forced the flow pattern to the right bank. The steep, unprotected upper and lower left banks show sever erosion created by the concentrated, high velocity flow entering the area from above (Figure 44).

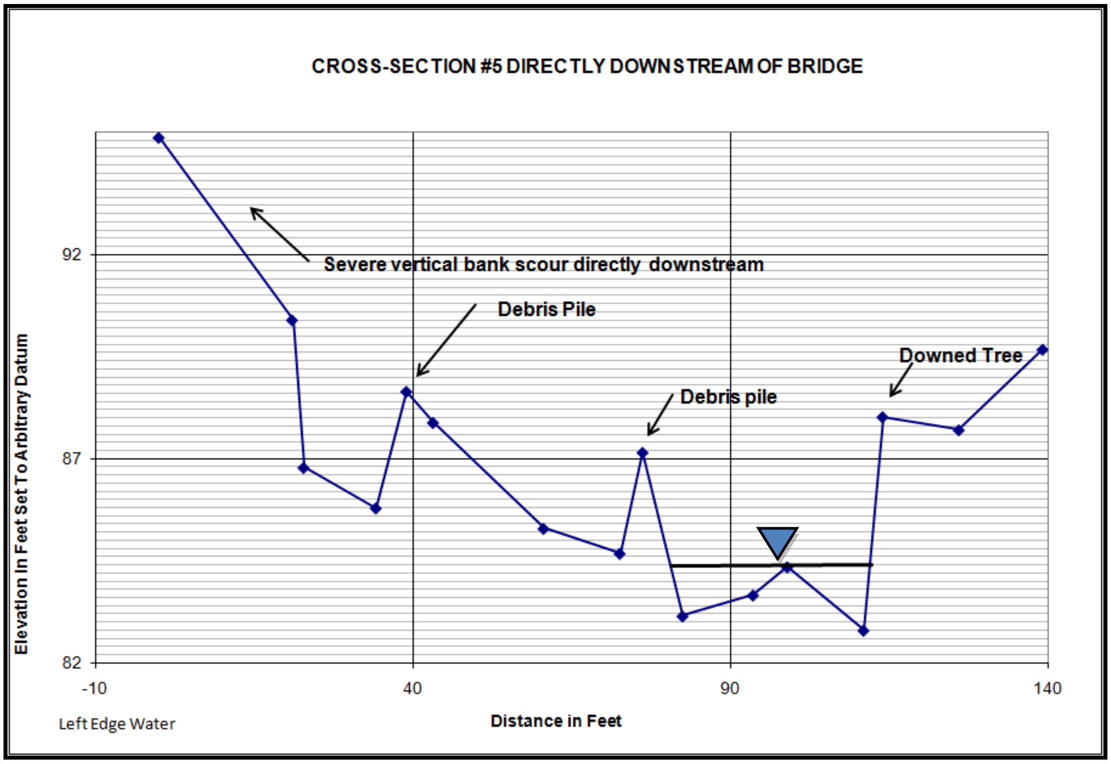

FIGURE 44. Cross-section #5 located directly downstream of the bridge.

Recommendation for Channel Stability Rehabilitation

Many measures were considered to improve channel stability above the bridge and mitigate the undermining of the bridge wingwall. Width/depth and entrenchment ratios will need to be altered to minimize further incision and provide an adequate channel for the flow regime. Additionally, flow pattern will need to be adjusted to divert a majority of the discharge towards the channel center, away from the left bank bridge wingwall, and in the direction of the abandoned perennial channel in the center.

Reference reach data, as illustrated previously in Table 21, indicate a more narrow cross-sectional profile and geometry than the full (bank to bank) width above the bridge, and significantly wider than the active channel in this location. The reference reach location therefore provides sufficient velocities and stream

power to transport materials at all ranges of discharge, with little near bank shear stress and erosional force. Width/depth ratios above the bridge are less with a greater entrenchment ratio in the active channel. This results in an increase in erosional forces in the active channel.

Channel evolution models indicate that the active channel is currently in Stage II (incision). As the river in this reach develops and adjusts to find a state of dynamic equilibrium and stable base level, the channel banks will fail and erode into the channel. This is stage III (widening) of the five stages of CEM.

A detailed topographic map of the reach was created using a Leica Total Station Model TCR307. One map was created illustrating contours of the channel with debris piles (Figure 45), and another without debris piles (Figure 46). The abandoned central channel is clearly shown, as well the steep, vertical upper banks. As mentioned in *Methods*, this map was then modified at the site manually to provide a better representation of true channel geometry (Figure 47). If instream structures will be constructed, an additional, highly detailed topographic map may be required after debris is removed and the left bank channel is filled, as discussed below.

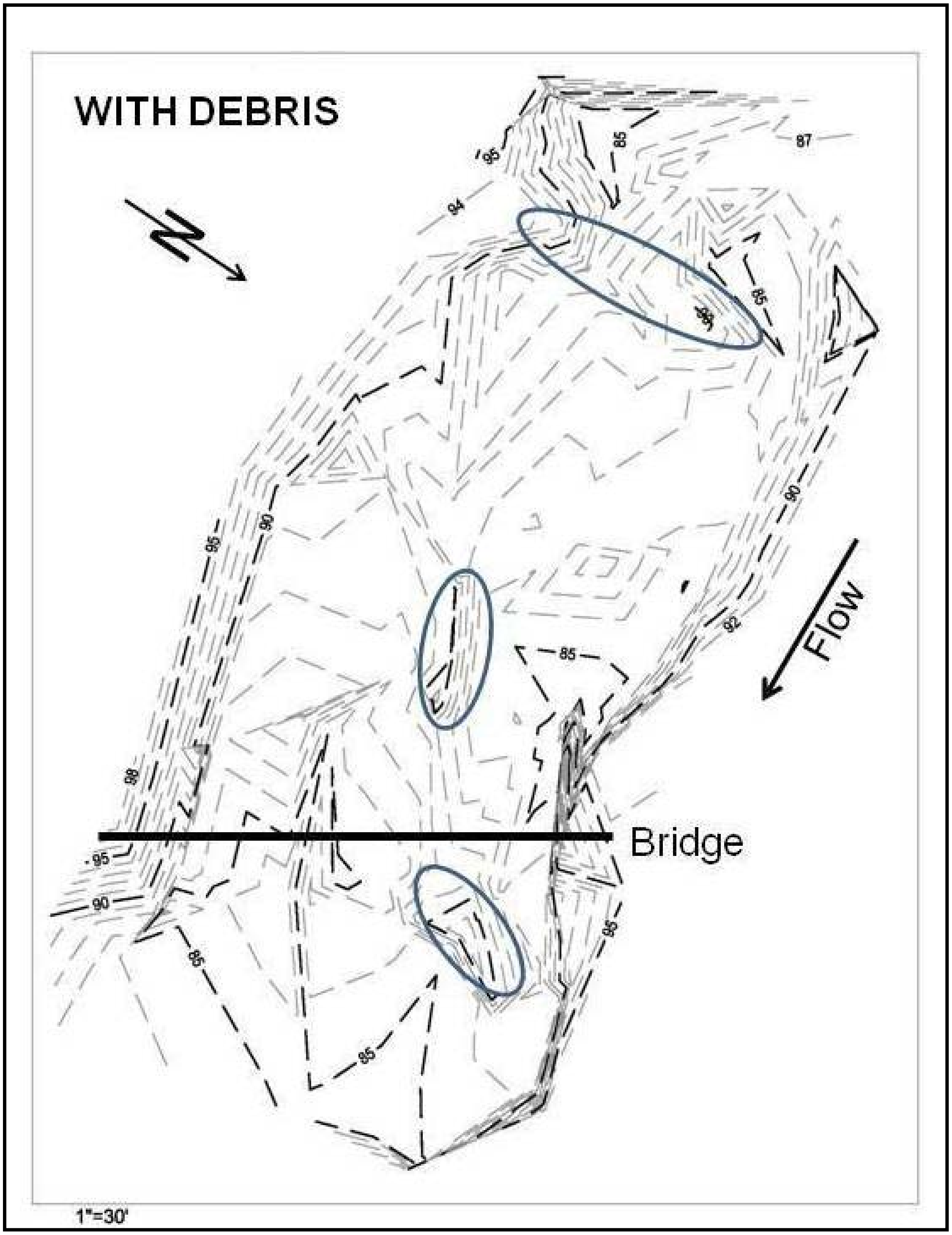

Figure 45. Topographic output of elevations with debris piles. Major debris piles indicated by ovals.

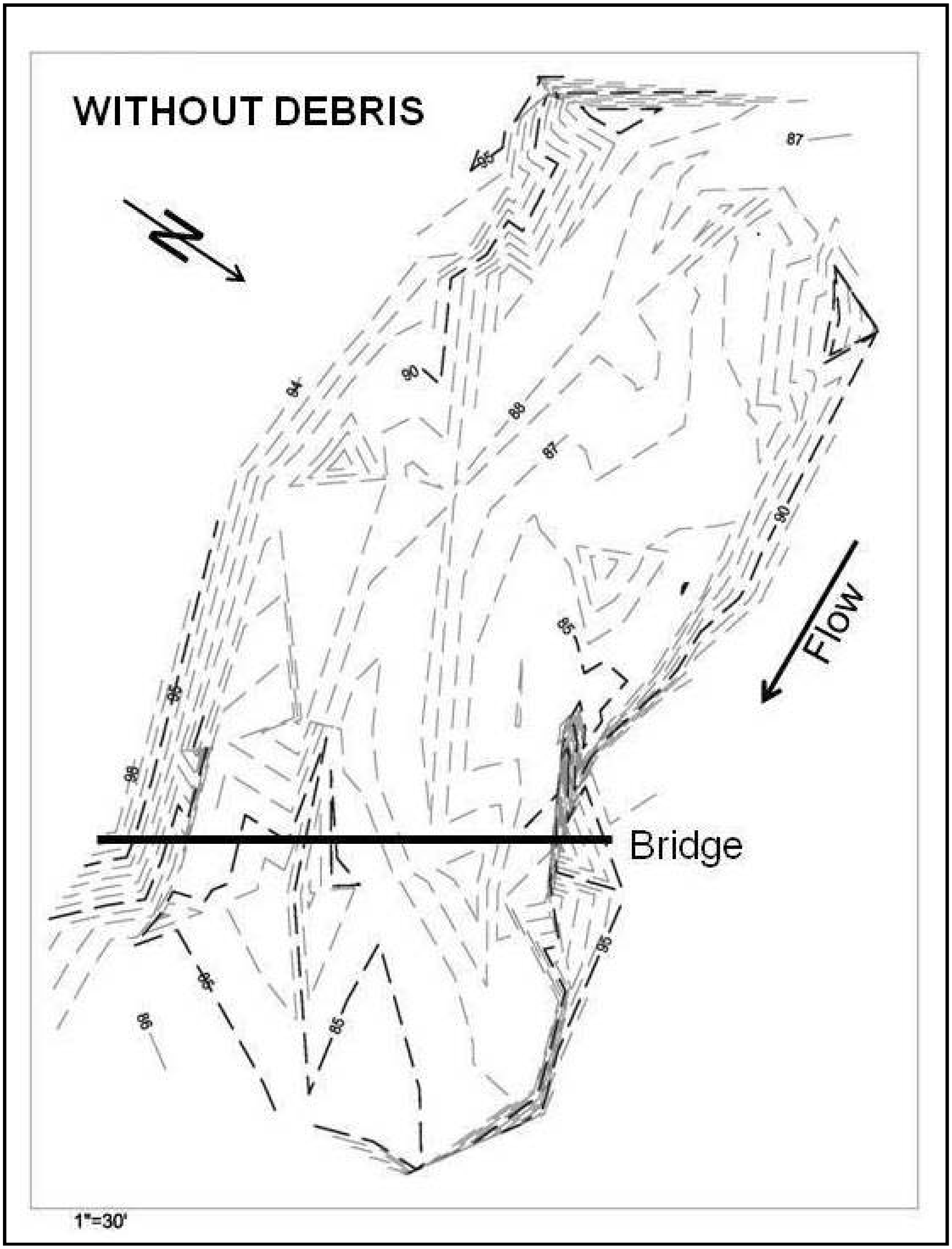

Figure 46. Topographic output of elevations without debris piles.

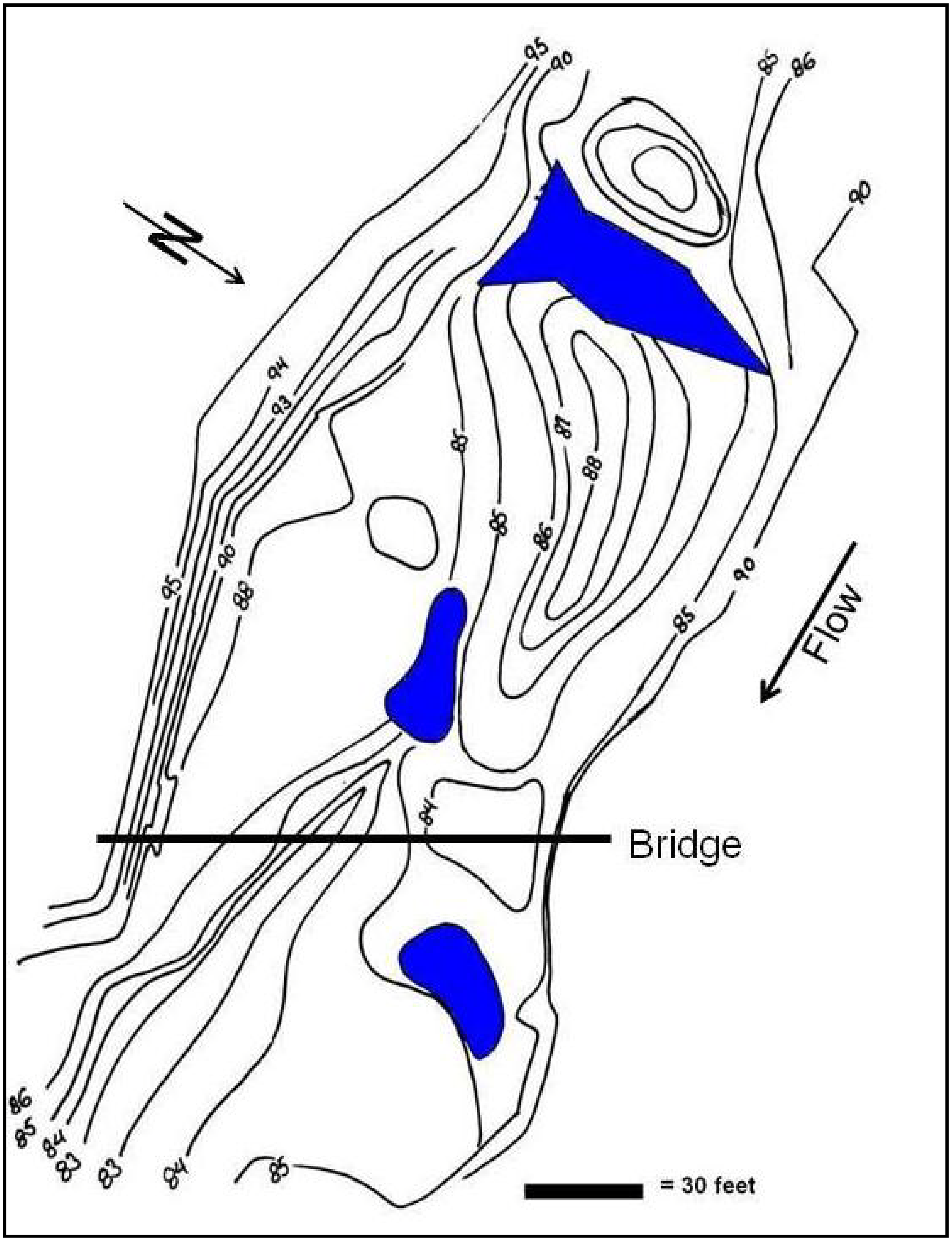

Figure 47. Manual topographic output of elevations. Major debris piles are shown in blue polygons.

An overriding consideration is the probability that channel debris cannot be removed from the active channel due to regulations and the possibility of adverse

consequences to fish habitat. However, in this author's opinion, it would first be necessary to remove, at a minimum, the largest of the debris jams upstream of the bridge to accomplish the desired results of channel stabilization. This includes the instream section of the upper debris jam and the debris pile directly above the bridge, as illustrated in the topographic diagram. The removal of this debris would provide an adequate cross-section for medium to high flows, and increase transport capacity at the channel's center. Removal of the debris pile directly downstream of the bridge will provide a better get-away section for the higher discharges and minimize further bank cutting and erosion. Eventually, after consecutive peak discharge events, the accumulation of sand and coarse gravel would be transported from the reach. If these debris piles are left in place however, additional measures for channel stability, such as cross-vanes and wing-deflectors, will not function properly and may even exacerbate the problem.

Removal of the debris however, will not solely protect the bridge, as the water will still seek the lowest elevation along the incised channel, therefore always migrating towards the left bank. The channel in this reach should be graded and the left bank incision filled for the entirety of its length. Materials deposited at the center of the channel can therefore be used as left bank fill. The prototype overflow channel located upstream should be used as a model if further channel investigations reveal this a regular occurrence along the B4c portion of Scott Creek.

Consideration was given to a large cross-vane structure which would span the entirety of the channel and divert the flow towards the channel's center and

maintain lateral stability (Figure 48). This would minimize bank shear stress and toe erosion in the confined channel, increase sediment transport capacity, while providing suitable habitat for fish spawning (Rosgen, 1996). In order for this structure to function however, the debris would need to be removed and the large sand/gravel bars removed and flattened from the channel. An installation of this feature would look similar to the representation in Figure 49.

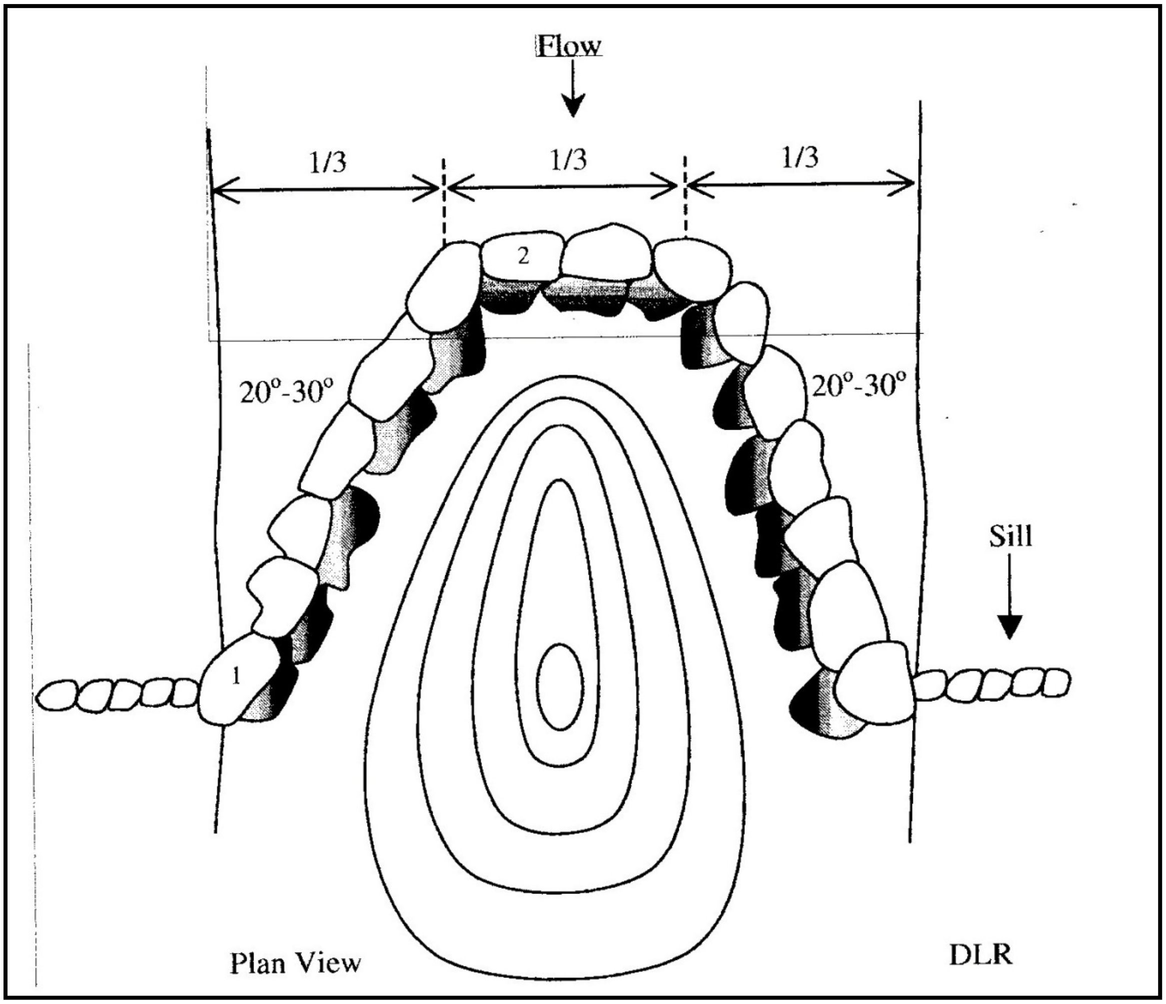

FIGURE 48. Cross-vane (Rosgen, 1998)

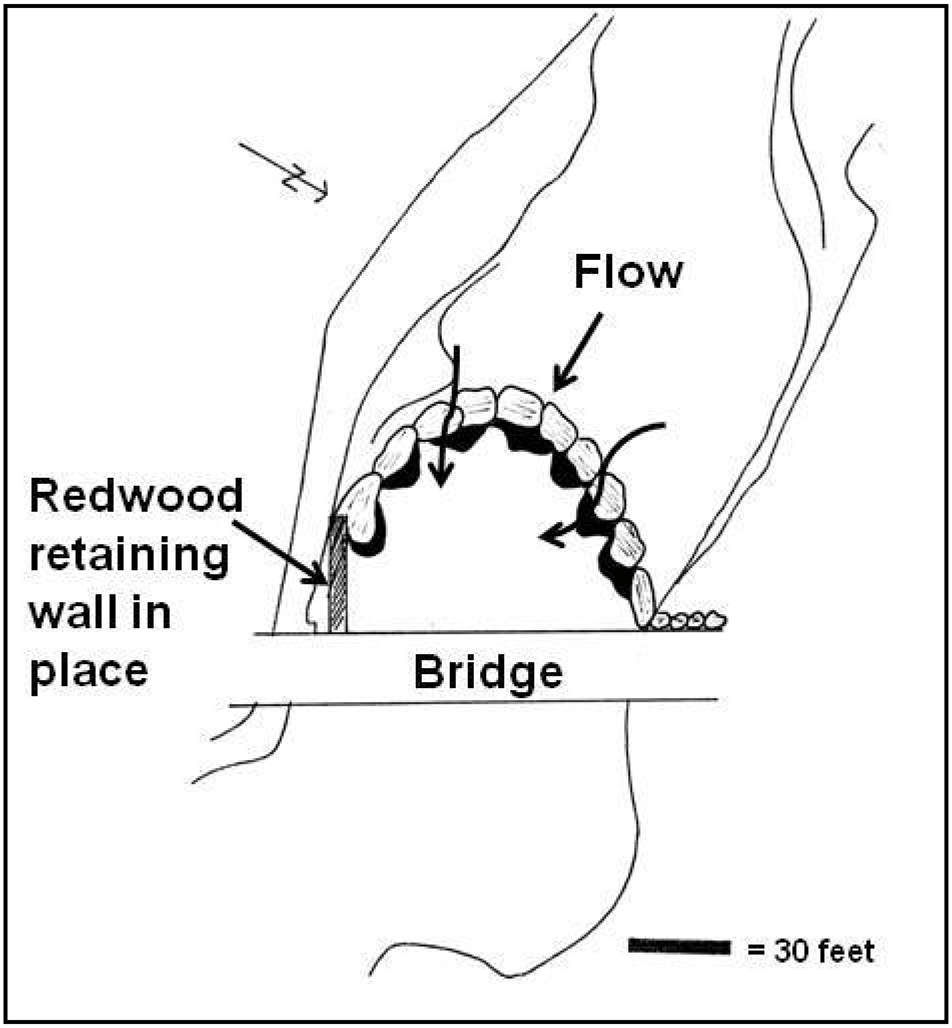

Figure 49. Potential placement of cross-vane above bridge.

A series of double and single wing deflectors (Figure 50) strategically positioned in the reach would provide the needed bank protection, redirect the flow pattern back towards the abandoned channel, and give the channel an opportunity to transport the sand/gravel deposits with an increased velocity in the channel's center (Rosgen, 1996). Width/depth ratios will be reduced and entrenchment ratios increased. Larger logs from the debris piles could be repositioned and used in the construction of these structures. An installation of these features along the reach would look similar to the representation in Figure 51. An added benefit of the wing-wall deflector, as opposed to the cross-vane, is

that channel grading and the filling of the incised left bank active channel could be minimal. The reduced width/depth ratio and increased velocity provided by these structures would likely clear the sand and gravel deposits after consecutive peak discharge events.

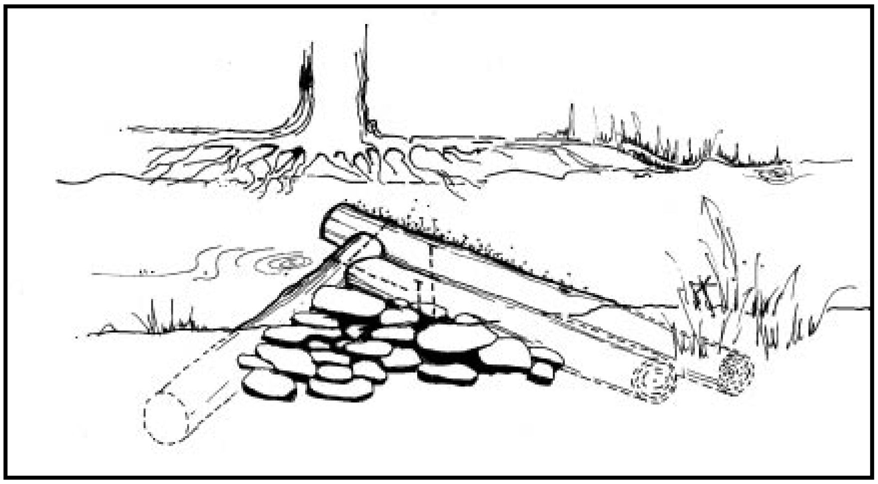

FIGURE 50. Single wing-deflector

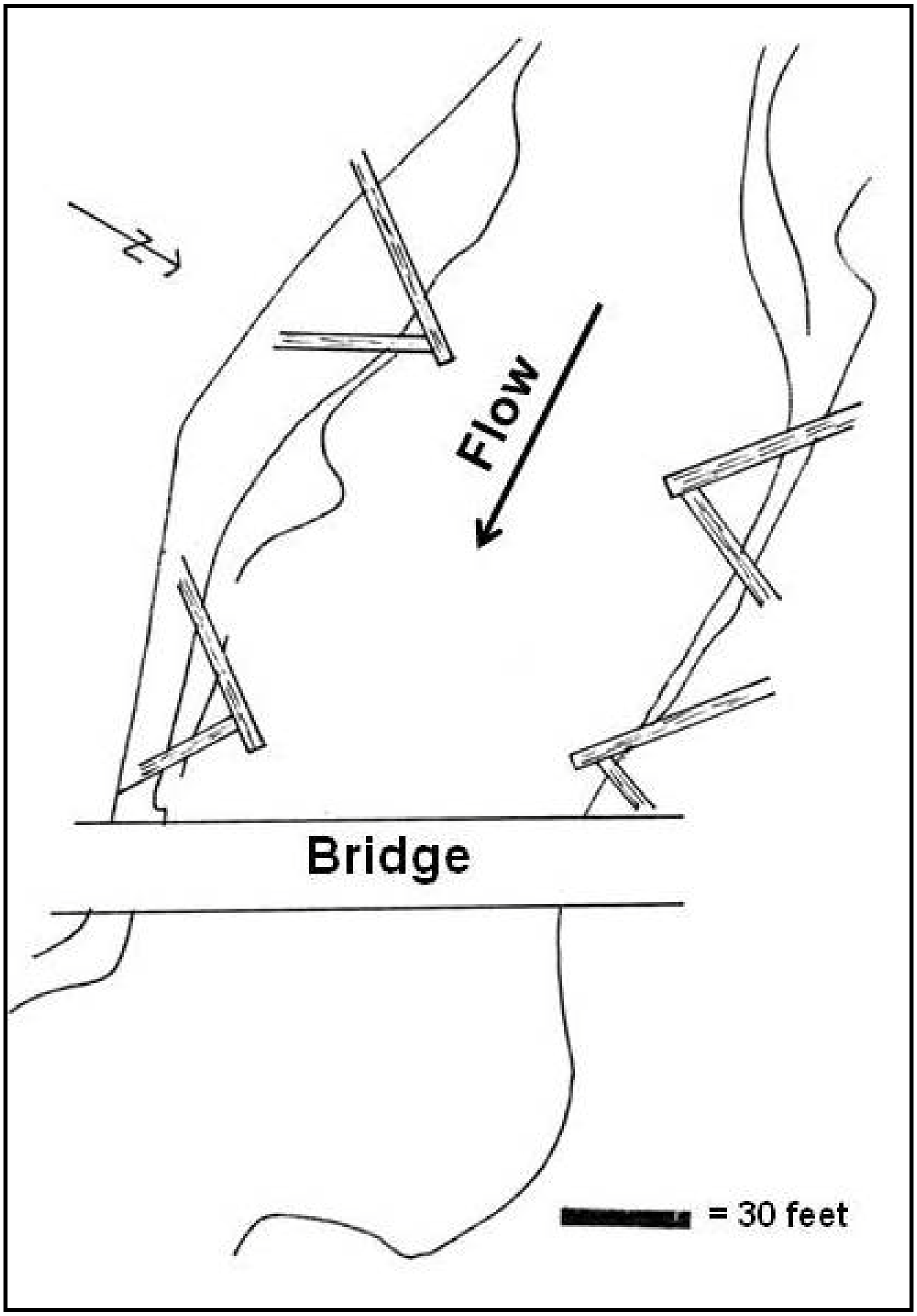

FIGURE 51. Potential placement of wing deflectors upstream of the Edgar J. Carnegie Railroad Bridge.

Gage Recording Equipment

In the channel's current condition, a large gage pool is located on the left bank, upstream side of the bridge, which provides an excellent location for monitoring changes in the water surface elevation. The control consists of a

gravel/cobble riffle directly downstream. The gage house should be placed on the upper left bank, downstream side of the bridge. The gage house will be situated in highly visible area along the railroad and could be constructed as a small redwood shed to match the surrounding environment and be aesthetically pleasing.

The monitoring equipment should consist of a pressure transducer to record on 15-minute intervals and transmit data on an hourly schedule. An orifice line should be encased in 1.5-inch galvanized piping down the bridge wingwall for a 30-foot span, and securely fastened to withstand extreme flow events. The remainder of the orifice length can be encased in 1.5-inch light flex non metallic conduit and buried before entering the gage structure. Staff plates at the orifice tip location should be installed on the wingwall with a wire weight gage attached to the bridge to obtain stage during high flow conditions. Crest-stage gages will also be required to verify high flow peak stages, and can be attached to the wingwall downstream of the staff plates.

Equipment to be installed in the gage structure could include a Design Analysis H-522+ Data Logger with integrated High Data Rate Goes transmitter. The system will allow sensor readings to be transmitted over the GOES Radio system. An H-3521 “Fluid” non-submersible pressure transducer will be required to measure the pressure (stage) of the water above the orifice tip. In addition, an H-355 “smart-gas” system could be used as the purge bubbler system. Other equipment required to finalize the installation includes a solar panel, rechargeable battery, H-223 GOES satellite antenna and voltage regulator. If

channel modifications are made to redirect the flow away from the left bank wingwall, an additional Design Analysis H-3611 Radar Water Level Sensor should be installed directly over the flowing channel and next to the wire weight gage. These data can transmit to the H-522 + using an H-424MS Radio Bridge, or wired directly into the data logger. For addition monitoring equipment specifications, please refer to Appendix P.

Measurements from the Existing Bridge

Please refer to Chapter VI, *Lower Scott Creek Gage, Existing Bridge* for recommendations.

Recommendations for Future Studies

The author recommends continuous monitoring of this channel reach to track scour at the base of the left bank wingwall, particularly after higher flow events. Reference marks should be established on both bridge wingwalls to monitor differential movement using level surveys. Channel migration and evolution should be monitored to track and record the changes as the channel adjusts to develop a state of equilibrium. Permanent cross-sections should be developed downstream of the bridge, directly upstream of the bridge, and above the avulsion in the B5c channel reach. Additionally, monitoring of the new overbank channel located upstream of the study reach can be used as a prototype, tracking change in geometry and scour with a permanent cross-section (Figure 52). This may lead to a better understanding of what transpired directly above the bridge, and how these situations could be mitigated. The data provided by the continuous collection of suspended sediment at the bridge would offer invaluable

data which would lead to a better understanding of the natural system, and clearly illustrate trends as the channel stabilizes.

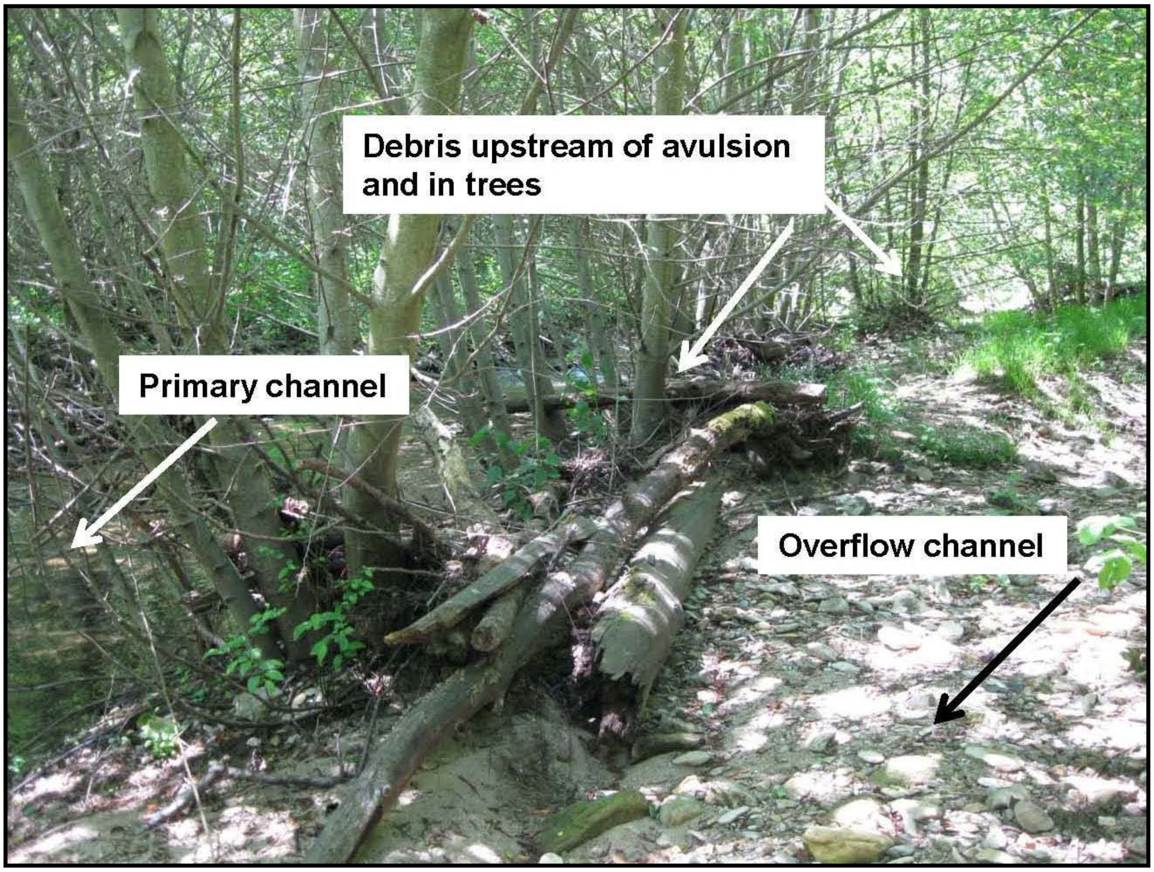

FIGURE 52. Prototype cross-section for monitoring upstream of unstable reach at upper end of B5c reach.

CHAPTER VIII: SUMMARY AND CONCLUSIONS

Flood frequency results indicate that a 100-year design discharge of 6,310 ft^3/s can be expected at the Upper Scott Creek gage location, and 6,520 ft^3/s at the lower site. These values were determined using 16 peak discharge values from Scott Creek above Little Creek, near Davenport (station 11161900) with a low outlier threshold of 250 ft^3/s. Indirect methods of discharge show that the reach located at Lower Scott Creek can contain a discharge of 2,500 ft^3/s, or slightly less than a 10-year recurrence interval, before the left-bank overtops and floods the adjacent agricultural fields. A cableway therefore, cannot be constructed to span the entirety of the design flow event. Conditions for high flow measurements are favorable at the Upper Scott Creek location where the Edgar J. Carnegie Bridge can be used to measure discharge in the confined channel. This stream reach however, is in a state of disequilibrium caused by recent and excessive debris jams. The main channel has been diverted toward the left bank and has led to channel incision which threatens the stability of the bridge wingwall. Rehabilitation of this reach will require, at a minimum, the removal of the largest of these debris jams. Additional channel remediation measures may include the construction of a series of single and double-wing deflectors, or a large cross-vane above the bridge. Without the implementation of these channel reach modifications, the new channel will continue to incise and widen, as discussed in the Channel Evolution Model, and undermine the bridge wingwall.

The data provided from this analysis indicate that given the two available options, the better location for a streamgage on Scott Creek is located at the Edgar J. Carnegie Bridge below the confluence with Little Creek. A gage can be installed and fully operation without the implementation of remediation measures for channel stabilization. A gage pool is present for monitoring stage and the full range of discharge measurements can be made regardless of the deteriorating condition of the channel. In order to create an ideal and stable channel condition for higher quality stage and discharge record, and more importantly, bridge stability and safety, the manual removal of the larger debris jams are required. The removal of the channel debris restrictions will provide the channel area needed for the full range of discharge. Larger flow events can then remove a portion of the finer material and debris deposited along this reach, and will eventually reach a state of equilibrium. The primary flow channel and thalweg however, will not return to its pre-existing location at the channel’s center, and will tend to follow the path of least resistance along the left bank incision. Instream structures and regrading will be necessary in order to force the flow to abandon the newly incised left bank channel. Permits will be required for this process however. The process for obtaining these permits, and the installation of instream structures are outside the scope of this report.

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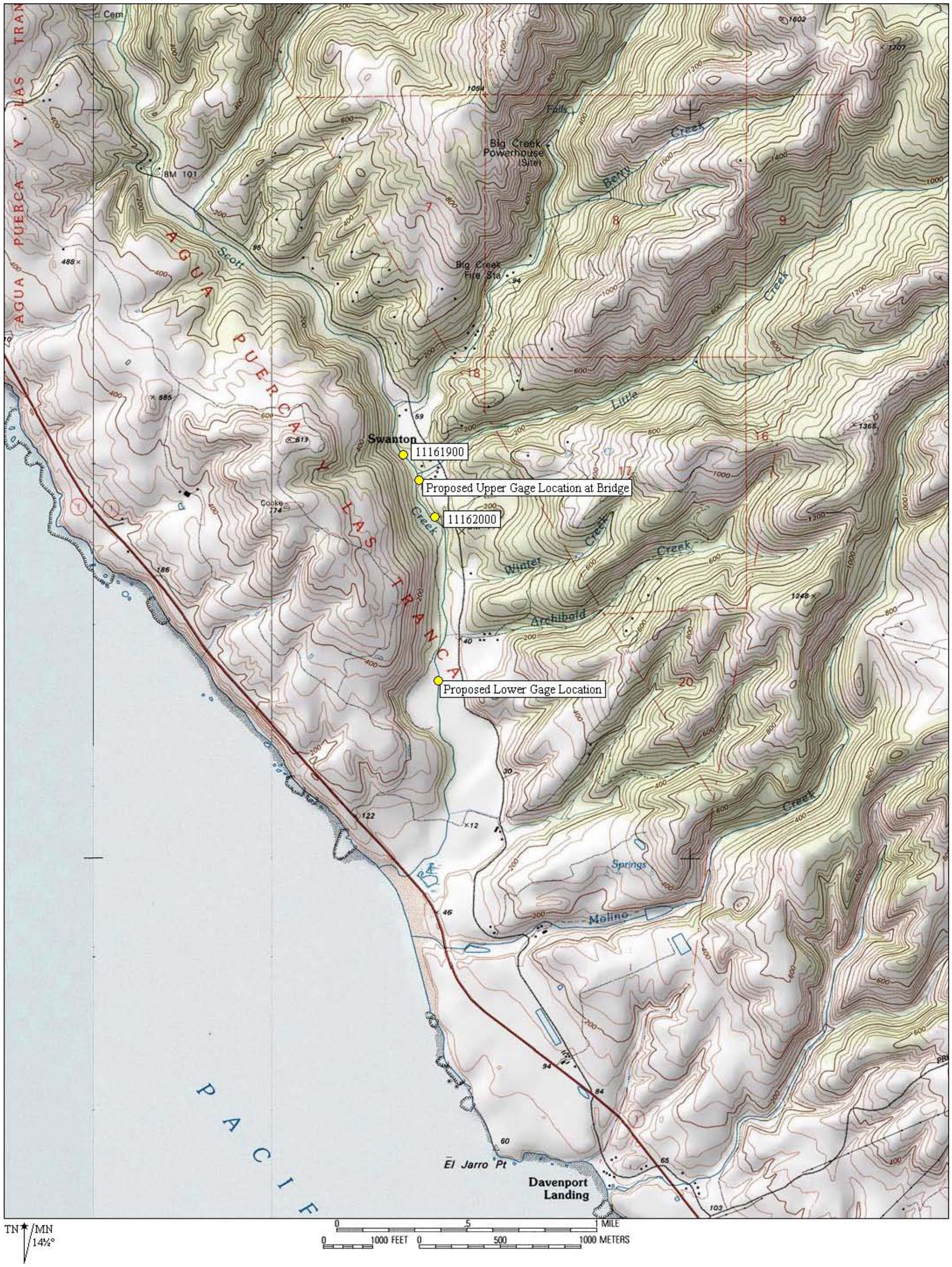
Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA

Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA



Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA

11161900
Scott Creek above Little Creek near Davenport, CA

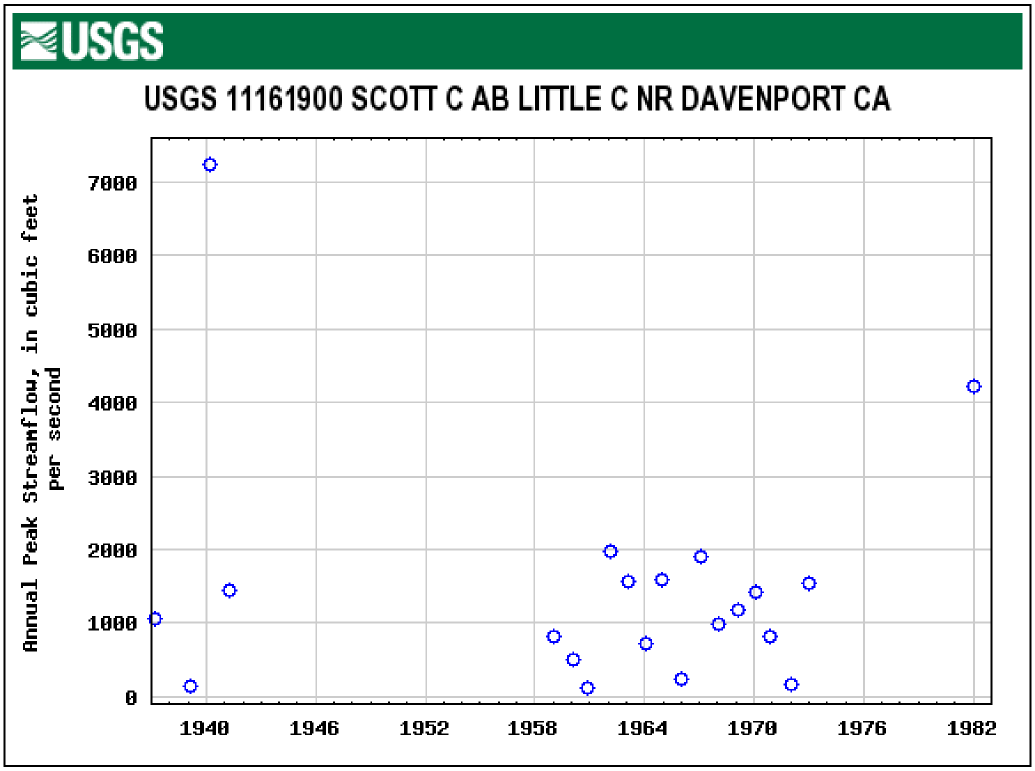
Santa Cruz County, California
Hydrologic Unit Code 18060001
Latitude 37°03'51", Longitude 122°13'42" NAD27
Drainage area 25.1 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1937	Mar. 21, 1937		1,050[2]	1965	Dec. 22, 1964	7.98	1,590
1939	Mar. 08, 1939		149[2]	1966	Jan. 05, 1966	2.46	229
1940	Feb. 27, 1940		7,240[2]	1967	Jan. 21, 1967	8.80	1,900
1941	Apr. 04, 1941		1,440[2]	1968	Jan. 30, 1968	5.18	995
1959	Jan. 09, 1959	6.68	806	1969	Feb. 15, 1969	5.31	1,180
1960	Feb. 01, 1960		500	1970	Jan. 21, 1970	5.09	1,420
1961	Nov. 26, 1960	3.83	122	1971	Nov. 29, 1970	4.20	810
1962	Feb. 13, 1962	9.36	1,970	1972	Dec. 27, 1971	2.48	170
1963	Jan. 31, 1963	8.71	1,560	1973	Jan. 16, 1973	5.25	1,550
1964	Jan. 20, 1964	5.30	720	1982	Jan. 04, 1982		4,220[7]

- 2 -- Discharge is an Estimate
- 7 -- Discharge is an Historic Peak

Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA

11161900 (continued)
Scott Creek above Little Creek near Davenport, CA



Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA

From Landslides, floods, and marine effects of the storm of January 3-5, 1982, in the San Francisco Bay region. U.S. Geological Survey Professional Paper 1434

13. PEAK DISCHARGE, VOLUME, AND FREQUENCY OF THE FLOOD IN THE SANTA CRUZ MOUNTAINS 239

TABLE 13.3.—*Peak discharges, volumes, and recurrence intervals during various durations of flow at selected stream-gaging stations, December 19–26, 1955, and December 30, 1981–January 6, 1982*

["Side" refers to side of the Santa Cruz Mountains drained by the stream]

Station		Side	Peak discharge			1-day volume		3-day volume		8-day volume	
No.	Name		Date	(m^3/s)	Recurrence interval (yr)	(10^3 m^3)	Recurrence interval (yr)	(10^3 m^3)	Recurrence interval (yr)	(10^3 m^3)	Recurrence interval (yr)
11153470	Llagas Creek above Chesbro Reservoir, near Morgan Hill.	East---	1- 4-82	27.75	4	---	---	---	---	---	---
[1]11153800	Alec Canyon near Morgan Hill.	do---	1- 4-82	4.47	4	---	---	---	---	---	---
11153900	Uvas Creek above Uvas Reservoir.	do---	1- 4-82	147.26	5	6,699	15	12,324	22	14,310	9
11154100	Bodfish Creek near Gilroy.	do---	1- 4-82	33.42	10	1,130	12	1,678	9	2,110	7
11158900	Pescadero Creek near Chittenden.	do---	1- 4-82	23.96	6	---	---	---	---	---	---
11159150	Corralitos Creek near Corralitos.	West---	1- 4-82	60.04	9	---	---	---	---	---	---
11159200	Corralitos Creek at Freedom.	do---	12-22-55	102.52	12	---	---	---	---	---	---
			1- 4-82	158.88	40	5,603	30	9,822	19	10,887	10
11159400	Green Valley Creek near Corralitos.	do---	1- 4-82	33.98	15	---	---	---	---	---	---
11159690	Aptos Creek near Aptos.	do---	1- 4-82	112.71	40	4,083	37	5,095	21	5,971	14
[1]11159770	Laurel Creek near Laurel.	do---	1- 4-82	7.65	6	---	---	---	---	---	---
11159800	West Branch Soquel Creek near Soquel.	do---	1- 4-82	106.20	9	---	---	---	---	---	---
11159940	Soquel Creek near Soquel.	do---	1- 4-82	169.92	9	---	---	---	---	---	---
11160000	Soquel Creek at Soquel.	do---	12-23-55	447.46	62	21,588	>100	34,911	>100	43,423	>100
		do---	1- 4-82	274.70	14	10,523	18	14,927	11	17,517	6
11160020	San Lorenzo River near Boulder Creek.	do---	1- 4-82	29.74	11	1,234	8	2,085	7	2,295	5
11160060	Bear Creek at Boulder Creek.	do---	1- 4-82	126.87	7	4,478	---	6,538	---	7,648	---
11160070	Boulder Creek at Boulder Creek.	do---	1- 4-82	99.12	14	2,233	6	4,404	6	5,502	4
11160300	Zayante Creek at Zayante.	do---	1- 4-82	103.93	7	4,182	16	5,428	10	5,909	6
11160500	San Lorenzo River at Big Trees.	do---	12-23-55	860.93	36	41,573	62	63,408	30	85,983	30
		do---	1- 5-82	841.10	33	36,022	36	58,103	24	66,492	11
11161500	Branciforte Creek at Santa Cruz.	do---	12-22-55	229.39	77	---	---	---	---	---	---
		do---	1- 4-82	188.33	29	---	---	---	---	---	---
11161800	San Vicente Creek near Davenport.	do---	1- 4-82	64.57	>100	2,085	38	2,813	27	3,158	10
11161900	Scott Creek above Little Creek, near Davenport.	do---	1- 4-82	119.51	20	---	---	---	---	---	---
[1]11162470	Pescadero Creek tributary near La Honda.	do---	1- 4-82	1.19	23	---	---	---	---	---	---
11162500	Pescadero Creek near Pescadero.	do---	12-23-55	266.77	21	13,570	41	21,342	31	31,334	25
			1- 4-82	266.21	21	8,561	14	12,336	7	14,927	6
11162540	Butano Creek near Pescadero.	do---	1- 4-82	59.47	11	---	---	---	---	---	---
11162570	San Gregorio Creek at San Gregorio.	do---	1- 4-82	224.01	43	---	---	---	---	---	---
11162600	Purisima Creek near Half Moon Bay.	do---	1- 4-82	31.15	>100	---	---	---	---	---	---
11162720	Colma Creek at South San Francisco.	East---	1- 4-82	72.22	40	2,011	>100	2,677	>100	3,417	>100
11162800	Redwood Creek at Redwood City.	do---	1- 4-82	10.73	5	421	29	528	9.2	738	9.1
11163500	Los Trancos Creek at Stanford University.	do---	1- 4-82	26.34	21	---	---	---	---	---	---
11166000	Matadero Creek at Palo Alto.	do---	12-22-55	24.19	7	819	15	1,332	16	1,776	11
			1- 4-82	17.78	4	801	13	1,021	8	1,283	8
11169500	Saratoga Creek at Saratoga.	do---	12-22-55	77.31	46	1,468	14	3,306	22	5,662	20
			1- 4-82	48.71	13	1,194	25	2,788	11	4,108	9
11169580	Calabazas Creek tributary at Mount Eden Road, near Saratoga.	do---	1- 4-82	3.12	4	---	---	---	---	---	---
11169600	Prospect Creek at the Saratoga Golf Course, near Saratoga.	do---	1- 4-82	1.56	5	---	---	---	---	---	---
Median values, 1982											
Study area					13.5	---	21.5	---	17.5	---	9.6
West side					20.5	---	33.0	---	20.0	---	10.0
East side					5.5	---	15.0	---	13.5	---	9.0
Median, 1955					36	---	62	---	22	---	30

[1]Crest-stage gage.

Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION:11161900 SCOTT C AB LITTLE C NR DAVENPORT CA TYPE:STREAM AGENCY:USGS STATE:06 COUNTY:087
LATITUDE: 370351 LONGITUDE: 1221342 NAD27 DRAINAGE AREA:25.1* CONTRIBUTING DRAINAGE AREA: DATUM:

Discharge, cubic feet per second
WATER YEAR OCTOBER 1958 TO SEPTEMBER 1959
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.0	2.0	2.1	1.5	16	54	18	10	6.3	2.2	1.3	0.80
2	2.0	2.0	2.1	1.4	16	49	17	10	6.0	2.1	1.3	0.80
3	2.0	2.0	2.0	1.4	16	45	17	10	5.7	2.1	1.3	0.80
4	2.0	2.0	2.0	1.4	16	40	16	10	5.4	2.0	1.3	0.90
5	2.0	2.0	2.0	44	16	38	16	10	5.1	2.0	1.3	0.80
6	2.0	2.0	1.9	45	16	37	16	9.9	4.8	1.9	1.2	0.80
7	2.0	2.0	2.0	13	16	35	15	9.3	4.5	1.9	1.2	0.80
8	2.0	2.0	2.1	21	15	33	15	9.3	4.3	1.8	1.2	0.90
9	2.0	2.3	2.1	405	16	31	14	9.0	4.1	1.7	1.1	1.0
10	2.0	3.0	2.0	152	28	29	14	9.0	4.1	1.6	1.1	1.0
11	2.0	2.4	2.0	58	61	27	14	8.7	3.9	1.5	1.0	1.0
12	2.0	2.3	2.0	107	55	26	13	8.7	3.9	1.5	0.90	0.80
13	2.0	2.3	2.0	68	45	25	13	8.7	3.7	1.5	0.90	0.80
14	2.0	2.8	2.0	49	38	24	13	9.0	3.7	1.6	1.0	0.80
15	2.0	3.0	2.0	38	69	23	13	8.4	3.5	1.7	1.1	0.80
16	2.0	2.4	2.0	34	222	22	13	8.1	3.5	1.7	1.2	0.80
17	2.0	2.3	2.0	30	141	22	13	8.1	3.2	1.6	1.2	0.80
18	2.0	2.2	2.0	26	208	22	12	7.5	3.2	1.6	1.2	99
19	2.0	2.2	1.9	23	168	21	12	7.5	3.0	1.5	1.3	41
20	2.0	2.2	1.9	21	146	21	12	7.2	3.0	1.5	1.5	13
21	2.0	2.2	2.3	20	174	20	12	7.5	2.8	1.5	1.2	8.4
22	2.0	2.2	2.3	19	132	21	11	7.5	2.8	1.5	1.2	6.0
23	2.0	2.2	2.1	18	105	22	11	7.8	2.6	1.4	1.0	4.3
24	2.0	2.2	2.1	19	87	21	10	7.8	2.6	1.3	1.0	3.7
25	2.0	2.1	2.8	30	72	21	12	7.5	2.5	1.2	0.90	3.0
26	2.0	2.1	3.2	25	64	20	16	7.5	2.5	1.2	0.80	2.8
27	2.0	2.1	9.2	21	60	19	13	7.5	2.4	1.2	0.90	2.8
28	2.0	2.1	2.4	20	58	19	11	7.2	2.3	1.2	0.90	2.8
29	2.0	2.1	1.8	19	---	19	11	6.9	2.3	1.2	0.90	2.8
30	2.0	2.1	1.8	18	---	19	10	6.6	2.2	1.3	0.80	2.8
31	2.0	---	1.5	17	---	19	---	6.6	---	1.3	0.80	---
TOTAL	62.0	66.8	71.6	1365.7	2076	844	403	258.8	109.9	49.3	34.00	206.80
MEAN	2.00	2.23	2.31	44.1	74.1	27.2	13.4	8.35	3.66	1.59	1.10	6.89
MAX	2.0	3.0	9.2	405	222	54	18	10	6.3	2.2	1.5	99
MIN	2.0	2.0	1.5	1.4	15	19	10	6.6	2.2	1.2	0.80	0.80
AC-FT	123	132	142	2710	4120	1670	799	513	218	98	67	410

Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION:11161900 SCOTT C AB LITTLE C NR DAVENPORT CA TYPE:STREAM AGENCY:USGS STATE:06 COUNTY:087
LATITUDE: 370351 LONGITUDE: 1221342 NAD27 DRAINAGE AREA:25.1* CONTRIBUTING DRAINAGE AREA: DATUM

Discharge, cubic feet per second
WATER YEAR OCTOBER 1959 TO SEPTEMBER 1960
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.5	1.5	1.5	2.1	159	23	21	15	7.0	3.7	1.0	0.80
2	2.4	1.7	1.5	2.1	84	22	20	13	6.5	3.7	1.2	0.70
3	2.4	1.9	1.5	2.2	58	21	20	14	6.2	3.5	1.0	0.70
4	2.4	2.0	1.5	2.2	51	20	19	14	6.2	3.5	1.1	0.70
5	2.4	1.9	1.5	2.3	150	20	19	13	5.9	3.5	1.1	0.60
6	2.3	1.8	1.6	2.5	109	21	18	12	6.5	3.5	1.0	0.70
7	2.3	1.8	1.7	2.6	73	27	18	12	6.5	3.5	1.0	0.60
8	2.3	1.7	1.8	9.0	192	27	17	11	6.2	3.5	1.0	0.60
9	2.3	1.7	1.7	17	159	23	17	11	6.2	3.7	1.0	0.60
10	2.2	1.7	1.7	17	159	22	17	11	6.2	3.7	1.0	0.60
11	2.1	1.7	1.8	43	109	21	17	10	5.9	3.7	1.1	0.60
12	2.0	1.8	1.9	30	83	31	15	9.6	5.4	3.3	1.0	0.50
13	1.9	1.9	1.8	18	68	46	15	9.3	5.1	2.6	1.0	0.50
14	1.8	1.9	1.8	30	58	34	14	9.3	4.8	2.3	1.0	0.60
15	1.8	1.9	1.7	34	55	29	13	9.3	4.4	2.2	1.1	0.70
16	1.7	1.9	1.8	23	50	26	13	9.0	3.9	2.1	1.1	0.80
17	1.7	1.9	1.8	19	44	24	12	8.3	4.1	2.0	1.0	0.90
18	1.7	1.9	1.9	15	43	23	11	7.6	4.6	1.9	0.90	0.90
19	1.7	1.9	2.0	14	39	22	11	7.6	4.6	1.8	0.90	0.90
20	1.7	1.8	2.1	12	36	21	11	7.6	4.6	1.8	0.80	0.80
21	1.9	1.8	2.1	25	34	21	11	7.6	3.7	1.8	0.80	0.80
22	1.7	1.7	2.1	28	32	20	11	7.6	3.5	1.6	0.80	0.80
23	1.7	1.7	4.2	23	29	20	11	8.6	3.5	1.5	0.70	0.80
24	1.8	1.6	5.1	32	28	19	11	9.3	3.5	1.5	0.80	0.80
25	1.7	1.7	4.6	51	27	19	11	8.6	3.9	1.5	0.80	0.80
26	1.7	1.7	3.0	53	26	19	13	7.6	4.1	1.5	0.80	0.80
27	1.8	1.7	2.5	40	25	25	26	7.0	4.1	1.4	0.80	0.80
28	1.7	1.5	2.3	30	24	28	18	7.0	4.1	1.3	0.80	0.80
29	1.7	1.6	2.2	26	23	23	16	6.8	4.1	1.4	0.90	0.90
30	1.5	1.8	2.1	23	---	25	15	6.5	3.9	1.3	0.90	1.0
31	1.5	---	2.1	21	---	23	---	7.0	---	1.3	0.80	---
TOTAL	60.3	53.1	66.9	649.0	2027	745	461	297.2	149.2	75.6	29.20	22.10
MEAN	1.95	1.77	2.16	20.9	69.9	24.0	15.4	9.59	4.97	2.44	0.94	0.74
MAX	2.5	2.0	5.1	53	192	46	26	15	7.0	3.7	1.2	1.0
MIN	1.5	1.5	1.5	2.1	23	19	11	6.5	3.5	1.3	0.70	0.50
AC-FT	120	105	133	1290	4020	1480	914	589	296	150	58	44

Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION:11161900 SCOTT C AB LITTLE C NR DAVENPORT CA TYPE:STREAM AGENCY:USGS STATE:06 COUNTY:087
LATITUDE: 370351 LONGITUDE: 1221342 NAD27 DRAINAGE AREA:25.1* CONTRIBUTING DRAINAGE AREA: DATUM:

Discharge, cubic feet per second
WATER YEAR OCTOBER 1960 TO SEPTEMBER 1961
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.1	1.0	29	2.8	26	4.8	18	6.8	5.4	1.6	0.50	0.30
2	1.2	1.1	29	2.8	19	4.6	17	6.5	5.4	1.6	0.50	0.30
3	1.3	1.1	16	2.8	17	4.4	16	5.9	4.8	1.5	0.50	0.30
4	1.3	1.1	11	2.6	14	4.6	15	5.9	4.8	1.5	0.60	0.30
5	1.2	1.1	9.0	2.6	11	6.3	13	6.5	4.6	1.5	0.60	0.30
6	1.8	1.3	6.8	2.5	9.3	9.0	13	10	4.6	1.5	0.60	0.30
7	2.0	1.4	6.2	2.5	7.9	7.0	12	14	4.4	1.5	0.40	0.30
8	1.5	1.4	5.4	2.5	7.0	6.8	11	9.3	3.7	1.5	0.40	0.30
9	1.2	1.4	4.8	2.4	6.8	7.9	11	8.3	3.7	1.5	0.50	0.40
10	1.0	1.4	5.1	2.3	6.2	6.5	10	10	3.7	1.5	0.50	0.40
11	1.0	1.8	6.5	2.3	26	5.9	9.3	8.3	2.8	1.0	0.40	0.50
12	1.1	4.4	5.1	2.2	24	5.9	10	7.6	3.5	1.0	0.40	0.50
13	1.1	7.3	4.6	2.1	17	5.9	10	7.0	3.3	1.1	0.40	0.50
14	1.1	3.5	4.1	2.0	14	6.2	9.6	7.0	2.8	1.0	0.40	0.50
15	1.0	2.4	4.4	2.0	15	29	8.3	6.5	2.6	1.0	0.40	0.50
16	1.0	2.1	5.1	2.0	15	21	7.9	6.5	2.8	0.90	0.50	0.60
17	1.0	1.9	4.8	2.0	13	47	7.6	6.2	3.0	0.80	0.40	0.80
18	1.0	2.1	4.4	2.0	11	28	6.8	5.9	3.5	0.60	0.40	0.80
19	1.0	2.1	4.1	1.9	8.6	23	6.5	6.5	3.3	0.60	0.40	0.80
20	1.0	2.1	4.1	1.9	7.9	25	6.5	6.8	2.8	0.50	0.40	0.80
21	1.0	2.1	3.9	1.9	7.3	20	7.0	6.5	2.6	0.50	0.40	0.80
22	1.1	2.1	3.7	1.9	6.8	17	12	5.9	2.4	0.50	0.30	0.80
23	1.1	2.2	3.5	2.1	6.2	17	15	5.9	2.3	0.50	0.30	0.80
24	1.1	2.2	3.3	2.2	5.6	22	11	5.6	2.3	0.60	0.30	0.70
25	1.1	5.9	3.3	4.6	5.6	28	9.0	5.4	2.1	0.60	0.30	0.70
26	1.2	53	3.3	27	5.4	27	7.9	5.1	2.1	0.60	0.30	0.60
27	1.1	13	2.8	13	4.8	29	7.3	4.8	2.0	0.60	0.30	0.50
28	1.0	7.0	2.8	8.3	5.1	28	6.8	4.8	1.8	0.60	0.30	0.50
29	1.0	5.9	2.8	7.3	---	24	6.8	4.6	1.7	0.60	0.40	0.40
30	1.0	12	2.8	10	---	22	7.0	4.8	1.6	0.50	0.40	0.60
31	1.0	---	2.8	24	---	20	---	4.8	---	0.50	0.40	---
TOTAL	35.6	147.4	204.5	148.5	322.5	512.8	308.3	209.7	96.4	29.80	12.90	15.90
MEAN	1.15	4.91	6.60	4.79	11.5	16.5	10.3	6.76	3.21	0.96	0.42	0.53
MAX	2.0	53	29	27	26	47	18	14	5.4	1.6	0.60	0.80
MIN	1.0	1.0	2.8	1.9	4.8	4.4	6.5	4.6	1.6	0.50	0.30	0.30
AC-FT	71	292	406	295	640	1020	612	416	191	59	26	32

Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION:11161900 SCOTT C AB LITTLE C NR DAVENPORT CA TYPE:STREAM AGENCY:USGS STATE:06 COUNTY:087
LATITUDE: 370351 LONGITUDE: 1221342 NAD27 DRAINAGE AREA:25.1* CONTRIBUTING DRAINAGE AREA: DATUM:

Discharge, cubic feet per second
WATER YEAR OCTOBER 1961 TO SEPTEMBER 1962
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.50	0.50	11	1.5	5.6	120	34	15	8.0	3.7	1.8	0.90
2	0.50	0.50	43	1.5	5.1	116	33	14	7.7	3.7	2.0	0.90
3	0.60	0.60	20	1.5	4.6	100	31	14	7.4	3.3	1.7	0.90
4	0.50	0.60	10	1.5	4.6	87	30	13	7.4	3.1	1.6	0.90
5	0.40	0.50	5.9	1.5	4.8	139	29	13	7.0	3.1	1.7	0.90
6	0.30	0.50	4.1	1.5	3.5	250	27	12	7.0	2.9	1.6	0.90
7	0.30	0.40	3.3	1.5	14	198	26	12	6.7	2.9	1.3	0.80
8	0.30	0.40	2.5	1.5	26	148	25	12	6.5	2.9	1.3	0.80
9	0.30	0.40	2.3	1.4	211	121	24	13	6.2	2.9	1.4	0.80
10	0.40	0.40	2.2	1.4	226	105	23	12	6.2	2.8	1.6	0.80
11	0.40	0.50	2.1	1.3	118	92	23	12	6.2	2.6	1.3	0.70
12	0.40	0.50	1.9	1.3	89	83	22	11	6.2	2.6	1.1	0.60
13	0.40	0.50	1.9	1.3	637	76	21	11	6.5	2.8	0.90	0.60
14	0.40	0.40	2.1	1.3	417	69	21	11	7.4	2.4	0.90	0.60
15	0.40	0.50	2.1	1.3	455	64	20	11	7.4	2.4	0.90	0.60
16	0.40	0.50	4.7	1.3	346	58	20	11	7.0	2.3	0.90	0.40
17	0.30	0.60	2.1	1.5	258	55	19	11	6.7	2.4	0.90	0.40
18	0.30	0.70	2.1	1.5	226	51	18	10	6.2	2.6	0.90	0.50
19	0.40	1.2	2.1	32	181	49	20	10	5.7	2.4	1.6	0.80
20	0.40	4.8	2.1	70	153	50	19	10	5.0	2.4	1.3	0.80
21	0.40	3.0	2.0	21	124	46	18	10	4.7	2.3	1.0	0.80
22	0.40	2.5	1.9	14	104	76	17	9.7	4.5	2.1	1.1	0.90
23	0.40	2.0	1.9	11	87	66	17	9.3	4.5	1.8	1.3	0.90
24	0.50	2.2	1.9	9.6	81	56	16	9.3	4.2	1.7	1.1	0.90
25	0.50	3.3	1.8	9.0	74	51	16	9.3	4.0	1.8	1.3	0.80
26	0.50	5.6	1.8	7.9	65	47	16	9.7	3.8	1.8	0.90	0.80
27	0.50	4.6	1.8	7.6	59	42	17	9.3	3.7	1.8	0.90	0.90
28	0.60	3.9	1.7	7.0	56	39	20	9.3	3.7	2.0	0.80	0.90
29	0.50	5.4	1.7	6.5	---	38	17	9.0	3.8	2.0	0.60	1.3
30	0.50	6.8	1.7	6.5	---	38	16	8.7	3.8	2.0	0.90	0.90
31	0.40	---	1.7	5.6	---	36	---	8.4	---	1.8	0.90	---
TOTAL	13.10	54.30	147.4	233.3	4035.2	2566	655	340.0	175.1	77.3	37.50	23.70
MEAN	0.42	1.81	4.75	7.53	144	82.8	21.8	11.0	5.84	2.49	1.21	0.79
MAX	0.60	6.8	43	70	637	250	34	15	8.0	3.7	2.0	1.3
MIN	0.30	0.40	1.7	1.3	3.5	36	16	8.4	3.7	1.7	0.60	0.40
AC-FT	26	108	292	463	8000	5090	1300	674	347	153	74	47

Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION:11161900 SCOTT C AB LITTLE C NR DAVENPORT CA TYPE:STREAM AGENCY:USGS STATE:06 COUNTY:087
LATITUDE: 370351 LONGITUDE: 1221342 NAD27 DRAINAGE AREA:25.1* CONTRIBUTING DRAINAGE AREA: DATUM:

Discharge, cubic feet per second
WATER YEAR OCTOBER 1962 TO SEPTEMBER 1963
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.80	7.7	5.2	12	644	57	87	97	31	16	7.7	3.7
2	0.70	8.4	6.0	12	303	56	80	91	29	16	7.7	4.0
3	0.60	8.0	9.3	13	184	52	74	90	28	15	7.7	3.5
4	0.60	8.0	9.0	14	151	51	70	90	26	15	7.7	3.8
5	0.60	7.7	7.7	14	125	47	69	84	25	15	7.4	3.8
6	0.70	7.4	7.0	14	105	48	291	76	24	14	7.0	3.1
7	0.50	6.7	6.7	14	93	43	383	74	23	14	6.7	2.8
8	0.60	7.0	7.0	13	95	43	192	71	23	13	7.0	2.6
9	0.60	7.4	6.7	12	388	42	157	69	22	13	7.4	2.9
10	1.7	7.7	6.7	14	444	38	152	73	21	11	6.7	2.8
11	5.7	7.7	7.0	14	267	35	135	70	21	12	6.7	2.6
12	8.1	7.7	7.4	13	297	35	124	66	20	12	6.5	2.9
13	499	7.7	11	13	376	31	125	69	19	12	6.2	3.3
14	157	7.5	17	13	246	34	256	71	18	11	5.7	2.9
15	48	7.5	121	14	197	34	233	65	18	11	5.5	2.4
16	32	7.0	100	14	172	87	186	63	17	10	5.5	2.3
17	23	6.5	116	13	148	64	167	58	18	10	5.5	2.6
18	18	6.0	57	13	128	52	156	57	17	9.7	5.0	2.8
19	16	6.0	29	12	116	47	257	54	18	10	5.0	2.8
20	15	5.5	19	11	105	44	211	51	20	10	4.0	2.8
21	14	5.5	15	12	95	42	192	49	20	9.7	4.0	2.8
22	13	5.0	12	14	90	50	168	47	20	9.7	4.5	2.8
23	12	5.0	10	12	83	67	154	44	20	9.3	4.7	2.9
24	11	5.0	10	11	77	57	143	43	19	8.7	4.7	2.9
25	10	4.8	9.3	11	74	52	152	43	19	8.7	4.2	2.8
26	10	6.0	9.0	11	70	49	144	42	18	8.4	4.0	2.6
27	9.3	19	9.3	10	65	131	118	40	17	8.4	3.7	2.3
28	8.7	8.4	10	10	62	270	111	38	17	8.4	3.7	2.3
29	8.7	6.2	11	13	---	143	106	36	16	8.4	3.7	2.3
30	8.4	5.7	11	400	---	113	105	35	16	8.4	3.7	2.3
31	7.7	---	12	1030	---	97	---	33	---	8.0	3.8	---
TOTAL	942.00	215.7	674.3	1796	5200	2011	4798	1889	620	345.8	173.3	86.4
MEAN	30.4	7.19	21.8	57.9	186	64.9	160	60.9	20.7	11.2	5.59	2.88
MAX	499	19	121	1030	644	270	383	97	31	16	7.7	4.0
MIN	0.50	4.8	5.2	10	62	31	69	33	16	8.0	3.7	2.3
AC-FT	1870	428	1340	3560	10310	3990	9520	3750	1230	686	344	171

Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION:11161900 SCOTT C AB LITTLE C NR DAVENPORT CA TYPE:STREAM AGENCY:USGS STATE:06 COUNTY:087
LATITUDE: 370351 LONGITUDE: 1221342 NAD27 DRAINAGE AREA:25.1* CONTRIBUTING DRAINAGE AREA: DATUM:

Discharge, cubic feet per second
WATER YEAR OCTOBER 1963 TO SEPTEMBER 1964
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.3	2.3	17	8.1	30	14	18	8.7	5.4	2.4	1.6	1.1
2	2.4	2.6	16	8.4	27	16	15	8.1	5.2	2.6	1.5	0.80
3	2.4	2.7	15	8.4	24	13	14	9.0	4.9	3.2	1.4	0.90
4	2.4	7.1	14	8.1	25	13	13	8.4	4.7	3.7	1.3	0.90
5	2.6	19	13	8.1	22	12	13	8.1	4.7	3.8	1.2	0.90
6	2.7	26	13	8.1	20	14	12	8.7	4.7	3.5	1.1	0.90
7	2.7	10	13	9.7	19	13	12	8.1	4.9	3.4	0.90	1.0
8	2.9	7.5	13	9.0	19	12	11	8.1	9.0	3.0	1.0	1.0
9	3.2	6.9	16	8.7	18	12	11	7.5	15	3.0	0.90	1.0
10	6.7	6.1	15	8.7	18	12	11	7.5	9.7	3.0	1.0	1.0
11	14	5.6	13	8.7	17	12	10	7.2	8.1	2.7	1.0	0.90
12	4.2	5.4	13	8.7	17	20	9.7	6.9	6.9	2.6	0.90	0.80
13	3.0	5.8	12	8.7	16	15	9.3	6.6	6.6	2.7	0.90	0.70
14	2.4	46	12	9.0	16	13	9.0	6.6	5.8	2.7	0.90	0.90
15	4.4	56	12	8.4	18	12	8.7	6.3	5.6	2.7	1.2	0.90
16	5.2	20	11	8.1	16	11	8.4	6.3	5.8	2.6	1.1	0.90
17	3.7	15	11	10	16	11	8.4	8.1	5.6	2.6	1.0	0.90
18	3.0	11	10	21	15	10	8.4	7.2	5.2	2.3	0.90	0.80
19	2.7	139	13	30	14	10	8.4	6.3	4.5	2.2	0.90	0.70
20	2.6	115	12	139	14	9.3	8.1	5.8	4.7	2.2	0.90	0.60
21	2.6	47	10	225	13	10	8.1	5.8	3.4	2.1	0.90	0.60
22	2.6	32	9.3	134	13	20	7.8	6.1	3.8	1.9	0.90	0.60
23	2.9	43	8.7	95	13	26	8.1	6.1	3.7	1.9	0.80	0.70
24	2.4	43	8.7	79	12	23	8.1	5.8	3.5	1.9	0.90	0.80
25	2.4	33	9.0	67	12	20	8.1	5.6	3.4	1.6	0.80	0.80
26	2.3	27	9.0	59	12	18	8.1	5.6	3.2	1.7	0.70	0.90
27	2.2	24	8.7	53	12	17	7.8	6.6	2.7	1.7	0.70	1.1
28	2.2	21	8.4	45	12	15	7.8	6.6	3.0	1.7	0.80	1.2
29	2.2	19	8.1	41	12	14	7.5	5.6	3.2	1.7	0.90	1.2
30	2.3	18	7.8	37	---	14	7.2	5.4	3.2	1.7	0.80	1.1
31	2.3	---	7.8	34	---	16	---	5.4	---	1.7	1.0	---
TOTAL	101.9	816.0	359.5	1205.9	492	447.3	297.0	214.1	160.1	76.5	30.80	26.60
MEAN	3.29	27.2	11.6	38.9	17.0	14.4	9.90	6.91	5.34	2.47	0.99	0.89
MAX	14	139	17	225	30	26	18	9.0	15	3.8	1.6	1.2
MIN	2.2	2.3	7.8	8.1	12	9.3	7.2	5.4	2.7	1.6	0.70	0.60
AC-FT	202	1620	713	2390	976	887	589	425	318	152	61	53

Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION:11161900 SCOTT C AB LITTLE C NR DAVENPORT CA TYPE:STREAM AGENCY:USGS STATE:06 COUNTY:087
LATITUDE: 370351 LONGITUDE: 1221342 NAD27 DRAINAGE AREA:25.1* CONTRIBUTING DRAINAGE AREA: DATUM:

Discharge, cubic feet per second
WATER YEAR OCTOBER 1964 TO SEPTEMBER 1965
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.90	4.6	2.9	283	54	30	35	41	21	12	4.5	2.9
2	0.80	4.7	3.2	278	53	29	32	40	20	11	4.4	2.9
3	0.80	3.9	3.6	457	53	27	32	42	20	10	4.3	2.9
4	1.0	3.0	3.8	502	57	27	29	41	19	9.7	4.2	2.7
5	0.90	2.7	4.0	567	75	30	29	40	19	9.0	4.1	2.7
6	1.1	2.4	4.0	653	65	33	27	38	19	8.7	4.0	2.7
7	1.4	2.3	4.0	476	58	32	29	35	18	7.8	3.9	2.9
8	1.1	4.3	4.2	324	53	31	88	34	18	7.8	3.8	2.7
9	1.1	32	4.7	251	50	30	194	33	18	7.8	3.8	2.6
10	1.1	50	5.2	211	48	29	118	31	17	6.6	4.0	2.6
11	0.90	24	7.2	181	46	29	67	29	16	6.6	4.0	2.6
12	1.1	26	7.2	160	44	33	53	29	16	6.6	3.8	2.6
13	1.3	15	6.3	139	43	36	44	28	16	6.6	3.8	2.6
14	1.3	8.7	6.1	131	42	33	42	29	16	6.5	4.0	2.4
15	1.2	5.4	6.3	118	48	31	43	29	16	6.4	3.8	2.3
16	1.1	4.2	6.3	109	40	30	106	28	16	6.2	4.0	2.3
17	1.1	3.7	5.8	103	38	29	75	28	15	6.0	4.0	2.2
18	0.80	3.2	6.3	98	37	29	69	26	14	5.9	3.7	2.1
19	0.80	2.9	65	93	35	29	65	26	14	5.8	3.5	2.2
20	0.80	2.6	66	86	34	29	60	26	14	5.7	3.2	2.2
21	0.80	2.4	230	79	32	28	56	26	14	5.6	3.2	2.2
22	0.80	3.7	747	84	32	28	55	27	14	5.5	3.2	2.1
23	0.90	2.9	854	97	32	26	53	26	14	5.4	3.2	2.1
24	1.0	2.6	661	118	29	26	51	25	14	5.3	3.2	2.2
25	1.7	2.6	406	98	29	26	49	24	14	5.2	3.2	2.3
26	1.2	2.6	481	87	29	29	46	23	13	5.1	3.0	2.3
27	1.2	2.4	501	80	39	38	44	22	12	5.0	2.9	2.6
28	1.7	2.3	376	73	32	32	44	21	12	4.8	2.9	2.7
29	5.2	2.2	360	72	---	30	43	20	12	4.7	2.9	2.6
30	5.2	2.2	368	63	---	29	43	20	12	4.6	2.7	4.7
31	3.0	---	328	57	---	40	---	20	---	4.6	2.7	---
TOTAL	43.30	231.5	5534.1	6128	1227	938	1721	907	473	208.5	111.9	76.9
MEAN	1.40	7.72	179	198	43.8	30.3	57.4	29.3	15.8	6.73	3.61	2.56
MAX	5.2	50	854	653	75	40	194	42	21	12	4.5	4.7
MIN	0.80	2.2	2.9	57	29	26	27	20	12	4.6	2.7	2.1
AC-FT	86	459	10980	12150	2430	1860	3410	1800	938	414	222	153

Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION:11161900 SCOTT C AB LITTLE C NR DAVENPORT CA TYPE:STREAM AGENCY:USGS STATE:06 COUNTY:087
LATITUDE: 370351 LONGITUDE: 1221342 NAD27 DRAINAGE AREA:25.1* CONTRIBUTING DRAINAGE AREA: DATUM:

Discharge, cubic feet per second
WATER YEAR OCTOBER 1965 TO SEPTEMBER 1966
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.9	1.6	6.4	34	71	32	14	8.8	6.1	2.2	1.0	0.80
2	2.6	1.7	6.1	28	61	33	13	8.4	5.5	2.2	0.90	0.80
3	2.3	1.7	5.5	24	50	31	13	8.4	5.5	2.0	0.90	0.80
4	2.8	1.7	5.2	27	132	30	13	8.0	5.2	2.0	0.90	0.60
5	2.5	1.7	4.9	164	111	30	12	7.6	4.9	2.0	0.90	0.60
6	2.2	1.5	4.9	99	92	26	12	7.6	4.9	2.0	0.90	0.80
7	1.9	1.5	4.6	61	73	27	12	7.3	4.9	2.0	0.80	0.90
8	2.0	1.6	4.6	47	62	29	12	7.6	4.4	2.0	0.90	0.90
9	2.0	1.7	4.6	39	54	28	14	8.0	4.2	2.0	0.90	0.90
10	1.9	1.7	4.6	36	49	28	16	8.0	4.2	2.0	1.0	0.70
11	1.9	1.6	5.2	31	44	27	14	7.6	4.1	2.0	1.0	0.60
12	1.8	2.3	8.8	29	41	25	14	7.3	3.7	2.0	1.0	0.60
13	1.7	7.3	7.3	27	37	25	14	7.3	3.7	2.0	1.0	0.60
14	1.8	26	6.4	24	34	24	13	7.0	3.7	1.9	0.90	0.60
15	1.7	11	6.1	23	31	23	13	6.7	3.7	1.8	0.90	0.60
16	1.9	9.6	6.1	21	30	22	12	6.7	3.9	1.7	0.80	0.60
17	1.8	17	5.8	19	30	21	12	6.4	3.9	1.6	0.70	0.60
18	1.8	30	5.8	19	28	21	12	6.4	3.7	1.5	0.60	0.50
19	1.8	15	5.8	19	58	19	12	6.1	3.2	1.4	0.60	0.60
20	1.8	10	5.8	17	49	19	12	6.1	3.0	1.4	0.60	0.50
21	1.7	8.0	5.8	17	41	19	11	6.1	3.0	1.5	0.70	0.50
22	1.5	6.7	5.8	17	38	18	11	6.1	3.0	1.5	0.90	0.50
23	1.4	8.4	5.5	16	41	17	10	6.1	3.0	1.4	0.80	0.40
24	1.3	12	5.8	16	40	16	10	6.1	3.0	1.3	0.60	0.40
25	1.3	17	27	15	38	16	9.2	6.1	2.8	1.2	0.50	0.40
26	1.2	14	16	15	38	16	8.8	6.1	2.6	1.1	0.50	0.40
27	1.3	11	13	15	35	15	8.8	6.1	2.6	1.2	0.50	0.40
28	1.3	9.2	32	14	34	15	8.8	6.1	2.5	1.2	0.40	0.50
29	1.4	8.0	90	41	---	15	9.6	6.4	2.3	1.2	0.40	0.40
30	1.5	7.0	63	83	---	14	9.2	6.4	2.2	1.3	0.50	0.40
31	1.5	---	45	50	---	14	---	6.4	---	1.4	0.80	---
TOTAL	57.5	247.5	423.4	1087	1442	695	355.4	215.3	113.4	52.0	23.80	17.90
MEAN	1.85	8.25	13.7	35.1	51.5	22.4	11.8	6.95	3.78	1.68	0.77	0.60
MAX	3.9	30	90	164	132	33	16	8.8	6.1	2.2	1.0	0.90
MIN	1.2	1.5	4.6	14	28	14	8.8	6.1	2.2	1.1	0.40	0.40
AC-FT	114	491	840	2160	2860	1380	705	427	225	103	47	36

Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION:11161900 SCOTT C AB LITTLE C NR DAVENPORT CA TYPE:STREAM AGENCY:USGS STATE:06 COUNTY:087
LATITUDE: 370351 LONGITUDE: 1221342 NAD27 DRAINAGE AREA:25.1* CONTRIBUTING DRAINAGE AREA: DATUM:

Discharge, cubic feet per second
WATER YEAR OCTOBER 1966 TO SEPTEMBER 1967
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.50	0.60	17	12	324	35	123	94	39	16	6.5	4.2
2	0.60	0.50	125	12	231	34	112	87	84	14	6.5	4.2
3	0.70	0.60	77	11	182	32	103	82	56	14	6.5	4.2
4	0.70	0.60	124	10	148	31	101	76	44	14	6.3	4.0
5	0.70	0.80	367	9.6	138	29	103	73	38	14	6.0	3.7
6	0.70	3.4	199	9.4	132	28	202	70	36	13	5.8	3.7
7	0.60	4.9	110	9.1	124	27	187	66	34	12	5.6	3.7
8	0.60	2.5	73	9.1	110	27	150	65	32	12	5.6	3.6
9	0.60	1.8	57	9.1	97	27	132	61	32	11	5.6	3.6
10	0.60	1.5	51	8.7	90	26	166	63	31	11	5.6	3.6
11	0.60	1.6	43	8.7	82	46	211	57	28	11	5.6	3.6
12	0.70	1.5	37	8.7	76	50	170	56	27	11	5.6	3.4
13	0.60	1.5	34	8.4	72	57	148	54	26	11	5.6	3.4
14	0.60	2.0	31	8.4	68	51	138	52	25	10	5.6	3.4
15	0.50	5.0	28	8.1	63	48	144	50	24	10	5.4	3.4
16	0.50	17	26	8.1	61	361	130	47	23	9.7	5.1	3.4
17	0.50	6.0	24	7.8	56	180	149	44	22	9.7	5.1	3.4
18	0.50	4.2	23	7.5	53	117	184	41	21	9.4	4.9	3.4
19	0.50	7.2	22	7.8	52	94	163	40	21	9.1	4.7	3.4
20	0.50	24	21	19	48	86	146	38	20	8.7	4.7	2.9
21	0.50	19	20	1190	47	89	166	37	19	8.4	4.7	2.9
22	0.50	27	20	759	44	79	152	35	19	8.4	4.7	3.1
23	0.60	12	19	387	44	90	166	34	18	8.4	4.7	3.2
24	0.60	7.8	18	605	46	81	168	31	18	8.1	4.7	3.2
25	0.50	6.0	18	329	47	75	152	31	18	7.8	4.7	3.2
26	0.50	5.6	17	213	41	70	138	30	18	7.5	4.7	3.2
27	0.60	4.9	16	161	38	65	132	29	18	7.1	4.7	2.9
28	0.70	8.5	15	151	37	62	121	29	18	7.1	4.7	2.9
29	0.70	38	15	515	---	61	112	29	17	6.8	4.4	2.9
30	0.60	18	14	742	---	122	103	27	16	5.8	4.4	2.9
31	0.60	---	13	512	---	156	---	26	---	6.3	4.2	---
TOTAL	18.20	234.00	1674	5756.5	2551	2336	4372	1554	842	312.3	162.9	102.6
MEAN	0.59	7.80	54.0	186	91.1	75.4	146	50.1	28.1	10.1	5.25	3.42
MAX	0.70	38	367	1190	324	361	211	94	84	16	6.5	4.2
MIN	0.50	0.50	13	7.5	37	26	101	26	16	5.8	4.2	2.9
AC-FT	36	464	3320	11420	5060	4630	8670	3080	1670	619	323	204

Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION:11161900 SCOTT C AB LITTLE C NR DAVENPORT CA TYPE:STREAM AGENCY:USGS STATE:06 COUNTY:087
LATITUDE: 370351 LONGITUDE: 1221342 NAD27 DRAINAGE AREA:25.1* CONTRIBUTING DRAINAGE AREA: DATUM:

Discharge, cubic feet per second
WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.8	2.2	4.7	5.8	94	43	40	14	7.5	3.7	2.0	1.4
2	3.4	2.2	3.6	5.8	68	38	35	14	7.1	3.7	2.0	1.3
3	4.4	2.2	4.3	5.6	56	36	30	14	7.1	3.7	1.9	1.3
4	3.2	2.2	16	5.8	47	34	29	14	6.8	3.7	1.8	1.5
5	3.1	2.3	23	5.8	42	32	28	13	7.5	3.6	1.7	1.5
6	3.1	2.5	11	5.8	37	30	27	13	7.8	3.6	1.7	1.4
7	2.9	2.6	17	5.8	33	30	26	12	7.8	3.6	1.6	1.3
8	2.8	2.5	12	5.8	30	35	25	12	7.5	3.4	1.5	1.3
9	2.6	2.4	8.7	6.3	28	29	24	12	7.1	3.4	1.5	1.2
10	2.6	2.4	7.5	40	27	27	23	12	6.8	3.5	1.5	1.1
11	2.6	2.4	6.5	21	27	26	23	12	6.5	3.4	1.4	1.1
12	2.6	2.4	6.8	14	25	55	22	12	6.5	3.1	1.4	1.1
13	2.6	2.5	6.3	11	23	110	21	14	6.3	3.0	1.7	1.1
14	2.6	3.1	6.3	11	23	100	20	14	6.0	3.1	1.9	1.3
15	2.5	2.9	6.5	26	21	75	20	13	6.0	3.1	1.9	1.3
16	2.6	2.8	6.5	21	66	110	19	11	5.6	3.0	1.7	1.0
17	2.4	2.8	8.4	16	293	130	19	11	5.6	2.9	1.6	0.97
18	2.4	2.8	14	14	157	95	18	10	5.6	2.7	1.5	1.0
19	2.4	2.6	13	12	101	75	18	10	5.4	2.5	2.2	0.97
20	2.5	2.8	11	11	225	60	18	9.7	5.4	2.4	2.4	0.97
21	2.5	2.6	9.4	10	184	54	17	9.4	5.4	2.5	2.0	0.98
22	2.6	2.5	8.4	9.4	138	51	16	9.4	5.1	2.5	1.9	0.90
23	2.6	2.5	8.1	9.1	112	50	16	9.1	4.9	2.5	1.7	0.85
24	2.6	2.5	7.8	8.7	84	45	16	9.1	4.9	2.3	1.6	0.82
25	2.4	2.5	7.1	8.4	70	43	16	9.7	4.9	2.4	1.6	0.82
26	2.4	2.3	6.8	8.4	60	40	15	8.4	4.9	2.4	1.6	0.83
27	2.4	2.3	6.3	8.7	53	38	15	8.1	4.7	2.3	1.5	0.82
28	2.6	3.1	6.3	8.7	48	35	14	8.1	4.4	2.3	1.4	0.89
29	2.5	3.4	6.0	14	45	33	14	7.8	3.9	2.3	1.3	0.95
30	2.2	5.6	6.0	440	---	32	14	7.8	3.7	2.1	1.3	1.1
31	2.2	---	5.8	197	---	31	---	7.8	---	2.1	1.4	---
TOTAL	83.1	79.9	271.1	971.9	2217	1622	638	341.4	178.7	90.8	52.2	33.07
MEAN	2.68	2.66	8.75	31.4	76.4	52.3	21.3	11.0	5.96	2.93	1.68	1.10
MAX	4.4	5.6	23	440	293	130	40	14	7.8	3.7	2.4	1.5
MIN	2.2	2.2	3.6	5.6	21	26	14	7.8	3.7	2.1	1.3	0.82
AC-FT	165	158	538	1930	4400	3220	1270	677	354	180	104	66

Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION:11161900 SCOTT C AB LITTLE C NR DAVENPORT CA TYPE:STREAM AGENCY:USGS STATE:06 COUNTY:087
LATITUDE: 370351 LONGITUDE: 1221342 NAD27 DRAINAGE AREA:25.1* CONTRIBUTING DRAINAGE AREA: DATUM:

Discharge, cubic feet per second
WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.1	1.6	2.9	36	196	510	53	31	13	9.9	4.0	2.3
2	1.2	2.2	2.6	31	161	388	66	28	13	9.6	3.9	2.2
3	1.3	7.5	2.5	27	134	312	66	27	13	11	3.7	2.2
4	1.2	3.9	2.4	24	114	272	54	26	12	11	3.5	2.2
5	1.1	3.0	2.4	21	157	239	142	24	12	9.5	3.4	2.1
6	1.1	2.7	2.3	20	278	216	119	23	12	8.7	3.4	2.1
7	1.1	2.6	2.3	18	231	196	97	23	12	8.4	3.4	2.5
8	1.1	2.4	2.9	16	168	172	82	23	11	8.4	3.4	2.2
9	1.0	2.3	4.8	16	152	161	75	23	12	8.3	3.3	2.1
10	0.94	2.2	36	14	123	150	68	23	13	8.1	3.3	1.9
11	1.2	2.2	32	14	457	138	61	22	13	7.4	3.2	1.9
12	4.5	2.7	15	17	442	144	57	22	13	7.2	3.1	2.1
13	3.4	2.4	11	535	297	124	56	22	12	7.1	3.1	2.1
14	2.7	2.9	59	345	312	123	51	22	11	6.9	3.1	2.1
15	2.4	20	61	177	845	114	48	22	11	6.7	3.0	2.1
16	2.0	7.5	48	128	468	108	45	23	10	6.2	3.0	2.1
17	1.7	4.9	28	103	381	106	43	23	9.7	6.0	3.1	2.0
18	1.6	4.2	20	255	342	101	43	23	9.6	6.0	3.2	1.9
19	1.5	3.7	18	812	348	92	38	22	9.6	5.9	3.3	1.9
20	1.5	3.4	15	832	303	106	37	21	11	5.7	3.1	1.9
21	1.4	3.0	13	848	272	110	36	21	12	5.6	2.9	2.0
22	1.4	2.8	11	598	258	103	35	20	13	5.6	2.8	1.9
23	1.4	2.6	10	451	370	92	46	20	13	5.5	2.7	1.7
24	1.4	2.7	16	468	493	86	42	18	13	5.2	2.6	1.6
25	1.3	2.7	38	815	395	79	40	18	12	5.2	2.6	1.6
26	1.3	2.5	80	732	333	75	41	17	12	5.2	2.5	1.6
27	1.4	2.4	47	469	297	70	38	16	11	5.0	2.4	1.8
28	1.4	2.4	114	378	541	65	37	16	11	4.9	2.3	2.0
29	1.8	2.3	76	290	---	62	37	14	11	4.7	2.3	1.8
30	2.1	3.2	52	416	---	61	35	14	10	4.5	2.3	1.6
31	1.9	---	43	234	---	56	---	13	---	4.3	2.3	---
TOTAL	50.44	110.9	868.1	9140	8868	4631	1688	660	350.9	213.7	94.2	59.5
MEAN	1.63	3.70	28.0	295	317	149	56.3	21.3	11.7	6.89	3.04	1.98
MAX	4.5	20	114	848	845	510	142	31	13	11	4.0	2.5
MIN	0.94	1.6	2.3	14	114	56	35	13	9.6	4.3	2.3	1.6
AC-FT	100	220	1720	18130	17590	9190	3350	1310	696	424	187	118

Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION:11161900 SCOTT C AB LITTLE C NR DAVENPORT CA TYPE:STREAM AGENCY:USGS STATE:06 COUNTY:087
LATITUDE: 370351 LONGITUDE: 1221342 NAD27 DRAINAGE AREA:25.1* CONTRIBUTING DRAINAGE AREA: DATUM:

Discharge, cubic feet per second
WATER YEAR OCTOBER 1969 TO SEPTEMBER 1970
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.4	2.3	2.6	38	132	217	38	20	9.8	4.9	2.9	1.7
2	1.4	2.3	2.6	33	120	146	38	19	9.4	4.6	2.8	1.7
3	1.3	2.3	2.5	30	111	116	37	19	9.0	4.3	2.8	1.7
4	1.1	2.3	2.5	28	105	245	35	18	8.6	4.1	2.7	1.7
5	1.1	4.4	2.6	26	98	214	34	18	8.6	3.9	2.7	1.6
6	1.1	4.9	2.5	24	91	154	34	18	8.9	3.8	2.6	1.6
7	1.2	3.7	2.6	22	86	131	33	18	8.8	3.9	2.6	1.6
8	1.3	3.4	3.3	22	81	119	32	17	9.0	3.9	2.5	1.6
9	1.4	3.2	3.5	79	77	110	31	18	13	4.0	2.5	1.5
10	1.7	3.0	4.5	86	73	103	30	17	10	4.0	2.5	1.5
11	1.6	2.9	4.6	67	70	94	30	16	9.2	3.9	2.4	1.5
12	1.3	2.8	17	73	77	88	29	19	8.6	3.9	2.4	1.4
13	1.4	2.8	15	87	85	83	29	20	8.6	3.8	2.3	1.4
14	1.5	2.8	8.8	476	77	78	29	16	9.3	3.8	2.3	1.4
15	6.5	2.9	6.9	237	71	74	28	15	9.1	3.7	2.3	1.3
16	17	2.9	5.9	653	72	70	28	15	8.7	3.7	2.2	1.3
17	6.4	3.4	5.4	280	87	67	27	14	8.6	3.6	2.2	1.3
18	4.0	2.8	5.4	190	75	64	25	14	8.0	3.6	2.2	1.3
19	3.4	2.8	77	170	69	61	26	14	7.5	3.5	2.1	1.2
20	2.9	2.7	194	250	66	58	24	14	7.3	3.5	2.1	1.2
21	2.8	2.6	217	960	62	56	24	13	6.9	3.4	2.1	1.2
22	2.6	2.6	103	493	59	54	24	12	6.8	3.4	2.0	1.2
23	2.8	2.6	59	392	57	52	23	12	6.6	3.3	2.0	1.1
24	2.8	2.8	246	539	55	51	22	11	6.3	3.3	2.0	1.1
25	2.8	2.8	299	291	52	50	22	12	6.1	3.2	1.9	1.1
26	2.6	2.8	127	227	50	47	22	12	5.7	3.2	1.9	1.1
27	2.6	2.6	84	321	52	44	22	12	5.5	3.1	1.9	1.1
28	2.5	2.6	64	231	90	44	21	11	5.5	3.1	1.8	1.0
29	2.4	2.6	57	188	---	42	20	11	5.4	3.0	1.8	1.0
30	2.4	2.6	49	163	---	41	20	10	5.2	3.0	1.8	1.0
31	2.4	---	42	145	---	40	---	9.9	---	2.9	1.8	---
TOTAL	87.7	87.2	1716.2	6821	2200	2813	837	464.9	240.0	113.3	70.1	40.4
MEAN	2.83	2.91	55.4	220	78.6	90.7	27.9	15.0	8.00	3.65	2.26	1.35
MAX	17	4.9	299	960	132	245	38	20	13	4.9	2.9	1.7
MIN	1.1	2.3	2.5	22	50	40	20	9.9	5.2	2.9	1.8	1.0
AC-FT	174	173	3400	13530	4360	5580	1660	922	476	225	139	80

Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION:11161900 SCOTT C AB LITTLE C NR DAVENPORT CA TYPE:STREAM AGENCY:USGS STATE:06 COUNTY:087
LATITUDE: 370351 LONGITUDE: 1221342 NAD27 DRAINAGE AREA:25.1* CONTRIBUTING DRAINAGE AREA: DATUM:

Discharge, cubic feet per second
WATER YEAR OCTOBER 1970 TO SEPTEMBER 1971
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.0	2.2	78	65	31	19	38	19	9.7	5.5	2.8	1.3
2	1.0	2.4	73	58	30	18	36	23	9.3	5.2	2.7	1.3
3	3.0	3.4	55	52	29	18	33	20	8.9	5.0	2.8	1.1
4	4.0	13	162	48	28	18	31	20	8.7	4.9	2.9	1.1
5	4.8	15	102	46	27	18	29	19	8.3	5.2	2.7	0.99
6	4.9	17	72	44	27	17	28	19	7.9	5.2	2.7	1.3
7	4.8	15	55	43	26	17	27	18	8.1	5.0	2.6	1.1
8	4.8	9.2	55	42	26	17	27	18	7.9	4.7	2.4	1.0
9	4.9	7.0	48	41	25	17	26	17	7.9	4.6	2.2	0.87
10	5.1	6.0	42	40	25	17	29	16	7.9	4.6	2.0	0.84
11	4.8	5.6	38	48	24	17	26	16	7.6	4.4	2.1	0.76
12	2.7	6.3	35	60	23	64	25	16	7.4	4.2	2.3	0.74
13	3.1	5.5	33	68	23	65	26	15	7.5	4.2	2.2	0.80
14	3.4	4.9	30	70	22	41	41	15	7.3	4.2	2.3	0.65
15	2.0	4.4	29	65	22	41	29	14	7.0	4.6	2.2	0.62
16	1.7	4.3	72	59	22	36	27	14	6.8	4.5	1.9	0.80
17	1.6	4.1	64	56	23	33	34	13	6.3	4.3	1.7	0.96
18	1.7	4.1	126	53	22	30	28	13	6.2	4.1	1.8	1.1
19	1.7	4.0	111	49	25	29	27	12	6.1	4.0	2.1	1.1
20	3.1	3.9	125	47	22	27	26	12	5.9	4.3	2.0	1.0
21	3.2	3.9	193	44	21	26	26	12	5.8	4.1	1.9	1.0
22	6.6	3.9	142	43	21	25	23	12	5.5	3.9	1.9	1.2
23	4.8	3.8	115	41	21	25	23	11	5.6	3.7	1.9	1.2
24	4.3	4.1	97	39	20	25	22	11	5.8	3.6	1.9	1.1
25	3.2	13	83	38	20	26	22	11	5.7	3.9	2.1	1.1
26	2.5	12	84	37	19	118	21	11	5.9	4.0	2.0	1.4
27	2.2	9.6	88	36	20	78	21	12	5.9	3.8	1.7	1.5
28	2.2	194	82	35	20	56	20	12	5.4	3.6	1.6	1.3
29	2.1	326	93	33	---	48	20	10	5.3	3.2	1.5	1.3
30	2.1	106	82	32	---	44	19	9.9	5.6	3.4	1.6	2.2
31	2.2	---	72	31	---	40	---	9.7	---	3.1	1.6	---
TOTAL	99.5	813.6	2536	1463	664	1070	810	450.6	209.2	133.0	66.1	32.73
MEAN	3.21	27.1	81.8	47.2	23.7	34.5	27.0	14.5	6.97	4.29	2.13	1.09
MAX	6.6	326	193	70	31	118	41	23	9.7	5.5	2.9	2.2
MIN	1.0	2.2	29	31	19	17	19	9.7	5.3	3.1	1.5	0.62
AC-FT	197	1610	5030	2900	1320	2120	1610	894	415	264	131	65

Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION:11161900 SCOTT C AB LITTLE C NR DAVENPORT CA TYPE:STREAM AGENCY:USGS STATE:06 COUNTY:087
LATITUDE: 370351 LONGITUDE: 1221342 NAD27 DRAINAGE AREA:25.1* CONTRIBUTING DRAINAGE AREA: DATUM:

Discharge, cubic feet per second
WATER YEAR OCTOBER 1971 TO SEPTEMBER 1972
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.7	0.88	2.4	19	13	10	4.9	5.4	2.4	1.2	0.32	0.24
2	1.3	0.93	5.0	16	12	9.4	4.9	5.1	2.3	1.3	0.34	0.21
3	1.2	0.91	6.0	14	11	9.1	4.7	5.1	1.9	1.5	0.48	0.07
4	1.1	0.85	5.0	12	11	8.7	4.7	5.1	1.9	1.6	0.45	0.21
5	0.98	0.84	4.0	12	54	8.4	6.0	5.4	1.8	1.4	0.53	0.31
6	0.89	0.84	3.5	11	61	8.1	10	5.4	1.7	1.5	0.46	0.34
7	0.91	0.79	3.0	10	43	7.8	7.1	5.4	1.7	1.2	0.40	0.23
8	0.91	0.82	2.8	9.4	34	7.8	5.8	5.4	1.9	1.0	0.37	0.27
9	0.89	0.93	3.3	9.1	29	7.5	5.4	4.9	2.4	0.95	0.44	0.21
10	0.82	0.89	3.8	8.4	25	8.1	5.1	4.7	2.6	0.85	0.55	0.22
11	0.84	2.1	3.8	8.1	22	7.5	6.0	4.2	2.2	0.88	0.44	0.25
12	0.82	3.8	13	7.8	20	7.1	11	4.0	2.1	0.91	0.36	0.25
13	0.75	9.4	14	7.8	18	6.8	19	3.9	1.8	0.83	0.26	0.39
14	0.71	4.8	9.1	7.1	17	6.5	12	3.7	1.7	0.69	0.26	0.33
15	0.67	2.5	7.8	6.8	16	6.3	9.4	3.6	1.6	0.48	0.28	0.32
16	1.1	1.9	6.8	6.8	15	6.0	8.7	3.4	1.5	0.69	0.28	0.28
17	0.88	1.7	6.0	6.5	14	6.0	8.1	3.4	1.6	0.73	0.32	0.29
18	0.91	1.4	5.8	6.5	14	5.8	7.8	3.6	1.7	0.79	0.39	0.28
19	0.93	1.1	5.4	6.3	13	5.8	7.1	3.7	1.7	0.87	0.38	0.30
20	0.94	1.2	5.4	6.3	12	5.6	6.8	3.9	1.6	1.2	0.49	0.27
21	0.94	1.7	6.0	6.3	12	5.6	6.3	3.6	1.7	1.6	0.34	0.18
22	0.88	1.7	30	6.5	13	6.0	6.3	3.6	1.8	1.4	0.01	0.01
23	0.91	1.4	25	9.4	12	5.8	6.3	3.4	2.1	1.0	0.00	0.00
24	0.91	1.4	36	7.8	11	5.6	9.1	3.4	2.2	0.90	0.00	0.00
25	0.90	1.4	84	9.4	11	5.4	7.5	3.2	1.8	0.60	0.00	0.00
26	0.91	1.2	48	12	11	5.4	6.5	3.1	1.9	0.44	0.03	0.25
27	0.91	1.7	125	22	11	5.1	6.0	3.1	1.8	0.43	0.19	6.2
28	0.76	6.0	52	22	9.7	5.1	5.8	2.9	1.6	0.37	0.31	3.6
29	0.65	4.8	35	18	12	5.1	5.6	2.6	1.5	0.31	0.33	2.0
30	0.64	3.3	27	16	---	4.9	5.6	2.4	1.4	0.31	0.27	1.5
31	0.81	---	22	14	---	4.9	---	2.4	---	0.32	0.23	---
TOTAL	28.47	63.18	605.9	334.3	556.7	207.2	219.5	123.0	55.9	28.25	9.51	19.01
MEAN	0.92	2.11	19.5	10.8	19.2	6.68	7.32	3.97	1.86	0.91	0.31	0.63
MAX	1.7	9.4	125	22	61	10	19	5.4	2.6	1.6	0.55	6.2
MIN	0.64	0.79	2.4	6.3	9.7	4.9	4.7	2.4	1.4	0.31	0.00	0.00
AC-FT	56	125	1200	663	1100	411	435	244	111	56	19	38

Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA

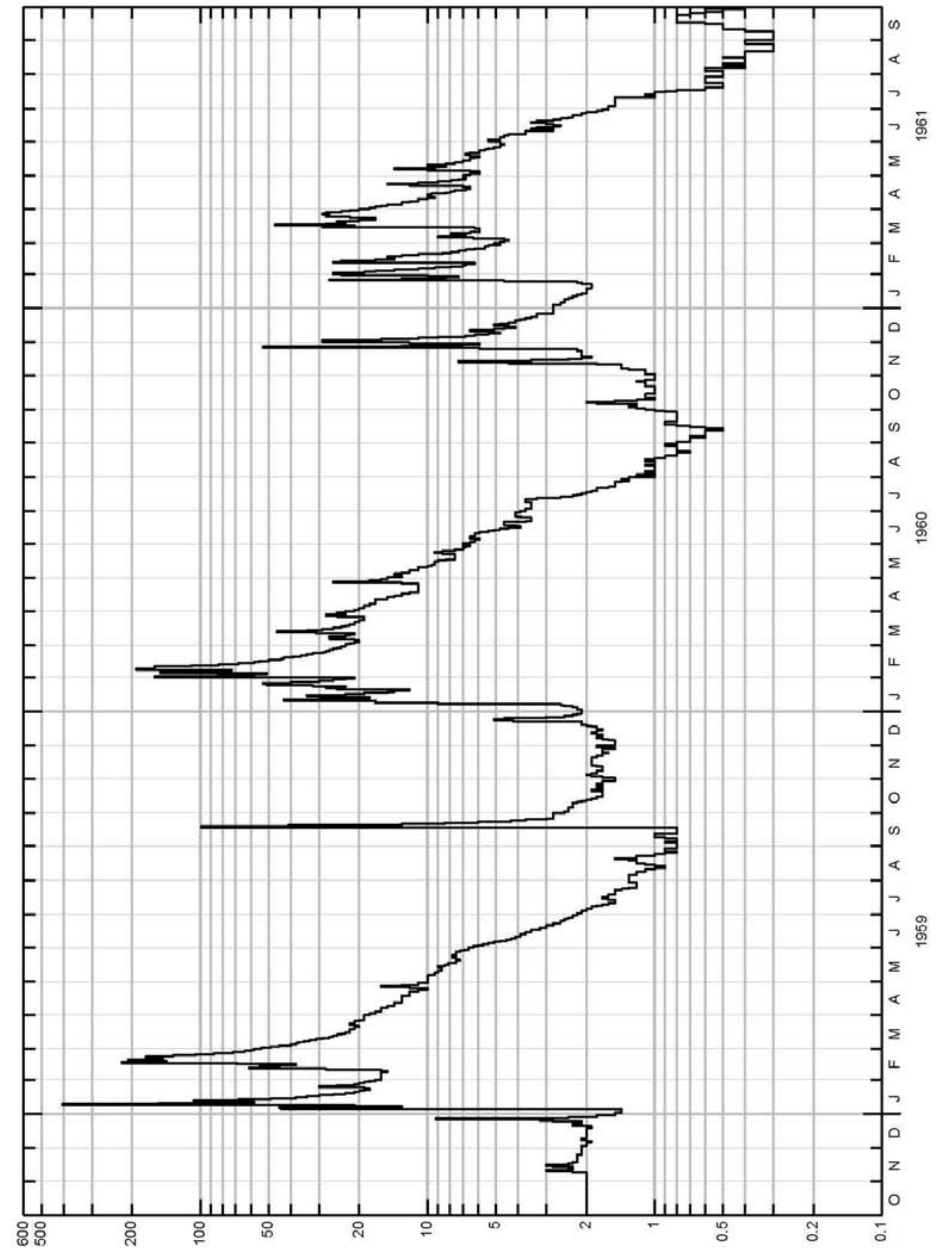
U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION:11161900 SCOTT C AB LITTLE C NR DAVENPORT CA TYPE:STREAM AGENCY:USGS STATE:06 COUNTY:087
LATITUDE: 370351 LONGITUDE: 1221342 NAD27 DRAINAGE AREA:25.1* CONTRIBUTING DRAINAGE AREA: DATUM:

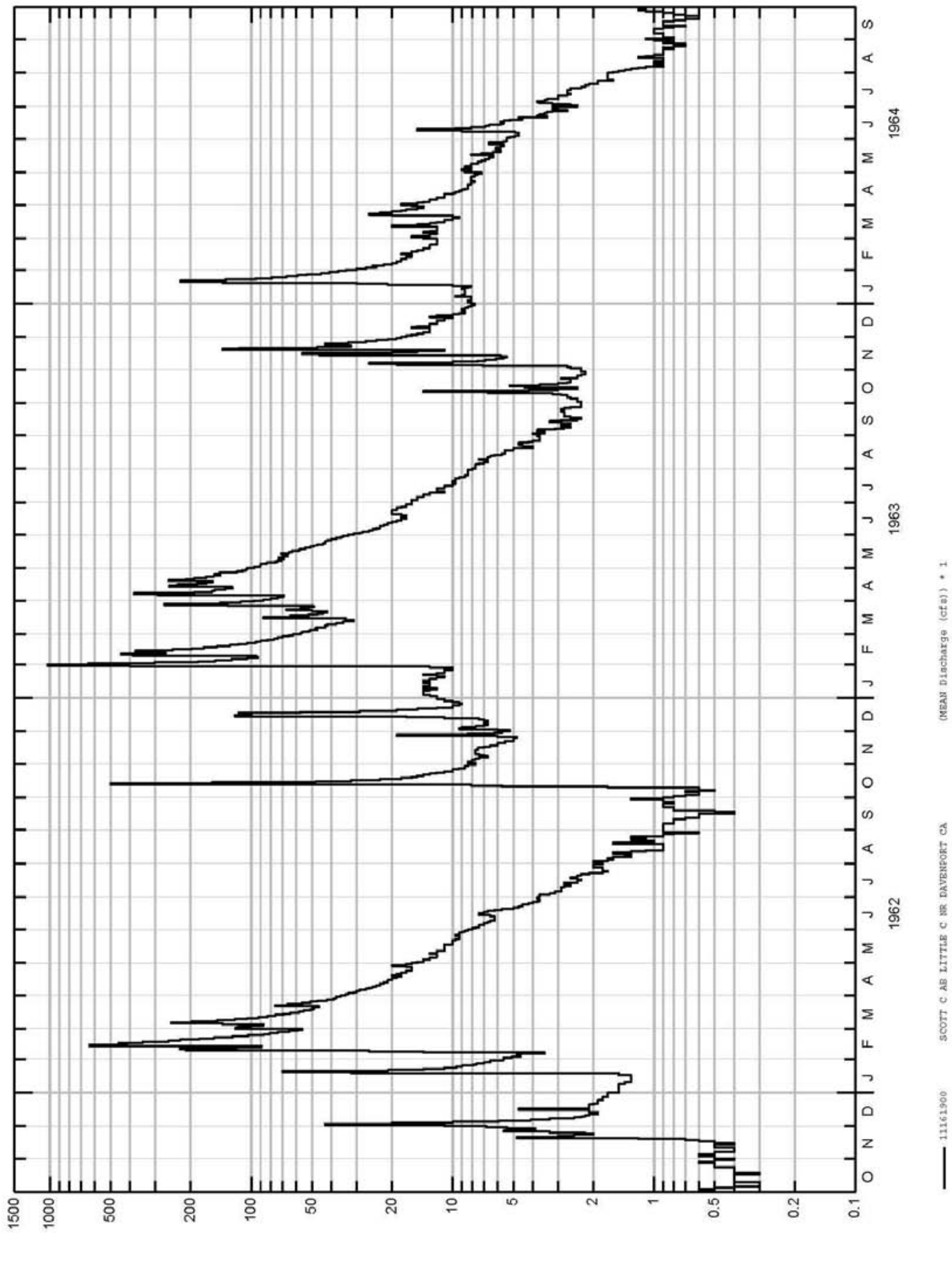
Discharge, cubic feet per second
WATER YEAR OCTOBER 1972 TO SEPTEMBER 1973
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.2	2.1	21	22	93	389	75	32	14	6.2	2.8	1.6
2	1.1	2.2	21	21	85	290	72	31	14	6.0	2.8	1.7
3	0.99	2.7	22	21	100	269	70	30	14	5.6	2.8	1.7
4	0.86	25	29	20	120	255	67	29	13	5.5	2.7	1.8
5	0.87	13	23	19	114	214	63	29	13	5.2	2.7	1.9
6	0.78	8.4	38	19	394	230	60	28	12	5.0	2.9	1.9
7	0.69	9.7	36	19	364	198	58	27	11	5.0	2.9	1.5
8	0.75	9.7	34	32	255	180	55	25	11	5.0	2.9	1.4
9	1.1	8.1	31	132	237	170	54	25	11	4.8	2.8	1.1
10	2.5	18	30	110	448	155	52	24	10	4.7	2.6	1.3
11	12	60	28	110	452	145	51	23	11	4.5	2.5	1.7
12	9.1	35	26	147	398	135	48	23	11	4.7	2.4	1.6
13	5.5	196	25	113	575	125	48	23	10	4.8	2.4	1.4
14	6.2	267	24	95	497	115	48	22	10	4.7	2.3	1.4
15	13	336	24	84	364	108	47	21	9.7	4.7	2.1	1.4
16	15	248	23	624	269	100	46	20	9.7	4.8	2.0	1.4
17	34	142	25	356	237	95	44	20	9.2	4.9	1.9	1.4
18	18	102	23	448	211	90	43	19	9.2	4.9	2.0	1.5
19	10	80	40	328	186	100	42	18	8.5	4.6	2.0	1.4
20	7.6	60	36	234	166	140	41	18	8.2	4.5	1.8	2.1
21	6.2	53	32	189	151	130	40	18	7.8	4.3	1.7	2.1
22	5.0	46	39	153	136	120	39	18	7.8	4.2	1.7	1.9
23	4.4	41	37	134	127	110	38	17	7.5	3.7	1.7	2.7
24	4.0	37	35	116	151	100	37	17	7.5	3.6	1.7	2.3
25	3.6	34	32	108	127	95	36	17	7.2	3.3	1.8	2.1
26	3.2	30	30	97	214	90	36	16	6.9	3.1	1.8	1.8
27	3.0	27	29	86	715	88	35	16	6.9	3.2	1.9	1.5
28	2.7	25	27	80	760	84	35	15	6.9	3.2	1.9	1.4
29	2.5	24	25	93	---	80	35	14	6.6	3.3	1.8	1.5
30	3.1	23	24	108	---	78	33	14	6.2	3.2	1.8	1.5
31	2.3	---	23	102	---	76	---	14	---	3.1	1.7	---
TOTAL	181.24	1964.9	892	4220	7946	4554	1448	663	290.8	138.3	68.8	50.0
MEAN	5.85	65.5	28.8	136	284	147	48.3	21.4	9.69	4.46	2.22	1.67
MAX	34	336	40	624	760	389	75	32	14	6.2	2.9	2.7
MIN	0.69	2.1	21	19	85	76	33	14	6.2	3.1	1.7	1.1
AC-FT	359	3900	1770	8370	15760	9030	2870	1320	577	274	136	99

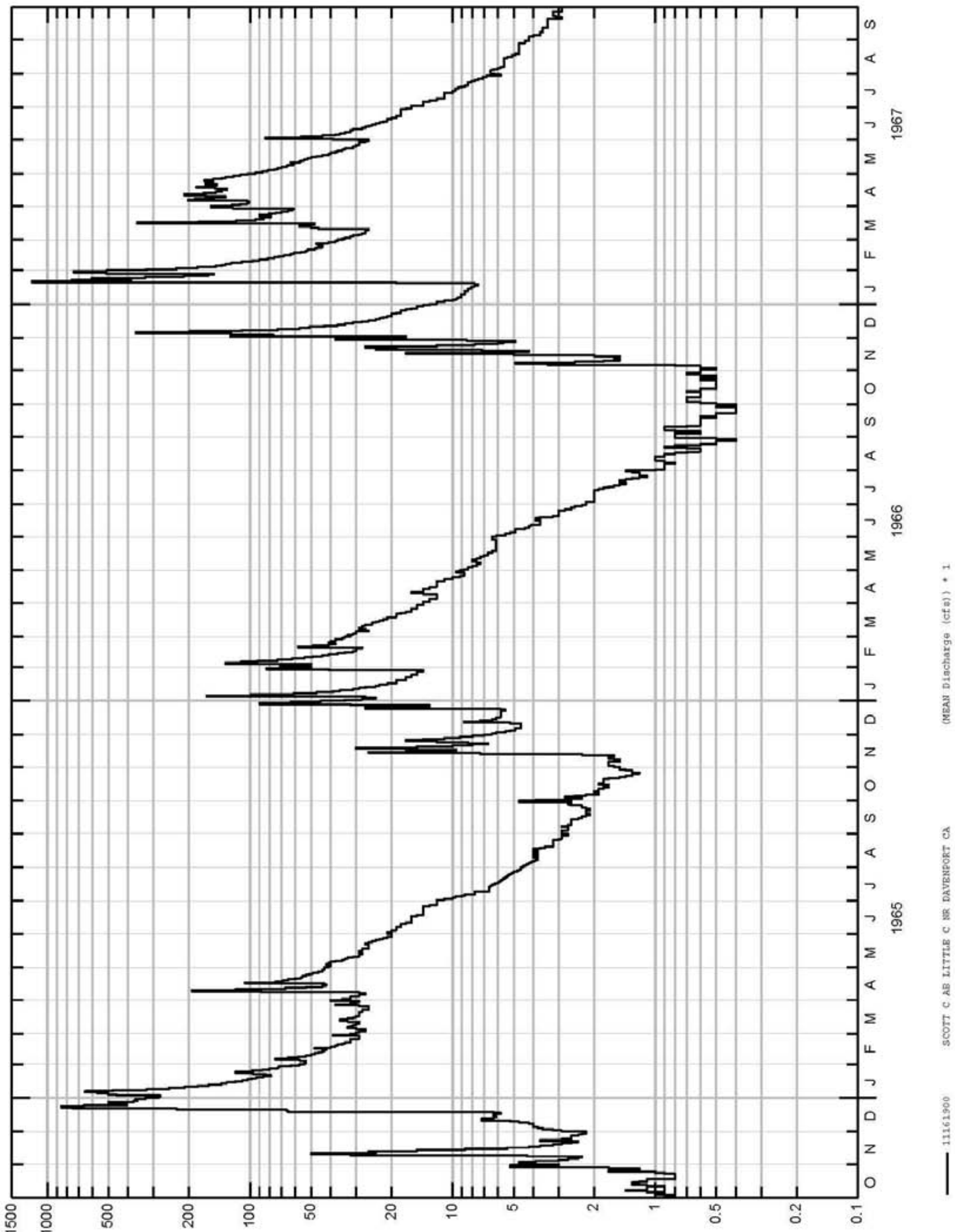
Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA



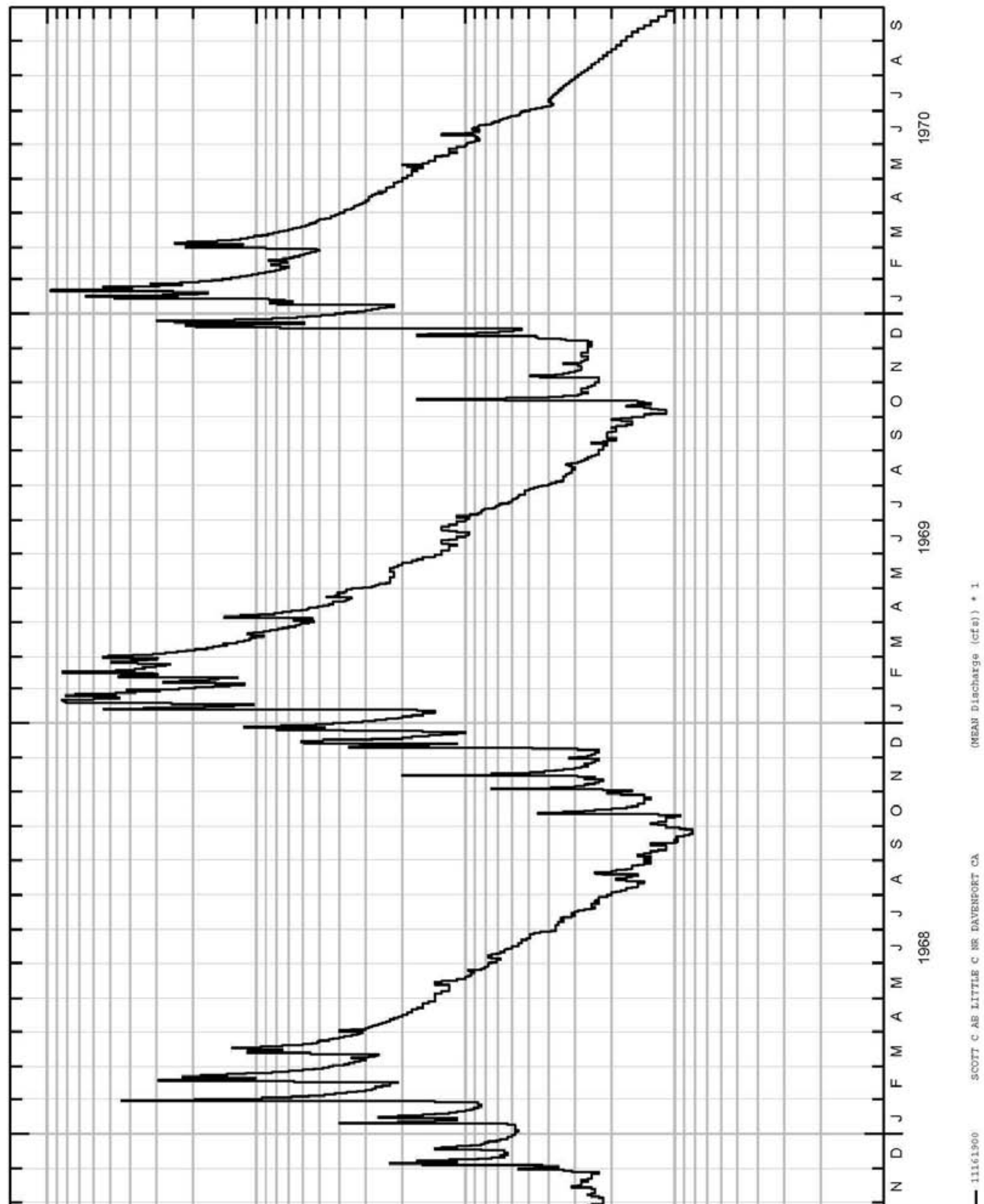
Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA



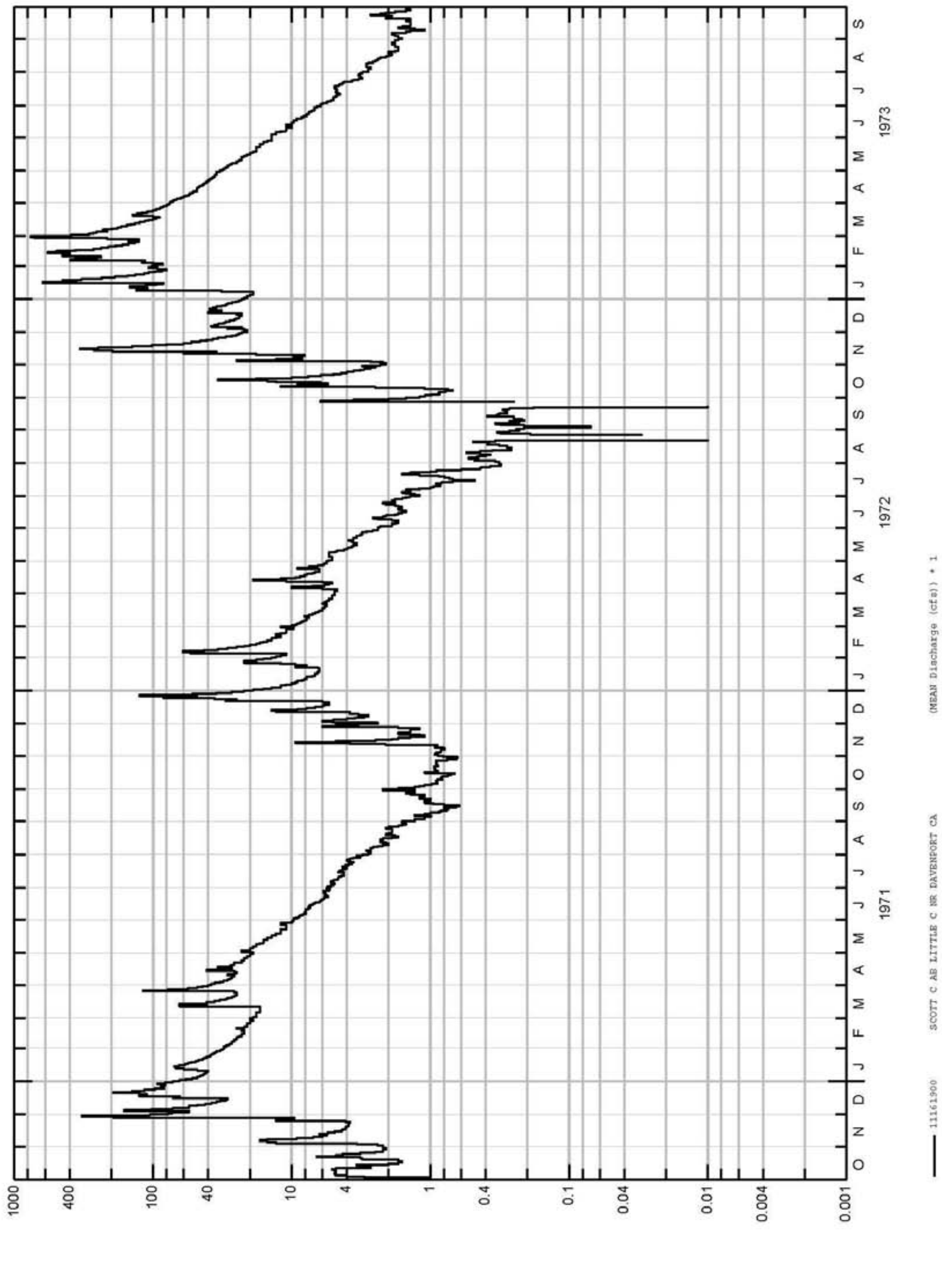
Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA



Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA



Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA



Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA

Streamflow measurements

USGS 11161900 Scott Creek above Little Creek near Davenport, CA

Meas. Number	Date	Time	Who	Stream flow (ft^3/s)	Gage Height (ft)	Rating No.	Shift Applied (ft)	% Diff.	GH Change (ft)	Meas. Duration (hr)	Meas. Rated	Control
213	1973-10-02	09:00	MR	1.72	0.80		0.00		0.00	0.40	GOOD	CLER
212	1973-07-31	12:35	KJC	3.34	0.89		0.00		0.00	0.30	GOOD	LGDB
210	1973-04-04	10:05	DM	66.6	1.88		0.00		0.00	0.40	GOOD	CLER
209	1973-03-08	13:55	DM	180.0	2.58		0.00		0.00	0.50	UNSP	CLER
208	1973-02-27	15:30	KJC/DM	1130	4.27		0.00		0.17	0.70	GOOD	CLER
207	1973-02-05	13:05	DM	110.0	2.05		0.00		0.00	0.40	GOOD	CLER
206	1973-01-18	16:15	D.M/TPL	585.0	3.29		0.00		-0.02	0.40	UNSP	CLER
205	1973-01-18	11:05	D.M/TPL	530.0	3.23		0.00		0.07	0.50	UNSP	
204	1973-01-08	13:45	DM	21.6	1.32		0.00		0.01	0.30	UNSP	CLER
203	1972-12-07	14:00	JNR	38.1	1.55		0.00		0.01	0.80	GOOD	CLER
202	1972-11-21	12:25	KJC/LLT	53.6	1.68		0.00		0.00	0.50	GOOD	CLER
201	1972-11-02	13:50	KJC	2.18	0.82		0.00		0.00	0.30	GOOD	CLER
200	1972-10-06	13:05	RJS	0.750	0.60		0.00		0.00	0.30	GOOD	CLER
199	1972-09-07	12:50	JRS/KJC	0.330	0.46		0.00		0.02	0.30	GOOD	LGDB
198	1972-08-04	10:05	GDM	0.530	0.56		0.00		0.00	0.50	GOOD	CLER
197	1972-07-06	17:15	GDM	1.24	0.67		0.00		0.00	0.30	UNSP	CLER
196	1972-06-05	09:40	GDM	1.90	0.81		0.00		0.00	0.30	UNSP	CLER
195	1972-05-04	13:55	GDM	4.76	0.94		0.00		0.00	0.40	GOOD	CLER
194	1972-04-06	15:45	GDM	10.3	1.10		0.00		0.00	0.50	GOOD	CLER
193	1972-02-29	15:05	GDM	11.7	1.16		0.00		0.00	0.50	GOOD	CLER
192	1972-02-04	15:15	GDM	10.7	1.12		0.00		0.00	0.50	GOOD	CLER
191	1972-01-05	14:05	KJC	11.6	1.13		0.00		0.00	0.30	GOOD	CLER
190	1971-12-07	12:15	KJC	3.05	0.86		0.00		0.00	0.30	GOOD	CLER
189	1971-11-03	17:20	JNR	0.850	0.70		0.00		0.00	0.20	FAIR	CLER
188	1971-09-30	14:30	KJC	2.33	0.78		0.00		0.00	0.30	GOOD	CLER
187	1971-08-06	09:50	KJC	2.67	0.79		0.00		0.00	0.40	GOOD	CLER
186	1971-07-02	13:25	KJC	5.45	0.96		0.00		0.00	0.50	GOOD	CLER
185	1971-06-04	14:30	CTP	8.63	1.11		0.00		-0.01	0.70	FAIR	CLER
184	1971-05-07	12:55	KJC	18.8	1.26		0.00		0.00	0.40	GOOD	CLER
183	1971-04-01	14:20	KJC	37.1	1.49		0.00		0.00	0.30	GOOD	CLER
182	1971-03-15	12:30	KJC	40.7	1.53		0.00		0.00	0.30	GOOD	CLER
181	1971-02-02	13:30	KJC	29.8	1.40		0.00		0.00	0.30	GOOD	CLER
180	1970-12-29	12:55	JNR/KJC	98.7	2.08		0.00		-0.01	0.70	GOOD	CLER
179	1970-12-09	14:00	KJC	48.3	1.65		0.00		0.00	0.40	GOOD	
178	1970-11-03	14:00	KJC	2.27	0.79		0.00		0.00	0.30	GOOD	CLER
177	1970-10-15	10:05	KJC	2.26	0.77		0.00		-0.01	0.40	GOOD	
176	1970-10-01	10:20	KLM	1.01		9.0	0.00				GOOD	
175	1970-09-08	13:15	KJC	1.65		8.0	0.00		0.00	0.30	GOOD	
174	1970-07-09	-- --	Dem	4.24	0.58	8.0	0.00		0.00	0.40	FAIR	
173	1970-06-04	09:45	VP	9.14	0.73	8.0	0.00	4.00	0.00	0.50	GOOD	
172	1970-05-08	11:15	VP	18.3	0.92	8.0	0.00	3.00	0.00	0.40	GOOD	
171	1970-04-08	15:30	VP	30.9	1.13	8.0	0.00	-4.00	0.00	0.50	GOOD	
169	1970-02-05	08:45	VP	97.0	1.65	8.0	0.00	-2.00	0.00	0.60	GOOD	
168	1970-01-21	-- --	JRB	981.0	3.75	8.0	0.00		-0.11	0.80	GOOD	
167	1970-01-16	-- --	JNR	621.0	3.16	7.0	0.00	2.00	-0.08	0.80	GOOD	
166	1970-01-07	14:15	VP	21.8	1.28	7.0	0.030		0.00	0.50	GOOD	CLER
165	1969-12-05	09:30	VP	2.63	0.81	7.0	-0.010		0.00	0.30	GOOD	CLER
164	1969-11-13	12:30	VP	2.79	0.84	7.0	-0.030		0.00	0.50	GOOD	LGDB
163	1969-10-04	-- --	Mel	1.06	0.64	7.0	0.00	2.00	0.00	0.50	GOOD	CLER
162	1969-08-05	-- --	Dem	3.54	0.86	7.0	0.00	0.00	0.00	0.45	GOOD	
161	1969-07-11	11:45	TPL	7.92	1.01	7.0	0.030		0.00	0.50	GOOD	
160	1969-07-10	-- --	FBM	8.06	0.99	7.0	0.060		0.00	0.50	GOOD	

Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA

Streamflow measurements (continued)

USGS 11161900 Scott Creek above Little Creek near Davenport, CA

Meas. Number	Date	Time	Who	Stream flow (ft³/s)	Gage Height (ft)	Rating No.	Shift Applied (ft)	% Diff.	GH Change (ft)	Meas. Duration (hr)	Meas. Rated	Control
159	1969-05-26	12:15	TPL	17.1	0.16	7.0	1.08		0.00	0.60	GOOD	
158	1969-05-01	10:40	TPL/FBI	33.3	0.31	7.0	1.14		0.00	0.30	GOOD	CLER
157	1969-04-01	12:30	JRB	55.3	0.74	7.0	0.910		-0.01	0.30	GOOD	HVDB
156	1969-03-11	-- --	JRB	137.0	1.50	7.0	0.650		0.00	0.40	GOOD	HVDB
155	1969-03-03	11:45	JRB	313.0	2.41	7.0	0.430		-0.02	0.50	GOOD	HVDB
154	1969-02-15	-- --	JRB	950.0	4.38	7.0	0.620		-0.08	0.60	GOOD	HVDB
153	1969-02-13	-- --	JRB	299.0	2.24	7.0	0.560		0.01	0.50	GOOD	HVDB
152	1969-01-30	-- --	JRB	308.0	2.10	7.0	0.730		-0.03	0.50	GOOD	HVDB
151	1969-01-14	-- --	JRB	285.0	2.64	7.0	0.110		-0.02	0.70	GOOD	
150	1969-01-10	09:45	JRB	14.7	1.18	7.0	0.020		0.00	0.30	GOOD	CLER
149	1968-12-05	10:15	JRB	2.43	0.87	7.0	-0.090		0.00	0.30	GOOD	CLER
148	1968-11-07	10:30	RJS	2.57	0.87	7.0	-0.070		0.00	0.50	GOOD	CLER
147	1968-10-09	13:00	JRB	1.07	0.69	7.0	-0.050		0.00	0.30	GOOD	
146	1968-09-10	11:00	Mel	1.12	0.72	7.0	-0.070		0.00	0.40	GOOD	CLER
145	1968-08-06	16:00	Mel	1.57	0.78	7.0	-0.070		0.00	0.50	GOOD	
144	1968-07-09	16:45	Mel	3.61	0.88	7.0	-0.020		-0.01	0.50	GOOD	
143	1968-06-04	14:30	Mel	6.85	1.01	7.0	0.00	0.00	0.00	0.50	GOOD	
142	1968-05-06	11:15	Mel	12.3	1.14	7.0	0.020		0.00	0.50	GOOD	
141	1968-04-02	15:00	Mel	33.3	1.46	7.0	-0.020		0.00	0.70	GOOD	
140	1968-01-31	-- --	Mel	177.0	2.27	7.0	0.060		-0.02	0.80	GOOD	CLER
139	1967-12-06	-- --	Mel	9.15	1.06	7.0	0.030		0.00	0.50	GOOD	
138	1967-11-07	-- --	Mel	2.46	0.83	7.0	-0.040		0.00	0.50	GOOD	CLER
137	1967-10-10	-- --	Mel	2.61	0.83	7.0	-0.030		0.00	0.50	GOOD	
136	1967-08-31	-- --	Dem	4.31	0.88	7.0	0.020		0.00	0.50	GOOD	CLER
135	1967-08-01	-- --	Mel	7.03	1.01	7.0	0.00	3.10	0.00	0.80	GOOD	
134	1967-07-12	-- --	Hol/Mel	11.0	1.13	7.0	0.00	-0.900	0.00	1.00	GOOD	
133	1967-06-05	-- --	Hol	38.7	1.50	7.0	0.00	2.90	0.00	0.50	GOOD	
132	1967-05-01	-- --	Hol	95.0	1.91	7.0	0.00	1.30	0.00	0.50	GOOD	
131	1967-04-10	-- --	Hol	118.0	2.07	7.0	0.00	-4.10	0.00	0.60	EXCL	
130	1967-03-17	-- --	RJS	169.0	2.33	7.0	0.00	-4.50	0.01	0.70	GOOD	
129	1967-03-03	-- --	Hol	33.0	1.46	7.0	-0.020	0.600	0.00	0.60	GOOD	
128	1967-01-31	-- --	Hol	522.0	3.35	7.0	0.00	8.30	-0.12	1.30	GOOD	
127	1967-01-24	-- --	Hol	544.0	3.63	7.0	0.00	-5.20	-0.10	1.50	GOOD	
126	1967-01-05	-- --	Hol	9.66	1.10	7.0	0.00	-0.400	0.00	0.80	GOOD	
125	1966-12-05	-- --	Hol	300.0	2.80	7.0	0.00		-0.01	0.60	GOOD	
124	1966-12-05	-- --	Hol	350.0	2.87	7.0	0.00	9.00	-0.08	1.00	GOOD	
123	1966-12-01	-- --	Hol	23.9	1.34	7.0	0.00	-1.20	0.00	1.00	GOOD	
122	1966-11-16	-- --	Hol	20.8	1.29	7.0	0.00	2.00	0.00	0.80	GOOD	
121	1966-11-04	-- --	Hol	0.630	0.58	7.0	0.00	-3.10	0.00	0.80	GOOD	
120	1966-10-05	-- --	Hol	0.740	0.59	7.0	0.00	5.70	0.00	0.80	GOOD	
119	1966-09-06	-- --	H	0.770	0.61	6.0	0.010		0.00	1.20	GOOD	
118	1966-08-04	-- --	Hol	1.02	0.67	6.0	-0.020		0.00	0.50	GOOD	
117	1966-07-12	-- --	KM	2.12	0.78	6.0	-0.020		0.00	0.30	GOOD	
116	1966-06-06	-- --	MrG	4.81	0.91	6.0	0.00	-1.40	0.00	0.50	GOOD	
115	1966-05-04	-- --	GCH	7.80	1.01	6.0	0.00	-2.50	0.00	0.40	EXCL	
114	1966-03-31	-- --	GCH	14.9	1.15	6.0	-0.050	4.90	0.00	0.50	EXCL	
113	1966-03-07	-- --	GCH	29.7	1.39	6.0	0.00	-0.300	0.00	0.60	EXCL	
112	1966-02-01	-- --	JJH	80.1	1.83	6.0	0.00	-5.10	0.00	0.70	UNSP	
111	1966-01-11	-- --	JJH	30.4	1.41	6.0	0.00	-3.20	0.00	0.50	GOOD	
110	1965-12-29	-- --	JJH	66.0	1.69	6.0	0.00	6.10	-0.03	0.70	UNSP	
109	1965-12-01	-- --	JJH	5.97	0.97	6.0	-0.020		0.00	0.60	UNSP	
108	1965-11-10	-- --	JJH	1.61	0.71	6.0	0.00	1.90	0.00	0.40	GOOD	

Appendix A: Location and historic discharge data for Scott Creek above Little Creek near Davenport, CA

Streamflow measurements (continued)

USGS 11161900 Scott Creek above Little Creek near Davenport, CA

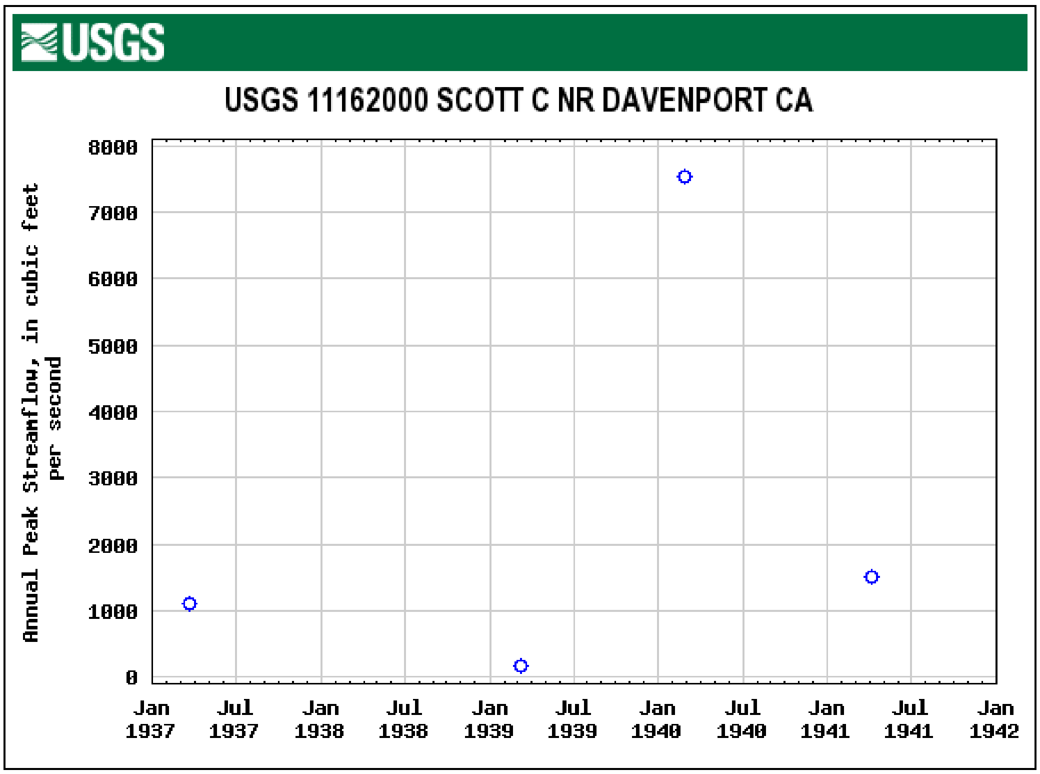
Meas. Number	Date	Time	Who	Stream flow (ft^3/s)	Gage Height (ft)	Rating No.	Shift Applied (ft)	% Diff.	GH Change (ft)	Meas. Duration (hr)	Meas. Rated	Control
107	1965-10-11	-- --	JJH	1.92	0.74	6.0	0.00	0.00	0.00	0.50	GOOD	
106	1965-09-08	-- --	JJH	2.74	0.77	5.0	0.250		0.00	0.70	GOOD	
105	1965-08-19	-- --	Fol/G.	3.30	0.80	5.0	2.60		0.00	0.50	GOOD	
57	1962-10-13	-- --	unk	1060	7.35	3.0	0.00	0.00			FAIR	
6	1959-01-27	-- --	VDB	19.8	2.67	1.0	-0.050		0.00	0.30	GOOD	
5	1959-01-09	-- --	BBE	646.0	6.18	1.0	0.00		-0.17	0.40	POOR	MDDB
4	1959-01-09	-- --	BBE	321.0	5.02	1.0	0.00	-4.00			UNSP	MDDB
3	1959-01-06	-- --	Hal/M.	33.0	3.16	1.0	-0.290		-0.02	0.60	GOOD	
2	1958-12-11	-- --	VDB/BB	1.95	2.44	1.0	-0.400		0.00	0.30	GOOD	
1	1958-10-22	-- --	VDB	1.88	2.50	1.0	-0.470		0.00	0.20	GOOD	

Appendix B: Historic discharge data for Scott Creek near Davenport, CA

Appendix B: Historic discharge data for Scott Creek near Davenport, CA

Santa Cruz County, California
Hydrologic Unit Code 18060001
Latitude 37°03'39", Longitude 122°13'30" NAD27
Drainage area 27.3 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1937	Mar. 21, 1937		1,100
1939	Mar. 08, 1939		155
1940	Feb. 27, 1940		7,550
1941	Apr. 04, 1941		1,500



Appendix B: Historic discharge data for Scott Creek near Davenport, CA

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION:11162000 SCOTT C NR DAVENPORT CA TYPE:STREAM AGENCY:USGS STATE:06 COUNTY:087
LATITUDE: 370339 LONGITUDE: 1221330 NAD27 DRAINAGE AREA:27.3* CONTRIBUTING DRAINAGE AREA: DATUM:

Discharge, cubic feet per second
WATER YEAR OCTOBER 1936 TO SEPTEMBER 1937
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.50	1.0	1.0	14	30	60	109	34	14	7.5	5.0	3.5
2	0.50	1.0	1.0	13	49	58	98	33	16	7.5	6.0	3.5
3	0.50	1.0	1.0	8.5	39	47	88	32	16	7.5	5.5	3.5
4	0.50	1.0	1.0	7.5	38	41	85	32	16	6.0	5.5	3.5
5	0.50	1.0	1.0	8.5	188	40	85	30	17	7.5	5.5	3.5
6	0.50	1.0	1.0	4.7	430	39	85	29	14	7.5	5.5	3.5
7	0.50	1.0	1.0	5.5	175	37	85	27	15	7.5	5.5	3.5
8	0.50	1.0	1.0	8.5	118	36	79	29	18	7.5	4.0	3.5
9	0.50	1.0	1.0	3.2	76	33	73	28	16	7.5	5.0	3.5
10	0.50	1.0	1.0	2.7	60	31	73	26	15	7.5	5.0	3.5
11	0.50	1.0	1.0	49	63	30	70	26	14	6.0	5.0	3.5
12	0.50	1.0	1.0	24	63	139	65	26	14	7.0	5.0	3.5
13	0.50	1.0	1.1	18	350	278	61	25	13	7.0	5.0	3.5
14	0.50	1.0	1.5	21	335	182	61	22	13	6.0	5.0	3.5
15	0.50	1.0	2.1	23	175	141	60	19	14	7.5	3.5	3.5
16	0.50	1.0	5.0	18	115	100	57	18	16	7.5	5.0	3.5
17	0.50	1.0	4.2	13	88	85	53	18	12	7.5	4.8	3.5
18	0.50	1.0	4.2	13	73	85	50	18	12	6.0	4.1	3.5
19	0.50	1.0	3.7	11	68	85	46	18	11	7.0	3.1	3.5
20	0.50	1.0	4.4	8.5	60	85	42	18	11	7.0	3.8	3.5
21	0.50	1.0	3.7	8.5	53	600	41	18	10	7.0	3.9	3.5
22	0.50	1.0	4.0	7.5	51	518	39	16	10	7.0	2.3	3.5
23	0.50	1.0	3.7	7.5	49	460	39	16	10	7.0	3.7	3.5
24	0.50	1.0	4.4	13	70	409	37	16	10	7.0	3.5	3.5
25	0.50	1.0	3.4	13	68	310	36	15	9.5	6.0	4.3	3.5
26	0.50	1.0	26	3.7	82	235	37	15	9.5	7.0	3.1	3.5
27	0.50	1.0	15	6.5	73	212	36	15	8.5	7.0	3.9	3.5
28	0.50	1.0	9.5	19	63	188	35	15	9.0	7.0	4.4	3.5
29	0.50	1.0	8.5	24	---	162	35	15	7.5	7.0	1.6	3.5
30	0.50	1.0	29	99	---	137	34	14	7.5	6.5	4.1	3.5
31	0.50	---	14	52	---	118	---	15	---	6.5	3.6	---
TOTAL	15.50	30.0	159.4	528.3	3102	4981	1794	678	378.5	217.0	135.2	105.0
MEAN	0.50	1.00	5.14	17.0	111	161	59.8	21.9	12.6	7.00	4.36	3.50
MAX	0.50	1.0	29	99	430	600	109	34	18	7.5	6.0	3.5
MIN	0.50	1.0	1.0	2.7	30	30	34	14	7.5	6.0	1.6	3.5
AC-FT	31	60	316	1050	6150	9880	3560	1340	751	430	268	20

Appendix B: Historic discharge data for Scott Creek near Davenport, CA

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION:11162000 SCOTT C NR DAVENPORT CA TYPE:STREAM AGENCY:USGS STATE:06 COUNTY:087
LATITUDE: 370339 LONGITUDE: 1221330 NAD27 DRAINAGE AREA:27.3* CONTRIBUTING DRAINAGE AREA: DATUM:

Discharge, cubic feet per second
WATER YEAR OCTOBER 1938 TO SEPTEMBER 1939
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	---	---	---	---	---	14	5.5	3.4	1.5	0.60	0.40
2	---	---	---	---	---	---	13	5.5	4.7	0.70	1.0	0.40
3	---	---	---	---	---	---	13	5.0	3.5	1.7	0.60	0.40
4	---	---	---	---	---	---	12	5.0	1.2	0.70	1.0	0.30
5	---	---	---	---	---	---	11	6.5	4.9	1.5	0.60	0.40
6	---	---	---	---	---	---	11	5.0	4.3	1.5	0.50	0.40
7	---	---	---	---	---	---	11	4.5	4.2	1.5	1.1	0.40
8	---	---	---	---	---	---	10	5.5	3.3	1.6	0.70	0.30
9	---	---	---	---	---	---	9.5	5.5	3.4	0.60	1.2	0.30
10	---	---	---	---	---	---	9.5	7.5	3.1	1.2	0.60	0.30
11	---	---	---	---	---	---	9.0	5.5	1.0	1.4	1.3	0.30
12	---	---	---	---	---	---	8.5	5.5	2.4	1.2	0.60	0.30
13	---	---	---	---	---	---	9.0	4.7	2.6	1.3	0.50	0.40
14	---	---	---	---	---	---	8.5	3.9	2.6	1.1	1.2	0.50
15	---	---	---	---	---	---	8.0	4.8	2.3	1.1	1.0	0.40
16	---	---	---	---	---	---	8.5	5.0	1.9	0.60	0.60	0.40
17	---	---	---	---	---	---	8.0	5.0	2.3	0.80	1.0	0.30
18	---	---	---	---	---	---	7.5	5.0	0.80	0.90	0.60	0.30
19	---	---	---	---	---	---	7.0	5.0	2.3	0.80	0.80	0.30
20	---	---	---	---	---	---	7.0	5.5	1.9	0.90	0.60	0.50
21	---	---	---	---	---	---	7.0	10	2.0	0.80	1.2	0.50
22	---	---	---	---	---	---	7.0	7.5	1.7	0.90	0.60	0.70
23	---	---	---	---	---	---	7.5	7.0	1.6	0.50	0.90	0.60
24	---	---	---	---	---	---	7.0	5.5	1.8	0.80	0.60	0.40
25	---	---	---	---	---	---	6.5	4.9	0.90	0.80	0.80	0.40
26	---	---	---	---	---	---	6.5	4.6	1.8	0.50	0.60	0.60
27	---	---	---	---	---	---	6.0	4.5	1.8	0.80	0.60	0.60
28	---	---	---	---	---	---	6.0	3.4	1.7	0.60	0.90	0.80
29	---	---	---	---	---	---	5.5	4.1	1.5	1.1	0.60	0.70
30	---	---	---	---	---	---	5.0	3.3	1.6	0.60	0.50	0.70
31	---	---	---	---	---	---	---	3.1	---	1.0	0.50	---
TOTAL	---	---	---	---	---	---	259.0	163.3	72.50	31.00	23.90	13.30
MEAN	---	---	---	---	---	---	8.63	5.27	2.42	1.00	0.77	0.44
MAX	---	---	---	---	---	---	14	10	4.9	1.7	1.3	0.80
MIN	---	---	---	---	---	---	5.0	3.1	0.80	0.50	0.50	0.30
AC-FT	---	---	---	---	---	---	514	324	144	61	47	26

Appendix B: Historic discharge data for Scott Creek near Davenport, CA

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION:11162000 SCOTT C NR DAVENPORT CA TYPE:STREAM AGENCY:USGS STATE:06 COUNTY:087
LATITUDE: 370339 LONGITUDE: 1221330 NAD27 DRAINAGE AREA:27.3* CONTRIBUTING DRAINAGE AREA: DATUM:

Discharge, cubic feet per second
WATER YEAR OCTOBER 1939 TO SEPTEMBER 1940
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.50	0.80	1.0	41	107	476	338	47	25	11	4.9	2.8
2	0.60	0.70	1.2	130	105	384	294	46	21	10	4.6	2.8
3	0.60	0.70	1.2	42	357	338	276	44	21	10	4.9	3.3
4	0.80	0.80	2.1	167	236	274	256	45	20	10	4.3	2.8
5	0.70	0.50	2.1	43	177	230	232	42	20	10	4.9	2.9
6	0.80	0.80	2.0	31	153	196	219	41	20	10	4.3	3.1
7	0.90	0.80	2.1	34	137	167	208	38	19	9.5	4.3	3.3
8	0.60	0.70	2.3	132	122	162	197	37	18	9.5	4.3	3.1
9	0.50	0.80	3.0	144	110	157	182	34	17	9.5	3.7	2.9
10	0.30	0.80	2.5	265	101	155	166	32	18	9.5	3.7	2.6
11	0.60	0.80	4.6	312	92	153	153	30	17	9.5	3.7	2.6
12	0.50	0.70	4.2	155	84	148	140	30	17	9.0	4.3	2.8
13	0.50	0.70	3.9	110	84	143	131	29	17	9.0	4.0	2.8
14	0.60	0.70	1.4	90	179	136	117	28	16	9.0	4.0	2.2
15	0.50	0.80	1.3	75	141	129	102	28	16	9.0	4.3	2.4
16	0.30	0.80	1.3	65	118	124	90	28	14	8.5	4.9	2.6
17	0.40	0.70	1.3	60	164	116	82	28	16	8.5	3.7	2.8
18	0.30	0.70	1.3	55	147	105	77	28	15	8.5	3.5	2.4
19	0.50	0.80	1.3	50	123	97	73	26	15	8.5	3.5	2.2
20	0.50	0.80	1.3	45	110	87	69	25	15	8.5	3.7	1.8
21	0.60	0.80	1.4	40	103	79	67	24	14	7.0	4.0	1.7
22	0.40	0.70	1.4	40	98	69	65	24	13	7.0	4.0	1.7
23	0.40	0.80	1.4	35	94	60	61	23	12	7.0	3.5	2.2
24	1.0	0.80	1.6	35	96	56	59	23	13	7.0	3.5	1.8
25	0.80	1.2	1.6	150	386	54	62	22	13	6.5	3.5	2.0
26	0.70	1.4	1.5	700	696	78	58	21	13	6.0	3.7	1.7
27	0.80	1.3	1.4	250	3020	157	55	22	13	6.0	3.3	2.0
28	0.70	1.2	1.5	172	1160	110	53	22	11	5.0	3.1	1.6
29	0.40	1.2	1.4	131	772	279	52	22	11	6.5	3.1	1.6
30	0.50	1.2	1.5	107	---	2190	49	28	10	5.0	2.9	1.8
31	0.60	---	1.6	94	---	599	---	28	---	7.0	2.9	---
TOTAL	17.90	25.50	57.7	3800	9272	7508	3983	945	480	257.0	121.0	72.3
MEAN	0.58	0.85	1.86	123	320	242	133	30.5	16.0	8.29	3.90	2.41
MAX	1.0	1.4	4.6	700	3020	2190	338	47	25	11	4.9	3.3
MIN	0.30	0.50	1.0	31	84	54	49	21	10	5.0	2.9	1.6
AC-FT	36	51	114	7540	18390	14890	7900	1870	952	510	240	143

Appendix B: Historic discharge data for Scott Creek near Davenport, CA

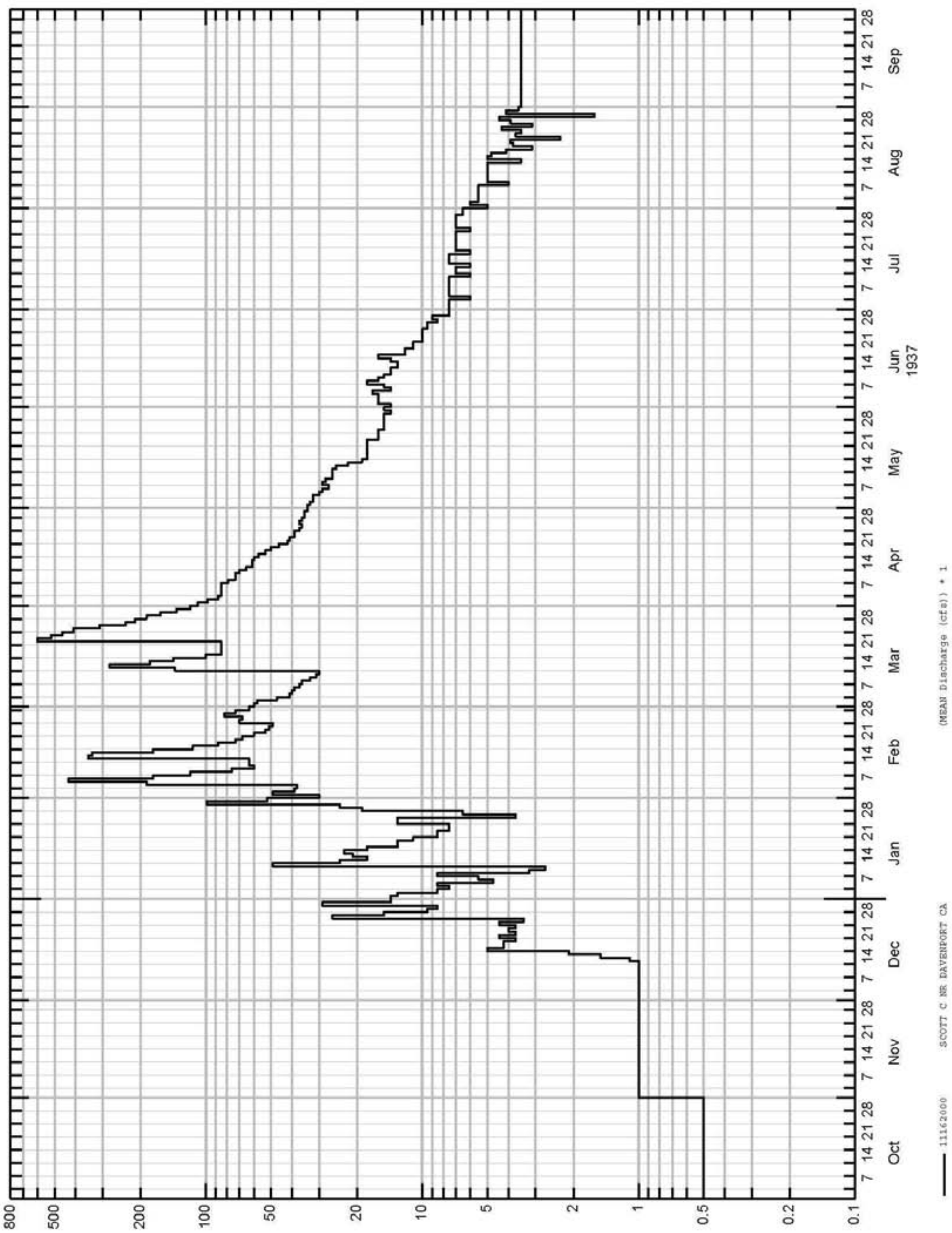
U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION:11162000 SCOTT C NR DAVENPORT CA TYPE:STREAM AGENCY:USGS STATE:06 COUNTY:087
LATITUDE: 370339 LONGITUDE: 1221330 NAD27 DRAINAGE AREA:27.3* CONTRIBUTING DRAINAGE AREA: DATUM:

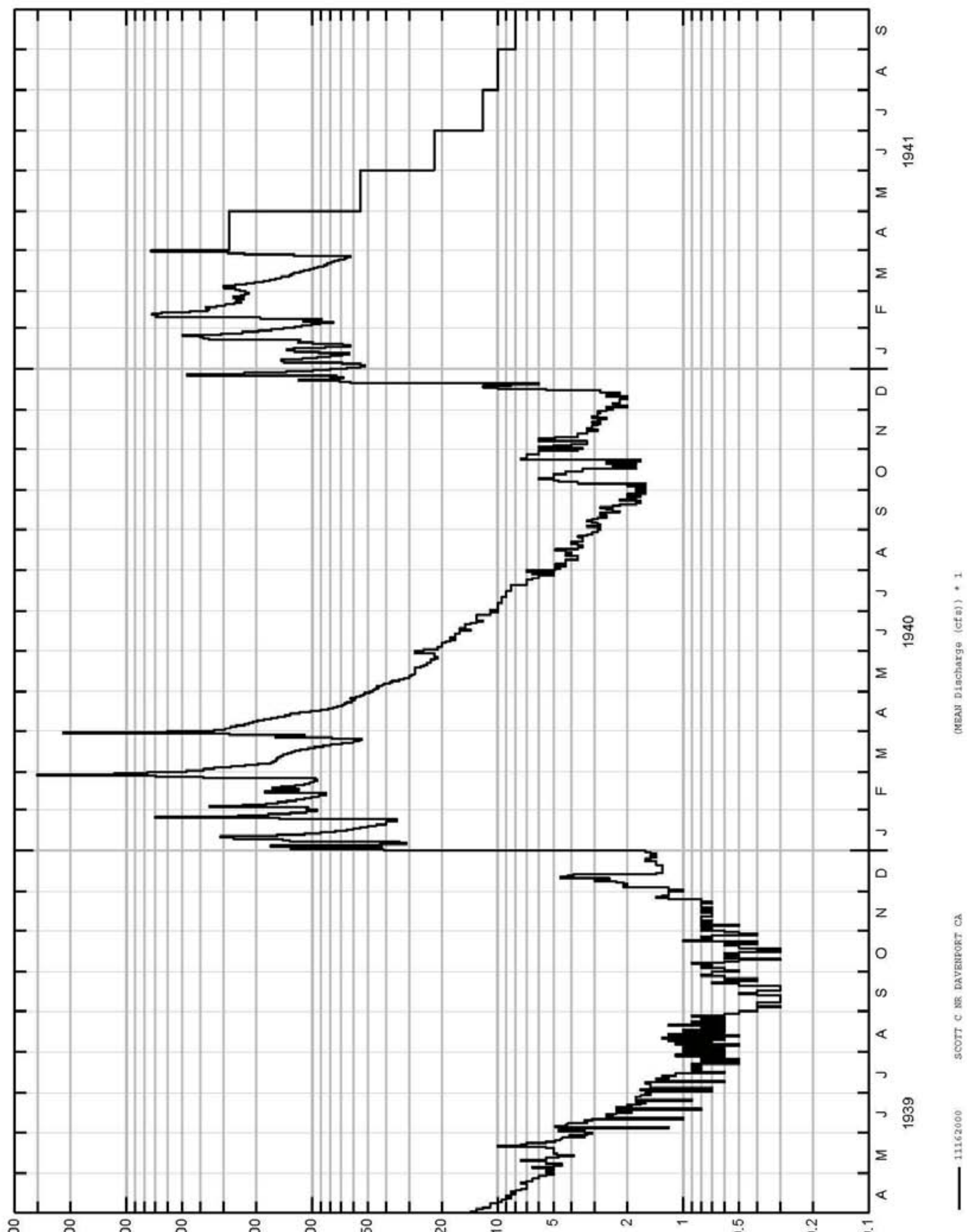
Discharge, cubic feet per second
WATER YEAR OCTOBER 1940 TO SEPTEMBER 1941
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.6	3.5	2.4	65	124	245	280	55	22	12	10	8.0
2	1.8	6.0	2.6	55	114	259	280	55	22	12	10	8.0
3	1.6	5.0	2.0	52	101	296	280	55	22	12	10	8.0
4	2.0	4.0	2.2	55	91	300	280	55	22	12	10	8.0
5	1.6	3.3	2.4	69	77	259	280	55	22	12	10	8.0
6	3.7	3.3	2.2	142	112	226	280	55	22	12	10	8.0
7	4.7	6.0	2.2	147	89	204	280	55	22	12	10	8.0
8	5.0	6.0	2.2	113	190	182	280	55	22	12	10	8.0
9	6.0	4.9	2.0	94	694	169	280	55	22	12	10	8.0
10	5.0	3.7	2.0	80	677	157	280	55	22	12	10	8.0
11	5.0	3.7	2.6	69	726	147	280	55	22	12	10	8.0
12	5.0	3.7	2.4	63	646	133	280	55	22	12	10	8.0
13	4.3	3.3	2.2	92	455	129	280	55	22	12	10	8.0
14	4.3	3.3	2.8	124	366	125	280	55	22	12	10	8.0
15	3.5	2.9	2.8	137	359	116	280	55	22	12	10	8.0
16	3.5	3.3	5.5	126	374	111	280	55	22	12	10	8.0
17	1.8	3.1	10	85	327	103	280	55	22	12	10	8.0
18	2.2	3.1	12	62	294	98	280	55	22	12	10	8.0
19	2.4	2.9	8.5	68	263	93	280	55	22	12	10	8.0
20	1.8	2.8	6.0	99	241	86	280	55	22	12	10	8.0
21	2.6	3.1	62	119	256	83	280	55	22	12	10	8.0
22	1.8	2.8	71	116	256	79	280	55	22	12	10	8.0
23	1.7	2.9	118	360	234	76	280	55	22	12	10	8.0
24	7.5	2.6	80	386	265	72	280	55	22	12	10	8.0
25	7.0	3.1	68	401	241	67	280	55	22	12	10	8.0
26	7.0	2.9	74	498	230	65	280	55	22	12	10	8.0
27	7.0	2.9	472	310	219	62	280	55	22	12	10	8.0
28	6.0	2.8	232	238	228	125	280	55	22	12	10	8.0
29	6.0	2.9	138	195	---	232	280	55	22	12	10	8.0
30	6.0	2.6	99	166	---	285	280	55	22	12	10	8.0
31	3.7	---	80	143	---	738	---	55	---	12	10	---
TOTAL	123.1	106.4	1571.0	4729	8249	5322	8400	1705	660	372	310	240.0
MEAN	3.97	3.55	50.7	153	295	172	280	55.0	22.0	12.0	10.0	8.00
MAX	7.5	6.0	472	498	726	738	280	55	22	12	10	8.0
MIN	1.6	2.6	2.0	52	77	62	280	55	22	12	10	8.0
AC-FT	244	211	3120	9380	16360	10560	16660	3380	1310	738	615	476

Appendix B: Historic discharge data for Scott Creek near Davenport, CA



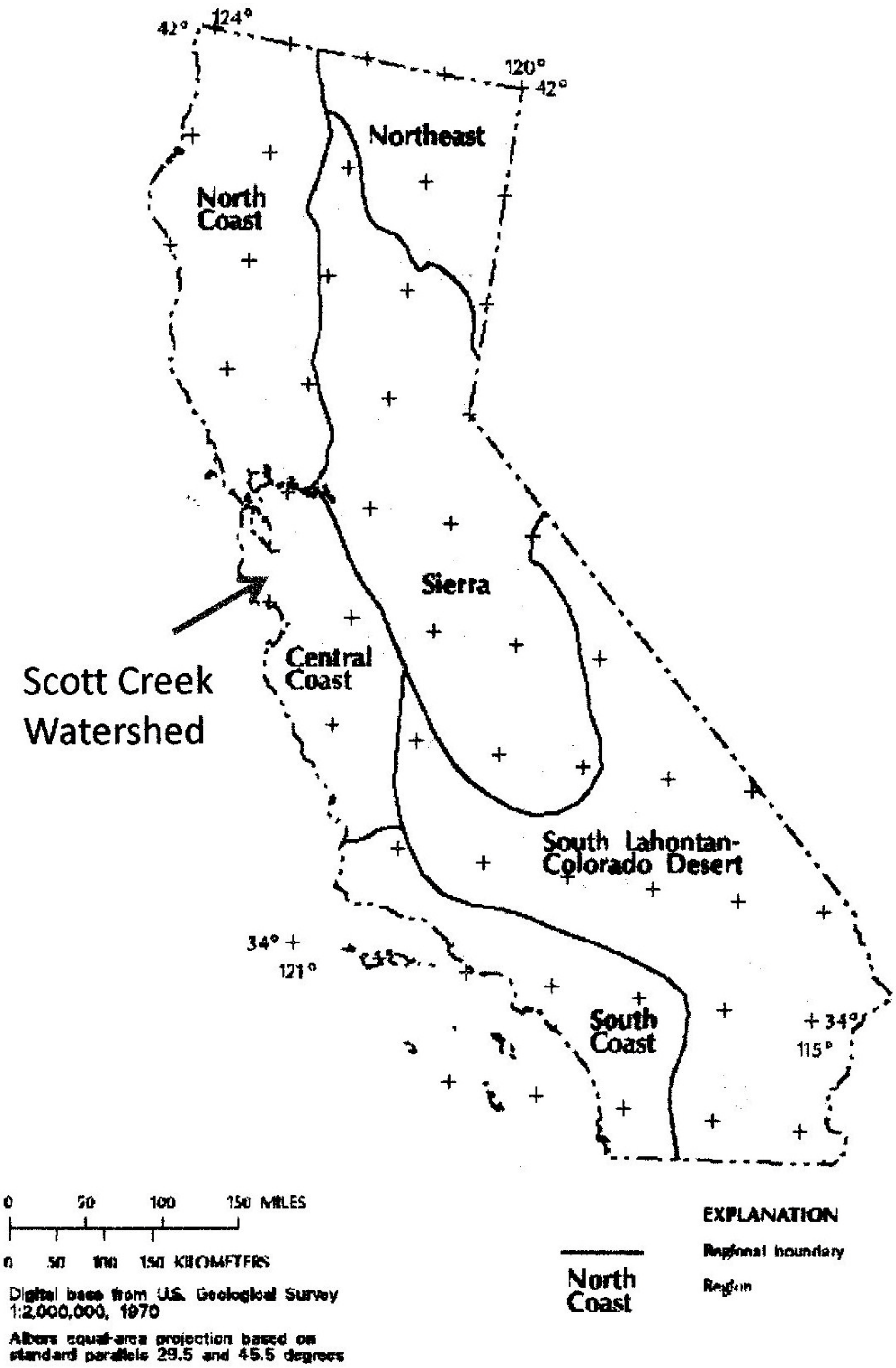
Appendix B: Historic discharge data for Scott Creek near Davenport, CA



Appendix C: Direct equation regions and California StreamStats output used with the direct equations

Appendix C: Direct equation regions and California StreamStats output used with the direct equations

U.S. Geological Survey
National Flood Frequency Program
Water-Resources Investigations Report 94-4002



Appendix C: Direct equation regions and California StreamStats output used with the direct equations

Basin Characteristics Report

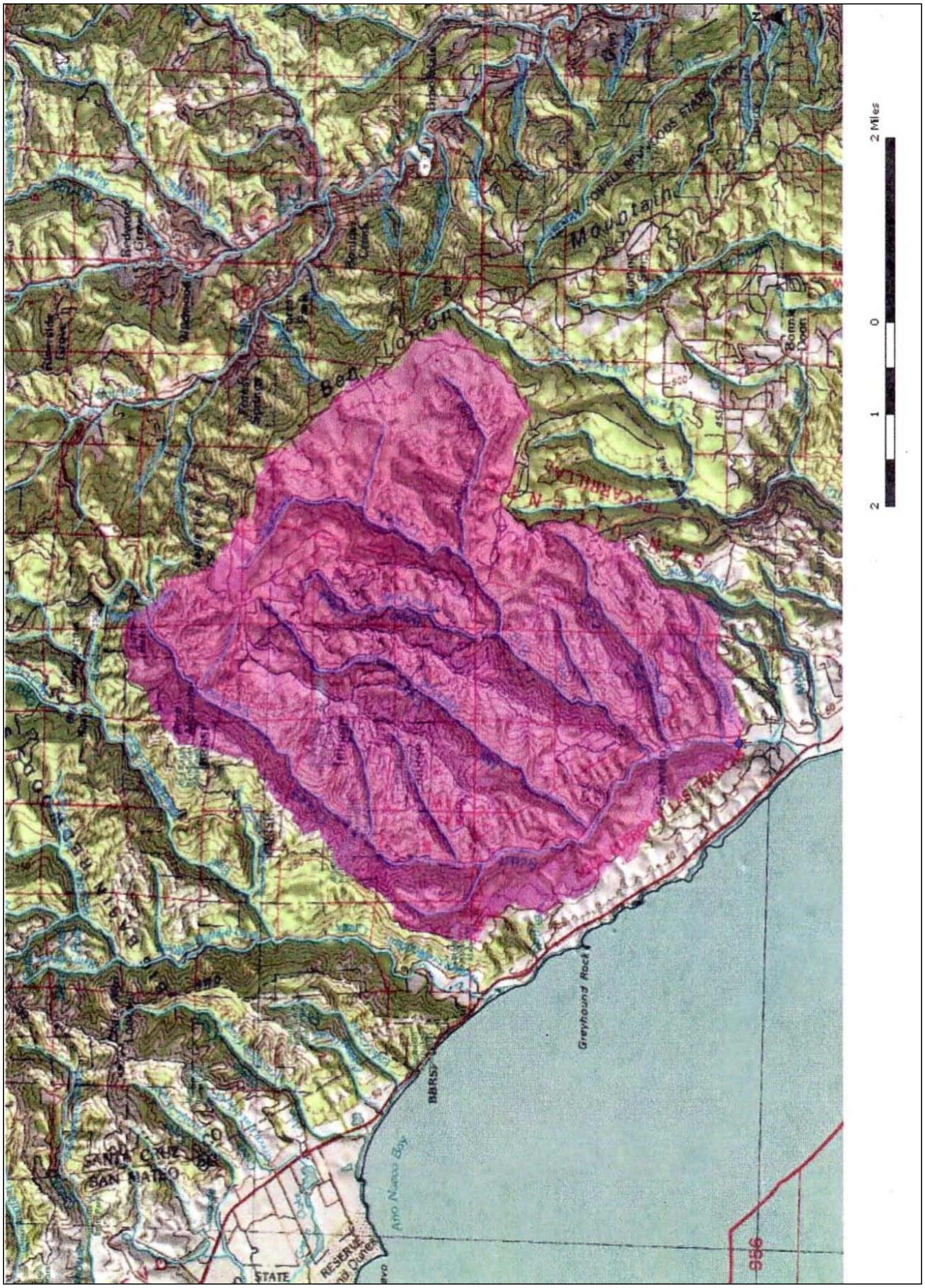
USGS
California StreamStats

Basin Characteristics Report

Date: Tue Mar 3 2009 12:59:47
NAD83 Latitude: 37.0638 (37 03 49)
NAD83 Longitude: -122.2294 (-122 13 45)
NAD27 Latitude: 37.0639 (37 03 49)
NAD27 Longitude: -122.2283 (-122 13 41)

Parameter	Value
Average basin slope, in percent	35.2
Average basin elevation, in feet	1370
Minimum elevation, in feet	36.3
X coordinate of the outlet, in map coordinates	-2281200.0
Perimeter, in miles	29.4
Relief, in feet	2610
Maximum elevation, in feet	2650
Average minimum January temperature, in Fahrenheit	42.3
Percentage of basin covered by forest	62.5
Area, in square miles	25.2
Percentage of basin covered by impervious surface	0.076
Distance in miles from basin centroid to the coast	3.62
Elevation at outlet, in feet	37.8
Y coordinate of the centroid, in map coordinates	1879315.6
X coordinate of the centroid, in map coordinates	-2278314.5
Relative relief, in feet per mile	88.8
Percent of area covered by lakes and ponds	0.0386
Average maximum January temperature, in Fahrenheit	56.3
Mean annual precipitation, in inches	49.6
High Elevation Index - Percent of area with elevation > 6000 feet	0
Y coordinate of the outlet, in map coordinates	1874730.0

Appendix C: Direct equation regions and California StreamStats output used with the direct equations



Appendix D: Location and peak discharge data for gages used in direct watershed comparison and drainage area adjustments

Appendix D: Location and peak discharge data for gages used in direct watershed comparison and drainage area adjustments

Appendix D: Location and peak discharge data for gages used in direct watershed comparison and drainage area adjustments

11159200
Corralitos Creek at Freedom, CA

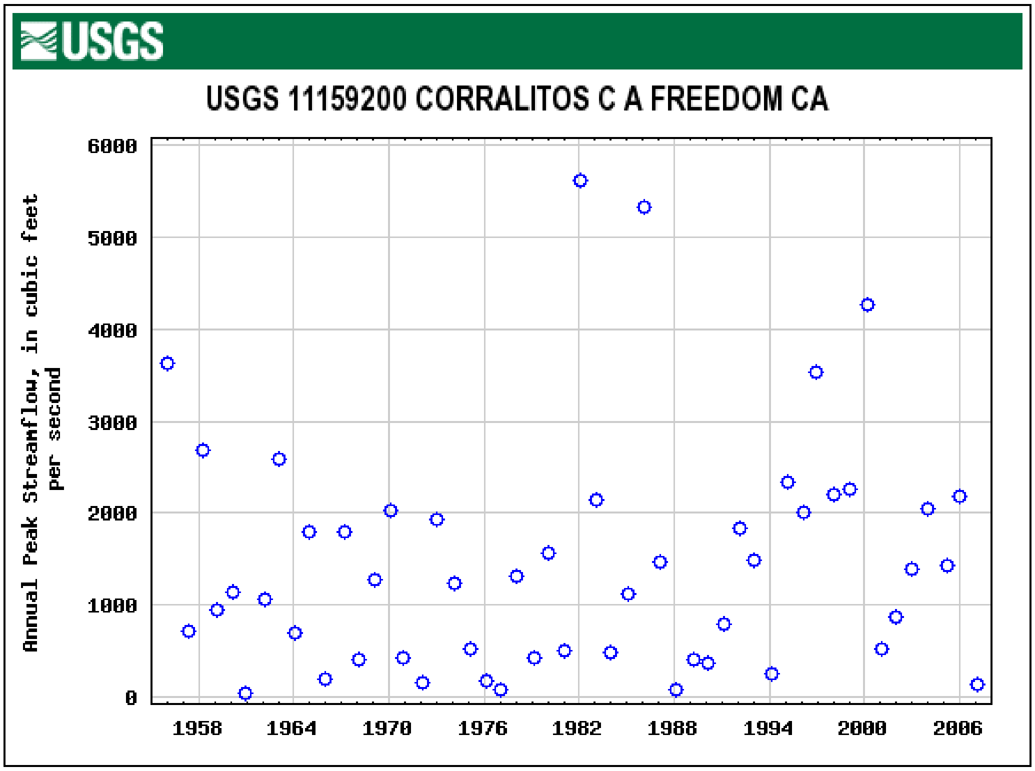
Santa Cruz County, California
Hydrologic Unit Code 18060002
Latitude 36°56'22", Longitude 121°46'10" NAD27
Drainage area 27.8 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1956	Dec. 22, 1955	15.60	3,620[7]	1982	Jan. 04, 1982	16.66	5,610[1,C]
1957	May 18, 1957	7.67	715	1983	Jan. 24, 1983	10.57	2,150[1,C]
1958	Apr. 02, 1958	12.59	2,680	1984	Dec. 25, 1983	5.79	488[C]
1959	Feb. 16, 1959	6.50	950	1985	Feb. 08, 1985	8.02	1,120[C]
1960	Feb. 08, 1960	7.50	1,140	1986	Feb. 17, 1986	16.44	5,320[1,C]
1961	Nov. 26, 1960	2.74	46.0	1987	Feb. 13, 1987	7.61	1,460[C]
1962	Feb. 14, 1962	6.66	1,050	1988	Jan. 17, 1988	3.93	83.0[C]
1963	Jan. 31, 1963	11.80	2,580	1989	Mar. 25, 1989	5.09	396[C]
1964	Jan. 20, 1964	5.54	702	1990	Feb. 16, 1990	5.02	372[C]
1965	Dec. 22, 1964	9.65	1,800	1991	Mar. 03, 1991	6.07	780[C]
1966	Dec. 25, 1965	4.09	199	1992	Feb. 20, 1992	8.45	1,830[C]
1967	Mar. 16, 1967	9.66	1,800	1993	Jan. 13, 1993	8.79	1,490[C]
1968	Jan. 30, 1968	4.98	405	1994	Feb. 19, 1994	4.97	245[C]
1969	Jan. 19, 1969	8.11	1,270	1995	Mar. 10, 1995	11.18	2,330[C]
1970	Jan. 16, 1970	10.44	2,030	1996	Feb. 19, 1996	10.43	2,000[C]
1971	Nov. 29, 1970	5.07	428	1997	Dec. 10, 1996	13.63	3,540[C]
1972	Feb. 05, 1972	3.81	155	1998	Feb. 03, 1998	10.88	2,190[C]
1973	Jan. 16, 1973	10.09	1,930	1999	Jan. 20, 1999	10.47	2,250[C]
1974	Mar. 01, 1974	8.04	1,230	2000	Feb. 13, 2000	14.40	4,260[C]
1975	Feb. 13, 1975	5.90	521	2001	Feb. 11, 2001	5.60	510[C]
1976	Feb. 29, 1976	3.58	168	2002	Dec. 21, 2001	6.85	867[C]
1977	Jan. 02, 1977	2.91	67.0	2003	Dec. 16, 2002	8.40	1,390[C]
1978	Jan. 16, 1978	8.39	1,320[C]	2004	Jan. 01, 2004	10.03	2,050[C]
1979	Feb. 22, 1979	4.56	413[C]	2005	Mar. 22, 2005	8.59	1,420[C]
1980	Jan. 12, 1980	9.25	1,560[C]	2006	Dec. 31, 2005	10.52	2,180[C]
1981	Jan. 29, 1981	6.24	498[C]	2007	Feb. 26, 2007	4.63	133[C]

- 1 -- Discharge is a Maximum Daily Average
- 7 -- Discharge is an Historic Peak
- C -- All or part of the record affected by Urbanization, Mining, Agricultural changes, Channelization, or other

Appendix D: Location and peak discharge data for gages used in direct watershed comparison and drainage area adjustments

11159200 (continued)
Corralitos Creek at Freedom, CA



Appendix D: Location and peak discharge data for gages used in direct watershed comparison and drainage area adjustments.

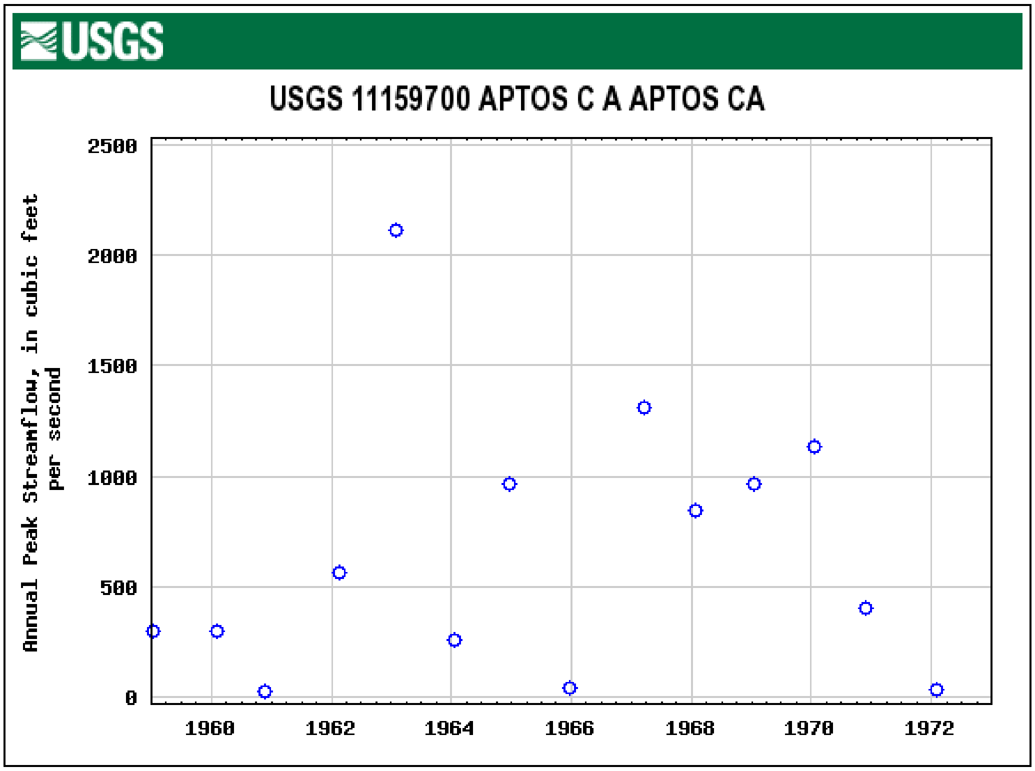
11159700
Aptos Creek at Aptos, CA

Santa Cruz County, California
Hydrologic Unit Code 18060001
Latitude 36°58'35", Longitude 121°54'05" NAD27
Drainage area 12.3 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1959	Jan. 09, 1959		299	1966	Dec. 25, 1965	4.23	46.0
1960	Feb. 08, 1960		302	1967	Mar. 16, 1967	8.53	1,310
1961	Nov. 26, 1960	3.41	24.0	1968	Jan. 30, 1968	7.39	846
1962	Feb. 14, 1962	6.02	560	1969	Jan. 18, 1969	7.55	966
1963	Jan. 31, 1963	10.82	2,110	1970	Jan. 16, 1970	7.91	1,130
1964	Jan. 21, 1964	5.30	262	1971	Nov. 29, 1970		400
1965	Dec. 22, 1964	7.55	968	1972	Feb. 05, 1972	3.92	34.0

Appendix D: Location and peak discharge data for gages used in direct watershed comparison and drainage area adjustments.

11159700 (continued)
Aptos Creek at Aptos, CA



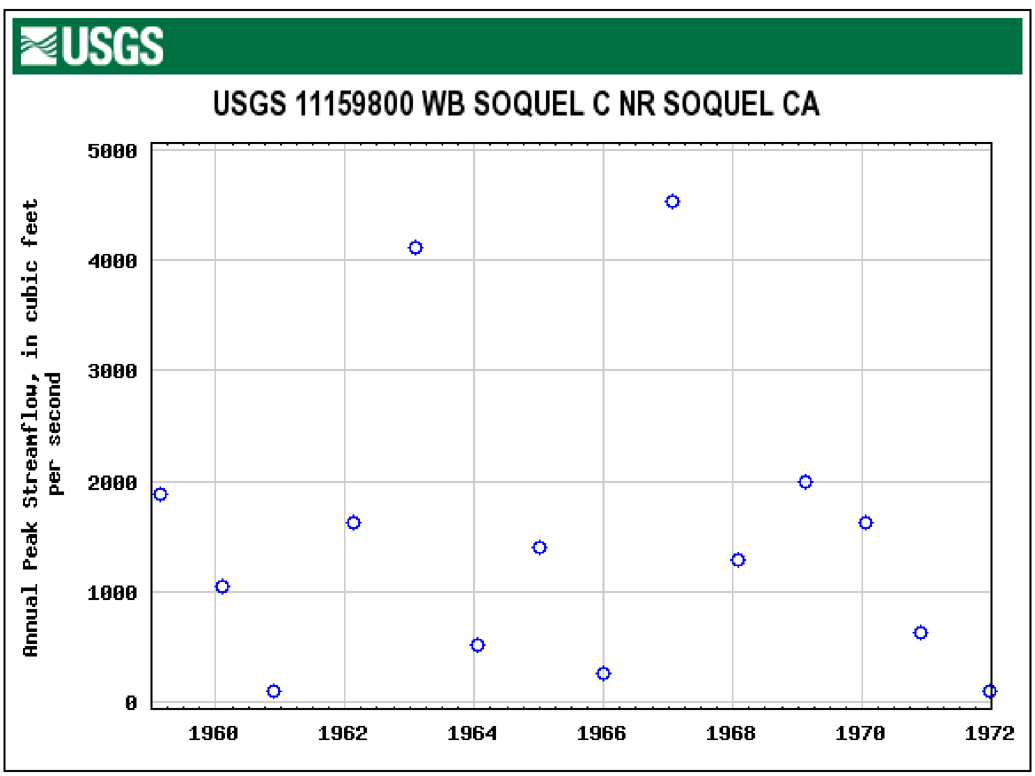
Appendix D: Location and peak discharge data for gages used in direct watershed comparison and drainage area adjustments

11159800
WB Soquel Creek near Soquel, CA

Santa Cruz County, California
Hydrologic Unit Code 18060001
Latitude 37°03'05", Longitude 121°56'17" NAD27
Drainage area 12.2 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1959	Feb. 16, 1959		1,880	1966	Dec. 25, 1965	4.63	260
1960	Feb. 01, 1960	6.03	1,040	1967	Jan. 24, 1967	11.47	4,530[C]
1961	Nov. 26, 1960	3.78	91.0	1968	Jan. 30, 1968	6.65	1,290
1962	Feb. 14, 1962	7.00	1,620	1969	Feb. 15, 1969	7.79	2,000
1963	Jan. 31, 1963	10.88	4,120[C]	1970	Jan. 16, 1970	7.19	1,630
1964	Jan. 20, 1964	5.10	510	1971	Nov. 28, 1970	5.30	620
1965	Jan. 05, 1965	6.83	1,400	1972	Dec. 24, 1971	3.80	94.0

- C -- All or part of the record affected by Urbanization, Mining, Agricultural changes, Channelization, or other



Appendix D: Location and peak discharge data for gages used in direct watershed comparison and drainage area adjustments

11160000
Soquel Creek at Soquel, CA

Santa Cruz County, California
Hydrologic Unit Code 18060001
Latitude 36°59'29", Longitude 121°57'17" NAD27
Drainage area 40.2 square miles

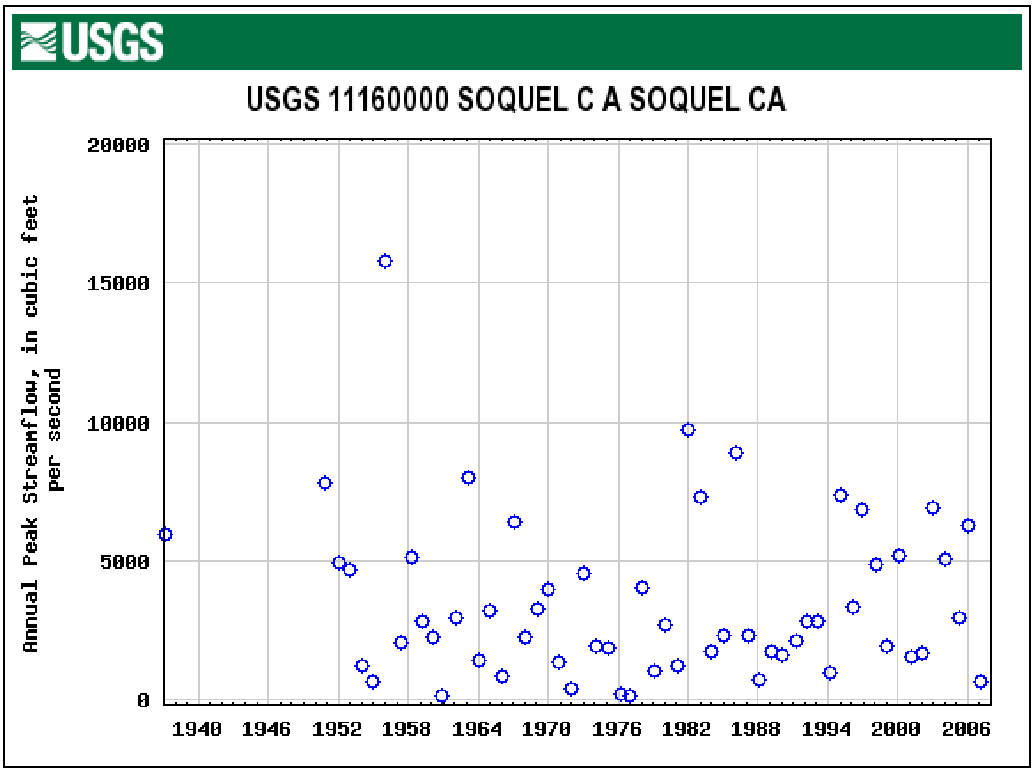
Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1937	Feb. 13, 1937	12.60[1]	5,950[7]	1979	Feb. 14, 1979	6.32	974
1951	Nov. 18, 1950	15.33	7,800	1980	Jan. 13, 1980	9.68	2,630
1952	Jan. 12, 1952	11.63	4,910	1981	Jan. 29, 1981	6.79	1,160
1953	Dec. 07, 1952	11.45	4,630	1982	Jan. 04, 1982	21.85	9,700
1954	Jan. 17, 1954	7.68	1,180	1983	Jan. 24, 1983	15.05	7,290
1955	Nov. 15, 1954	6.35	578	1984	Dec. 25, 1983	7.53	1,680
1956	Dec. 23, 1955	22.33	15,800	1985	Feb. 08, 1985	8.63	2,270
1957	May 18, 1957	9.01	2,010	1986	Feb. 17, 1986	15.68	8,900
1958	Apr. 02, 1958	13.24	5,080	1987	Feb. 13, 1987	7.75	2,270
1959	Feb. 16, 1959	9.58	2,770	1988	Jan. 17, 1988	4.84	649
1960	Feb. 01, 1960	9.15	2,240	1989	Mar. 11, 1989	6.81	1,670
1961	Nov. 26, 1960	4.68	106	1990	Feb. 16, 1990	6.67	1,590
1962	Feb. 14, 1962	10.20	2,940	1991	Mar. 24, 1991	9.75	2,070
1963	Jan. 31, 1963	16.27	7,950	1992	Feb. 14, 1992	10.98	2,770
1964	Jan. 21, 1964	7.55	1,390	1993	Jan. 13, 1993	10.09	2,800
1965	Dec. 22, 1964	10.47	3,180	1994	Feb. 19, 1994	6.26	900
1966	Dec. 25, 1965	6.15	805	1995	Jan. 09, 1995	17.93	7,370
1967	Jan. 24, 1967	14.76	6,410	1996	Feb. 19, 1996	11.03	3,330
1968	Jan. 30, 1968	9.07	2,190	1997	Dec. 10, 1996	15.63	6,850
1969	Feb. 15, 1969	10.76	3,230	1998	Feb. 03, 1998	13.15	4,810
1970	Jan. 16, 1970	11.74	3,920	1999	Jan. 20, 1999	8.48	1,910
1971	Nov. 29, 1970	7.06	1,300	2000	Jan. 24, 2000	13.59	5,150
1972	Dec. 24, 1971	4.54	377	2001	Mar. 04, 2001	7.60	1,510
1973	Jan. 16, 1973	12.55	4,530	2002	Jan. 02, 2002	7.95	1,630
1974	Jan. 17, 1974	8.41	1,880	2003	Dec. 16, 2002	15.63	6,870
1975	Mar. 21, 1975	7.82	1,840	2004	Dec. 29, 2003	13.48	5,060

Appendix D: Location and peak discharge data for gages used in direct watershed comparison and drainage area adjustments

11160000 (continued)
Soquel Creek at Soquel, CA

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1976	Feb. 29, 1976	3.57	134	2005	Mar. 22, 2005	10.68	2,930
1977	Dec. 30, 1976	3.46	118	2006	Dec. 31, 2005	15.17	6,280
1978	Jan. 16, 1978	11.77	4,010	2007	Feb. 10, 2007	5.59	614

- 7 -- Discharge is an Historic Peak

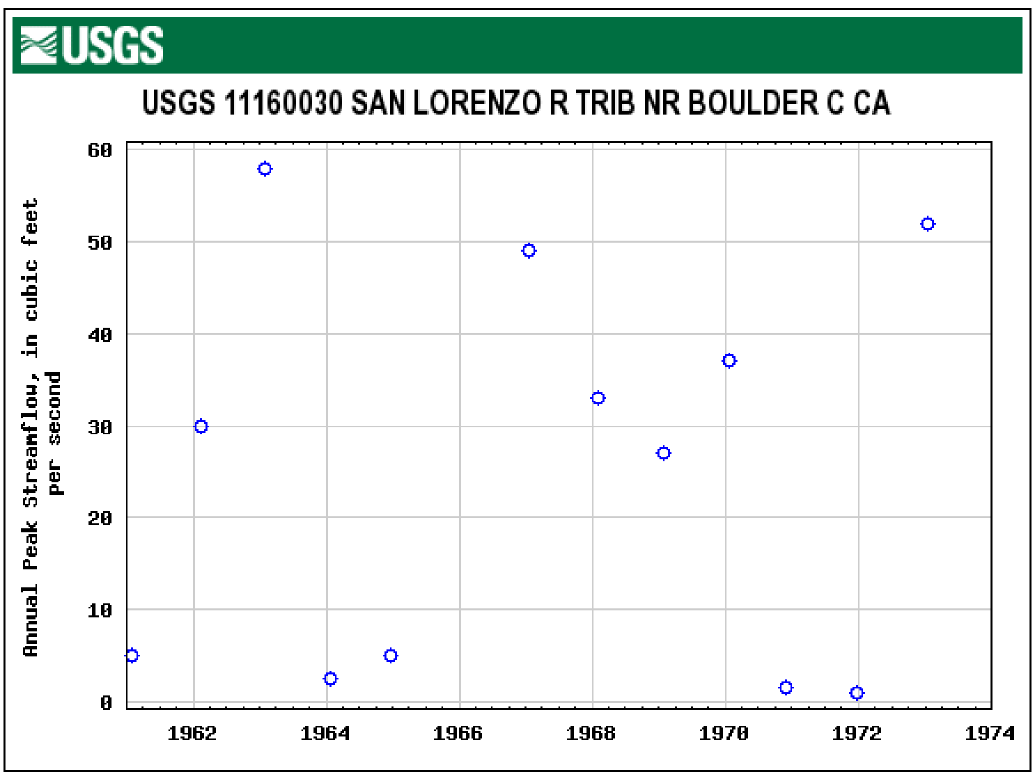


Appendix D: Location and peak discharge data for gages used in direct watershed comparison and drainage area adjustments

11160030
San Lorenzo River Tributary near Boulder Creek, CA

Santa Cruz County, California
Hydrologic Unit Code 18060001
Latitude 37°10'10", Longitude 122°08'05" NAD27
Drainage area 0.26 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1961	Jan. 26, 1961	51.18	5.00	1968	Jan. 30, 1968	51.92	33.0
1962	Feb. 09, 1962	51.83	30.0	1969	Jan. 26, 1969	51.73	27.0
1963	Jan. 31, 1963	52.80	58.0	1970	Jan. 21, 1970	52.05	37.0
1964	Jan. 20, 1964	51.02	2.40	1971	Nov. 29, 1970	50.93	1.50
1965	Dec. 22, 1964	51.18	5.00	1972	Dec. 27, 1971		1.00
1967	Jan. 21, 1967	52.43	49.0	1973	Jan. 18, 1973	52.60	52.0



Appendix D: Location and peak discharge data for gages used in direct watershed comparison and drainage area adjustments

11160300
Zayante Creek at Zayante, CA

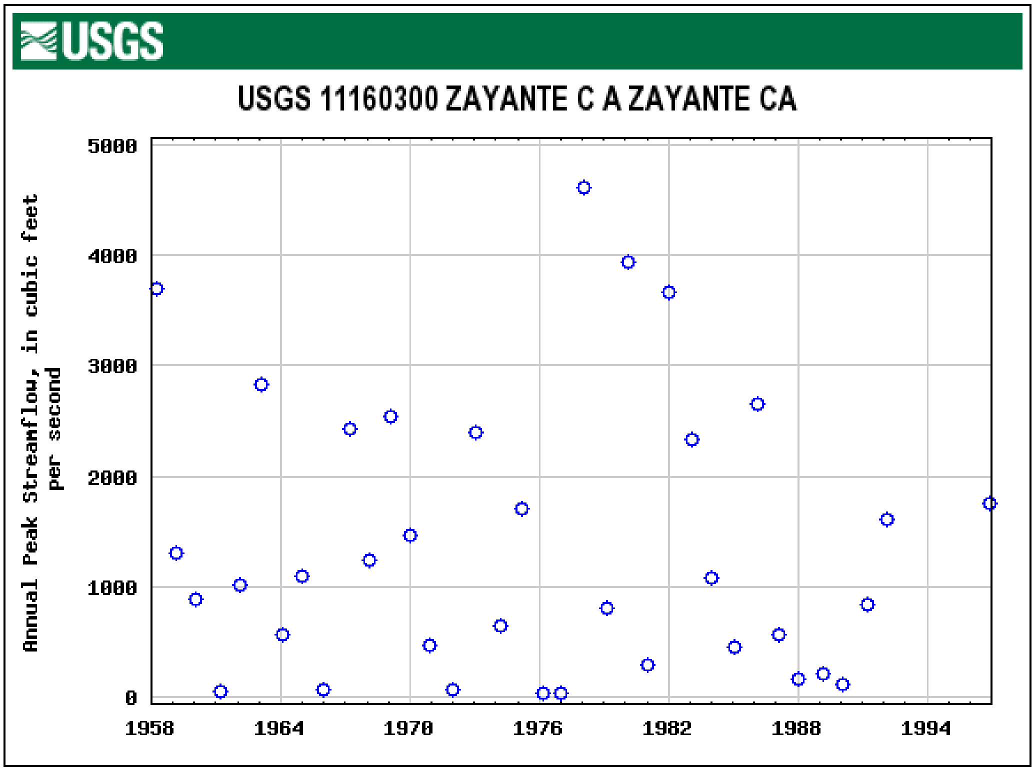
Santa Cruz County, California
Hydrologic Unit Code 18060001
Latitude 37°05'10", Longitude 122°02'45" NAD27
Drainage area 11.1 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1958	Apr. 02, 1958	7.70	3,700	1976	Feb. 29, 1976	2.16	25.0
1959	Feb. 16, 1959	5.40	1,300	1977	Jan. 02, 1977	2.32	37.0
1960	Feb. 01, 1960	4.86	880	1978	Jan. 14, 1978	8.52[6]	4,620
1961	Mar. 15, 1961	2.09	45.0	1979	Feb. 13, 1979	4.43	800
1962	Feb. 14, 1962	5.07	1,010	1980	Feb. 19, 1980	7.83	3,940
1963	Jan. 31, 1963	6.86	2,830	1981	Jan. 28, 1981	3.39	293
1964	Jan. 20, 1964	4.10	560	1982	Jan. 04, 1982	8.86	3,670
1965	Jan. 05, 1965	5.00	1,100	1983	Jan. 24, 1983	6.82	2,330
1966	Dec. 29, 1965	2.56	62.0	1984	Dec. 25, 1983	4.93	1,080
1967	Mar. 16, 1967	6.50	2,430	1985	Feb. 08, 1985	3.78	455
1968	Jan. 30, 1968	5.20	1,240	1986	Feb. 17, 1986	7.35	2,660
1969	Feb. 15, 1969	6.60	2,540	1987	Feb. 13, 1987	3.99	555
1970	Jan. 16, 1970	5.49	1,470	1988	Jan. 17, 1988	2.90	160
1971	Dec. 02, 1970	3.90	470	1989	Mar. 09, 1989	3.06	201
1972	Dec. 27, 1971	2.56	62.0	1990	Feb. 16, 1990	2.72	116
1973	Jan. 16, 1973	6.47	2,400	1991	Mar. 24, 1991	4.51	837
1974	Mar. 30, 1974	4.28	650	1992	Feb. 14, 1992	5.72	1,600
1975	Mar. 07, 1975	5.75	1,700	1997	Dec. 10, 1996	5.95	1,760

- 6 -- Gage datum changed during this year

Appendix D: Location and peak discharge data for gages used in direct watershed comparison and drainage area adjustments

11160300 (continued)
Zayante Creek at Zayante, CA



Appendix D: Location and peak discharge data for gages used in direct watershed comparison and drainage area adjustments

11160500
San Lorenzo River at Big Trees, CA

Santa Cruz County, California
Hydrologic Unit Code 18060001
Latitude 37°02'40", Longitude 122°04'17" NAD27
Drainage area 106 square miles

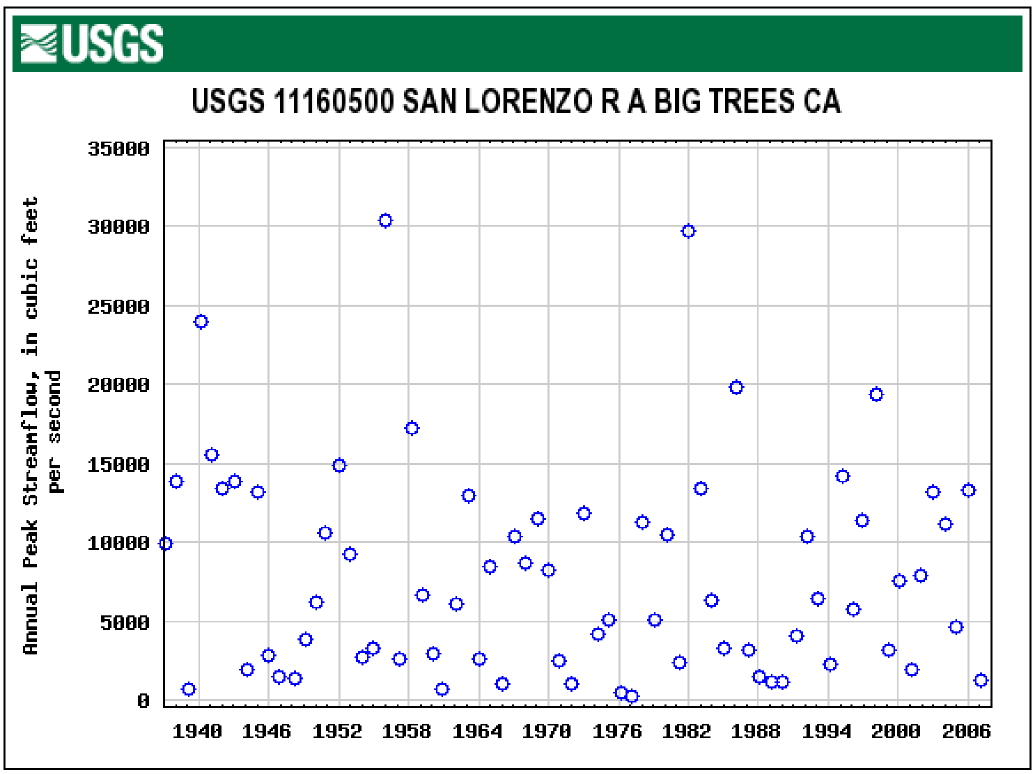
Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1937	Feb. 14, 1937	14.10	9,910	1972	Dec. 27, 1971	4.75	1,060
1938	Jan. 31, 1938	16.30	13,800	1973	Jan. 16, 1973	22.53[6]	11,800
1939	Mar. 09, 1939	4.45	678	1974	Mar. 28, 1974	11.80	4,220
1940	Feb. 27, 1940	21.10	24,000	1975	Mar. 21, 1975	13.05	5,040
1941	Feb. 09, 1941	17.15	15,500	1976	Feb. 29, 1976	5.09	458
1942	Jan. 24, 1942	16.10	13,400	1977	Mar. 15, 1977	4.36	263
1943	Jan. 21, 1943	16.35	13,900	1978	Jan. 14, 1978	21.85	11,300
1944	Mar. 04, 1944	7.12	1,890	1979	Feb. 13, 1979	13.12	5,080
1945	Feb. 02, 1945	15.98	13,200	1980	Feb. 19, 1980	20.82	10,500
1946	Dec. 27, 1945	8.35	2,810	1981	Mar. 21, 1981	8.86	2,410[D]
1947	Nov. 22, 1946	6.30	1,450	1982	Jan. 05, 1982	28.85	29,700
1948	Apr. 29, 1948	6.18	1,390	1983	Jan. 24, 1983	20.69	13,400
1949	Mar. 10, 1949	9.56	3,880	1984	Dec. 25, 1983	15.12	6,290
1950	Feb. 06, 1950	11.58	6,190	1985	Feb. 08, 1985	11.69	3,290
1951	Nov. 18, 1950	14.50	10,600	1986	Feb. 17, 1986	21.22	19,800
1952	Jan. 12, 1952	16.85	14,900	1987	Feb. 13, 1987	9.69	3,220
1953	Dec. 07, 1952	13.69	9,250	1988	Jan. 17, 1988	7.19	1,460
1954	Jan. 17, 1954	8.22	2,710	1989	Mar. 11, 1989	6.60	1,150
1955	Dec. 02, 1954	8.95	3,300	1990	Feb. 16, 1990	6.64	1,170
1956	Dec. 23, 1955	22.55	30,400	1991	Mar. 24, 1991	10.68	4,100
1957	Feb. 24, 1957	7.15	2,560	1992	Feb. 12, 1992	16.45	10,400
1958	Apr. 02, 1958	17.76	17,200	1993	Jan. 13, 1993	13.64	6,430
1959	Feb. 16, 1959	11.35	6,690	1994	Feb. 19, 1994	9.04	2,290
1960	Feb. 01, 1960	7.70	2,990	1995	Mar. 10, 1995	20.71[2]	14,200
1961	Nov. 26, 1960	3.81	639	1996	Feb. 19, 1996	13.32	5,790
1962	Feb. 14, 1962	10.98	6,090	1997	Dec. 10, 1996	18.61	11,400
1963	Jan. 31, 1963	15.80	13,000	1998	Feb. 03, 1998	24.04	19,400
1964	Jan. 21, 1964	7.29	2,660	1999	Feb. 09, 1999	10.70	3,200

Appendix D: Location and peak discharge data for gages used in direct watershed comparison and drainage area adjustments

11160500 (continued)
San Lorenzo River at Big Trees, CA

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1965	Jan. 05, 1965	12.93	8,450	2000	Feb. 13, 2000	15.40	7,550
1966	Dec. 29, 1965	4.80	1,080	2001	Mar. 04, 2001	8.73	1,900
1967	Jan. 21, 1967	14.34	10,400	2002	Dec. 02, 2001	14.29	7,880
1968	Jan. 30, 1968	13.14	8,720	2003	Dec. 16, 2002	17.64	13,200
1969	Feb. 15, 1969	14.97	11,500	2004	Jan. 01, 2004	16.56	11,200
1970	Jan. 16, 1970	12.73	8,190	2005	Jan. 07, 2005	12.17	4,620
1971	Nov. 29, 1970	7.12	2,530	2006	Dec. 31, 2005	20.04	13,300
				2007	Feb. 10, 2007	7.44	1,210

- 2 -- Gage height not the maximum for the year
- 6 -- Gage datum changed during this year
- D -- Base Discharge changed during this year



Appendix D: Location and peak discharge data for gages used in direct watershed comparison and drainage area adjustments

11161500
Branciforte Creek at Santa Cruz, CA

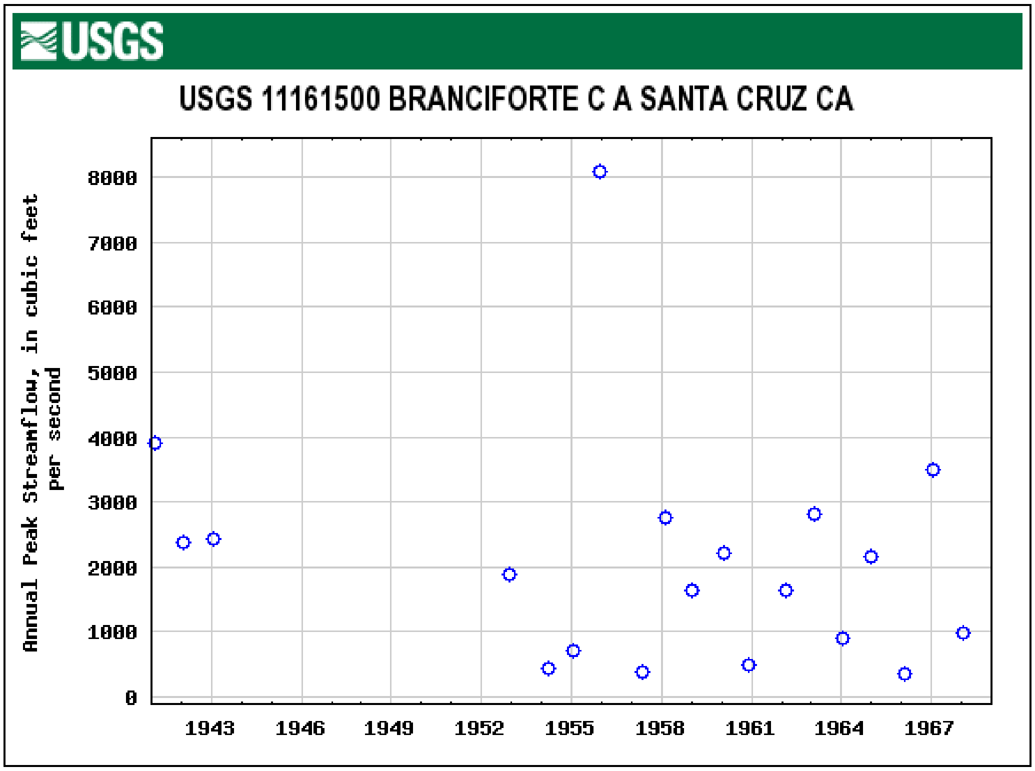
Santa Cruz County, California
Hydrologic Unit Code 18060001
Latitude 36°59'10", Longitude 122°00'48" NAD27
Drainage area 17.3 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1941	Feb. 09, 1941	[6]	3,910	1959	Jan. 09, 1959	10.78	1,630
1942	Jan. 24, 1942	[6]	2,370	1960	Feb. 01, 1960	12.08	2,210
1943	Jan. 21, 1943	[6]	2,430	1961	Nov. 26, 1960	7.56	503
1953	Dec. 07, 1952	12.28	1,890	1962	Feb. 13, 1962	10.81	1,640
1954	Mar. 29, 1954	6.29	426	1963	Jan. 31, 1963	13.34	2,820
1955	Jan. 18, 1955	7.82	720	1964	Jan. 20, 1964	9.05	903
1956	Dec. 22, 1955	22.04	8,100	1965	Dec. 22, 1964	11.98	2,170
1957	May 18, 1957	6.45	382	1966	Feb. 19, 1966	6.55	345
1958	Feb. 19, 1958	14.01	2,760	1967	Jan. 24, 1967	14.64	3,500
				1968	Jan. 30, 1968	8.68	984

- 6 -- Gage datum changed during this year

Appendix D: Location and peak discharge data for gages used in direct watershed comparison and drainage area adjustments

11161500 (continued)
Branciforte Creek at Santa Cruz, CA

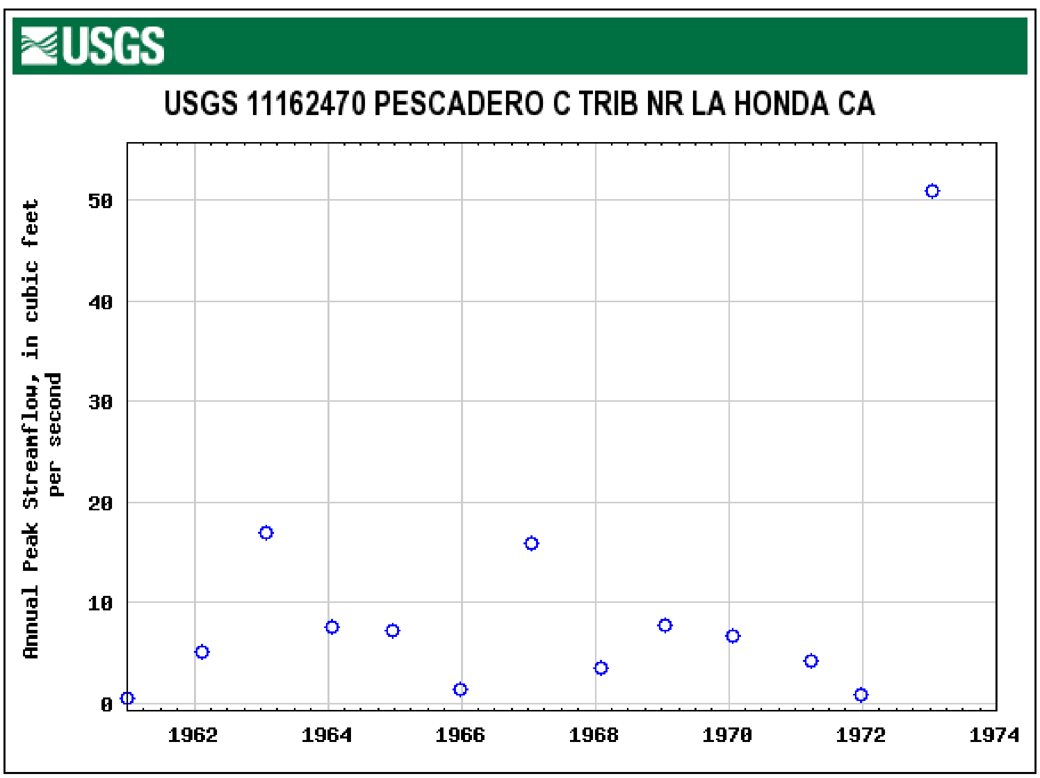


Appendix D: Location and peak discharge data for gages used in direct watershed comparison and drainage area adjustments

11162470
Pescadero Creek Tributary near La Honda, CA

San Mateo County, California
Hydrologic Unit Code 18050006
Latitude 37°16'40", Longitude 122°17'35" NAD27
Drainage area 0.22 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1961	Jan. 1961		0.50	1967	Jan. 21, 1967	49.67	16.0
1962	Feb. 14, 1962	48.86	5.10	1968	Jan. 30, 1968	48.68	3.50
1963	Jan. 31, 1963	49.67	17.0	1969	Jan. 20, 1969	49.10	7.80
1964	Jan. 20, 1964	49.07	7.60	1970	Jan. 21, 1970	49.01	6.80
1965	Dec. 22, 1964	49.05	7.20	1971	Mar. 26, 1971	48.76	4.20
1966	Dec. 28, 1965	48.37	1.40	1972	Dec. 26, 1971	48.30	0.90
				1973	Jan. 16, 1973	51.75	51.0



Appendix D: Location and peak discharge data for gages used in direct watershed comparison and drainage area adjustments

11162500
Pescadero Creek near Pescadero, CA

San Mateo County, California
Hydrologic Unit Code 18050006
Latitude 37°15'39", Longitude 122°19'40" NAD27
Drainage area 45.9 square miles

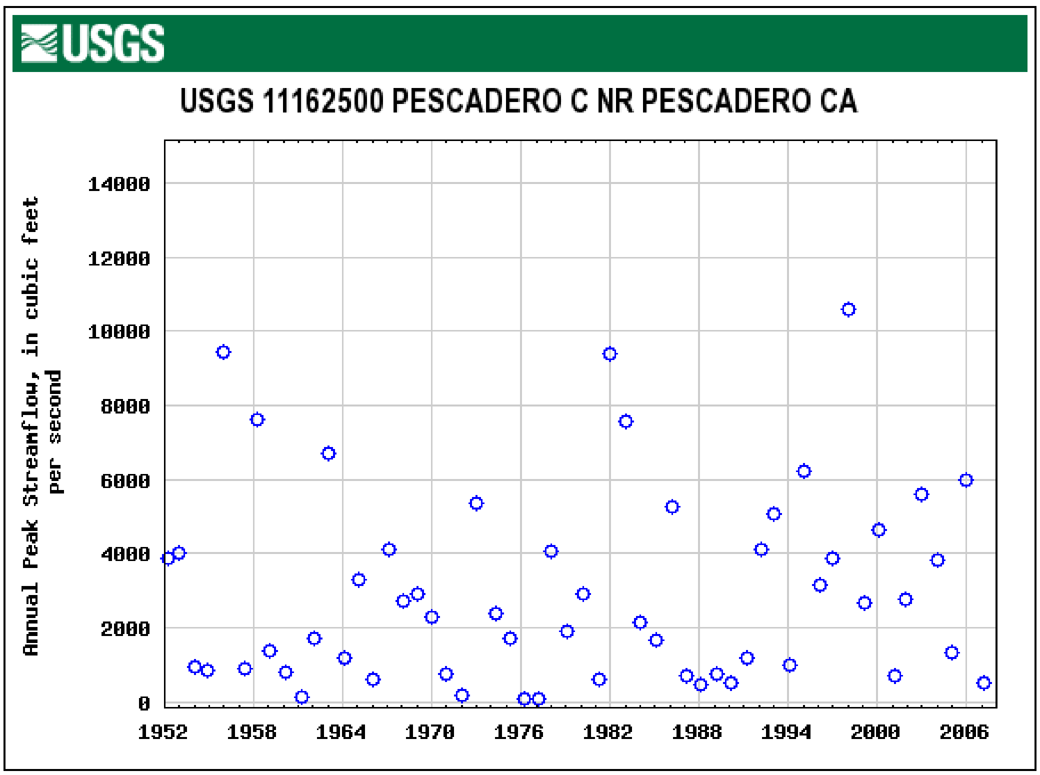
Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1952	Mar. 14, 1952	15.39	3,870	1980	Feb. 19, 1980	10.39	2,940
1953	Dec. 07, 1952	15.61	4,030	1981	Mar. 21, 1981	4.79	631
1954	Jan. 17, 1954	8.51	953	1982	Jan. 04, 1982	20.92	9,400
1955	Dec. 02, 1954	8.04	840	1983	Jan. 26, 1983	18.80	7,550
1956	Dec. 23, 1955	21.27	9,420	1984	Dec. 25, 1983		2,150[2]
1957	May 18, 1957	9.43	908	1985	Feb. 08, 1985	8.72	1,680
1958	Apr. 02, 1958	19.72	7,630	1986	Feb. 17, 1986	15.52	5,270
1959	Feb. 16, 1959	9.79	1,380	1987	Feb. 13, 1987	5.72	702
1960	Feb. 08, 1960	7.83	816	1988	Jan. 17, 1988	4.75	475
1961	Mar. 15, 1961	4.16	150	1989	Mar. 11, 1989	5.92	751
1962	Feb. 15, 1962	10.80	1,720	1990	Feb. 16, 1990	4.94	508
1963	Jan. 31, 1963	18.80	6,700	1991	Mar. 04, 1991	7.35	1,180
1964	Jan. 20, 1964	9.06	1,170	1992	Feb. 12, 1992	13.75	4,100
1965	Jan. 05, 1965	14.26	3,310	1993	Jan. 13, 1993	15.33	5,060
1966	Dec. 28, 1965	6.66	626	1994	Feb. 19, 1994	7.21	991
1967	Jan. 21, 1967	15.59	4,100	1995	Jan. 09, 1995	17.31	6,210
1968	Jan. 30, 1968	11.65	2,740	1996	Feb. 04, 1996	11.50	3,180
1969	Jan. 19, 1969	11.97	2,900	1997	Jan. 02, 1997	12.77	3,870
1970	Jan. 16, 1970	10.66	2,300	1998	Feb. 03, 1998	22.47	10,600
1971	Nov. 29, 1970	6.25	770	1999	Feb. 09, 1999	10.56	2,700
1972	Dec. 27, 1971	3.59	205	2000	Feb. 13, 2000	14.12	4,660
1973	Jan. 16, 1973	15.21	5,380	2001	Mar. 04, 2001	5.45	710
1974	Apr. 01, 1974	9.88	2,370	2002	Dec. 02, 2001	10.45	2,770
1975	Mar. 22, 1975	8.55	1,740	2003	Dec. 16, 2002	15.34	5,600
1976	Feb. 29, 1976	2.34	86.0	2004	Jan. 01, 2004	12.39	3,810
1977	Mar. 16, 1977	2.43	67.0	2005	Dec. 30, 2004	6.93	1,340

Appendix D: Location and peak discharge data for gages used in direct watershed comparison and drainage area adjustments

11162500 (continued)
Pescadero Creek near Pescadero, CA

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1978	Jan. 14, 1978	12.78	4,060	2006	Dec. 31, 2005	15.92	5,980
1979	Feb. 14, 1979	8.89	1,900	2007	Feb. 11, 2007	4.39	518

- 2 -- Discharge is an Estimate



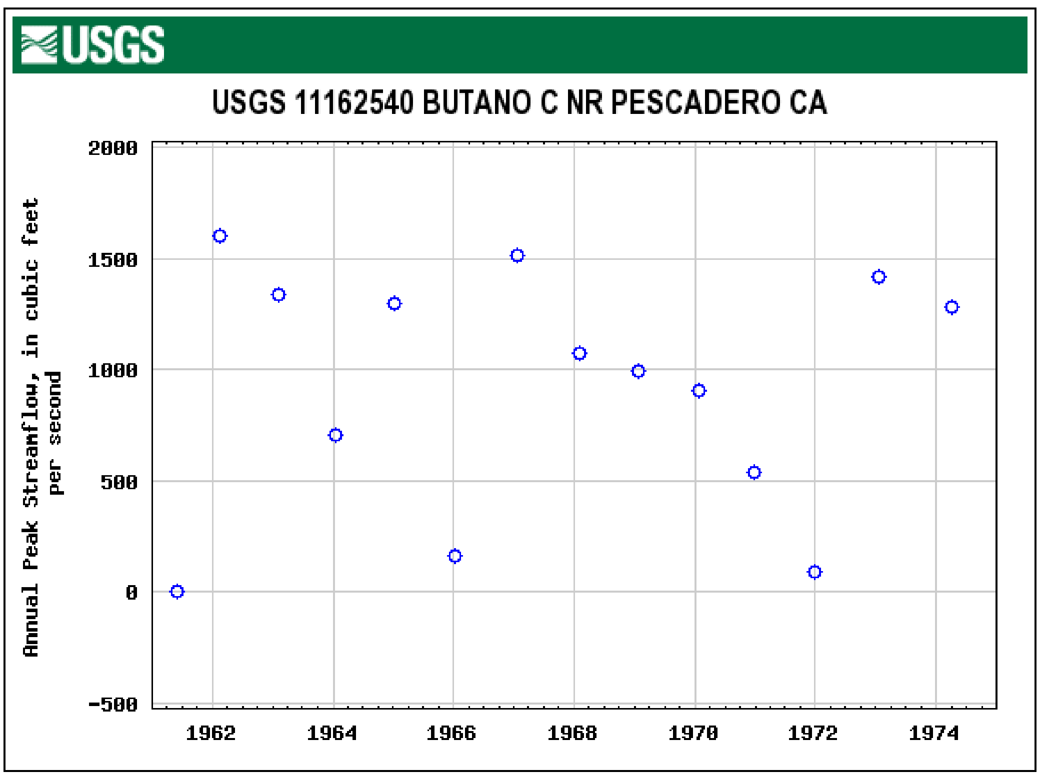
Appendix D: Location and peak discharge data for gages used in direct watershed comparison and drainage area adjustments

11162540
Butano Creek near Pescadero, CA

San Mateo County, California
Hydrologic Unit Code 18050006
Latitude 37°14'01", Longitude 122°21'56" NAD27
Drainage area 18.3 square miles

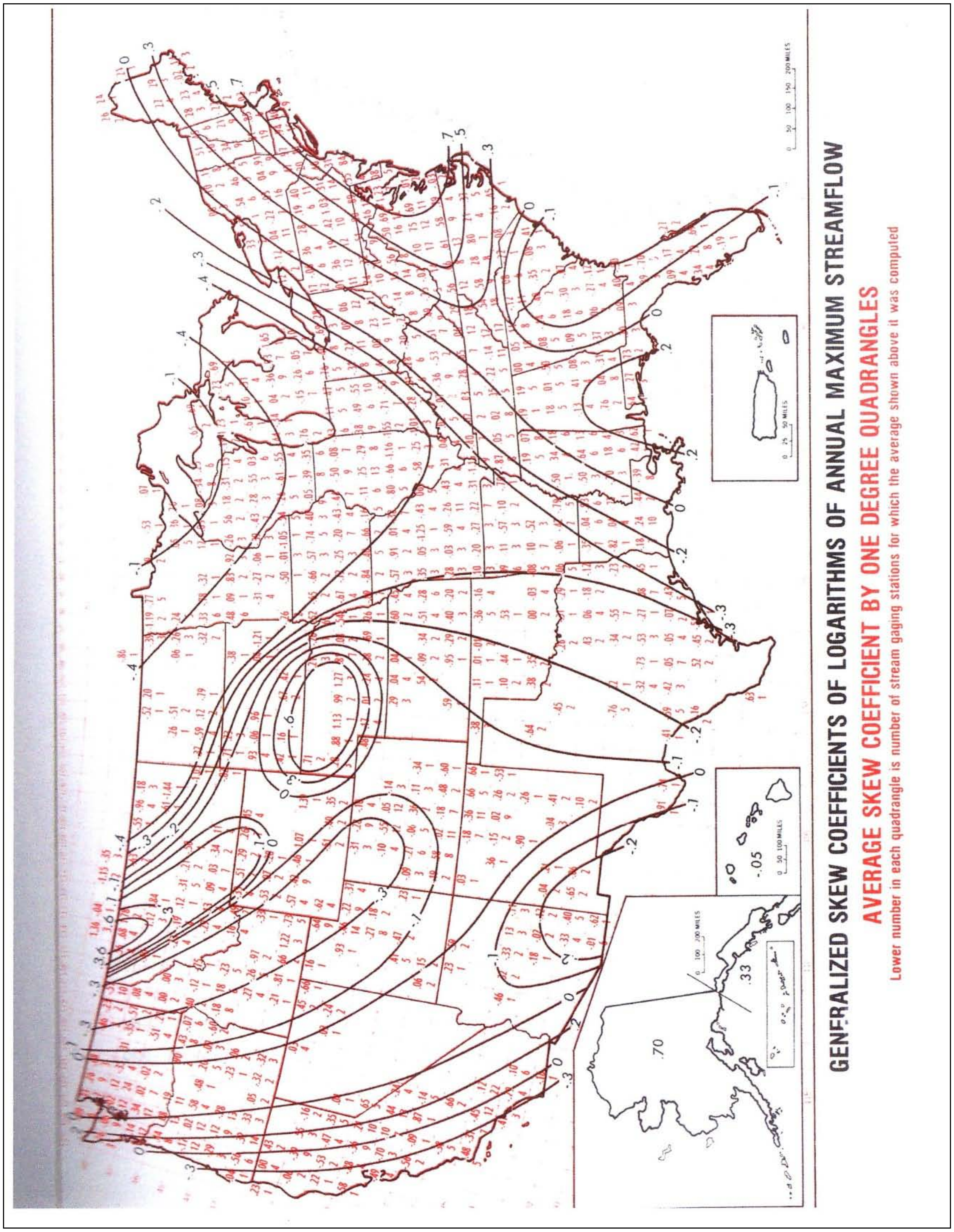
Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1961	1961		0.00	1968	Jan. 30, 1968	14.70	1,070
1962	Feb. 13, 1962	10.04	1,600	1969	Jan. 19, 1969	12.59	993
1963	Jan. 31, 1963	15.67[2]	1,340	1970	Jan. 21, 1970	11.97	906
1964	Jan. 21, 1964	12.00	705	1971	Dec. 21, 1970	9.34	538
1965	Jan. 05, 1965		1,300	1972	Dec. 27, 1971	6.15	95.0
1966	Jan. 05, 1966	6.86	163	1973	Jan. 16, 1973	15.67	1,420
1967	Jan. 21, 1967	18.35	1,510	1974	Apr. 01, 1974	14.66	1,280

- 2 -- Gage height not the maximum for the year



Appendix E: Bulletin 17B national skew map and accompanying PEAKFQ frequency output

Appendix E: Bulletin 17B national skew map and accompanying PEAKFQ frequency output



Appendix E: Bulletin 17B national skew map and accompanying PEAKFQ frequency output

No low outlier threshold

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          U. S. GEOLOGICAL SURVEY
    ANNUAL PEAK FLOW FREQUENCY ANALYSIS
    Following Bulletin 17-B Guidelines
              Program peakfq
         (Version 4.1, February, 2002)


       --- PROCESSING DATE/TIME ---

           2009 APR 27 15:55:36

        --- PROCESSING OPTIONS ---

     Plot option          = Graphics device
     Basin char output    = None
     Print option         = Yes
     Debug print          = No
     Input peaks listing  = Long
     Input peaks format   = WATSTORE peak file



          U. S. GEOLOGICAL SURVEY
    ANNUAL PEAK FLOW FREQUENCY ANALYSIS
    Following Bulletin 17-B Guidelines
              Program peakfq
         (Version 4.1, February, 2002)



 Station - 11161900  SCOTT C AB LITTLE C NR DAVENPORT CA
                2009 APR 27 15:55:36


      I N P U T   D A T A   S U M M A R Y

   Number of peaks in record           =       20
   Peaks not used in analysis          =        0
   Systematic peaks in analysis        =       20
   Historic peaks in analysis          =        0
   Years of historic record            =        0
   Generalized skew                    =   -0.300
   Standard error of generalized skew  =    0.550
   Skew option                         =   WEIGHTED
   Gage base discharge                 =      0.0
   User supplied high outlier threshold =   --
   User supplied low outlier criterion  =   --
   Plotting position parameter         =     0.00


*********  NOTICE  --  Preliminary machine computations.        *********
*********  User responsible for assessment and interpretation.  *********

  WCF134I-NO SYSTEMATIC PEAKS WERE BELOW GAGE BASE.                   0.0
  WCF195I-NO LOW OUTLIERS WERE DETECTED BELOW CRITERION.             72.0
  WCF163I-NO HIGH OUTLIERS OR HISTORIC PEAKS EXCEEDED HHBASE.     11723.0
```

Appendix E: Bulletin 17B national skew map and accompanying PEAKFQ frequency output

No low outlier threshold (continued)

Station - 11161900 SCOTT C AB LITTLE C NR DAVENPORT CA
2009 APR 27 15:55:36

ANNUAL FREQUENCY CURVE PARAMETERS -- LOG-PEARSON TYPE III

	FLOOD BASE		LOGARITHMIC		
	DISCHARGE	EXCEEDANCE PROBABILITY	MEAN	STANDARD DEVIATION	SKEW
SYSTEMATIC RECORD	0.0	1.0000	2.9633	0.4636	-0.393
BULL.17B ESTIMATE	0.0	1.0000	2.9633	0.4636	-0.348

ANNUAL FREQUENCY CURVE -- DISCHARGES AT SELECTED EXCEEDANCE PROBABILITIES

ANNUAL EXCEEDANCE PROBABILITY	BULL.17B ESTIMATE	SYSTEMATIC RECORD	'EXPECTED PROBABILITY' ESTIMATE	95-PCT CONFIDENCE LIMITS FOR BULL. 17B ESTIMATES LOWER	UPPER
0.9950	41.5	39.7	25.0	12.3	87.1
0.9900	58.6	56.6	39.9	19.5	115.5
0.9500	143.8	142.1	122.0	63.7	243.9
0.9000	226.2	225.4	204.9	114.6	360.3
0.8000	382.8	384.2	364.8	221.7	577.8
0.5000	977.5	985.3	977.5	653.2	1477.0
0.2000	2287.0	2289.0	2374.0	1511.0	3981.0
0.1000	3448.0	3424.0	3699.0	2186.0	6661.0
0.0400	5210.0	5117.0	5888.0	3126.0	11330.0
0.0200	6713.0	6535.0	7924.0	3875.0	15770.0
0.0100	8358.0	8065.0	10350.0	4658.0	21040.0
0.0050	10140.0	9700.0	13210.0	5471.0	27170.0
0.0020	12710.0	12010.0	17750.0	6592.0	36650.0
0.6667	611.4	(1.50-year flood)			
0.4292	1183.2	(2.33-year flood)			

Station - 11161900 SCOTT C AB LITTLE C NR DAVENPORT CA
2009 APR 27 15:55:36

I N P U T   D A T A   L I S T I N G

WATER YEAR	DISCHARGE	CODES	WATER YEAR	DISCHARGE	CODES
1937	1050.0		1965	1590.0	
1939	149.0		1966	229.0	
1940	7240.0		1967	1900.0	
1941	1440.0		1968	995.0	
1959	806.0		1969	1180.0	
1960	500.0		1970	1420.0	
1961	122.0		1971	810.0	
1962	1970.0		1972	170.0	
1963	1560.0		1973	1550.0	
1964	720.0		1982	4220.0	

Explanation of peak discharge qualification codes

Appendix E: Bulletin 17B national skew map and accompanying PEAKFQ frequency output

No low outlier threshold (continued)

```
PEAKFQ  WATSTORE
       CODE     CODE   DEFINITION

         D        3    Dam failure, non-recurrent flow anomaly
         G        8    Discharge greater than stated value
         X       3+8   Both of the above
         L        4    Discharge less than stated value
         K      6 OR C Known effect of regulation or urbanization
         H        7    Historic peak


           Station - 11161900  SCOTT C AB LITTLE C NR DAVENPORT CA
                          2009 APR 27 15:55:36


   EMPIRICAL FREQUENCY CURVES -- WEIBULL PLOTTING POSITIONS

      WATER         RANKED       SYSTEMATIC      BULL.17B
       YEAR       DISCHARGE        RECORD        ESTIMATE

       1940         7240.0         0.0476         0.0476
       1982         4220.0         0.0952         0.0952
       1962         1970.0         0.1429         0.1429
       1967         1900.0         0.1905         0.1905
       1965         1590.0         0.2381         0.2381
       1963         1560.0         0.2857         0.2857
       1973         1550.0         0.3333         0.3333
       1941         1440.0         0.3810         0.3810
       1970         1420.0         0.4286         0.4286
       1969         1180.0         0.4762         0.4762
       1937         1050.0         0.5238         0.5238
       1968          995.0         0.5714         0.5714
       1971          810.0         0.6190         0.6190
       1959          806.0         0.6667         0.6667
       1964          720.0         0.7143         0.7143
       1960          500.0         0.7619         0.7619
       1966          229.0         0.8095         0.8095
       1972          170.0         0.8571         0.8571
       1939          149.0         0.9048         0.9048
       1961          122.0         0.9524         0.9524
1

                           U. S. GEOLOGICAL SURVEY
                     ANNUAL PEAK FLOW FREQUENCY ANALYSIS
                     Following Bulletin 17-B Guidelines
                               Program peakfq
                          (Version 4.1, February, 2002)



 End PEAKFQ analysis.
   Stations processed :       1
   Number of errors   :       0
   Stations skipped   :       0
   Station years      :      20
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Appendix E: Bulletin 17B national skew map and accompanying PEAKFQ frequency output

Low outlier threshold of 250 ft^3/s

```
                       U. S. GEOLOGICAL SURVEY
                 ANNUAL PEAK FLOW FREQUENCY ANALYSIS
                 Following Bulletin 17-B Guidelines
                           Program peakfq
                      (Version 4.1, February, 2002)


                    --- PROCESSING DATE/TIME ---

                        2009 APR 27 16:05:07

                     --- PROCESSING OPTIONS ---

                  Plot option         = Graphics device
                  Basin char output   = None
                  Print option        = Yes
                  Debug print         = No
                  Input peaks listing = Long
                  Input peaks format  = WATSTORE peak file


                       U. S. GEOLOGICAL SURVEY
                 ANNUAL PEAK FLOW FREQUENCY ANALYSIS
                 Following Bulletin 17-B Guidelines
                           Program peakfq
                      (Version 4.1, February, 2002)


        Station - 11161900  SCOTT C AB LITTLE C NR DAVENPORT CA
                        2009 APR 27 16:05:07


                 I N P U T   D A T A   S U M M A R Y

            Number of peaks in record           =       20
            Peaks not used in analysis          =        0
            Systematic peaks in analysis        =       20
            Historic peaks in analysis          =        0
            Years of historic record            =        0
            Generalized skew                    =   -0.300
            Standard error of generalized skew  =    0.550
            Skew option                         =   WEIGHTED
            Gage base discharge                 =      0.0
            User supplied high outlier threshold =   --
            User supplied low outlier criterion  =      250.0
            Plotting position parameter         =     0.00


 *********  NOTICE  --  Preliminary machine computations.        *********
 *********  User responsible for assessment and interpretation.  *********

   WCF134I-NO SYSTEMATIC PEAKS WERE BELOW GAGE BASE.                    0.0
  *WCF191I-USER LOW-OUTLIER CRITERION SUPERSEDES 17B.       250.0     72.0
   WCF198I-LOW OUTLIERS BELOW FLOOD BASE WERE DROPPED.          4    250.0
   WCF163I-NO HIGH OUTLIERS OR HISTORIC PEAKS EXCEEDED HHBASE.     10468.7
```

Appendix E: Bulletin 17B national skew map and accompanying PEAKFQ frequency output

Low outlier threshold of 250 ft^3/s (continued)

Station - 11161900 SCOTT C AB LITTLE C NR DAVENPORT CA
2009 APR 27 16:05:07

ANNUAL FREQUENCY CURVE PARAMETERS -- LOG-PEARSON TYPE III

	FLOOD BASE		LOGARITHMIC		
	DISCHARGE	EXCEEDANCE PROBABILITY	MEAN	STANDARD DEVIATION	SKEW
SYSTEMATIC RECORD	0.0	1.0000	2.9633	0.4636	-0.393
BULL.17B ESTIMATE	250.0	0.8000	3.0646	0.3143	0.237

ANNUAL FREQUENCY CURVE -- DISCHARGES AT SELECTED EXCEEDANCE PROBABILITIES

ANNUAL EXCEEDANCE PROBABILITY	BULL.17B ESTIMATE	SYSTEMATIC RECORD	'EXPECTED PROBABILITY' ESTIMATE	95-PCT CONFIDENCE LIMITS FOR BULL. 17B ESTIMATES LOWER	UPPER
0.9950	--	39.7	--	--	--
0.9900	--	56.6	--	--	--
0.9500	--	142.1	--	--	--
0.9000	--	225.4	--	--	--
0.8000	--	384.2	--	--	--
0.5000	1128.0	985.3	1128.0	853.6	1484.0
0.2000	2113.0	2289.0	2181.0	1598.0	3063.0
0.1000	2982.0	3424.0	3179.0	2177.0	4721.0
0.0400	4361.0	5117.0	4921.0	3016.0	7724.0
0.0200	5614.0	6535.0	6691.0	3727.0	10770.0
0.0100	7079.0	8065.0	9002.0	4514.0	14650.0
0.0050	8787.0	9700.0	12050.0	5390.0	19540.0
0.0020	11480.0	12010.0	17700.0	6699.0	27940.0
0.6667	831.4	(1.50-year flood)			
0.4292	1281.3	(2.33-year flood)			

Station - 11161900 SCOTT C AB LITTLE C NR DAVENPORT CA
2009 APR 27 16:05:07

I N P U T D A T A L I S T I N G

WATER YEAR	DISCHARGE	CODES	WATER YEAR	DISCHARGE	CODES
1937	1050.0		1965	1590.0	
1939	149.0		1966	229.0	
1940	7240.0		1967	1900.0	
1941	1440.0		1968	995.0	
1959	806.0		1969	1180.0	
1960	500.0		1970	1420.0	
1961	122.0		1971	810.0	
1962	1970.0		1972	170.0	
1963	1560.0		1973	1550.0	
1964	720.0		1982	4220.0	

Explanation of peak discharge qualification codes

Appendix E: Bulletin 17B national skew map and accompanying PEAKFQ frequency output

Low outlier threshold of 250 ft^3/s (continued)

PEAKFQ CODE	WATSTORE CODE	DEFINITION
D	3	Dam failure, non-recurrent flow anomaly
G	8	Discharge greater than stated value
X	3+8	Both of the above
L	4	Discharge less than stated value
K	6 OR C	Known effect of regulation or urbanization
H	7	Historic peak

Station - 11161900 SCOTT C AB LITTLE C NR DAVENPORT CA
2009 APR 27 16:05:07

EMPIRICAL FREQUENCY CURVES -- WEIBULL PLOTTING POSITIONS

WATER YEAR	RANKED DISCHARGE	SYSTEMATIC RECORD	BULL.17B ESTIMATE
1940	7240.0	0.0476	0.0476
1982	4220.0	0.0952	0.0952
1962	1970.0	0.1429	0.1429
1967	1900.0	0.1905	0.1905
1965	1590.0	0.2381	0.2381
1963	1560.0	0.2857	0.2857
1973	1550.0	0.3333	0.3333
1941	1440.0	0.3810	0.3810
1970	1420.0	0.4286	0.4286
1969	1180.0	0.4762	0.4762
1937	1050.0	0.5238	0.5238
1968	995.0	0.5714	0.5714
1971	810.0	0.6190	0.6190
1959	806.0	0.6667	0.6667
1964	720.0	0.7143	0.7143
1960	500.0	0.7619	0.7619
1966	229.0	0.8095	0.8095
1972	170.0	0.8571	0.8571
1939	149.0	0.9048	0.9048
1961	122.0	0.9524	0.9524

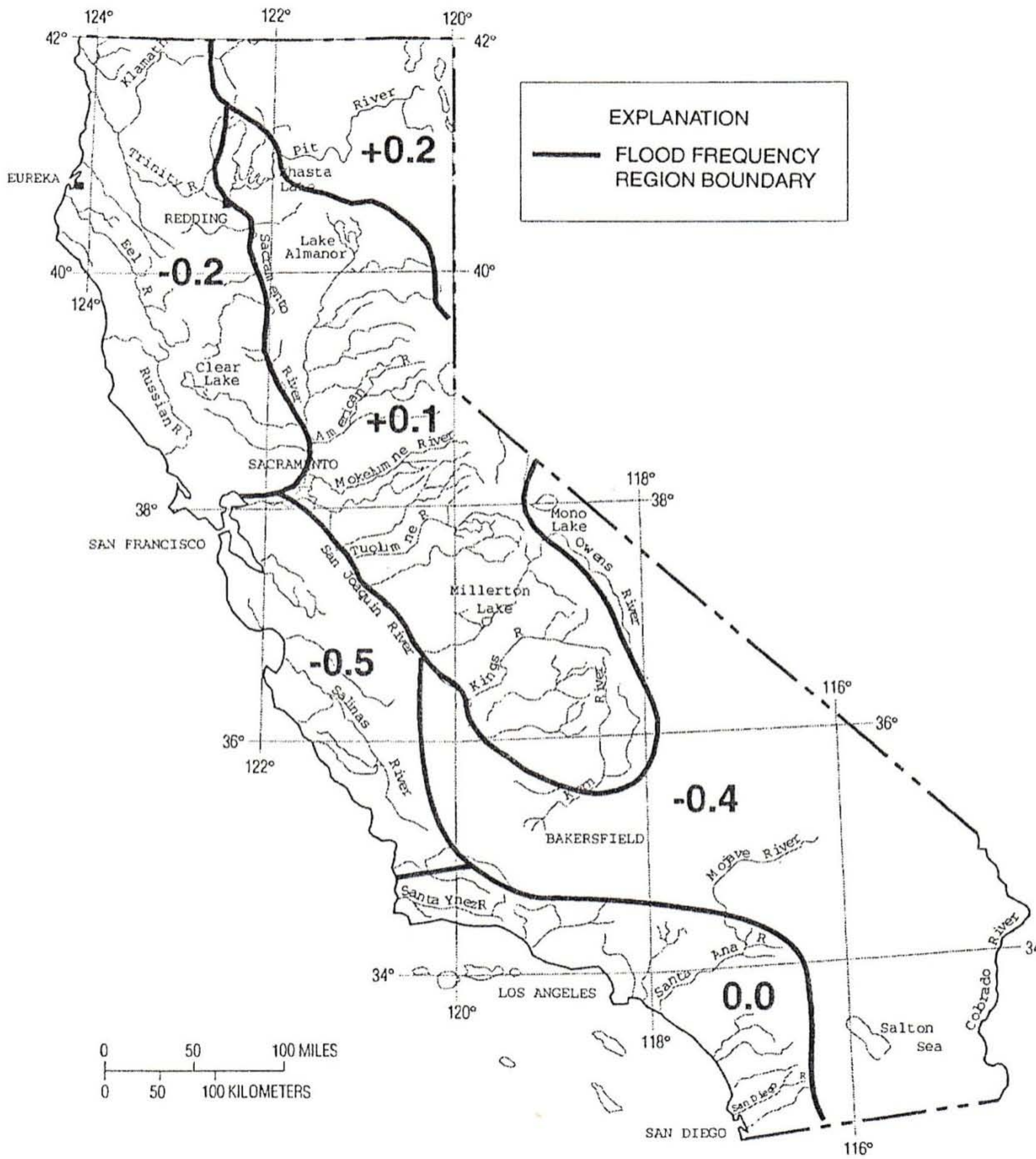
U. S. GEOLOGICAL SURVEY
ANNUAL PEAK FLOW FREQUENCY ANALYSIS
Following Bulletin 17-B Guidelines
Program peakfq
(Version 4.1, February, 2002)

End PEAKFQ analysis.

Stations processed	:	1
Number of errors	:	0
Stations skipped	:	0
Station years	:	20

Appendix F: California skew map and accompanying PEAKFQ frequency output

Appendix F: California skew map and accompanying PEAKFQ frequency output



Appendix F: California skew map and accompanying PEAKFQ frequency output

No low outlier threshold

```
                U. S. GEOLOGICAL SURVEY
          ANNUAL PEAK FLOW FREQUENCY ANALYSIS
          Following Bulletin 17-B Guidelines
                    Program peakfq
               (Version 4.1, February, 2002)


             --- PROCESSING DATE/TIME ---

                 2009 APR 27 16:24:17

              --- PROCESSING OPTIONS ---

           Plot option         = Graphics device
           Basin char output   = None
           Print option        = Yes
           Debug print         = No
           Input peaks listing = Long
           Input peaks format  = WATSTORE peak file


                U. S. GEOLOGICAL SURVEY
          ANNUAL PEAK FLOW FREQUENCY ANALYSIS
          Following Bulletin 17-B Guidelines
                    Program peakfq
               (Version 4.1, February, 2002)

 Station - 11161900  SCOTT C AB LITTLE C NR DAVENPORT CA
                 2009 APR 27 16:24:17

          I N P U T   D A T A   S U M M A R Y

     Number of peaks in record           =       20
     Peaks not used in analysis          =        0
     Systematic peaks in analysis        =       20
     Historic peaks in analysis          =        0
     Years of historic record            =        0
     Generalized skew                    =   -0.500
     Standard error of generalized skew  =    0.550
     Skew option                         =   WEIGHTED
     Gage base discharge                 =      0.0
     User supplied high outlier threshold =   --
     User supplied low outlier criterion  =   --
     Plotting position parameter         =     0.00

 *********  NOTICE  --  Preliminary machine computations.        *********
 *********  User responsible for assessment and interpretation.  *********

 *WCF107I-ACCEPTED GEN SKEW OUTSIDE MAP LIMITS.  -0.500  -0.400   0.800
  WCF134I-NO SYSTEMATIC PEAKS WERE BELOW GAGE BASE.                  0.0
  WCF195I-NO LOW OUTLIERS WERE DETECTED BELOW CRITERION.            72.0
  WCF163I-NO HIGH OUTLIERS OR HISTORIC PEAKS EXCEEDED HHBASE.     11724.4
```

Appendix F: California skew map and accompanying PEAKFQ frequency output

No low outlier threshold (continued)

Station - 11161900 SCOTT C AB LITTLE C NR DAVENPORT CA
2009 APR 27 16:24:17

ANNUAL FREQUENCY CURVE PARAMETERS -- LOG-PEARSON TYPE III

	FLOOD BASE		LOGARITHMIC		
	DISCHARGE	EXCEEDANCE PROBABILITY	MEAN	STANDARD DEVIATION	SKEW
SYSTEMATIC RECORD	0.0	1.0000	2.9633	0.4636	-0.393
BULL.17B ESTIMATE	0.0	1.0000	2.9633	0.4636	-0.445

ANNUAL FREQUENCY CURVE -- DISCHARGES AT SELECTED EXCEEDANCE PROBABILITIES

ANNUAL EXCEEDANCE PROBABILITY	BULL.17B ESTIMATE	SYSTEMATIC RECORD	'EXPECTED PROBABILITY' ESTIMATE	95-PCT CONFIDENCE LIMITS FOR BULL. 17B ESTIMATES LOWER	UPPER
0.9950	37.8	39.7	21.9	10.8	80.6
0.9900	54.5	56.6	36.2	17.7	108.8
0.9500	140.2	142.1	118.1	61.7	238.8
0.9000	224.6	225.5	202.6	113.5	358.1
0.8000	385.9	384.2	367.2	223.9	582.2
0.5000	994.4	985.4	994.4	665.2	1505.0
0.2000	2292.0	2289.0	2376.0	1514.0	3991.0
0.1000	3397.0	3424.0	3630.0	2157.0	6536.0
0.0400	5011.0	5117.0	5613.0	3023.0	10770.0
0.0200	6336.0	6535.0	7373.0	3691.0	14620.0
0.0100	7740.0	8064.0	9384.0	4368.0	19020.0
0.0050	9216.0	9698.0	11650.0	5053.0	23940.0
0.0020	11260.0	12010.0	15070.0	5967.0	31220.0
0.6667	620.9	(1.50-year flood)			
0.4292	1203.5	(2.33-year flood)			

Station - 11161900 SCOTT C AB LITTLE C NR DAVENPORT CA
2009 APR 27 16:24:17

I N P U T D A T A L I S T I N G

WATER YEAR	DISCHARGE	CODES	WATER YEAR	DISCHARGE	CODES
1937	1052.0		1965	1590.0	
1939	149.0		1966	229.0	
1940	7240.0		1967	1900.0	
1941	1440.0		1968	995.0	
1959	806.0		1969	1180.0	
1960	500.0		1970	1420.0	
1961	122.0		1971	810.0	
1962	1970.0		1972	170.0	
1963	1560.0		1973	1550.0	
1964	720.0		1982	4220.0	

Appendix F: California skew map and accompanying PEAKFQ frequency output

No low outlier threshold (continued)

Explanation of peak discharge qualification codes

PEAKFQ CODE	WATSTORE CODE	DEFINITION
D	3	Dam failure, non-recurrent flow anomaly
G	8	Discharge greater than stated value
X	3+8	Both of the above
L	4	Discharge less than stated value
K	6 OR C	Known effect of regulation or urbanization
H	7	Historic peak

Station - 11161900 SCOTT C AB LITTLE C NR DAVENPORT CA
2009 APR 27 16:24:17

EMPIRICAL FREQUENCY CURVES -- WEIBULL PLOTTING POSITIONS

WATER YEAR	RANKED DISCHARGE	SYSTEMATIC RECORD	BULL.17B ESTIMATE
1940	7240.0	0.0476	0.0476
1982	4220.0	0.0952	0.0952
1962	1970.0	0.1429	0.1429
1967	1900.0	0.1905	0.1905
1965	1590.0	0.2381	0.2381
1963	1560.0	0.2857	0.2857
1973	1550.0	0.3333	0.3333
1941	1440.0	0.3810	0.3810
1970	1420.0	0.4286	0.4286
1969	1180.0	0.4762	0.4762
1937	1052.0	0.5238	0.5238
1968	995.0	0.5714	0.5714
1971	810.0	0.6190	0.6190
1959	806.0	0.6667	0.6667
1964	720.0	0.7143	0.7143
1960	500.0	0.7619	0.7619
1966	229.0	0.8095	0.8095
1972	170.0	0.8571	0.8571
1939	149.0	0.9048	0.9048
1961	122.0	0.9524	0.9524

U. S. GEOLOGICAL SURVEY
ANNUAL PEAK FLOW FREQUENCY ANALYSIS
Following Bulletin 17-B Guidelines
Program peakfq
(Version 4.1, February, 2002)

End PEAKFQ analysis.
Stations processed : 1
Number of errors : 0
Stations skipped : 0
Station years : 20

Appendix F: California skew map and accompanying PEAKFQ frequency output

Low outlier threshold of 250 ft^3/s

```
                  U. S. GEOLOGICAL SURVEY
             ANNUAL PEAK FLOW FREQUENCY ANALYSIS
               Following Bulletin 17-B Guidelines
                         Program peakfq
                    (Version 4.1, February, 2002)


                  --- PROCESSING DATE/TIME ---

                      2009 APR 27 16:17:10

                   --- PROCESSING OPTIONS ---

                Plot option         = Graphics device
                Basin char output   = None
                Print option        = Yes
                Debug print         = No
                Input peaks listing = Long
                Input peaks format  = WATSTORE peak file

                     U. S. GEOLOGICAL SURVEY
               ANNUAL PEAK FLOW FREQUENCY ANALYSIS
               Following Bulletin 17-B Guidelines
                         Program peakfq
                    (Version 4.1, February, 2002)

        Station - 11161900  SCOTT C AB LITTLE C NR DAVENPORT CA
                      2009 APR 27 16:17:10

               I N P U T   D A T A   S U M M A R Y

          Number of peaks in record           =       20
          Peaks not used in analysis          =        0
          Systematic peaks in analysis        =       20
          Historic peaks in analysis          =        0
          Years of historic record            =        0
          Generalized skew                    =   -0.500
          Standard error of generalized skew  =    0.550
          Skew option                         =   WEIGHTED
          Gage base discharge                 =      0.0
          User supplied high outlier threshold =   --
          User supplied low outlier criterion  =      250.0
          Plotting position parameter         =     0.00


 *********  NOTICE  --  Preliminary machine computations.        *********
 *********  User responsible for assessment and interpretation.  *********

  *WCF107I-ACCEPTED GEN SKEW OUTSIDE MAP LIMITS.  -0.500  -0.400   0.800
   WCF134I-NO SYSTEMATIC PEAKS WERE BELOW GAGE BASE.                  0.0
  *WCF191I-USER LOW-OUTLIER CRITERION SUPERSEDES 17B.       250.0     72.0
   WCF198I-LOW OUTLIERS BELOW FLOOD BASE WERE DROPPED.          4    250.0
   WCF163I-NO HIGH OUTLIERS OR HISTORIC PEAKS EXCEEDED HHBASE.     10468.7
```

Appendix F: California skew map and accompanying PEAKFQ frequency output

Low outlier threshold of 250 ft^3/s (continued)

Station - 11161900 SCOTT C AB LITTLE C NR DAVENPORT CA
2009 APR 27 16:17:10

ANNUAL FREQUENCY CURVE PARAMETERS -- LOG-PEARSON TYPE III

	FLOOD BASE		LOGARITHMIC		
	DISCHARGE	EXCEEDANCE PROBABILITY	MEAN	STANDARD DEVIATION	SKEW
SYSTEMATIC RECORD	0.0	1.0000	2.9633	0.4636	-0.393
BULL.17B ESTIMATE	250.0	0.8000	3.0646	0.3143	0.133

ANNUAL FREQUENCY CURVE -- DISCHARGES AT SELECTED EXCEEDANCE PROBABILITIES

ANNUAL EXCEEDANCE PROBABILITY	BULL.17B ESTIMATE	SYSTEMATIC RECORD	'EXPECTED PROBABILITY' ESTIMATE	95-PCT CONFIDENCE LIMITS FOR BULL. 17B ESTIMATES LOWER	UPPER
0.9950	--	39.7	--	--	--
0.9900	--	56.6	--	--	--
0.9500	--	142.1	--	--	--
0.9000	--	225.4	--	--	--
0.8000	--	384.2	--	--	--
0.5000	1142.0	985.3	1142.0	865.3	1504.0
0.2000	2123.0	2289.0	2188.0	1604.0	3081.0
0.1000	2962.0	3424.0	3149.0	2164.0	4681.0
0.0400	4255.0	5117.0	4768.0	2954.0	7480.0
0.0200	5398.0	6535.0	6359.0	3607.0	10230.0
0.0100	6703.0	8065.0	8373.0	4316.0	13620.0
0.0050	8190.0	9700.0	10950.0	5088.0	17790.0
0.0020	10470.0	12010.0	15520.0	6217.0	24700.0
0.6667	839.3	(1.50-year flood)			
0.4292	1298.3	(2.33-year flood)			

Station - 11161900 SCOTT C AB LITTLE C NR DAVENPORT CA
2009 APR 27 16:17:10

I N P U T   D A T A   L I S T I N G

WATER YEAR	DISCHARGE	CODES	WATER YEAR	DISCHARGE	CODES
1937	1050.0		1965	1590.0	
1939	149.0		1966	229.0	
1940	7240.0		1967	1900.0	
1941	1440.0		1968	995.0	
1959	806.0		1969	1180.0	
1960	500.0		1970	1420.0	
1961	122.0		1971	810.0	
1962	1970.0		1972	170.0	
1963	1560.0		1973	1550.0	
1964	720.0		1982	4220.0	

Explanation of peak discharge qualification codes

Appendix F: California skew map and accompanying PEAKFQ frequency output

Low outlier threshold of 250 ft^3/s (continued)

PEAKFQ CODE	WATSTORE CODE	DEFINITION
D	3	Dam failure, non-recurrent flow anomaly
G	8	Discharge greater than stated value
X	3+8	Both of the above
L	4	Discharge less than stated value
K	6 OR C	Known effect of regulation or urbanization
H	7	Historic peak

Station - 11161900 SCOTT C AB LITTLE C NR DAVENPORT CA
2009 APR 27 16:17:10

EMPIRICAL FREQUENCY CURVES -- WEIBULL PLOTTING POSITIONS

WATER YEAR	RANKED DISCHARGE	SYSTEMATIC RECORD	BULL.17B ESTIMATE
1940	7240.0	0.0476	0.0476
1982	4220.0	0.0952	0.0952
1962	1970.0	0.1429	0.1429
1967	1900.0	0.1905	0.1905
1965	1590.0	0.2381	0.2381
1963	1560.0	0.2857	0.2857
1973	1550.0	0.3333	0.3333
1941	1440.0	0.3810	0.3810
1970	1420.0	0.4286	0.4286
1969	1180.0	0.4762	0.4762
1937	1050.0	0.5238	0.5238
1968	995.0	0.5714	0.5714
1971	810.0	0.6190	0.6190
1959	806.0	0.6667	0.6667
1964	720.0	0.7143	0.7143
1960	500.0	0.7619	0.7619
1966	229.0	0.8095	0.8095
1972	170.0	0.8571	0.8571
1939	149.0	0.9048	0.9048
1961	122.0	0.9524	0.9524

U. S. GEOLOGICAL SURVEY
ANNUAL PEAK FLOW FREQUENCY ANALYSIS
Following Bulletin 17-B Guidelines
Program peakfq
(Version 4.1, February, 2002)

```
 End PEAKFQ analysis.
   Stations processed :       1
   Number of errors   :       0
   Stations skipped   :       0
   Station years      :      20
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Appendix G: Peak discharge data for gages used in regional analysis

Appendix G: Peak discharge data for gages used in regional analysis

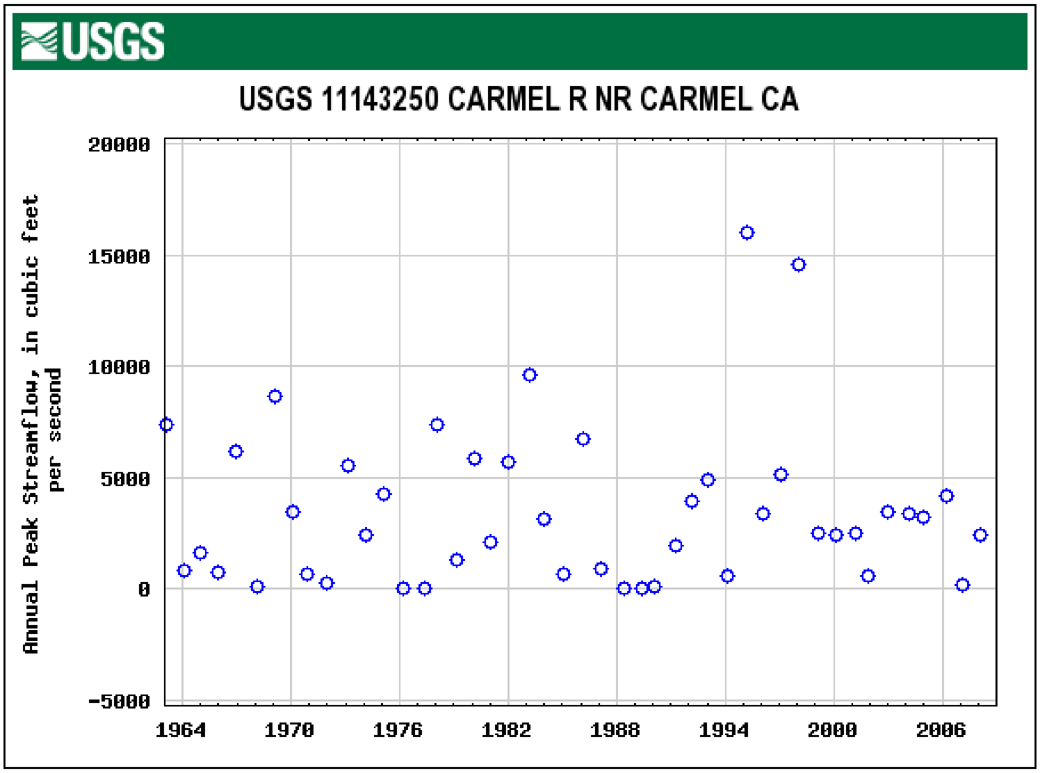
11143250
Carmel R near Carmel, CA

Monterey County, California
Hydrologic Unit Code 18060012
Latitude 36°32'21", Longitude 121°52'46" NAD27
Drainage area 247 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1963	Jan. 31, 1963	14.72	7,360	1986	Feb. 14, 1986	14.76	6,730
1964	Jan. 22, 1964	6.89	800	1987	Feb. 13, 1987	7.48	941
1965	Jan. 07, 1965	7.87	1,620	1988	1988	0.00	0.00
1966	Dec. 31, 1965	6.11	774	1989	1989	0.00	0.00
1967	Dec. 06, 1966	12.26	6,160	1990	Feb. 17, 1990	4.01	134
1968	Feb. 18, 1968	3.82	140	1991	Mar. 25, 1991	8.93	1,970
1969	Jan. 26, 1969	17.30	8,620	1992	Feb. 15, 1992	11.48	3,910
1970	Jan. 16, 1970	10.47	3,500	1993	Jan. 14, 1993	12.76	4,940
1971	Dec. 02, 1970	6.62	670	1994	Feb. 20, 1994	4.92	636
1972	Dec. 27, 1971	4.48	238	1995	Mar. 10, 1995	20.85	16,000
1973	Feb. 11, 1973	12.34	5,520	1996	Feb. 19, 1996	10.67	3,360
1974	Mar. 02, 1974	8.83	2,410	1997	Jan. 29, 1997	11.34	5,170
1975	Feb. 02, 1975		4,300	1998	Feb. 03, 1998	19.35	14,600
1976	Mar. 02, 1976	2.62	4.10	1999	Feb. 09, 1999	12.03	2,510
1977	1977		0.00	2000	Feb. 14, 2000	11.81	2,450
1978	Jan. 16, 1978	14.92	7,360	2001	Mar. 05, 2001	11.23	2,550
1979	Feb. 14, 1979	8.25	1,340	2002	Dec. 02, 2001	8.45	625
1980	Feb. 19, 1980	14.26	5,880	2003	Dec. 16, 2002	11.7	3,470
1981	Jan. 27, 1981	9.19	2,130	2004	Feb. 25, 2004	10.87	3,380
1982	Jan. 05, 1982	14.07	5,670	2005	Dec. 31, 2004	10.74	3,220
1983	Feb. 28, 1983	18.22	9,590	2006	Apr. 05, 2006	11.57	4,210
1984	Dec. 25, 1983	11.11	3,150	2007	Feb. 27, 2007	5.88	219
1985	Feb. 08, 1985	6.33	637	2008	Jan. 28, 2008	10.02	2,470

Appendix G: Peak discharge data for gages used in regional analysis

11143250 (continued)
Carmel R near Carmel, CA



Appendix G: Peak discharge data for gages used in regional analysis

11152540
El Toro Creek near Spreckels, CA

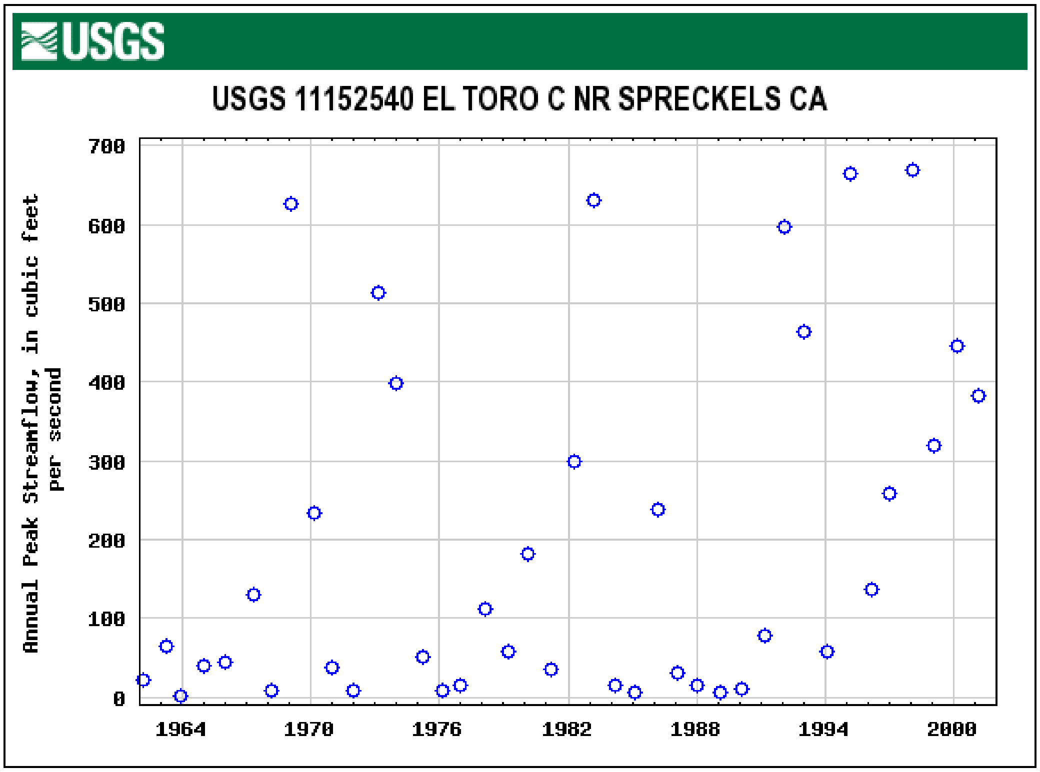
Monterey County, California
Hydrologic Unit Code 18060005
Latitude 36°35'00", Longitude 121°42'50" NAD27
Drainage area 31.9 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1962	Mar. 06, 1962	3.72	22.0	1982	Apr. 02, 1982	5.05	300
1963	Mar. 28, 1963	4.10	64.0	1983	Mar. 02, 1983	6.10	630
1964	Nov. 19, 1963	3.32	1.80	1984	Mar. 15, 1984	4.01[6]	16.0
1965	Jan. 07, 1965	3.85	40.0	1985	Feb. 08, 1985	3.03	7.10
1966	Dec. 31, 1965	3.95	44.0	1986	Mar. 15, 1986	5.01	238
1967	Apr. 21, 1967	4.56	131	1987	Feb. 13, 1987	2.10	30.0[2]
1968	Mar. 12, 1968	3.60	9.50	1988	Jan. 17, 1988	2.02	15.0
1969	Jan. 26, 1969	5.99	626	1989	Feb. 04, 1989	1.81	6.10
1970	Mar. 04, 1970	4.88	235	1990	Feb. 03, 1990	1.93	11.0
1971	Dec. 20, 1970	3.89	37.0	1991	Mar. 26, 1991	2.91	78.0
1972	Dec. 25, 1971	3.51	8.00	1992	Feb. 15, 1992	5.14	597
1973	Feb. 11, 1973	5.71	514	1993	Jan. 14, 1993	5.71	463
1974	Jan. 03, 1974	5.44	399	1994	Feb. 19, 1994	2.29	59.0
1975	Mar. 14, 1975	3.83	52.0	1995	Mar. 10, 1995	7.08	664
1976	Mar. 02, 1976	3.13	8.30	1996	Feb. 22, 1996	3.12	137
1977	Jan. 02, 1977	3.32	16.0	1997	Jan. 02, 1997	4.13	259
1978	Feb. 12, 1978	4.31	113	1998	Feb. 03, 1998	7.11	669
1979	Mar. 28, 1979	3.92	57.0	1999	Feb. 09, 1999	4.58	320
1980	Feb. 19, 1980	4.68	182	2000	Mar. 05, 2000	5.49	446
1981	Mar. 21, 1981	3.60	36.0	2001	Mar. 04, 2001	5.03	382

- 6 -- Gage datum changed during this year
- 2 -- Discharge is an Estimate

Appendix G: Peak discharge data for gages used in regional analysis

11152540 (continued)
El Toro Creek near Spreckels, CA



Appendix G: Peak discharge data for gages used in regional analysis

11152600
Gabilan Creek near Salinas, CA

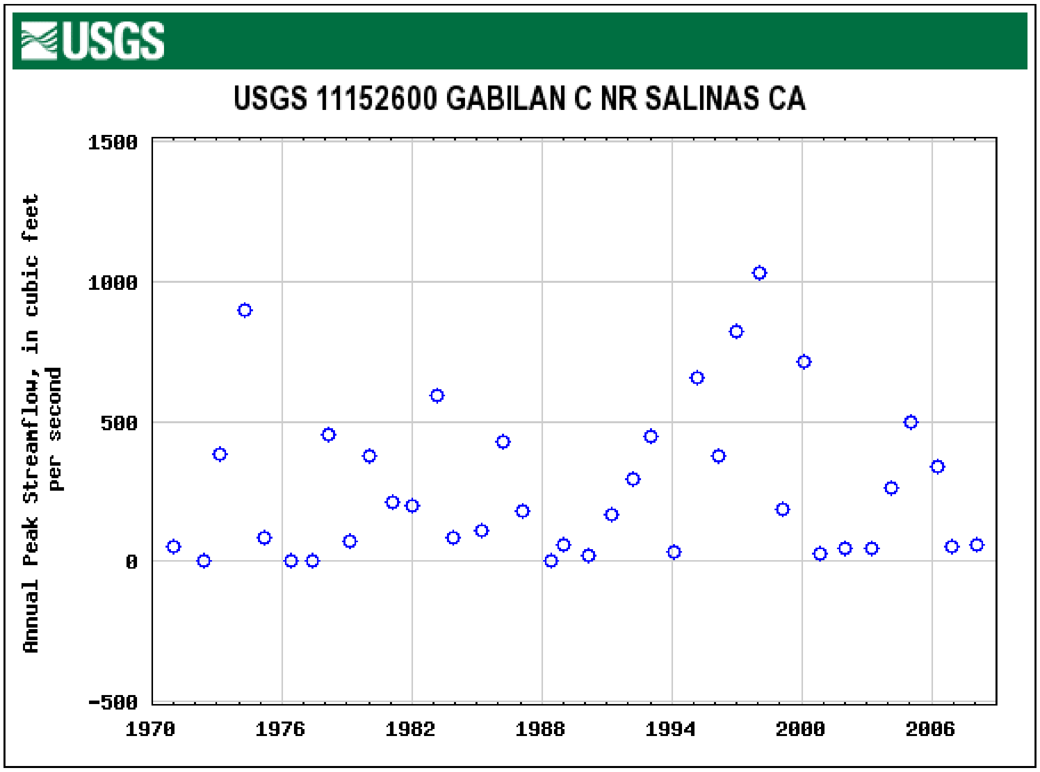
Monterey County, California
Hydrologic Unit Code 18060011
Latitude 36°45'21", Longitude 121°36'34" NAD27
Drainage area 36.7 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1971	Dec. 21, 1970	1.75	54.0	1990	Feb. 17, 1990	2.33	20.0
1972	1972		0.00	1991	Mar. 26, 1991	3.27	166
1973	Feb. 13, 1973	4.02	385	1992	Mar. 06, 1992	3.44	292
1974	Apr. 01, 1974	11.13	898	1993	Jan. 17, 1993	3.69	446
1975	Mar. 22, 1975	7.27	81.0	1994	Feb. 19, 1994	2.47	35.0
1976	1976		0.00	1995	Mar. 10, 1995	4.33	659
1977	1977		0.00	1996	Feb. 21, 1996	3.50	374
1978	Feb. 09, 1978	3.71	453	1997	Jan. 02, 1997	5.04	822
1979	Feb. 22, 1979	2.51	69.0	1998	Feb. 03, 1998	5.17	1,030
1980	Jan. 13, 1980	3.51	378	1999	Feb. 09, 1999	3.38	187
1981	Jan. 30, 1981	3.08	210	2000	Feb. 13, 2000	4.61	711
1982	Jan. 05, 1982		200[8]	2001	Oct. 29, 2000	2.38	25
1983	Feb. 25, 1983	4.12	593	2002	Dec. 21, 2001	2.49	43
1984	Nov. 24, 1983	2.73	83.0	2003	Mar. 15, 2003	2.50	45
1985	Mar. 26, 1985	2.83	111	2004	Feb. 25, 2004	3.36	262
1986	Mar. 16, 1986	3.65	430	2005	Jan. 11, 2005	4.05	494
1987	Feb. 13, 1987	3.01	179	2006	Apr. 05, 2006	3.60	340
1988	1988		0.00	2007	Dec. 26, 2006	2.54	52
1989	Dec. 24, 1988	2.60	55.0	2008	Feb. 03, 2008	2.76	60

- 8 -- Discharge actually greater than indicated value

Appendix G: Peak discharge data for gages used in regional analysis

11152600 (continued)
Gabilan Creek near Salinas, CA



Appendix G: Peak discharge data for gages used in regional analysis

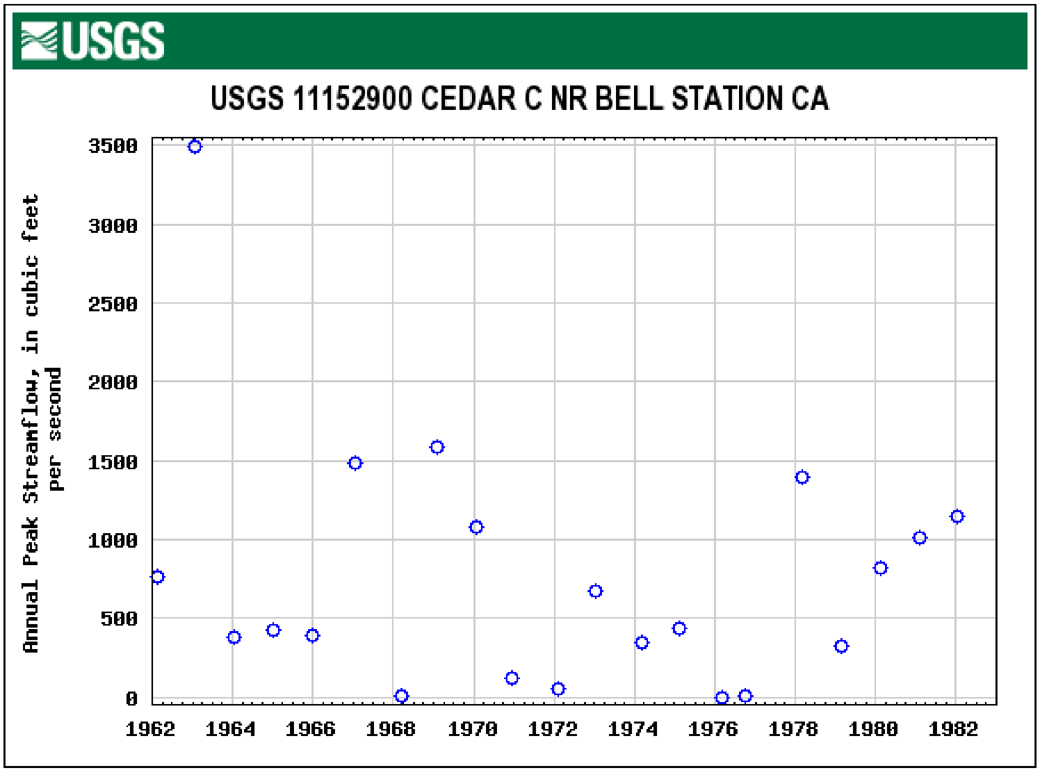
11152900
Cedar Creek near Bell Station, CA

Santa Clara County, California
Hydrologic Unit Code 18060002
Latitude 37°03'00", Longitude 121°19'35" NAD27
Drainage area 12.8 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1962	Feb. 15, 1962	4.30	760	1972	Feb. 05, 1972	2.11	50.0
1963	Jan. 31, 1963	6.85	3,490	1973	Jan. 09, 1973	3.99	677
1964	Jan. 22, 1964	3.38	378	1974	Mar. 02, 1974	3.25	346
1965	Jan. 06, 1965	3.63	426	1975	Feb. 09, 1975	3.49	439
1966	Dec. 28, 1965	3.50	390	1976	Feb. 29, 1976	1.26	0.58
1967	Jan. 24, 1967	5.17	1,490	1977	Oct. 01, 1976	1.36	1.50
1968	Mar. 13, 1968	1.59	3.00	1978	Mar. 04, 1978	5.05	1,390
1969	Jan. 25, 1969	5.27	1,590	1979	Feb. 21, 1979	3.19	324
1970	Jan. 16, 1970	4.66	1,080	1980	Feb. 16, 1980	4.24	818
1971	Dec. 18, 1970	2.53	119	1981	Jan. 29, 1981	4.54	1,010
				1982	Jan. 04, 1982	4.74	1,150

Appendix G: Peak discharge data for gages used in regional analysis

11152900 (continued)
Cedar Creek near Bell Station, CA



Appendix G: Peak discharge data for gages used in regional analysis

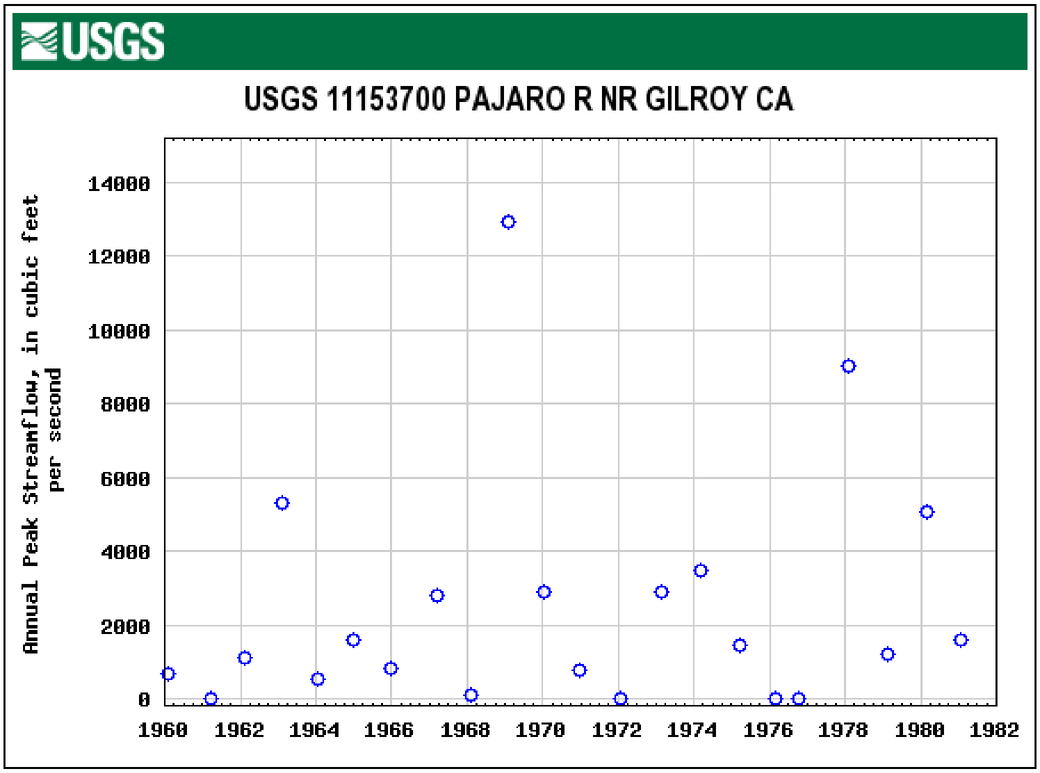
11153700
Pajaro River near Gilroy, CA

Santa Clara County, California
Hydrologic Unit Code 18060002
Latitude 36°56'54", Longitude 121°30'39" NAD27
Drainage area 399 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1960	Feb. 08, 1960		695	1971	Dec. 20, 1970		800
1961	Mar. 15, 1961	3.72	13.0	1972	Jan. 27, 1972	4.21	24.0
1962	Feb. 15, 1962	9.00	1,120	1973	Feb. 13, 1973	10.82	2,910
1963	Feb. 01, 1963	13.81	5,320	1974	Mar. 03, 1974	9.98	3,460
1964	Jan. 22, 1964	7.91	552	1975	Mar. 22, 1975	8.01	1,450
1965	Jan. 06, 1965	10.80	1,620	1976	Feb. 29, 1976	4.28	32.0
1966	Dec. 31, 1965	5.87	830	1977	Oct. 01, 1976	3.89	10.0
1967	Mar. 16, 1967	9.97	2,810	1978	Feb. 09, 1978	13.71	9,000
1968	Jan. 31, 1968	2.80	91.0	1979	Feb. 23, 1979	7.67	1,200
1969	Jan. 25, 1969	14.63	12,900	1980	Feb. 21, 1980	15.27	5,090
1970	Jan. 16, 1970	8.89	2,900	1981	Jan. 29, 1981	8.95	1,600

Appendix G: Peak discharge data for gages used in regional analysis

11153700 (continued)
Pajaro River near Gilroy, CA



Appendix G: Peak discharge data for gages used in regional analysis

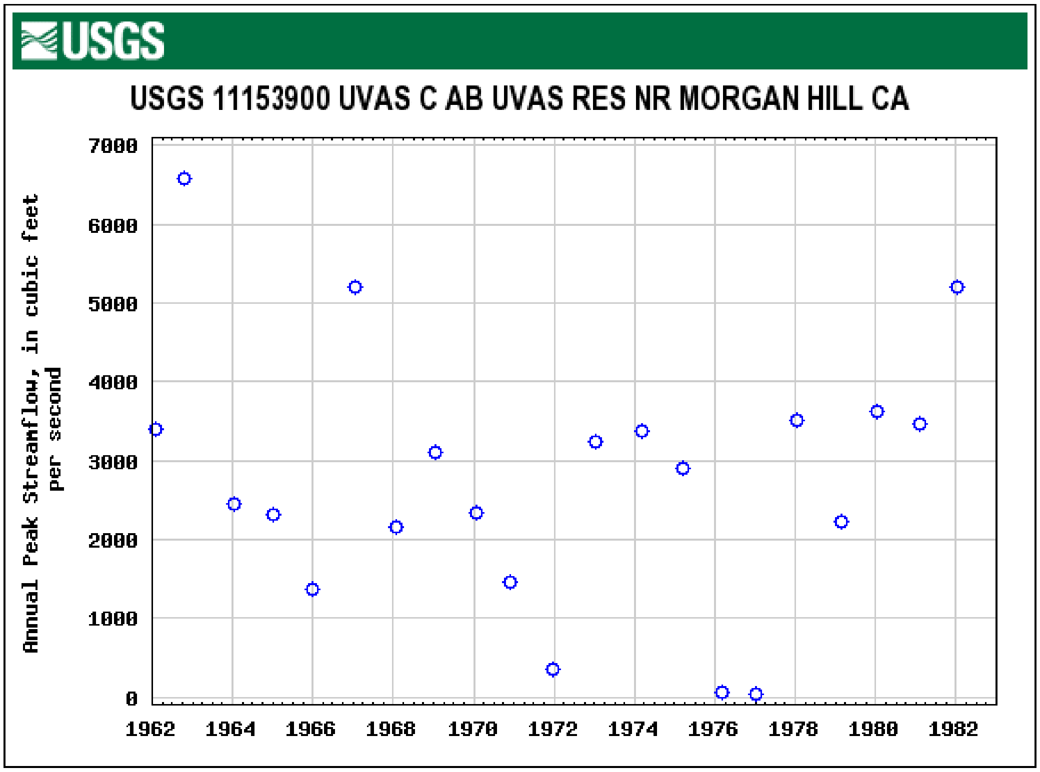
11153900
Uvas Creek above Uvas Reservoir near Morgan Hill, CA

Santa Clara County, California
Hydrologic Unit Code 18060002
Latitude 37°05'34", Longitude 121°43'02" NAD27
Drainage area 21.0 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1962	Feb. 09, 1962	11.59	3,390	1972	Dec. 27, 1971	5.30	350
1963	Oct. 13, 1962	13.18	6,580	1973	Jan. 16, 1973	9.71	3,230
1964	Jan. 20, 1964	10.48	2,460	1974	Mar. 01, 1974	9.88	3,380
1965	Jan. 05, 1965	10.32	2,320	1975	Mar. 21, 1975	9.40	2,910
1966	Dec. 25, 1965	8.26	1,380	1976	Feb. 29, 1976	4.31	72.0
1967	Jan. 21, 1967	13.00	5,200	1977	Jan. 02, 1977	3.88	35.0
1968	Jan. 30, 1968		2,160	1978	Jan. 16, 1978	10.01	3,510
1969	Jan. 19, 1969	9.58	3,100	1979	Feb. 22, 1979	8.68	2,230
1970	Jan. 16, 1970	8.56	2,340	1980	Jan. 13, 1980	10.13	3,620
1971	Dec. 02, 1970	7.31	1,470	1981	Jan. 29, 1981	9.98	3,470
				1982	Jan. 04, 1982	11.99	5,200

Appendix G: Peak discharge data for gages used in regional analysis

11153900 (continued)
Uvas Creek above Uvas Reservoir near Morgan Hill, CA



Appendix G: Peak discharge data for gages used in regional analysis

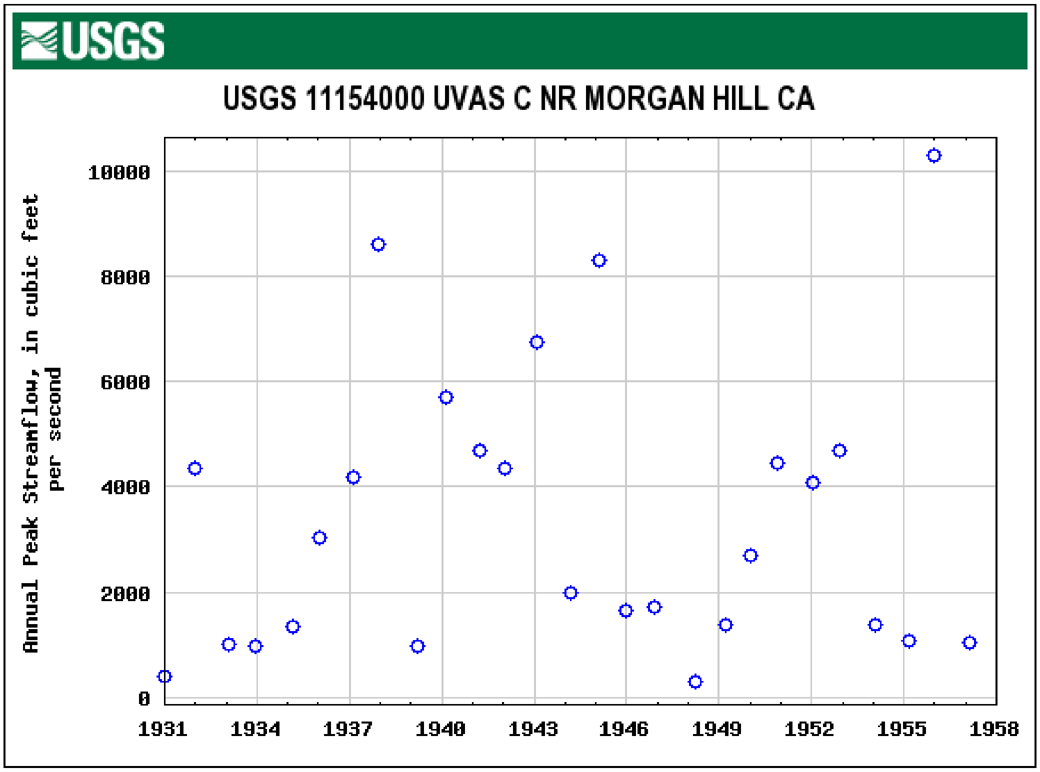
11154000
Uvas Creek near Morgan Hill, CA

Santa Clara County, California
Hydrologic Unit Code 18060002
Latitude 37°04'00", Longitude 121°41'30" NAD27
Drainage area 30.4 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1931	Jan. 02, 1931	4.30	385	1944	Feb. 28, 1944	7.96	1,990
1932	Dec. 27, 1931	10.82	4,340	1945	Feb. 01, 1945	13.50	8,300
1933	Jan. 29, 1933	5.85	1,020	1946	Dec. 21, 1945	7.46	1,660
1934	Dec. 12, 1933	5.70	970	1947	Nov. 22, 1946	7.53	1,700
1935	Mar. 06, 1935	6.40	1,340	1948	Mar. 24, 1948	4.26	305
1936	Jan. 11, 1936	9.00	3,020	1949	Mar. 11, 1949	6.97	1,380
1937	Feb. 13, 1937	10.60	4,180	1950	Jan. 14, 1950	8.87	2,710
1938	Dec. 11, 1937	13.70	8,630	1951	Nov. 18, 1950	10.54	4,450
1939	Mar. 08, 1939	5.97	975	1952	Jan. 12, 1952	10.22	4,090
1940	Feb. 27, 1940	11.37	5,720	1953	Dec. 07, 1952	10.76	4,680
1941	Apr. 04, 1941	10.75	4,700	1954	Jan. 17, 1954	6.96	1,370
1942	Jan. 24, 1942	10.45	4,340	1955	Feb. 27, 1955	6.13	1,090
1943	Jan. 21, 1943	12.35	6,740	1956	Dec. 23, 1955	14.30	10,300
				1957	Feb. 24, 1957	6.42	1,040

Appendix G: Peak discharge data for gages used in regional analysis

11154000 (continued)
Uvas Creek near Morgan Hill, CA



Appendix G: Peak discharge data for gages used in regional analysis

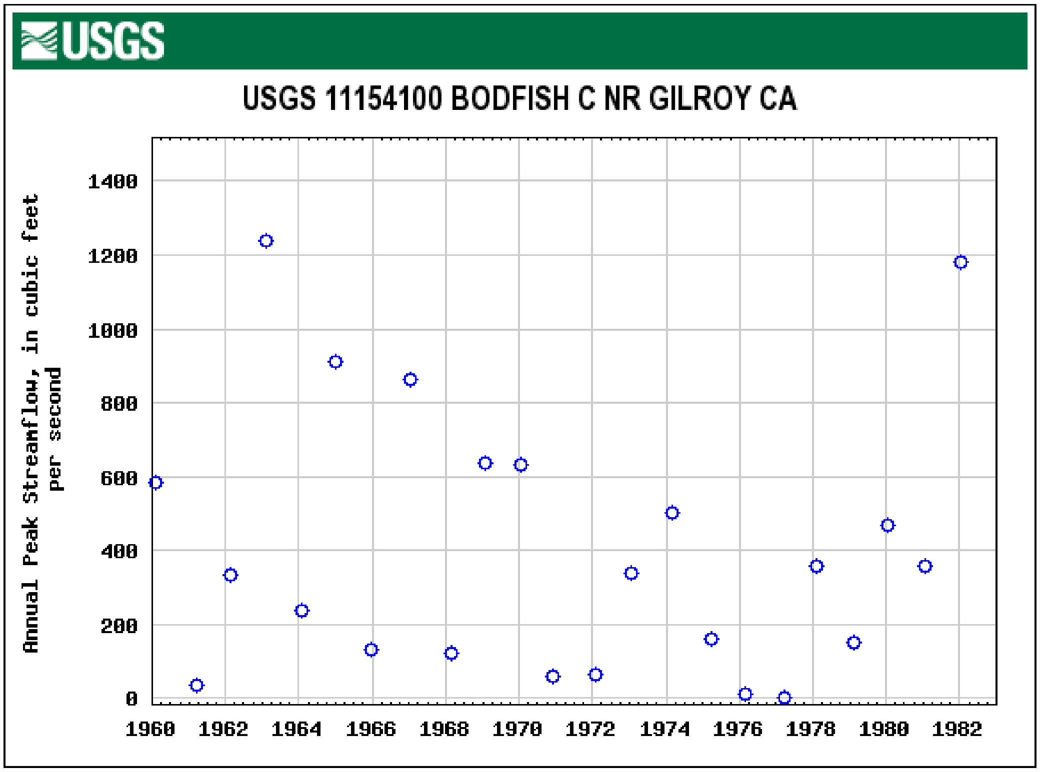
11154100
Bodfish Creek near Gilroy, CA

Santa Clara County, California
Hydrologic Unit Code 18060002
Latitude 37°00'15", Longitude 121°39'58" NAD27
Drainage area 7.40 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1960	Feb. 01, 1960	6.35	585	1971	Nov. 29, 1970	3.84	57.0
1961	Mar. 20, 1961	3.32	37.0	1972	Feb. 05, 1972	3.69	64.0
1962	Feb. 13, 1962	5.36	332	1973	Jan. 16, 1973	5.86	338
1963	Jan. 31, 1963	8.25	1,240	1974	Mar. 01, 1974	6.60	500
1964	Jan. 22, 1964	4.87	236	1975	Mar. 21, 1975	4.68	160
1965	Dec. 22, 1964	8.08	913	1976	Feb. 29, 1976	2.81	9.90
1966	Dec. 28, 1965	4.21	130	1977	Mar. 15, 1977	2.61	3.30
1967	Jan. 21, 1967	7.94	862	1978	Feb. 09, 1978	5.93	358
1968	Feb. 20, 1968	4.14	121	1979	Feb. 21, 1979	4.61	151
1969	Jan. 19, 1969	7.11	638	1980	Jan. 14, 1980	6.65	470
1970	Jan. 16, 1970	7.08	630	1981	Jan. 29, 1981	5.93	358
				1982	Jan. 04, 1982	8.86	1,180

Appendix G: Peak discharge data for gages used in regional analysis

1154100 (continued)
Bodfish Creek near Gilroy, CA



Appendix G: Peak discharge data for gages used in regional analysis

11157500
Tres Pinos Creek near Tres Pinos, CA

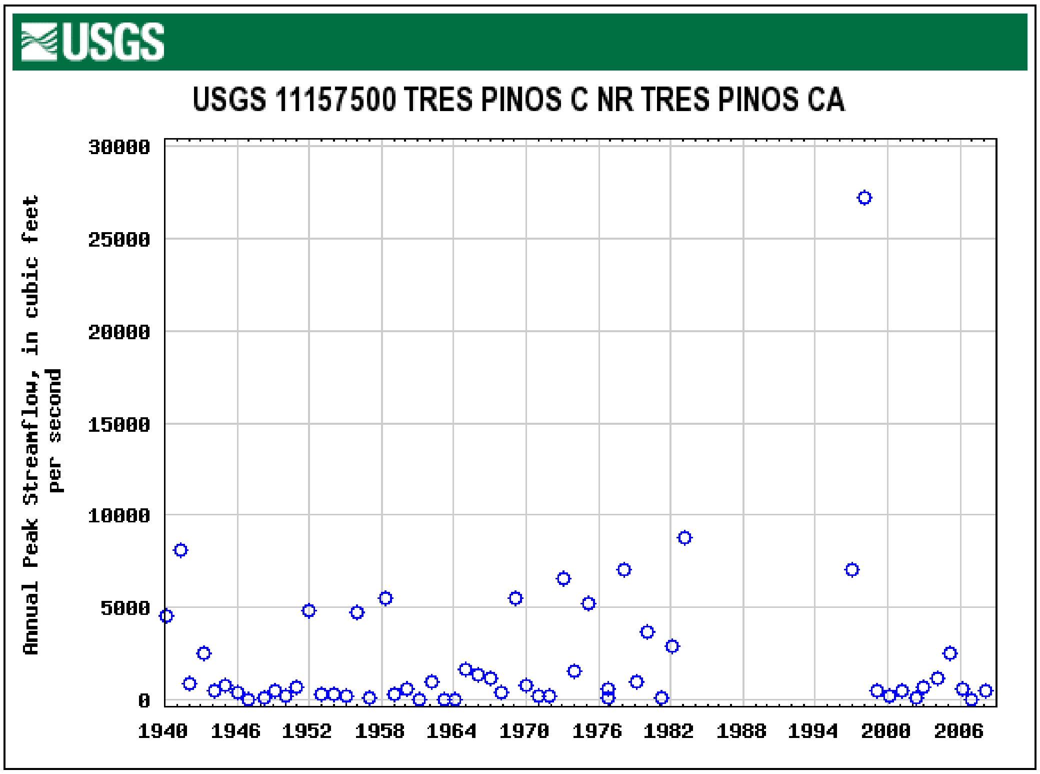
San Benito County, California
Hydrologic Unit Code 18060002
Latitude 36°45'57", Longitude 121°17'55" NAD27
Drainage area 208 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1938	Feb. 1938	9.00[5]		1967	Jan. 24, 1967	5.21	1,140
1940	Feb. 25, 1940	6.75[2]	4,500	1968	Dec. 03, 1967	4.50	420
1941	Apr. 04, 1941	7.75	8,060	1969	Feb. 24, 1969	9.49	5,520
1942	Feb. 06, 1942	3.63	896	1970	Jan. 16, 1970	5.77	759
1943	Mar. 09, 1943	4.78	2,520	1971	Dec. 21, 1970	4.99	206
1944	Feb. 22, 1944	2.78	506	1972	Dec. 25, 1971	4.89	178
1945	Feb. 02, 1945	3.22	749	1973	Feb. 11, 1973	9.88	6,540
1946	Jan. 05, 1946	2.55	400	1974	Jan. 07, 1974	7.20	1,520
1947	Nov. 20, 1946	1.24	7.80	1975	Mar. 07, 1975	9.28	5,180
1948	Apr. 10, 1948	1.61	62.0	1976	Sep. 30, 1976	6.18	586
1949	Mar. 03, 1949	2.82	525	1977	Oct. 01, 1976	4.94	90.0
1950	Jan. 14, 1950	2.09	218	1978	Feb. 12, 1978	10.01	7,060
1951	Nov. 19, 1950	4.15	642	1979	Feb. 22, 1979	6.65	951
1952	Jan. 12, 1952	7.54	4,840	1980	Jan. 14, 1980	8.74	3,690
1953	Jan. 14, 1953	3.04	247	1981	Mar. 13, 1981	4.64	105
1954	Jan. 24, 1954	2.90	292	1982	Feb. 16, 1982	8.25	2,940
1955	Jan. 18, 1955	2.77	217	1983	Jan. 27, 1983	11.14	8,790
1956	Dec. 23, 1955	6.90	4,750	1997	Jan. 26, 1997	9.88[6]	7,030
1957	Dec. 16, 1956	2.38	54.0	1998	Feb. 03, 1998	16.00	27,200
1958	Apr. 03, 1958	7.41	5,490	1999	Feb. 09, 1999	3.33	505
1959	Jan. 08, 1959	3.59	283	2000	Mar. 08, 2000	2.20	200
1960	Feb. 10, 1960	4.19	593	2001	Mar. 04, 2001	3.31	458[B]
1961	Jan. 26, 1961	2.75	4.10	2002	May 25, 2002	1.91	59
1962	Feb. 15, 1962	5.08	978	2003	Dec. 20, 2002	3.99	680
1963	Mar. 28, 1963	4.30	43.0	2004	Feb. 25, 2004	4.74	1,120
1964	Jan. 23, 1964	4.53	43.0	2005	Mar. 04, 2005	6.26	2,460
1965	Jan. 07, 1965	5.58	1,650	2006	Apr. 04, 2006	4.44	538
1966	Dec. 31, 1965	5.40	1,350	2007	Dec. 22, 2006	2.57[2]	10
				2008	Feb. 03, 2008	5.20	500

Appendix G: Peak discharge data for gages used in regional analysis

11157500 (continued)
Tres Pinos Creek near Tres Pinos, CA

- 2 -- Gage height not the maximum for the year
- 5 -- Gage height is an estimate
- 6 -- Gage datum changed during this year
- B -- Month or Day of occurrence is unknown or not exact



Appendix G: Peak discharge data for gages used in regional analysis

11158600
San Benito River at Highway 156 near Hollister, CA

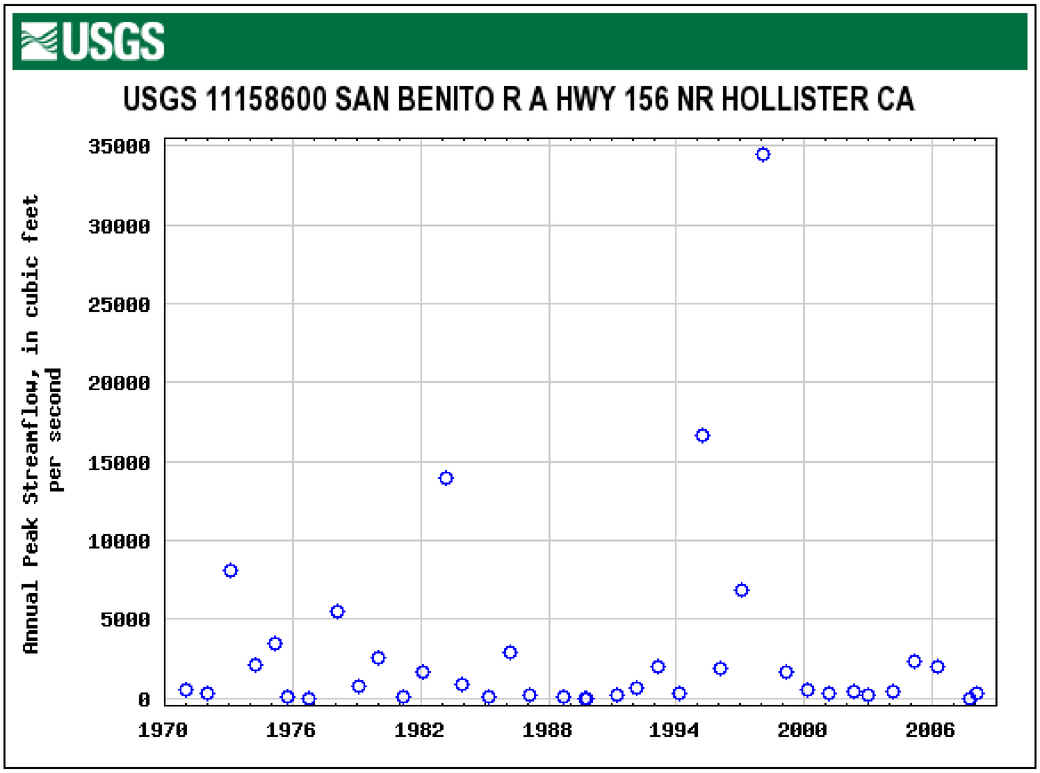
San Benito County, California
Hydrologic Unit Code 18060002
Latitude 36°51'07", Longitude 121°25'44" NAD27
Drainage area 607 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1971	Dec. 22, 1970	4.23	514	1990	Oct. 11, 1989	2.65	13.0
1972	Dec. 28, 1971		300	1991	Mar. 27, 1991	3.34	152
1973	Feb. 11, 1973	9.18	8,030	1992	Feb. 13, 1992	4.67	676
1974	Apr. 02, 1974	5.98	2,080	1993	Feb. 20, 1993	6.37	1,960
1975	Mar. 07, 1975	7.27	3,430	1994	Feb. 20, 1994	3.93	334
1976	Oct. 11, 1975	2.71	49.0	1995	Mar. 10, 1995	13.30	16,700
1977	Oct. 01, 1976	2.13	0.01	1996	Feb. 01, 1996	6.23	1,930
1978	Feb. 09, 1978	10.23	5,460	1997	Jan. 26, 1997	9.35	6,850
1979	Feb. 21, 1979	5.09	781	1998	Feb. 03, 1998	13.48	34,500
1980	Jan. 14, 1980	6.90	2,550	1999	Feb. 09, 1999	3.06	1,640
1981	Mar. 20, 1981	5.48	93.0	2000	Feb. 23, 2000	5.28	470
1982	Feb. 16, 1982	9.00	1,700	2001	Mar. 05, 2001	5.37	334
1983	Mar. 01, 1983	11.97	13,900	2002	May 06, 2002	5.5	375[6]
1984	Dec. 25, 1983	5.42	840	2003	Dec. 20, 2002	5.23	216
1985	Mar. 27, 1985	5.67	103	2004	Feb. 27, 2004	6.07	382
1986	Mar. 15, 1986	7.27	2,930	2005	Mar. 05, 2005	7.97	2,330
1987	Feb. 14, 1987	3.13	209	2006	Apr. 06, 2006	7.21	2,010
1988	Sep. 05, 1988	3.04	33.0	2007	Sep. 22, 2007	2.06	1.7
1989	Sep. 30, 1989	2.49	6.80	2008	Feb. 04, 2008	5.04	248

- 6 -- Discharge affected by Regulation or Diversion

Appendix G: Peak discharge data for gages used in regional analysis

11158600 (continued)
San Benito River at Highway 156 near Hollister, CA



Appendix G: Peak discharge data for gages used in regional analysis

11159000
Pajaro River at Chittenden, CA

Santa Cruz County, California
Hydrologic Unit Code 18060002
Latitude 36°54'01", Longitude 121°35'48" NAD27
Drainage area 1,186 square miles

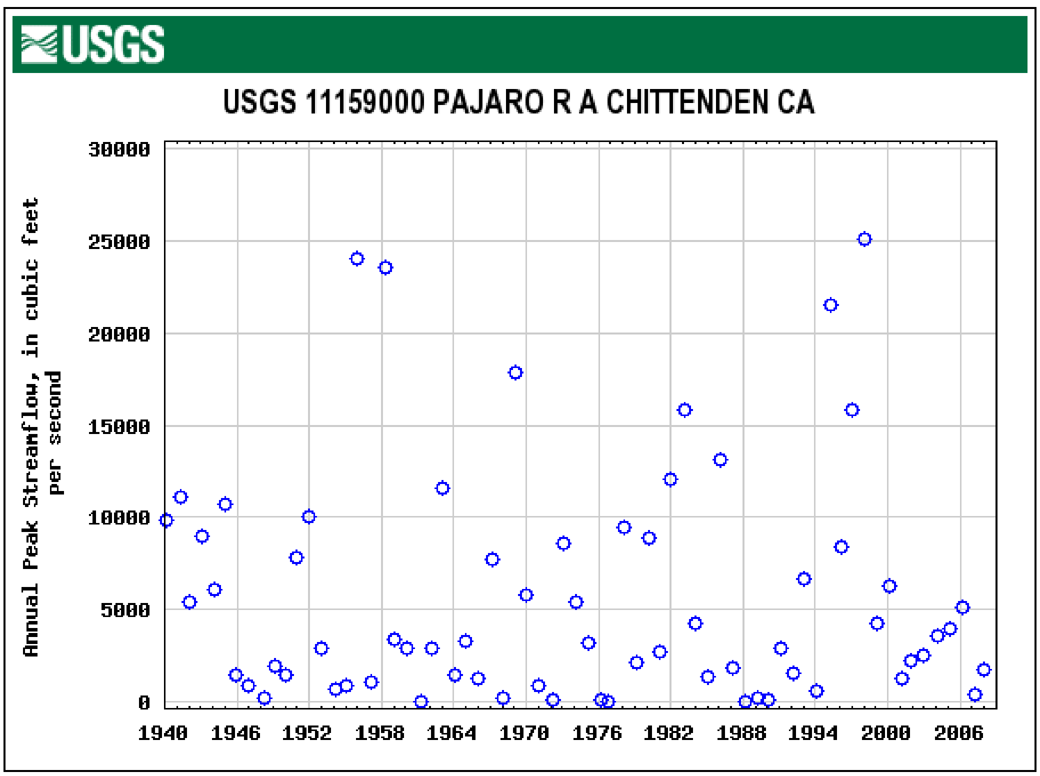
Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1938	Feb. 1938	31.30		1974	Mar. 03, 1974	13.08	5,400
1940	Feb. 28, 1940	25.50	9,880	1975	Mar. 22, 1975	10.44	3,230[1]
1941	Apr. 04, 1941	26.20	11,100	1976	Feb. 29, 1976	2.10	104
1942	Jan. 25, 1942	19.20	5,390	1977	Oct. 02, 1976	2.40	16.0
1943	Jan. 21, 1943	24.00	9,000	1978	Feb. 09, 1978	21.06	9,420
1944	Feb. 29, 1944	20.60	6,080	1979	Feb. 23, 1979	10.06	2,130
1945	Feb. 02, 1945	25.80	10,700	1980	Feb. 21, 1980	21.08	8,890
1946	Dec. 25, 1945	11.82	1,500	1981	Jan. 29, 1981	11.94	2,680
1947	Nov. 23, 1946	10.65	896	1982	Jan. 05, 1982	25.51	12,100
1948	Apr. 30, 1948	6.38	220	1983	Mar. 02, 1983	28.03	15,800
1949	Mar. 12, 1949	14.63	1,980	1984	Dec. 26, 1983	15.45	4,240
1950	Feb. 05, 1950	11.73	1,430	1985	Feb. 09, 1985	10.68	1,360[D]
1951	Nov. 19, 1950	22.68[2]	7,810	1986	Feb. 19, 1986	27.68	13,100
1952	Jan. 15, 1952	25.15	10,000	1987	Feb. 13, 1987	12.29	1,870
1953	Dec. 07, 1952	16.42	2,870	1988	Mar. 01, 1988	3.11	51.0
1954	Feb. 14, 1954	9.89	682	1989	Mar. 26, 1989	5.31	251
1955	Jan. 18, 1955	9.87	871	1990	Feb. 17, 1990	4.51	148
1956	Dec. 24, 1955	32.46	24,000	1991	Mar. 04, 1991	14.96	2,960
1957	Feb. 25, 1957	10.91	1,110	1992	Feb. 16, 1992	12.59	1,540
1958	Apr. 03, 1958	33.11	23,500	1993	Jan. 14, 1993	24.85	6,630[2]
1959	Feb. 16, 1959	16.04	3,390	1994	Feb. 20, 1994	8.02	600
1960	Feb. 08, 1960	14.96	2,880	1995	Mar. 11, 1995	32.20	21,500
1961	Mar. 17, 1961	5.56	23.0	1996	Feb. 20, 1996	24.76	8,430
1962	Feb. 15, 1962	12.58	2,910	1997	Jan. 03, 1997	29.53	15,800
1963	Feb. 01, 1963	20.76	11,600	1998	Feb. 03, 1998	33.73	25,100
1964	Jan. 22, 1964	9.24	1,460	1999	Feb. 09, 1999	16.99	4,300
1965	Jan. 06, 1965	12.80	3,300	2000	Feb. 14, 2000	21.70	6,320
1966	Dec. 31, 1965	8.94	1,320	2001	Mar. 06, 2001	10.49	1,280
1967	Mar. 16, 1967	17.77	7,720	2002	Dec. 21, 2001	13.06	2,240

Appendix G: Peak discharge data for gages used in regional analysis

11159000 (continued)
Pajaro River at Chittenden, CA

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1968	Jan. 31, 1968	4.13	205	2003	Dec. 17, 2002	13.69	2,510
1969	Feb. 25, 1969	23.90	17,800	2004	Feb. 26, 2004	16.75	3,560
1970	Jan. 16, 1970	12.58	5,820	2005	Mar. 23, 2005	19.26	4,010
1971	Dec. 21, 1970	6.51	874	2006	Apr. 05, 2006	20.75	5,110
1972	Mar. 18, 1972	4.23	128	2007	Feb. 28, 2007	7.04	449
1973	Feb. 11, 1973	17.73	8,610	2008	Jan. 05, 2008	12.42	1,750

- 2 -- Gage height not the maximum for the year
- 1 -- Discharge is a Maximum Daily Average
- 2 -- Discharge is an Estimate
- D -- Base Discharge changed during this year

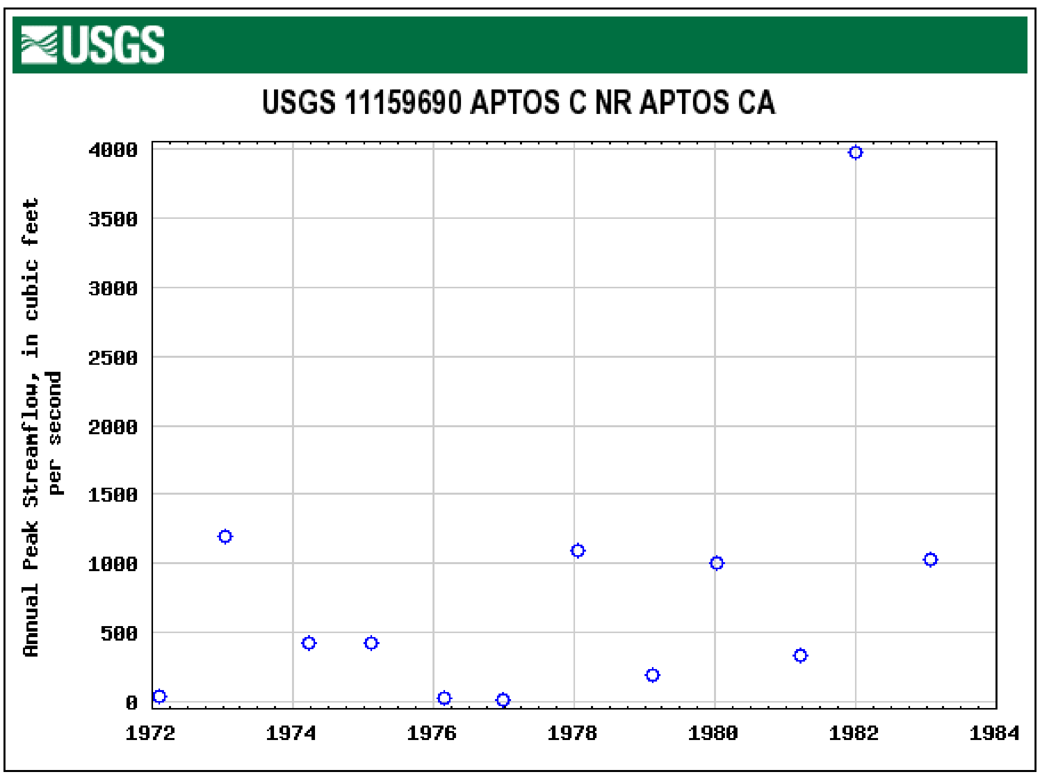


Appendix G: Peak discharge data for gages used in regional analysis

11159690
Aptos Creek near Aptos, CA

Santa Cruz County, California
Hydrologic Unit Code 18060001
Latitude 37°00'06", Longitude 121°54'18" NAD27
Drainage area 10.2 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1972	Feb. 05, 1972	1.53	30.0	1978	Jan. 16, 1978	5.37	1,090
1973	Jan. 16, 1973	5.65	1,200	1979	Feb. 13, 1979	2.56	192
1974	Mar. 28, 1974	5.58	420	1980	Jan. 13, 1980	5.16	1,000
1975	Feb. 13, 1975	3.98	425	1981	Mar. 21, 1981	3.07	328
1976	Feb. 29, 1976	1.40	27.0	1982	Jan. 04, 1982	12.10	3,980
1977	Dec. 30, 1976	1.13	13.0	1983	Jan. 24, 1983	10.31	1,030



Appendix G: Peak discharge data for gages used in regional analysis

11160020
San Lorenzo River near Boulder Creek, CA

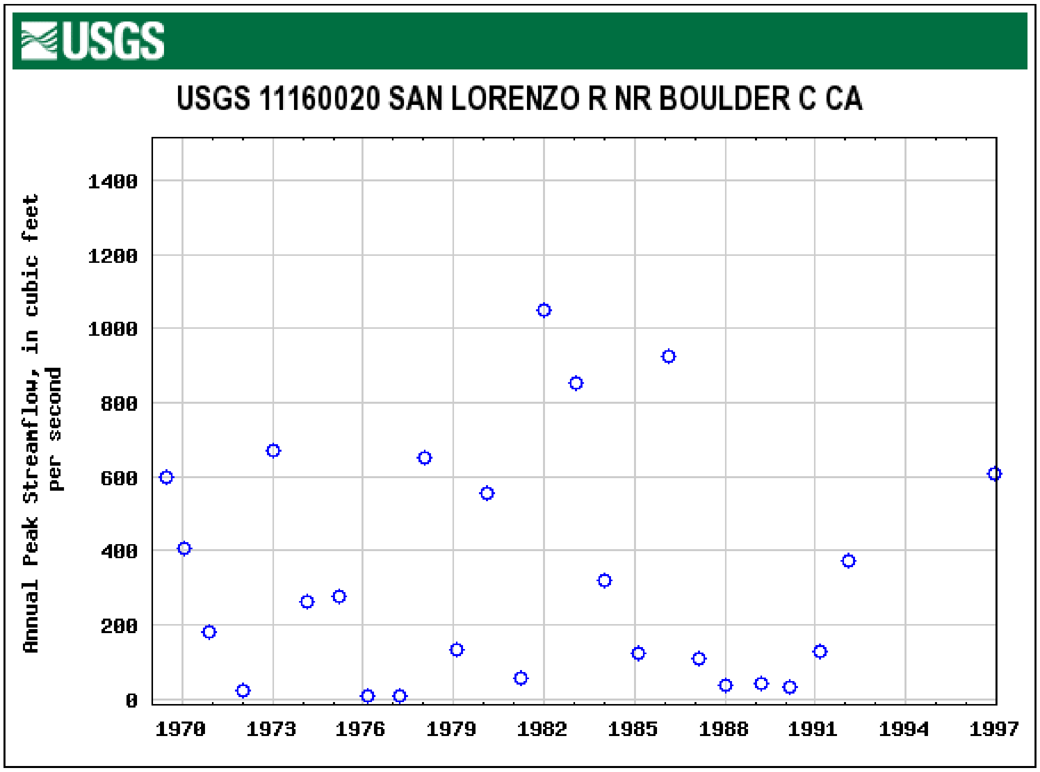
Santa Cruz County, California
Hydrologic Unit Code 18060001
Latitude 37°12'24", Longitude 122°08'38" NAD27
Drainage area 6.17 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1969	Jun. 26, 1969	8.48	600	1981	Mar. 21, 1981	3.24	59.0
1970	Jan. 16, 1970	6.94	408	1982	Jan. 04, 1982	11.48	1,050
1971	Nov. 29, 1970	4.83	183	1983	Jan. 24, 1983	10.08	851[D]
1972	Dec. 27, 1971	2.62	24.0	1984	Dec. 25, 1983	5.88	322
1973	Jan. 16, 1973	9.10	672	1985	Feb. 08, 1985	3.92	122
1974	Mar. 01, 1974	5.39	263	1986	Feb. 17, 1986	10.60	924
1975	Mar. 21, 1975	5.59	278	1987	Feb. 13, 1987	3.81	112
1976	Feb. 29, 1976	2.46	9.90	1988	Jan. 17, 1988	3.01	40.0
1977	Mar. 15, 1977	2.47	11.0	1989	Mar. 11, 1989	3.08	45.0
1978	Jan. 14, 1978	8.92	651	1990	Feb. 16, 1990	2.82	35.0
1979	Feb. 13, 1979	3.91	135	1991	Mar. 04, 1991	3.98	127
1980	Feb. 19, 1980	8.08	555	1992	Feb. 12, 1992	6.33	372
				1997	Dec. 10, 1996	8.25	610

D -- Base Discharge changed during this year

Appendix G: Peak discharge data for gages used in regional analysis

11160020 (continued)
San Lorenzo River near Boulder Creek, CA



Appendix G: Peak discharge data for gages used in regional analysis

11160060
Bear Creek at Boulder Creek, CA

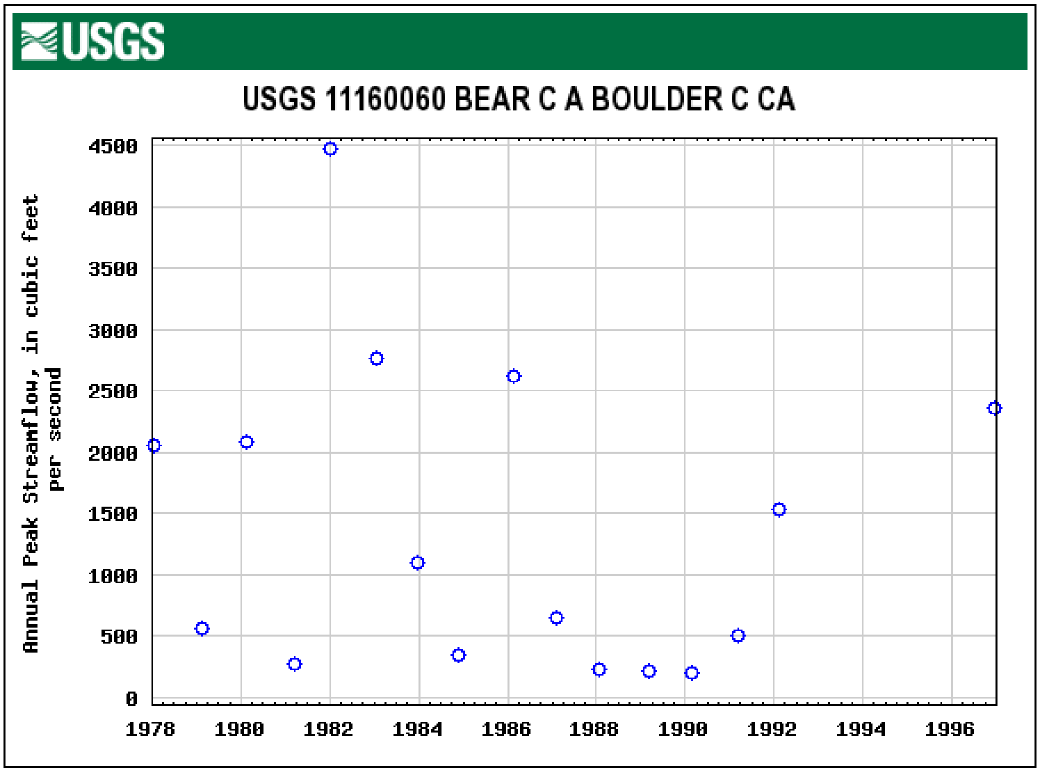
Santa Cruz County, California
Hydrologic Unit Code 18060001
Latitude 37°07'40", Longitude 122°06'57" NAD27
Drainage area 16.0 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1978	Jan. 14, 1978	10.50	2,060	1986	Feb. 17, 1986	9.94	2,620
1979	Feb. 13, 1979	4.68	557	1987	Feb. 13, 1987	4.78	643
1980	Feb. 19, 1980	10.36	2,080	1988	Jan. 17, 1988	2.87	226
1981	Mar. 21, 1981	3.11	276	1989	Mar. 11, 1989	2.76	209
1982	Jan. 04, 1982	13.30	4,480	1990	Feb. 16, 1990	2.70	195
1983	Jan. 24, 1983	10.25	2,770[D]	1991	Mar. 04, 1991	4.20	497
1984	Dec. 25, 1983		1,100[2]	1992	Feb. 12, 1992		1,530[2]
1985	Nov. 27, 1984	3.49	343	1997	Dec. 10, 1996	9.42	2,360

- 2 -- Discharge is an Estimate
- D -- Base Discharge changed during this year

Appendix G: Peak discharge data for gages used in regional analysis

11160060 (continued)
Bear Creek at Boulder Creek, CA

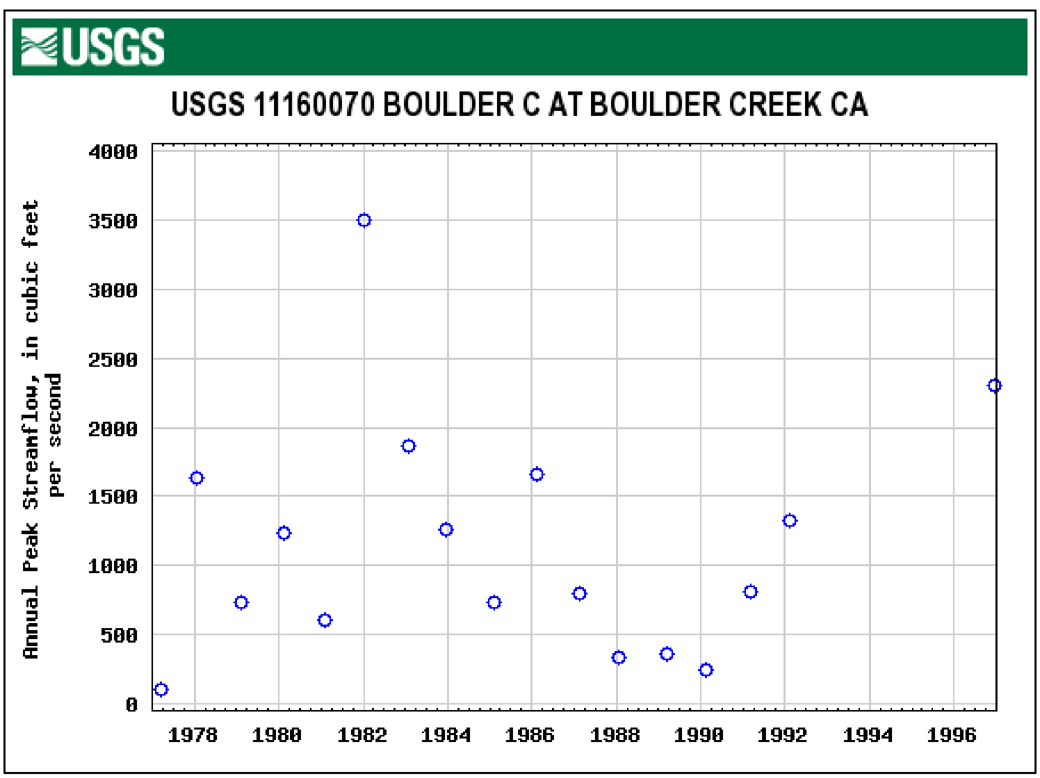


Appendix G: Peak discharge data for gages used in regional analysis

11160070
Boulder Creek at Boulder Creek, CA

Santa Cruz County, California
Hydrologic Unit Code 18060001
Latitude 37°07'36", Longitude 122°07'18" NAD27
Drainage area 11.3 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1977	Mar. 15, 1977	2.29	108	1985	Feb. 08, 1985	4.19	740
1978	Jan. 14, 1978	6.03	1,630	1986	Feb. 17, 1986	5.93	1,660
1979	Feb. 13, 1979	4.22	741	1987	Feb. 13, 1987	4.17	805
1980	Feb. 19, 1980	5.33	1,230	1988	Jan. 17, 1988	3.00	333
1981	Jan. 27, 1981	3.80	607	1989	Mar. 11, 1989	3.09	365
1982	Jan. 04, 1982	9.50	3,500	1990	Feb. 16, 1990	2.72	244
1983	Jan. 24, 1983	6.53	1,870	1991	Mar. 04, 1991	4.19	813
1984	Dec. 25, 1983	5.38	1,260	1992	Feb. 12, 1992	5.30	1,330
				1997	Dec. 10, 1996	7.19	2,300



Appendix G: Peak discharge data for gages used in regional analysis

11160430
Bean Creek near Scotts Valley, CA

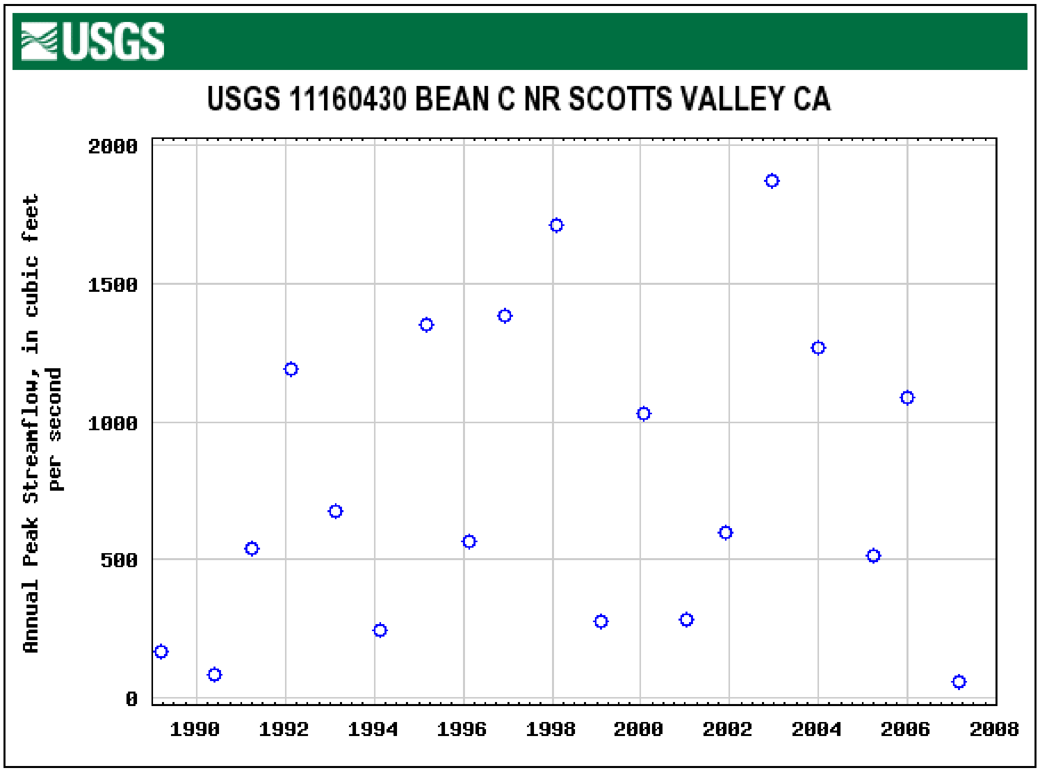
Santa Cruz County, California
Hydrologic Unit Code 18060001
Latitude 37°03'19", Longitude 122°02'25" NAD27
Drainage area 8.81 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1989	Mar. 09, 1989	5.65	170	1998	Feb. 03, 1998	10.85	1,710
1990	May 28, 1990	5.18	86.0	1999	Feb. 07, 1999	6.18	276
1991	Mar. 24, 1991	7.10	538	2000	Jan. 24, 2000	8.78	1,030
1992	Feb. 14, 1992	9.29	1,190	2001	Jan. 11, 2001	6.23	286
1993	Feb. 18, 1993	7.49	674	2002	Dec. 02, 2001	7.37	599
1994	Feb. 19, 1994	5.99	246	2003	Dec. 16, 2002	11.28	1,870[7]
1995	Mar. 10, 1995	9.77	1,350	2004	Jan. 01, 2004	9.82	1,270
1996	Feb. 19, 1996	7.20	566	2005	Mar. 22, 2005	7.42	516
1997	Dec. 10, 1996	9.88	1,380	2006	Dec. 31, 2005	9.34	1,090
				2007	Feb. 25, 2007	5.07	59

- 7 -- Discharge is an Historic Peak

Appendix G: Peak discharge data for gages used in regional analysis

11160430 (continued)
Bean Creek near Scotts Valley, CA

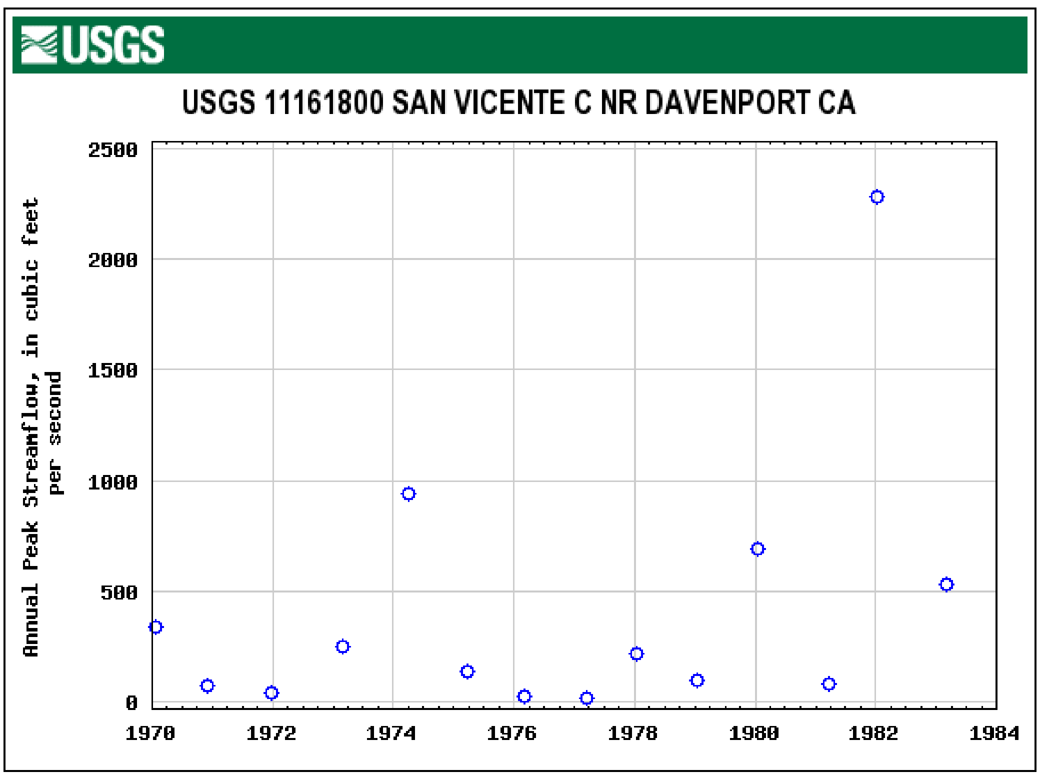


Appendix G: Peak discharge data for gages used in regional analysis

11161800
San Vicente Creek near Davenport, CA

Santa Cruz County, California
Hydrologic Unit Code 18060001
Latitude 37°03'19", Longitude 122°10'52" NAD27
Drainage area 6.07 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1970	Jan. 21, 1970	4.90	335	1977	Mar. 15, 1977	3.08	12.0
1971	Nov. 29, 1970	3.90	71.0	1978	Jan. 14, 1978	4.58	218
1972	Dec. 27, 1971	3.60	38.0	1979	Jan. 11, 1979	4.03	94.0
1973	Feb. 28, 1973	4.68	253	1980	Jan. 12, 1980	5.52	694
1974	Apr. 01, 1974	5.83	937	1981	Mar. 21, 1981	3.92	78.0
1975	Mar. 21, 1975	4.27	138	1982	Jan. 04, 1982	8.90	2,280
1976	Feb. 29, 1976	3.36	21.0	1983	Mar. 02, 1983	5.59	529



Appendix G: Peak discharge data for gages used in regional analysis

11162570
San Gregorio Creek at San Gregorio, CA

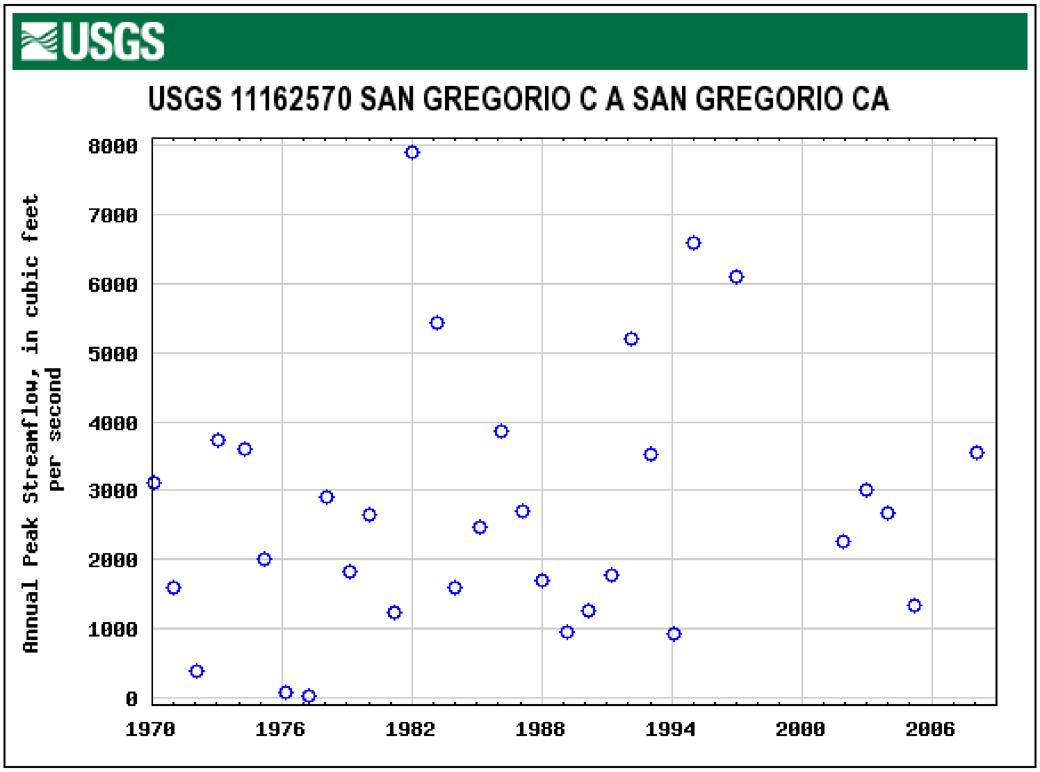
San Mateo County, California
Hydrologic Unit Code 18050006
Latitude 37°19'33", Longitude 122°23'08" NAD27
Drainage area 50.9 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1970	Jan. 21, 1970	15.29	3,120	1986	Feb. 19, 1986	11.83	3,860
1971	Dec. 18, 1970	10.88	1,590	1987	Feb. 13, 1987	9.62	2,710
1972	Feb. 05, 1972	6.30	366	1988	Jan. 17, 1988	7.80	1,700
1973	Jan. 16, 1973	17.50	3,730	1989	Mar. 11, 1989	7.85	946
1974	Apr. 01, 1974	17.20	3,600	1990	Feb. 16, 1990	8.48	1,250
1975	Mar. 21, 1975	12.52	2,010	1991	Mar. 24, 1991	9.37	1,780
1976	Feb. 29, 1976	3.88	67.0	1992	Feb. 12, 1992	17.48	5,200
1977	Mar. 16, 1977		19.0[1,8]	1993	Jan. 13, 1993	15.07	3,530
1978	Jan. 14, 1978	15.25	2,910	1994	Feb. 19, 1994	9.31	923
1979	Feb. 14, 1979	11.93	1,830	1995	Jan. 09, 1995	19.44	6,600[7]
1980	Jan. 13, 1980	14.51	2,650	1997	Jan. 01, 1997	18.74	6,100
1981	Mar. 21, 1981	9.69	1,240	2002	Dec. 02, 2001	10.52	2,250
1982	Jan. 04, 1982	21.28	7,910	2003	Dec. 16, 2002	12.14	3,010
1983	Mar. 02, 1983	14.40	5,440	2004	Jan. 01, 2004	12.21	2,670
1984	Dec. 25, 1983	7.01	1,600	2005	Mar. 22, 2005	9.43	1,320
1985	Feb. 08, 1985	8.86	2,470	2008	Jan. 25, 2008	14.32	3,540

- 1 -- Discharge is a Maximum Daily Average
- 7 -- Discharge is an Historic Peak
- 8 -- Discharge actually greater than indicated value

Appendix G: Peak discharge data for gages used in regional analysis

11162570 (continued)
San Gregorio Creek at San Gregorio, CA



Appendix G: Peak discharge data for gages used in regional analysis

11162630
Pilarcitos Creek at Half Moon Bay, CA

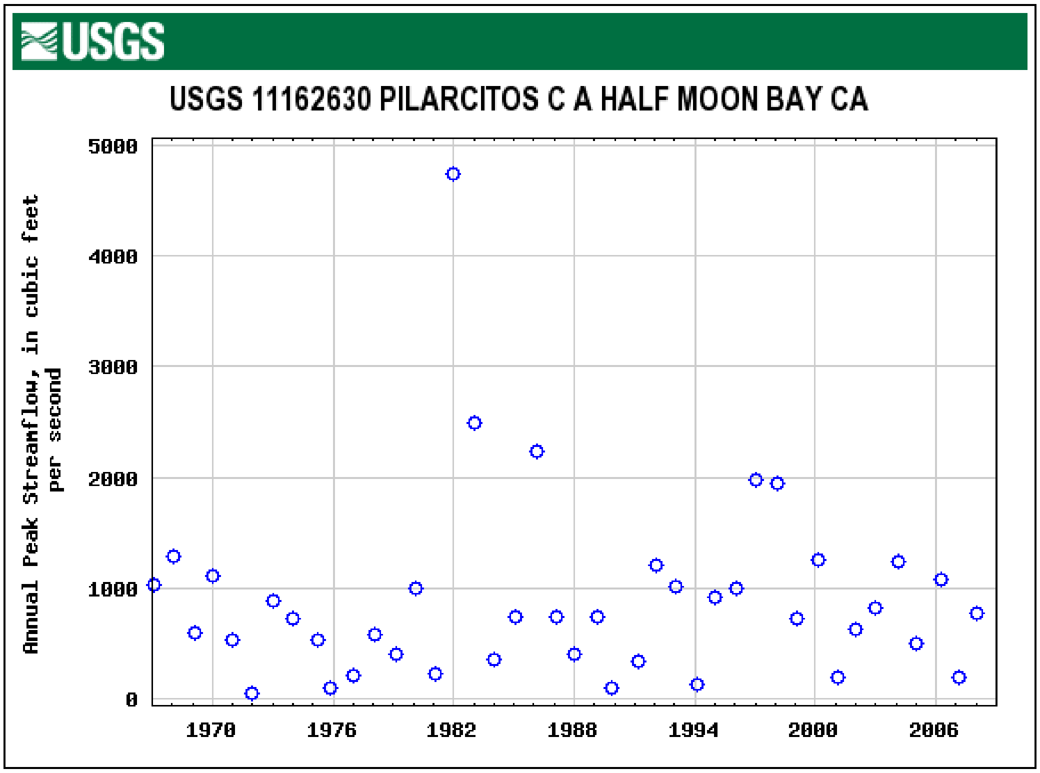
San Mateo County, California
Hydrologic Unit Code 18050006
Latitude 37°28'00", Longitude 122°25'59" NAD27
Drainage area 27.1 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1967	Jan. 21, 1967	9.85	1,020	1988	Jan. 17, 1988	4.43	399
1968	Jan. 30, 1968	11.20	1,290	1989	Mar. 10, 1989	5.88	730
1969	Feb. 05, 1969	7.00	594	1990	Nov. 25, 1989	2.56	94.0
1970	Jan. 21, 1970	10.30	1,110	1991	Mar. 26, 1991	4.20	338
1971	Dec. 20, 1970	7.18	521	1992	Feb. 12, 1992	9.07	1,200
1972	Dec. 24, 1971	4.62	48.0	1993	Jan. 13, 1993	8.22	1,010
1973	Jan. 18, 1973	9.14	878	1994	Feb. 20, 1994	2.72	129
1974	Jan. 03, 1974	7.95	722	1995	Jan. 09, 1995	7.69	908
1975	Mar. 21, 1975	6.68	530	1996	Jan. 31, 1996	8.16	1,000
1976	Nov. 08, 1975	3.77	99.0	1997	Jan. 02, 1997	11.29	1,970
1977	Dec. 30, 1976	4.46	199	1998	Feb. 03, 1998	12.27	1,950
1978	Feb. 07, 1978	7.25	580	1999	Feb. 09, 1999	8.53	729
1979	Feb. 14, 1979	6.24	393	2000	Feb. 13, 2000	10.64	1,250
1980	Feb. 19, 1980	9.58	997	2001	Feb. 24, 2001	5.64	194
1981	Jan. 29, 1981	4.61	221	2002	Dec. 22, 2001	8.56	621[5]
1982	Jan. 04, 1982	13.08	4,750	2003	Dec. 16, 2002	10.04	824
1983	Jan. 24, 1983	10.20	2,500[2]	2004	Feb. 25, 2004	10.85	1,240
1984	Dec. 25, 1983	5.28[6]	345	2005	Jan. 02, 2005	6.93[2]	492[D]
1985	Feb. 08, 1985	6.74	744	2006	Mar. 25, 2006	10.37[2]	1,080
1986	Feb. 18, 1986	9.97	2,240	2007	Feb. 10, 2007	6.05	191
1987	Feb. 13, 1987	5.93	742	2008	Jan. 25, 2008	8.72	769

- 2 -- Gage height not the maximum for the year
- 6 -- Gage datum changed during this year
- 2 -- Discharge is an Estimate
- 5 -- Discharge affected to unknown degree by Regulation or Diversion
- D -- Base Discharge changed during this year

Appendix G: Peak discharge data for gages used in regional analysis

11162630 (continued)
Pilarcitos Creek at Half Moon Bay, CA



Appendix G: Peak discharge data for gages used in regional analysis

11162800
Redwood Creek at Redwood City, CA

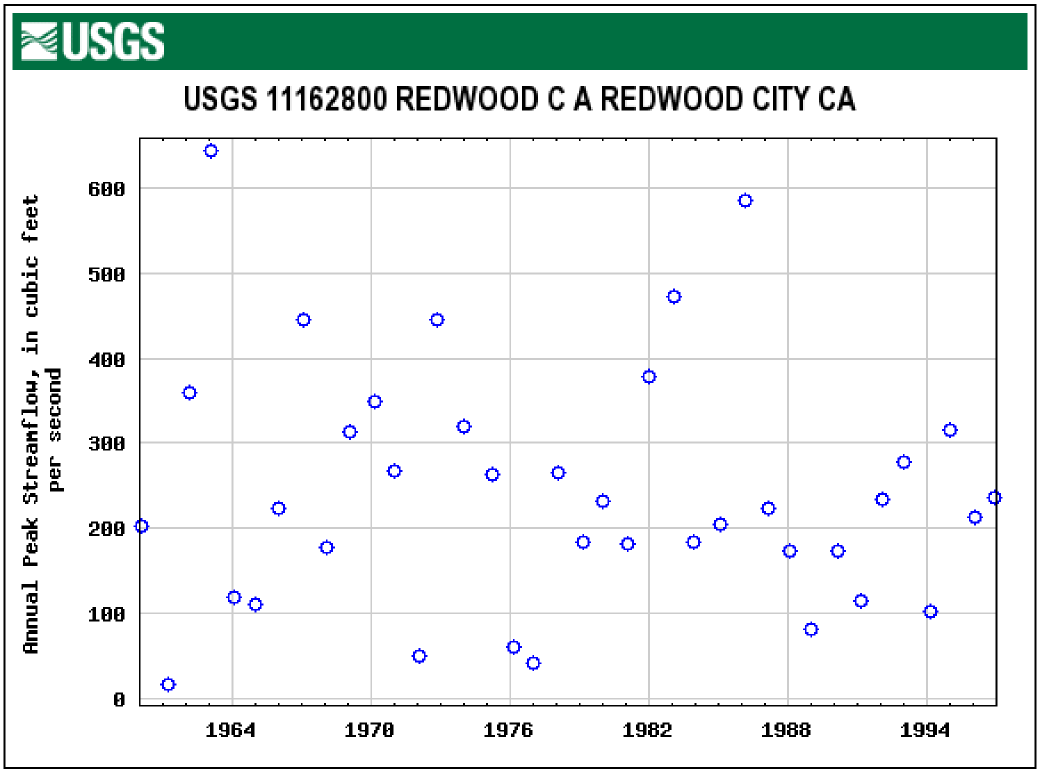
San Mateo County, California
Hydrologic Unit Code 18050004
Latitude 37°26'58", Longitude 122°13'57" NAD27
Drainage area 1.82 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1960	Feb. 08, 1960		203	1979	Feb. 22, 1979	4.84	183
1961	Mar. 14, 1961	2.01	16.0	1980	Jan. 13, 1980	5.49	232
1962	Mar. 05, 1962	6.68	360	1981	Jan. 28, 1981	4.91	182^D
1963	Jan. 31, 1963	9.36	644	1982	Jan. 04, 1982	6.95	379
1964	Jan. 20, 1964	4.20	118	1983	Jan. 23, 1983	7.85	473
1965	Dec. 23, 1964	4.08	110	1984	Nov. 24, 1983	4.92	183
1966	Dec. 28, 1965	5.39	224	1985	Feb. 08, 1985	5.19	205
1967	Jan. 21, 1967	7.56	446	1986	Feb. 18, 1986	8.87	586
1968	Jan. 30, 1968	4.88	177	1987	Feb. 13, 1987	5.40	224
1969	Feb. 05, 1969	6.28	313	1988	Jan. 17, 1988	4.79	173
1970	Mar. 04, 1970	8.60	350	1989	Dec. 22, 1988	3.49	82.0
1971	Dec. 20, 1970	5.82	267	1990	Feb. 16, 1990	4.79	173
1972	Jan. 27, 1972	2.98	49.0	1991	Mar. 04, 1991	3.99	114
1973	Nov. 15, 1972	7.55	445	1992	Feb. 11, 1992	5.51	233
1974	Jan. 03, 1974	6.35	319	1993	Jan. 13, 1993	5.97	277
1975	Mar. 21, 1975	5.78	264	1994	Feb. 19, 1994	3.79	101
1976	Feb. 29, 1976	2.89	60.0	1995	Jan. 09, 1995	6.35	315
1977	Jan. 02, 1977	2.60	42.0	1996	Jan. 27, 1996	5.27	212
1978	Jan. 16, 1978	5.80	266	1997	Dec. 10, 1996	5.54	236

- D -- Base Discharge changed during this year

Appendix G: Peak discharge data for gages used in regional analysis

11162800 (continued)
Redwood Creek at Redwood City, CA



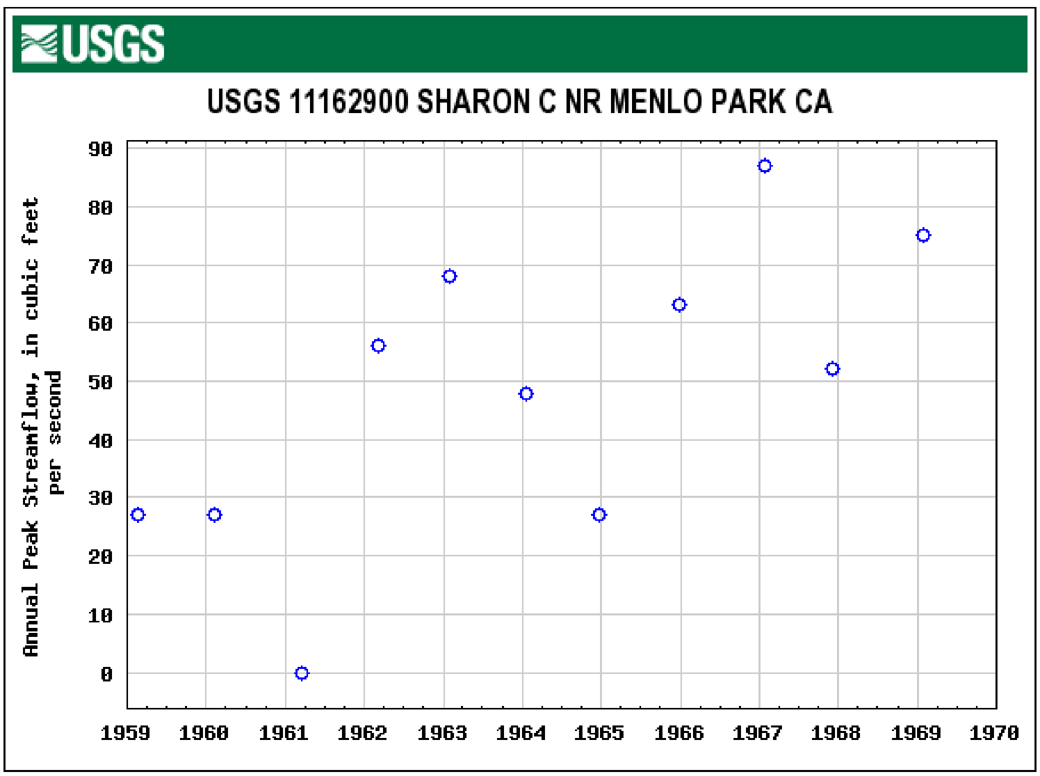
Appendix G: Peak discharge data for gages used in regional analysis

11162900
Sharon Creek near Menlo Park, CA

San Mateo County, California
Hydrologic Unit Code 18050004
Latitude 37°25'45", Longitude 122°13'02" NAD27
Drainage area 0.38 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1958	Apr. 02, 1958	4.20		1964	Jan. 20, 1964	2.74	48.0
1959	Feb. 16, 1959	2.40	27.0	1965	Dec. 22, 1964	2.22[2]	27.0
1960	Feb. 08, 1960	2.41	27.0	1966	Dec. 28, 1965	2.99	63.0
1961	Mar. 17, 1961	1.16	0.00	1967	Jan. 24, 1967	3.38	87.0
1962	Mar. 05, 1962	3.10	56.0	1968	Dec. 04, 1967	2.78	52.0
1963	Jan. 31, 1963	3.07	68.0	1969	Jan. 26, 1969	3.18	75.0

- 2 -- Gage height not the maximum for the year



Appendix G: Peak discharge data for gages used in regional analysis

11164500
San Francisquito Creek at Stanford University, CA

Santa Clara County, California
Hydrologic Unit Code 18050003
Latitude 37°25'24", Longitude 122°11'18" NAD27
Drainage area 37.4 square miles

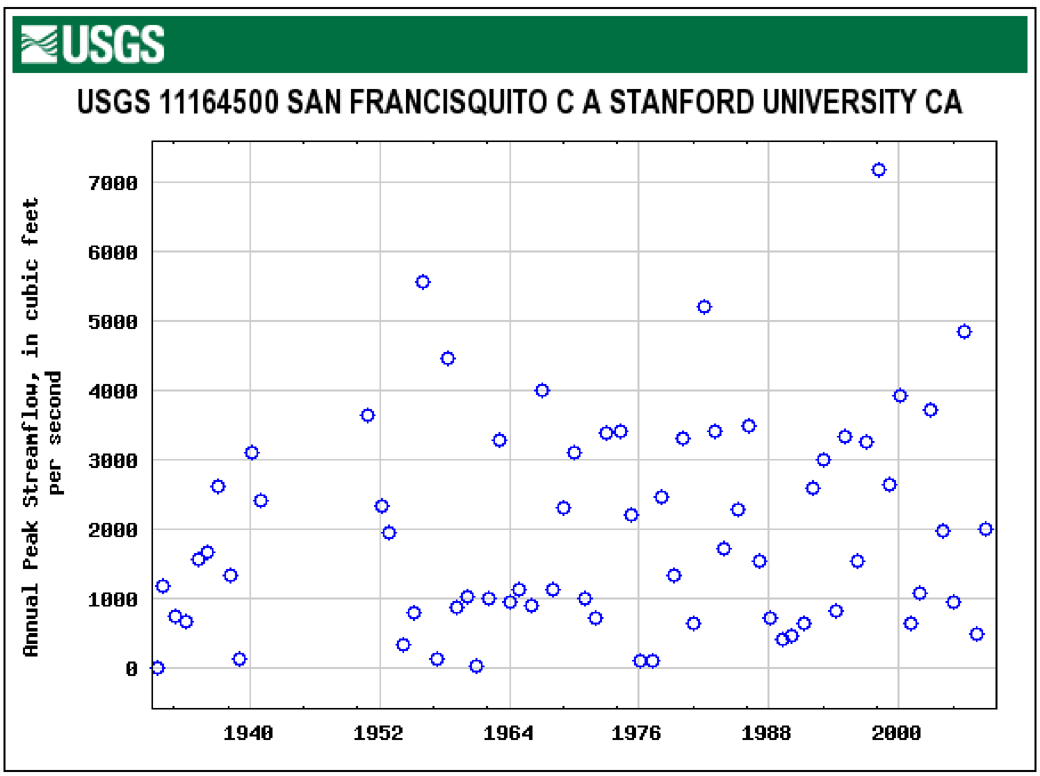
Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1931	1931		0.00	1974	Apr. 01, 1974	7.85	3,410
1932	Dec. 27, 1931	5.20	1,160	1975	Mar. 21, 1975	6.17	2,190
1933	Jan. 27, 1933	4.18	730	1976	Feb. 29, 1976	1.66	82.0
1934	Feb. 08, 1934	4.03	670	1977	Mar. 15, 1977	1.66	82.0
1935	Apr. 08, 1935	6.35	1,560	1978	Jan. 16, 1978	6.56	2,470
1936	Feb. 21, 1936	6.72	1,660	1979	Feb. 22, 1979	4.91	1,330
1937	Feb. 04, 1937	9.15	2,620	1980	Jan. 13, 1980	9.00	3,300
1938	Mar. 13, 1938	6.03	1,330	1981	Jan. 29, 1981	3.79	626
1939	Feb. 08, 1939	2.02	120	1982	Jan. 04, 1982	12.42	5,220
1940	Feb. 27, 1940	9.40	3,100	1983	Jan. 26, 1983	9.21	3,420
1941	Feb. 11, 1941	8.08	2,410	1984	Nov. 24, 1983	6.11	1,700
1951	Nov. 18, 1950	10.40	3,650	1985	Feb. 08, 1985	7.18	2,270
1952	Mar. 14, 1952	7.90	2,320	1986	Feb. 17, 1986	9.33	3,480
1953	Dec. 07, 1952	7.15	1,950	1987	Feb. 13, 1987	5.78	1,540
1954	Mar. 19, 1954	3.15	332	1988	Jan. 17, 1988	3.97	712
1955	Feb. 27, 1955	4.55	797	1989	Mar. 25, 1989	3.13	394
1956	Dec. 22, 1955	13.60	5,560	1990	Feb. 16, 1990	3.33	460
1957	May 18, 1957		125[1,2]	1991	Mar. 26, 1991	3.77	626
1958	Apr. 02, 1958	11.04	4,460	1992	Feb. 12, 1992	7.76	2,580
1959	Feb. 16, 1959	4.48	868	1993	Jan. 13, 1993	8.51	3,010
1960	Feb. 08, 1960	4.84	1,020	1994	Feb. 19, 1994	4.24	824
1961	Nov. 26, 1960	0.83	12.0	1995	Jan. 09, 1995	9.04	3,320
1962	Mar. 05, 1962	5.04	996	1996	Feb. 04, 1996	5.72	1,520
1963	Jan. 31, 1963	9.28	3,270	1997	Jan. 02, 1997	7.95	3,250
1964	Jan. 21, 1964	4.92	948	1998	Feb. 03, 1998	13.40	7,200
1965	Dec. 23, 1964	5.35	1,120	1999	Feb. 07, 1999	6.93	2,640
1966	Dec. 28, 1965	4.80	880	2000	Feb. 13, 2000	9.04	3,930
1967	Jan. 21, 1967	8.60	4,000	2001	Feb. 22, 2001	3.62	621
1968	Jan. 30, 1968	4.60	1,130	2002	Dec. 02, 2001	4.44	1,060

Appendix G: Peak discharge data for gages used in regional analysis.

11164500 (continued)
San Francisquito Creek at Stanford University, CA

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1969	Jan. 26, 1969	6.28	2,300	2003	Dec. 16, 2002	8.73	3,730
1970	Jan. 21, 1970	7.44	3,110	2004	Jan. 01, 2004	5.88	1,980
1971	Dec. 20, 1970		1,000	2005	Dec. 30, 2004	4.25	940
1972	Dec. 25, 1971		700	2006	Dec. 31, 2005	10.35	4,840
1973	Jan. 16, 1973	7.84	3,390	2007	Feb. 27, 2007	3.28	483
				2008	Jan. 25, 2008	6.08	2,000

- 1 -- Discharge is a Maximum Daily Average
- 2 -- Discharge is an Estimate



Appendix G: Peak discharge data for gages used in regional analysis.

11166000
Matadero Creek at Palo Alto, CA

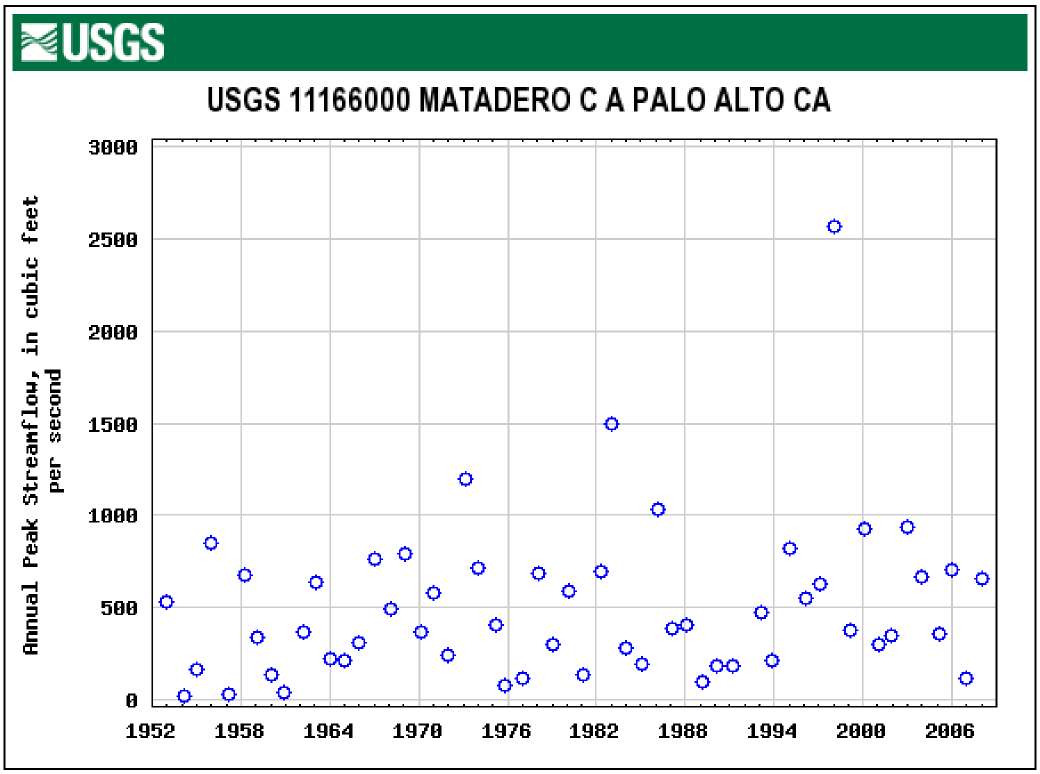
Santa Clara County, California
Hydrologic Unit Code 18050003
Latitude 37°25'18", Longitude 122°08'04" NAD27
Drainage area 7.26 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1953	Dec. 06, 1952		535	1980	Feb. 19, 1980	3.26	594
1954	Mar. 19, 1954		26.0	1981	Jan. 27, 1981	1.72	133
1955	Jan. 18, 1955		170	1982	Mar. 31, 1982	3.89	691
1956	Dec. 22, 1955		854	1983	Jan. 24, 1983	6.51	1,500
1957	Feb. 24, 1957		28.0	1984	Dec. 11, 1983	2.45	286
1958	Apr. 02, 1958	[6]	672	1985	Feb. 08, 1985	2.08	197
1959	Feb. 16, 1959	2.85	340	1986	Feb. 18, 1986	5.45	1,030
1960	Feb. 08, 1960	1.70	139	1987	Feb. 13, 1987	2.82	388
1961	Nov. 25, 1960	1.10	45.0	1988	Jan. 17, 1988	2.88	405
1962	Mar. 05, 1962	2.94	365	1989	Mar. 10, 1989	1.58	102
1963	Jan. 31, 1963	3.97	641	1990	Feb. 16, 1990	2.04	188[E]
1964	Jan. 20, 1964	2.34	223	1991	Mar. 24, 1991	2.02	184
1965	Jan. 05, 1965	2.24	219	1993	Feb. 26, 1993	5.26[6]	474[C]
1966	Dec. 28, 1965	2.71	311	1994	Nov. 28, 1993	4.30	210[C]
1967	Jan. 24, 1967	4.65	765	1995	Jan. 10, 1995	6.24	824[C]
1968	Jan. 30, 1968	3.65	490	1996	Feb. 04, 1996	5.46	550[C]
1969	Jan. 26, 1969	4.74	792	1997	Jan. 25, 1997	5.74	633[C]
1970	Mar. 04, 1970	3.10	368	1998	Feb. 02, 1998	10.00	2,560[C]
1971	Dec. 20, 1970	3.20	576	1999	Feb. 09, 1999	4.93	374[C]
1972	Dec. 21, 1971	2.04	246	2000	Feb. 22, 2000	6.55	931[C]
1973	Feb. 27, 1973	5.57	1,200	2001	Jan. 10, 2001	4.68	302[C]
1974	Jan. 03, 1974	3.97	713	2002	Dec. 02, 2001	4.85	350[C]
1975	Mar. 21, 1975	2.61	405	2003	Dec. 19, 2002	6.57	938[C]
1976	Oct. 10, 1975	1.43	81.0	2004	Jan. 01, 2004	5.84	668[C]
1977	Jan. 02, 1977	1.68	114	2005	Feb. 18, 2005	4.87	356[C]
1978	Jan. 16, 1978	3.86	683	2006	Dec. 31, 2005	5.94	705[C]
1979	Jan. 14, 1979	2.24	305	2007	Dec. 12, 2006	3.96	117[C]
				2008	Jan. 25, 2008	5.82	661[C]

Appendix G: Peak discharge data for gages used in regional analysis.

11166000 (continued)
Matadero Creek at Palo Alto, CA

- C -- All or part of the record affected by Urbanization, Mining, Agricultural changes, Channelization
- E -- Only Annual Maximum Peak available for this year



Appendix G: Peak discharge data for gages used in regional analysis.

11169500
Saratoga Creek at Saratoga, CA

Santa Clara County, California
Hydrologic Unit Code 18050003
Latitude 37°15'16", Longitude 122°02'18" NAD27
Drainage area 9.22 square miles

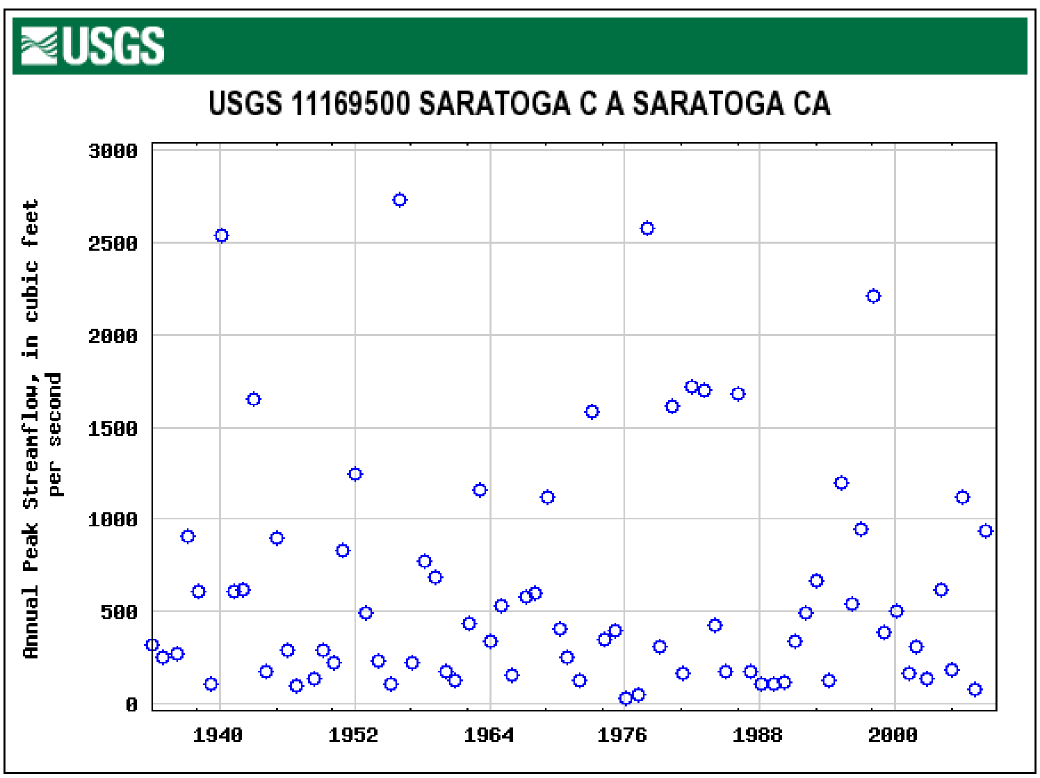
Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1934	Jan. 01, 1934	3.13	314	1971	Nov. 28, 1970	4.38	255
1935	Jan. 04, 1935	2.90	254	1972	Dec. 27, 1971	3.91	127
1936	Feb. 21, 1936	2.80	268	1973	Jan. 16, 1973	6.03	1,580
1937	Feb. 13, 1937	3.80	910	1974	Mar. 01, 1974	4.50	345
1938	Feb. 02, 1938	3.71	611	1975	Mar. 07, 1975	4.61	398
1939	Mar. 08, 1939	2.41	110	1976	Feb. 29, 1976	3.00	25.0
1940	Feb. 27, 1940	5.35[2]	2,540	1977	Mar. 15, 1977	3.29	50.0
1941	Apr. 04, 1941	3.78	608	1978	Jan. 14, 1978	6.69	2,580
1942	Jan. 24, 1942	3.80	620	1979	Jan. 15, 1979	4.40	307
1943	Jan. 21, 1943	4.80	1,650	1980	Feb. 19, 1980	6.89	1,610
1944	Mar. 04, 1944	2.68	175	1981	Jan. 27, 1981	4.19	161
1945	Feb. 01, 1945	4.15	898	1982	Jan. 04, 1982	7.06	1,720
1946	Dec. 21, 1945	3.13	287	1983	Jan. 24, 1983	7.03	1,700
1947	Nov. 22, 1946	2.46	100	1984	Dec. 25, 1983	4.74	426
1948	Apr. 29, 1948	2.63	134	1985	Nov. 27, 1984	3.97	177
1949	Mar. 11, 1949	3.08	293	1986	Feb. 17, 1986	7.00	1,680
1950	Feb. 05, 1950	2.95	222	1987	Feb. 13, 1987	3.96	174
1951	Nov. 18, 1950	4.07	826	1988	Jan. 17, 1988	3.64	109
1952	Jan. 12, 1952	4.63	1,240	1989	Mar. 11, 1989	3.60	102
1953	Dec. 07, 1952	3.58	494	1990	Feb. 16, 1990	3.70	119
1954	Jan. 17, 1954	2.98	232	1991	Mar. 04, 1991	4.49	336
1955	Feb. 26, 1955	2.50	107	1992	Feb. 12, 1992	4.91	493
1956	Dec. 22, 1955	6.40	2,730	1993	Jan. 13, 1993	5.30	665
1957	Feb. 24, 1957	3.42	225	1994	Feb. 19, 1994	3.71	121
1958	Apr. 02, 1958	4.95	772	1995	Mar. 09, 1995	6.28	1,200
1959	Feb. 16, 1959	4.75	683	1996	Feb. 21, 1996	4.92	539
1960	Feb. 08, 1960	3.24	178	1997	Jan. 01, 1997	5.85	944
1961	Dec. 01, 1960	3.00	129	1998	Feb. 03, 1998	7.80	2,210
1962	Feb. 14, 1962	4.12	432	1999	Feb. 09, 1999	4.47	383

Appendix G: Peak discharge data for gages used in regional analysis.

11169500 (continued)
Saratoga Creek at Saratoga, CA

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1963	Jan. 31, 1963	5.68	1,160	2000	Feb. 14, 2000	4.71	502
1964	Jan. 20, 1964	3.84	338	2001	Mar. 04, 2001	3.75	162
1965	Jan. 05, 1965	4.40	535	2002	Dec. 02, 2001	4.25	310
1966	Dec. 28, 1965	2.98	151	2003	Nov. 08, 2002	3.59	131
1967	Mar. 16, 1967	4.52	583	2004	Feb. 25, 2004	5.03	620
1968	Jan. 30, 1968	4.48	598	2005	Dec. 30, 2004	4.00	188[D]
1969	Jan. 26, 1969	4.00[6]	1,120	2006	Dec. 31, 2005	6.31	1,120
1970	Mar. 04, 1970	4.75	406	2007	Feb. 10, 2007	3.40	74
				2008	Jan. 04, 2008	5.98	936

- 2 -- Gage height not the maximum for the year
- 6 -- Gage datum changed during this year
- D -- Base Discharge changed during this year



Appendix G: Peak discharge data for gages used in regional analysis.

11170000
Coyote Creek near Madrone, CA

Santa Clara County, California
Hydrologic Unit Code 18050003
Latitude 37°10'06", Longitude 121°38'55" NAD27
Drainage area 196 square miles

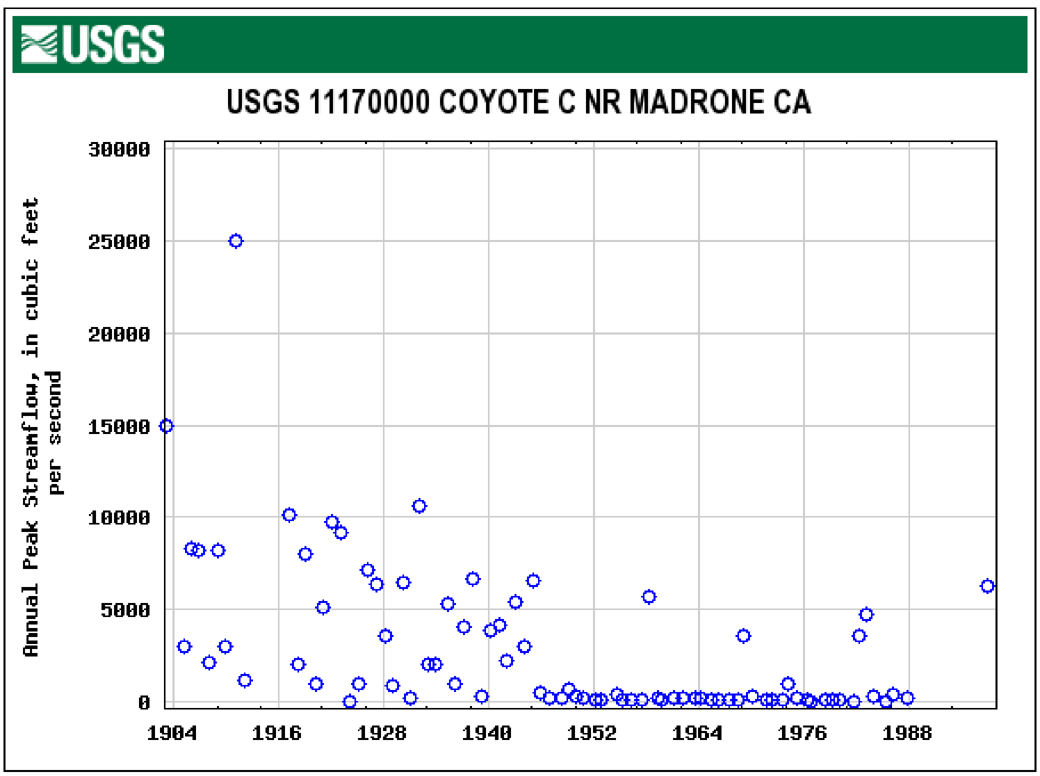
Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1903	Mar. 31, 1903		15,000
1905	Mar. 19, 1905		3,000
1906	Jan. 19, 1906		8,350
1907	Dec. 11, 1906		8,210
1908	Jan. 25, 1908		2,150
1909	Jan. 21, 1909		8,230
1910	Dec. 09, 1909		3,000
1911	Mar. 07, 1911		25,000
1912	Mar. 12, 1912		1,210
1917	Feb. 21, 1917	14.50	10,100
1918	Mar. 12, 1918	8.50	2,090
1919	Feb. 10, 1919	13.00	8,030
1920	Mar. 22, 1920	6.90	970
1921	Jan. 30, 1921	11.20	5,130
1922	Feb. 10, 1922	14.00	9,760
1923	Jan. 24, 1923		9,200
1924	Jan. 27, 1924	2.62	8.00
1925	Feb. 23, 1925	7.00	1,000
1926	Feb. 13, 1926	12.50	7,180
1927	Feb. 16, 1927	12.00	6,340
1928	Mar. 27, 1928	10.00	3,580
1929	Feb. 03, 1929	6.80	920
1930	Mar. 05, 1930	12.10	6,500
1931	Feb. 15, 1931	4.61	178
1932	Dec. 28, 1931	14.48	10,600
1933	Jan. 29, 1933	8.72	2,080
1934	Jan. 01, 1934	8.65	2,010
1935	Apr. 08, 1935	11.35	5,340
1936	Feb. 22, 1936	6.85	1,020[6]
1948	Apr. 12, 1948	4.97	221[6]
1949	Mar. 11, 1949	6.34	663[6]
1950	Jan. 28, 1950	5.60[6]	365[6]
1951	Nov. 22, 1950	4.00	230[6]
1952	Mar. 31, 1952	2.70	93.0[6]
1953	Dec. 07, 1952	2.70	93.0[6]
1954	Sep. 17, 1954	5.20	460[6]
1955	Apr. 17, 1955	2.80	113[6]
1956	May 16, 1956	2.70	98.0[6]
1957	Jul. 14, 1957	2.97	127[6]
1958	Apr. 03, 1958	9.65	5,750[6]
1959	Apr. 05, 1959	2.77	176[6]
1960	Oct. 20, 1959	2.78	170[6]
1961	Apr. 13, 1961	2.81	180[6]
1962	Feb. 22, 1962	2.79	183[6]
1963	Jul. 17, 1963	3.05	245[6]
1964	Mar. 25, 1964	2.94	217[6]
1965	Jun. 19, 1965	2.74	113[6]
1966	May 02, 1966	2.57	110[6]
1967	Jul. 31, 1967	2.67	96.0[6]
1968	Jun. 25, 1968	2.65	112[6]
1969	Feb. 25, 1969	8.16	3,570[6]
1970	Mar. 10, 1970	3.24	346[6]
1971	Sep. 20, 1971	2.48	88.0[6]
1972	Apr. 12, 1972	2.53	99.0[6]
1973	Aug. 09, 1973	2.44	77.0[6]
1974	Apr. 02, 1974	4.71	985[6]
1975	Apr. 05, 1975	2.89	217[6]
1976	Jun. 18, 1976	2.57	113[6]

Appendix G: Peak discharge data for gages used in regional analysis.

11170000 (continued)
Coyote Creek near Madrone, CA

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1937	Mar. 22, 1937	10.40	4,060[6]	1977	Oct. 01, 1976	2.33	51.0[6]
1938	Feb. 11, 1938	12.20	6,670[6]	1978	May 28, 1978	2.49	90.0[6]
1939	Mar. 09, 1939	5.21	283[6]	1979	May 16, 1979	2.48	87.0[6]
1940	Feb. 29, 1940	10.28	3,920[6]	1980	Feb. 25, 1980	2.55	107[6]
1941	Apr. 04, 1941	10.48	4,180[6]	1981	Aug. 29, 1981	2.42	71.0[6]
1942	Feb. 06, 1942	8.67	2,230[6]	1982	Apr. 01, 1982	8.80	3,630[6]
1943	Jan. 21, 1943	11.42	5,450[6]	1983	Mar. 01, 1983	9.58	4,720[6]
1944	Mar. 04, 1944	9.50	3,050[6]	1984	Dec. 03, 1983	3.36	352[6]
1945	Feb. 02, 1945	12.15	6,580[6]	1985	Apr. 26, 1985	2.44	74.0[6]
1946	Jan. 05, 1946	5.96	504[6]	1986	Mar. 20, 1986	3.46	386[6]
1947	Nov. 23, 1946	4.85	196[6]	1987	Sep. 25, 1987	2.91	201[6]
				1997	Jan. 26, 1997	10.84	6,280

- 6 -- Gage datum changed during this year
- 6 -- Discharge affected by Regulation or Diversion



Appendix G: Peak discharge data for gages used in regional analysis.

11171500
Coyote Creek near Edenvale, CA

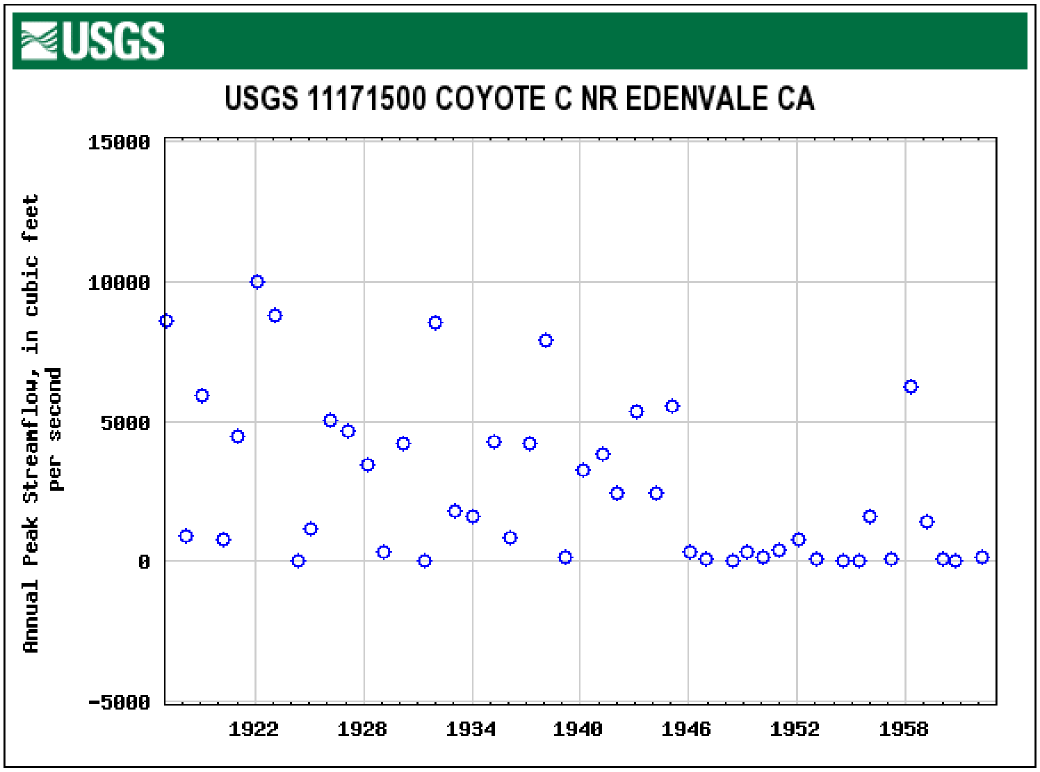
Santa Clara County, California
Hydrologic Unit Code 18050003
Latitude 37°16'15", Longitude 121°47'47" NAD27
Drainage area 229 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1917	Feb. 21, 1917	12.20	8,590	1940	Feb. 29, 1940	6.72	3,230[6]
1918	Mar. 12, 1918	5.60	915	1941	Apr. 04, 1941	7.05	3,810[6]
1919	Feb. 11, 1919	10.00	5,940	1942	Jan. 24, 1942	5.60	2,420[6]
1920	Mar. 22, 1920	5.35	800	1943	Jan. 21, 1943	7.25	5,350[6]
1921	Jan. 30, 1921	8.90	4,430	1944	Mar. 05, 1944	5.60	2,420[6]
1922	Feb. 10, 1922	12.80	10,000	1945	Feb. 02, 1945	7.35	5,550[6]
1923	Jan. 24, 1923		8,800	1946	Jan. 05, 1946	3.71	346[6]
1924	1924		0.00	1947	Nov. 25, 1946	3.14	95.0[6]
1925	Feb. 13, 1925	5.70	1,130	1948	1948		0.00[6]
1926	Feb. 13, 1926	9.30	5,010	1949	Mar. 12, 1949	3.77	329[6]
1927	Feb. 16, 1927	9.00	4,630	1950	Jan. 28, 1950	3.29	143[6]
1928	Mar. 27, 1928	7.80	3,430	1951	Dec. 08, 1950	3.80	400[6]
1929	Feb. 04, 1929	4.05	326	1952	Jan. 12, 1952	4.77	768[6]
1930	Mar. 05, 1930	8.50	4,200	1953	Jan. 09, 1953	3.16	102[6]
1931	1931		0.00	1954	Jul. 18, 1954	2.73	24.0[6]
1932	Dec. 28, 1931	11.20	8,520	1955	May 28, 1955	2.81	34.0[6]
1933	Jan. 29, 1933	6.00	1,820	1956	Dec. 23, 1955	5.02	1,610[6]
1934	Jan. 01, 1934	5.80	1,620	1957	Feb. 25, 1957	2.91	47.0[6]
1935	Apr. 08, 1935	7.00	4,250[6]	1958	Apr. 03, 1958	7.80	6,250[6]
1936	Feb. 23, 1936	4.39	861[6]	1959	Feb. 16, 1959	4.97	1,410[6]
1937	Mar. 21, 1937	6.78	4,220[6]	1960	Jan. 13, 1960	3.05	71.0[6]
1938	Feb. 11, 1938	8.70	7,920[6]	1961	Oct. 04, 1960	2.68	16.0[6]
1939	Mar. 09, 1939	3.31	162[6]	1962	Mar. 07, 1962	3.33	159[6]

- 6 -- Discharge affected by Regulation or Diversion

Appendix G: Peak discharge data for gages used in regional analysis.

11171500 (continued)
Coyote Creek near Edenvale, CA



Appendix G: Peak discharge data for gages used in regional analysis.

11172100
Upper Penitencia Creek at San Jose, CA

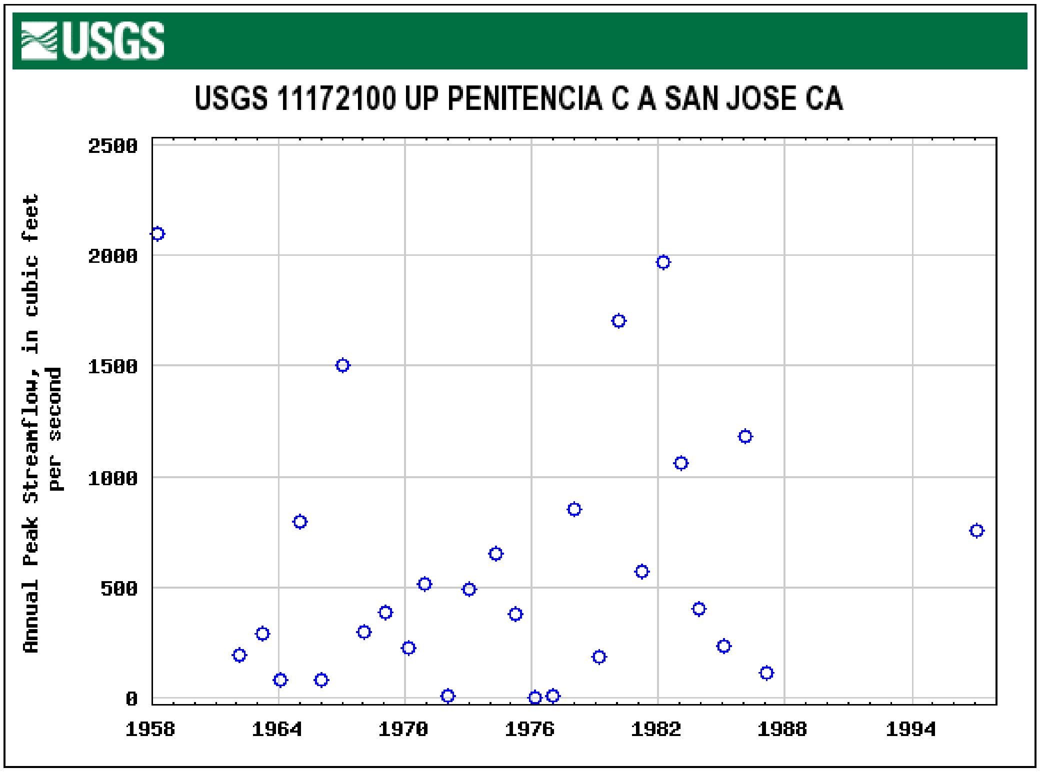
Santa Clara County, California
Hydrologic Unit Code 18050003
Latitude 37°23'43", Longitude 121°49'38" NAD27
Drainage area 21.5 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1958	Apr. 02, 1958	5.37	2,100[7]	1975	Mar. 21, 1975	4.84	376
1962	Feb. 16, 1962	2.25	198	1976	Mar. 02, 1976	2.95	2.80
1963	Mar. 28, 1963	3.53	295	1977	Jan. 02, 1977	3.10	7.20
1964	Jan. 21, 1964	4.00	86.0	1978	Jan. 14, 1978	5.59	851
1965	Dec. 23, 1964	6.50	800	1979	Feb. 22, 1979	4.34	186
1966	Dec. 28, 1965	4.00	80.0	1980	Feb. 19, 1980	6.41	1,700
1967	Jan. 21, 1967	6.24	1,500	1981	Mar. 13, 1981	5.20	571
1968	Jan. 30, 1968	4.53	298	1982	Mar. 31, 1982	8.71	1,970
1969	Jan. 25, 1969	4.71	386	1983	Jan. 26, 1983	6.05	1,060[D]
1970	Mar. 01, 1970	4.46	227	1984	Nov. 24, 1983	4.93	407
1971	Dec. 02, 1970	4.94	519	1985	Feb. 08, 1985	4.49	237
1972	Dec. 25, 1971	3.27	12.0	1986	Feb. 17, 1986	6.26	1,180
1973	Jan. 18, 1973	5.07	494	1987	Feb. 13, 1987	3.99	111
1974	Apr. 01, 1974	5.32	651	1997	Jan. 22, 1997	5.59	754[7]

- 7 -- Discharge is an Historic Peak
- D -- Base Discharge changed during this year

Appendix G: Peak discharge data for gages used in regional analysis.

11172100 (continued)
Upper Penitencia Creek at San Jose, CA



Appendix G: Peak discharge data for gages used in regional analysis.

11176000
Arroyo Mocho near Livermore, CA

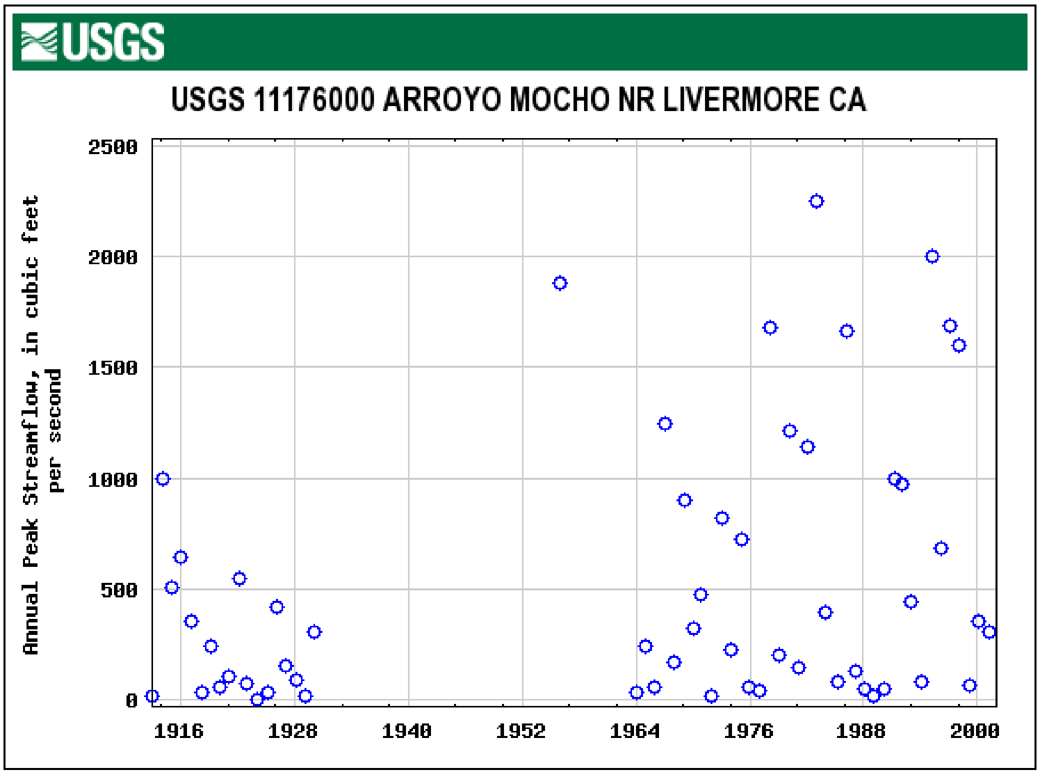
Alameda County, California
Hydrologic Unit Code 18050004
Latitude 37°37'35", Longitude 121°42'13" NAD27
Drainage area 38.2 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1913	Jan. 17, 1913		17.0[1]	1973	Feb. 27, 1973	7.03	820
1914	Jan. 25, 1914		1,000[1,2]	1974	Dec. 27, 1973	6.16	228
1915	Feb. 02, 1915	[6]	508[1]	1975	Mar. 08, 1975	6.93	725
1916	Jan. 03, 1916		645[1]	1976	Oct. 30, 1975	5.51	57.0
1917	Feb. 25, 1917		351[1]	1977	Jan. 03, 1977	5.40	44.0
1918	Mar. 19, 1918		36.0[1]	1978	Mar. 05, 1978	7.66	1,680
1919	Feb. 11, 1919		238[1]	1979	Feb. 22, 1979	6.67	205
1920	Mar. 22, 1920		59.0[1]	1980	Feb. 19, 1980	9.14	1,210
1921	Jan. 18, 1921		106	1981	Jan. 29, 1981	4.52	146
1922	Feb. 10, 1922		543	1982	Jan. 05, 1982	7.55	1,140
1923	Dec. 12, 1922		74.0	1983	Jan. 24, 1983	8.80	2,250
1924	Jan. 29, 1924		0.90	1984	Dec. 25, 1983	7.86	396
1925	Feb. 13, 1925		36.0	1985	Mar. 28, 1985	6.12	83.0
1926	Feb. 13, 1926		422	1986	Feb. 19, 1986	10.44	1,660
1927	Feb. 16, 1927		154	1987	Feb. 13, 1987	6.41	129
1928	Mar. 27, 1928		89.0	1988	Jan. 17, 1988	5.82	47.0
1929	Feb. 04, 1929		18.0	1989	Dec. 24, 1988	5.49	20.0
1930	Mar. 05, 1930		304	1990	Feb. 16, 1990	5.82	47.0[E]
1956	Dec. 23, 1955		1,880[7]	1991	Mar. 24, 1991	9.19	1,000
1964	Jan. 21, 1964	2.59[6]	33.0	1992	Feb. 15, 1992	8.82	970
1965	Dec. 23, 1964	4.92	242	1993	Jan. 13, 1993	6.98	440
1966	Dec. 29, 1965	4.10	60.0	1994	Feb. 20, 1994	4.93	83.0
1967	Jan. 22, 1967	5.90	1,250	1995	Mar. 10, 1995	9.29	2,000
1968	Jan. 30, 1968	4.46	168	1996	Feb. 19, 1996	6.54	685
1969	Jan. 26, 1969	6.36	900	1997	Jan. 23, 1997	8.24	1,690
1970	Mar. 01, 1970	5.15	324	1998	Feb. 03, 1998	10.28	1,600
1971	Dec. 02, 1970	5.54	475	1999	Feb. 09, 1999	4.71	68
1972	Dec. 25, 1971	5.17	13.0	2000	Feb. 23, 2000	5.46	354
				2001	Mar. 04, 2001	5.35	303

Appendix G: Peak discharge data for gages used in regional analysis.

11176000 (continued)
Arroyo Mocho near Livermore, CA

- 6 -- Gage datum changed during this year
- 1 -- Discharge is a Maximum Daily Average
- 2 -- Discharge is an Estimate
- 7 -- Discharge is an Historic Peak
- E -- Only Annual Maximum Peak available for this year



Appendix G: Peak discharge data for gages used in regional analysis.

11176200
Arroyo Mocho near Pleasanton, CA

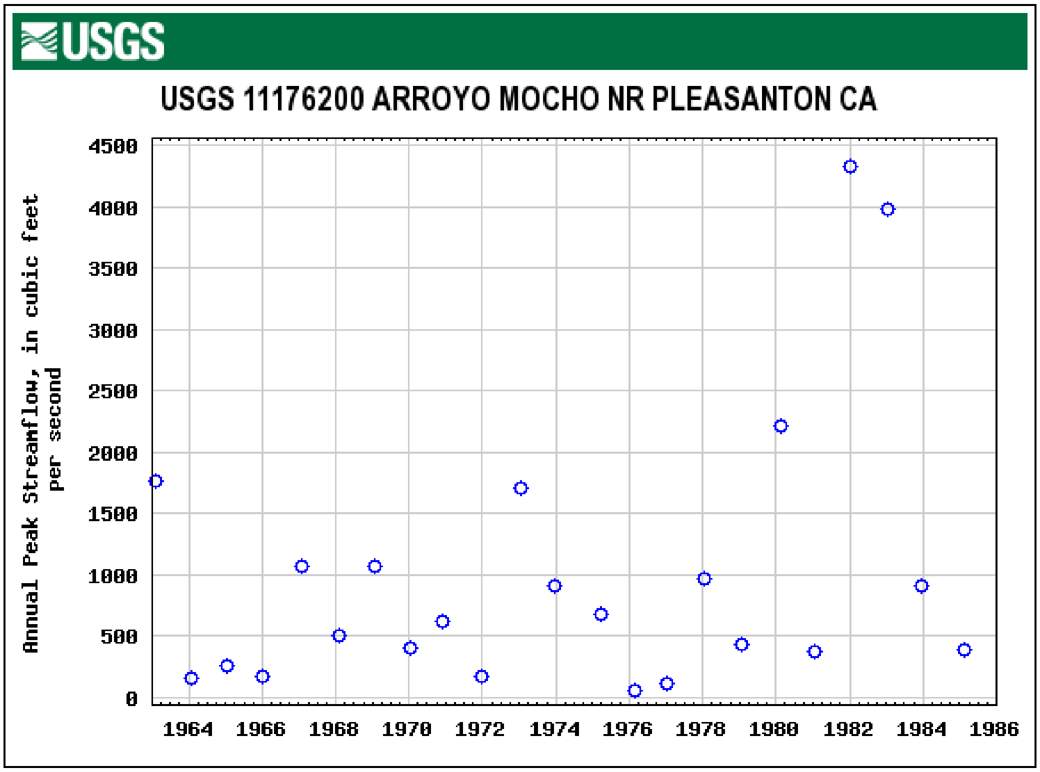
Alameda County, California
Hydrologic Unit Code 18050004
Latitude 37°41'26", Longitude 121°52'20" NAD27
Drainage area 142 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1963	Feb. 01, 1963	8.60	1,760	1974	Dec. 27, 1973	11.07	917
1964	Jan. 21, 1964	3.07	150	1975	Mar. 21, 1975	10.53	682
1965	Jan. 07, 1965	4.89	265	1976	Feb. 29, 1976	8.79	62.0
1966	Dec. 29, 1965	3.51	164	1977	Jan. 02, 1977	9.03	119
1967	Jan. 22, 1967	6.65	1,070	1978	Jan. 17, 1978	11.17	969
1968	Jan. 30, 1968	31.00[3]	505	1979	Jan. 15, 1979	9.87	434
1969	Jan. 26, 1969	14.63	1,070	1980	Feb. 19, 1980	11.87	2,220
1970	Jan. 21, 1970	12.07	407	1981	Jan. 27, 1981	9.69	374
1971	Nov. 29, 1970	12.50	622	1982	Jan. 05, 1982	13.97	4,330
1972	Dec. 25, 1971	9.62	165	1983	Jan. 24, 1983	13.73	3,980
1973	Jan. 18, 1973	12.47	1,700	1984	Dec. 24, 1983	10.73	917
				1985	Feb. 08, 1985	9.71	385

- 3 -- Gage height at different site and(or) datum

Appendix G: Peak discharge data for gages used in regional analysis.

11176200 (continued)
Arroyo Mocho near Pleasanton, CA



Appendix G: Peak discharge data for gages used in regional analysis.

11176400
Arroyo Valley below Lang Canyon near Livermore, CA

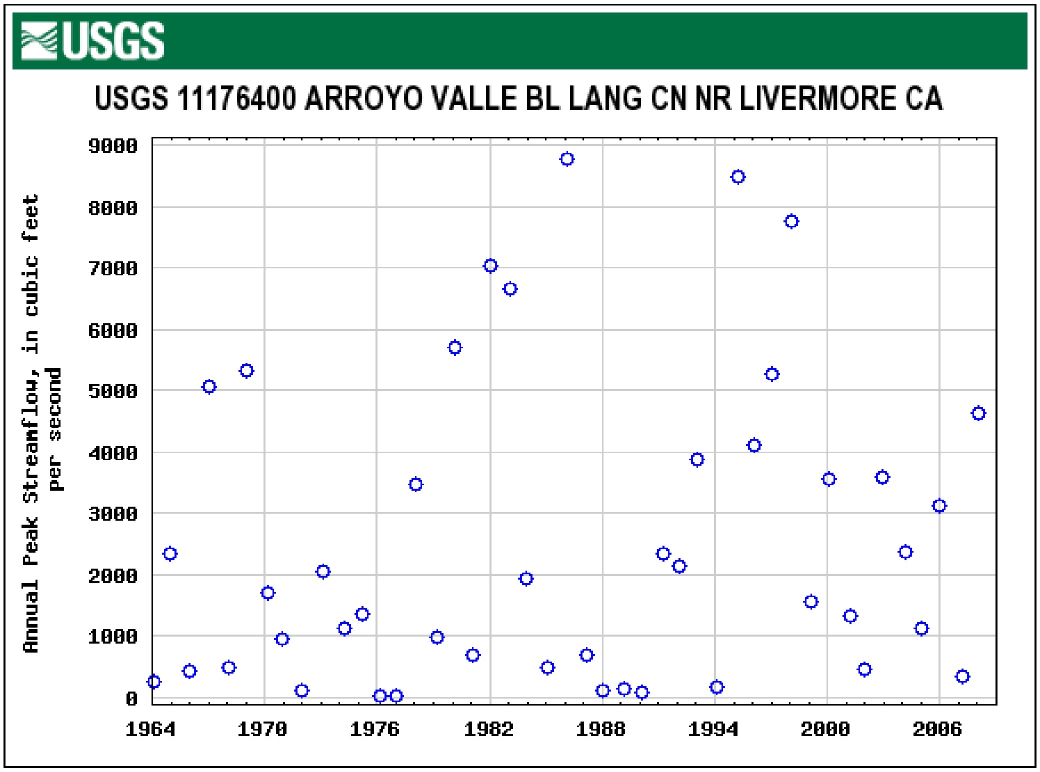
Alameda County, California
Hydrologic Unit Code 18050004
Latitude 37°33'41", Longitude 121°40'58" NAD27
Drainage area 130 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1964	Jan. 21, 1964	3.73	256
1965	Dec. 23, 1964	6.12	2,330
1966	Dec. 29, 1965	4.02	430
1967	Jan. 21, 1967	8.14	5,080
1968	Jan. 30, 1968	4.35	492
1969	Jan. 25, 1969	8.90	5,340
1970	Mar. 01, 1970	6.22	1,710
1971	Dec. 02, 1970	5.28	947
1972	Dec. 25, 1971	3.27	105
1973	Feb. 07, 1973	6.56	2,040
1974	Apr. 01, 1974	5.53	1,130
1975	Mar. 07, 1975	5.80	1,350
1976	Mar. 02, 1976	1.07[6]	8.20
1977	Jan. 03, 1977	1.05	7.00
1978	Jan. 16, 1978	4.13	3,470
1979	Feb. 22, 1979	2.59	989
1980	Feb. 19, 1980	5.40	5,710
1981	Jan. 29, 1981	2.37	685
1982	Jan. 05, 1982	6.22	7,030
1983	Jan. 24, 1983	6.04	6,660
1984	Dec. 25, 1983	3.26	1,940
1985	Feb. 08, 1985	1.99	470
1986	Feb. 17, 1986	7.36	8,790
1987	Feb. 13, 1987	2.24	676
1988	Jan. 17, 1988	1.37	106
1989	Mar. 11, 1989	1.47	148
1990	Feb. 17, 1990	1.31	86.0[E]
1991	Mar. 24, 1991	3.51	2,340
1992	Feb. 15, 1992	3.38	2,130
1993	Jan. 13, 1993	4.45	3,890
1994	Feb. 20, 1994	1.51	166
1995	Mar. 10, 1995	7.18	8,490
1996	Feb. 19, 1996	4.58	4,110
1997	Jan. 23, 1997	5.27	5,280
1998	Feb. 03, 1998	6.73	7,750
1999	Feb. 09, 1999	3.01	1,570
2000	Feb. 13, 2000	4.25	3,560
2001	Mar. 05, 2001	2.82	1,320
2002	Dec. 29, 2001	1.97	448
2003	Dec. 16, 2002	4.27	3,590
2004	Feb. 25, 2004	3.53	2,370
2005	Dec. 31, 2004	2.67	1,130[6]
2006	Dec. 31, 2005	3.98	3,110[6]
2007	Feb. 26, 2007	1.80	328[6]
2008	Jan. 26, 2008	4.65	4,620[6]

- 6 -- Gage datum changed during this year
- 6 -- Discharge affected by Regulation or Diversion
- E -- Only Annual Maximum Peak available for this year

Appendix G: Peak discharge data for gages used in regional analysis.

11176400 (continued)
Arroyo Valley below Lang Canyon near Livermore, CA



Appendix G: Peak discharge data for gages used in regional analysis.

11180500
Dry Creek at Union City, CA

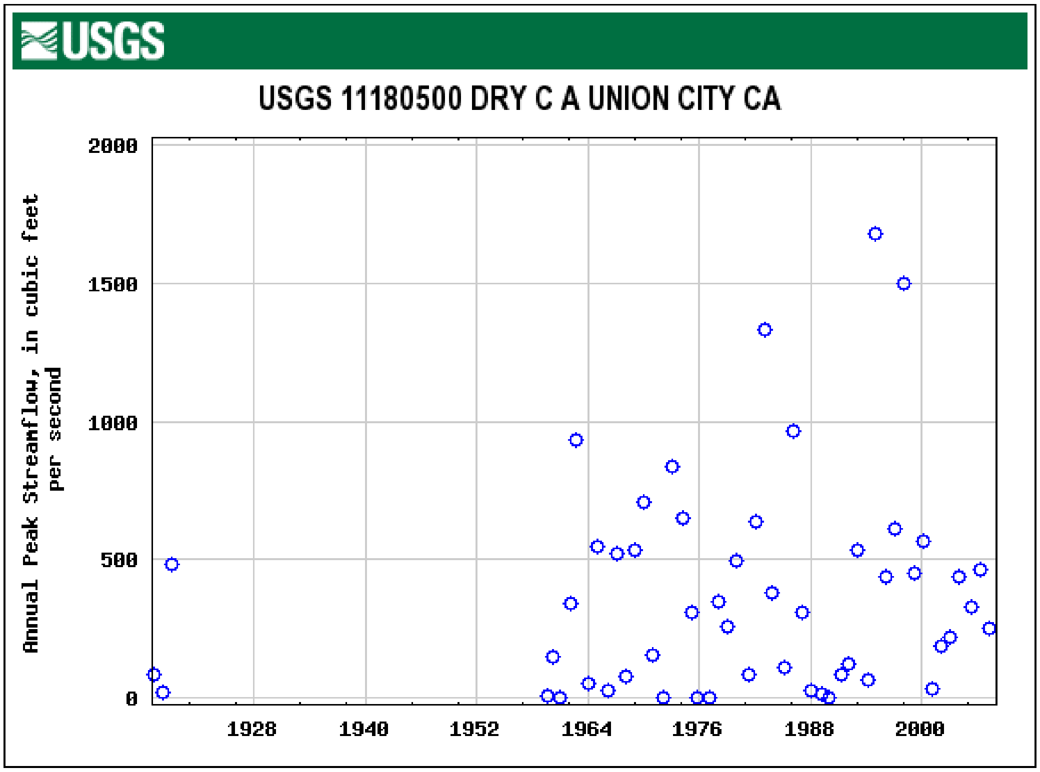
Alameda County, California
Hydrologic Unit Code 18050004
Latitude 37°36'22", Longitude 122°01'22" NAD27
Drainage area 9.39 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1917	Feb. 24, 1917		87.0	1982	Feb. 15, 1982	4.00	637[D]
1918	Mar. 19, 1918		22.5[1]	1983	Jan. 26, 1983	5.14	1,330[D]
1919	Feb. 10, 1919		480	1984	Nov. 24, 1983	3.43	380
1959	Sep. 18, 1959		6.40	1985	Feb. 08, 1985	2.63	109
1960	Feb. 08, 1960		151	1986	Feb. 18, 1986	4.59	965
1961	Nov. 26, 1960	1.73	3.90	1987	Feb. 13, 1987	3.26	313
1962	Feb. 14, 1962	3.50	345	1988	Jan. 17, 1988	2.13	25.0
1963	Oct. 13, 1962	5.27	930	1989	Mar. 25, 1989	1.99	15.0
1964	Jan. 20, 1964	2.44	54.0	1990	Nov. 25, 1989	1.72	4.00[E]
1965	Jan. 05, 1965	[5]	545	1991	Mar. 26, 1991	2.53	86.0
1966	Jan. 30, 1966	2.17	29.0	1992	Feb. 14, 1992	2.68	121
1967	Jan. 30, 1967	3.75	522	1993	Jan. 13, 1993	3.79	537
1968	Jan. 30, 1968	2.50	79.0	1994	Feb. 20, 1994	2.44	66.0
1969	Jan. 25, 1969	3.78	536	1995	Jan. 09, 1995	5.32	1,680
1970	Jan. 21, 1970	4.14	710	1996	Jan. 27, 1996	3.67	441
1971	Dec. 04, 1970	2.81	158	1997	Jan. 02, 1997	4.00	614
1972	Feb. 05, 1972	1.65	2.60	1998	Feb. 03, 1998	5.15	1,500
1973	Jan. 16, 1973	4.37	834	1999	Feb. 07, 1999	3.69	451
1974	Apr. 01, 1974	4.02	650	2000	Feb. 13, 2000	3.91	564
1975	Mar. 25, 1975	3.20	313	2001	Feb. 24, 2001	2.22	37
1976	Oct. 29, 1975	1.72	3.80	2002	Dec. 30, 2001	3.00	188
1977	Jan. 03, 1977	1.62	2.20	2003	Dec. 19, 2002	3.11	221
1978	Jan. 14, 1978	3.35	347	2004	Jan. 01, 2004	3.67	441
1979	Jan. 11, 1979	3.11	258	2005	Mar. 23, 2005	3.41	328
1980	Jan. 13, 1980	3.69	494	2006	Mar. 25, 2006	3.71	462
1981	Mar. 21, 1981	2.51	82.0	2007	Feb. 26, 2007	3.19	249

- 5 -- Gage height is an estimate
- 1 -- Discharge is a Maximum Daily Average
- D -- Base Discharge changed during this year
- E -- Only Annual Maximum Peak available for this year

Appendix G: Peak discharge data for gages used in regional analysis.

11180500 (continued)
Dry Creek at Union City, CA



Appendix G: Peak discharge data for gages used in regional analysis.

11180700
Alameda Creek Flood Channel at Union City, CA

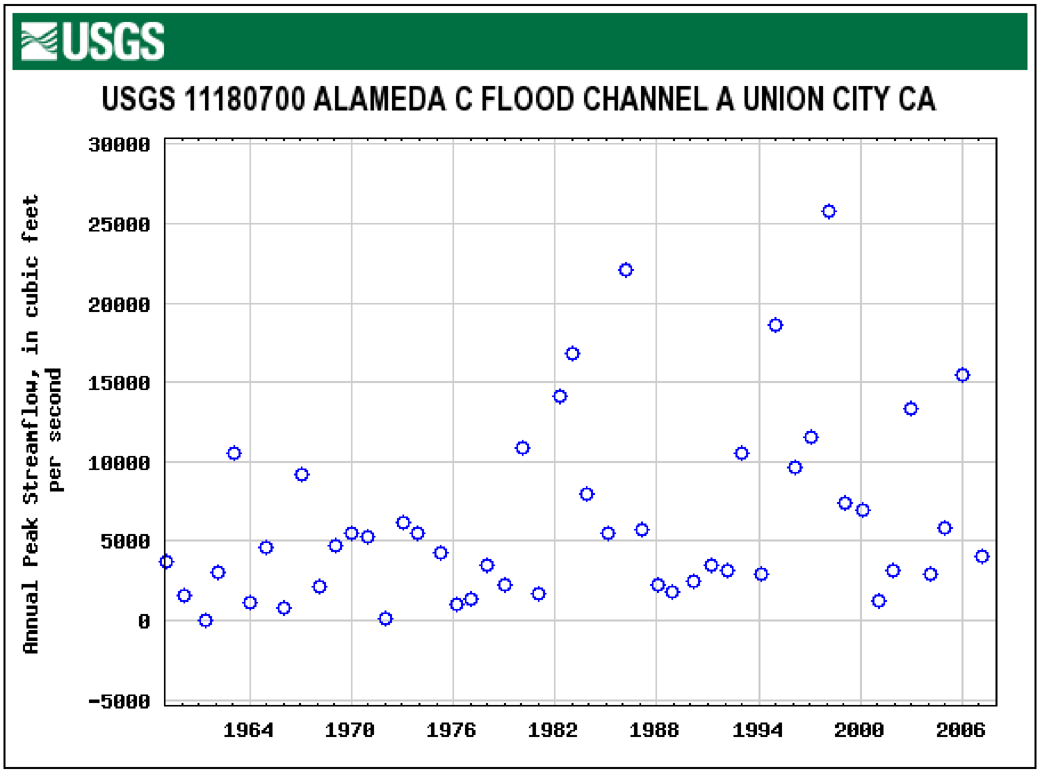
Alameda County, California
Hydrologic Unit Code 18050004
Latitude 37°35'09", Longitude 122°02'50" NAD27
Drainage area 639 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1959	Feb. 16, 1959		3,700	1983	Jan. 24, 1983	16.70	16,800
1960	Feb. 09, 1960		1,600	1984	Nov. 24, 1983	13.53	7,920
1961	1961		0.00	1985	Feb. 08, 1985	12.31	5,530
1962	Feb. 15, 1962	12.66	3,030	1986	Feb. 19, 1986	18.44	22,100
1963	Feb. 01, 1963	20.40	10,500	1987	Feb. 13, 1987	12.74	5,710
1964	Jan. 22, 1964	10.46	1,100	1988	Jan. 16, 1988	10.39	2,240
1965	Dec. 23, 1964	15.98	4,580	1989	Nov. 23, 1988	10.51	1,830
1966	Dec. 29, 1965	9.54	739	1990	Feb. 16, 1990	7.83	2,490[6]
1967	Jan. 22, 1967	15.20	9,150	1991	Mar. 24, 1991	10.09	3,500[6]
1968	Jan. 30, 1968	9.08	2,110	1992	Feb. 15, 1992	10.74	3,190[6]
1969	Jan. 19, 1969	12.51	4,760	1993	Jan. 13, 1993	15.20	10,500[6]
1970	Jan. 21, 1970	12.38	5,530	1994	Feb. 20, 1994	10.87	2,910[6]
1971	Nov. 29, 1970	13.90	5,300[3]	1995	Jan. 09, 1995	17.57	18,600[6]
1972	Dec. 26, 1971	7.19	154	1996	Feb. 21, 1996	15.67	9,610[6]
1973	Jan. 18, 1973	15.20	6,130	1997	Jan. 26, 1997	16.40	11,600[6]
1974	Nov. 06, 1973	14.35	5,470	1998	Feb. 03, 1998	20.43	25,800[6]
1975	Mar. 22, 1975	13.53	4,280	1999	Feb. 09, 1999	14.23	7,420[6]
1976	Mar. 02, 1976	7.93	998	2000	Feb. 14, 2000	13.98	6,900[6]
1977	Jan. 03, 1977	8.18	1,320	2001	Jan. 25, 2001	8.85	1,290[6]
1978	Jan. 16, 1978	10.71	3,430	2002	Dec. 02, 2001	11.13	3,180[6]
1979	Jan. 15, 1979	9.65	2,300	2003	Dec. 16, 2002	16.60	13,300[6]
1980	Feb. 19, 1980	14.71	10,900	2004	Feb. 25, 2004	10.90	2,930[6]
1981	Jan. 29, 1981	9.08	1,710	2005	Dec. 31, 2004	13.12	5,780[6]
1982	Mar. 31, 1982	15.81	14,100	2006	Dec. 31, 2005	17.37	15,500[6]
				2007	Feb. 26, 2007	12.55	4,070[6]

- 3 -- Discharge affected by Dam Failure
- 6 -- Discharge affected by Regulation or Diversion

Appendix G: Peak discharge data for gages used in regional analysis.

11180700 (continued)
Alameda Creek Flood Channel at Union City, CA

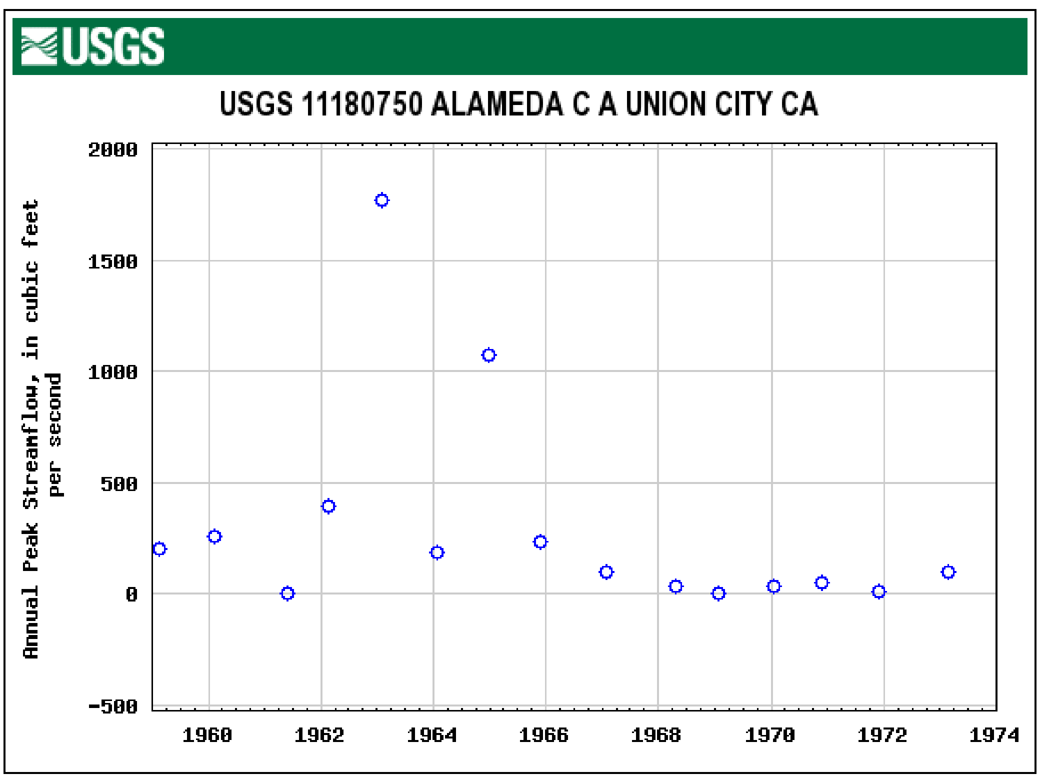


Appendix G: Peak discharge data for gages used in regional analysis.

11180750
Alameda Creek at Union City, CA

Alameda County, California
Hydrologic Unit Code 18050004
Latitude 37°35'46", Longitude 122°03'15" NAD27
Drainage area 653 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1959	Feb. 16, 1959		206	1966	Nov. 24, 1965	11.46	233
1960	Feb. 09, 1960		260	1967	Jan. 21, 1967	10.37	98.0
1961	1961		0.00	1968	Apr. 21, 1968	9.87	37.0
1962	Feb. 15, 1962	13.08	394	1969	Jan. 25, 1969	9.41	1.80
1963	Feb. 01, 1963	19.25	1,770	1970	Jan. 21, 1970	10.83	37.0
1964	Jan. 22, 1964	11.11	187	1971	Nov. 29, 1970	11.39	52.0
1965	Dec. 23, 1964	15.98	1,070	1972	Dec. 02, 1971	10.28	14.0
				1973	Feb. 27, 1973	11.81	102



Appendix G: Peak discharge data for gages used in regional analysis.

11180960
Cull Creek above Cull C Reservoir near Castro Valley, CA

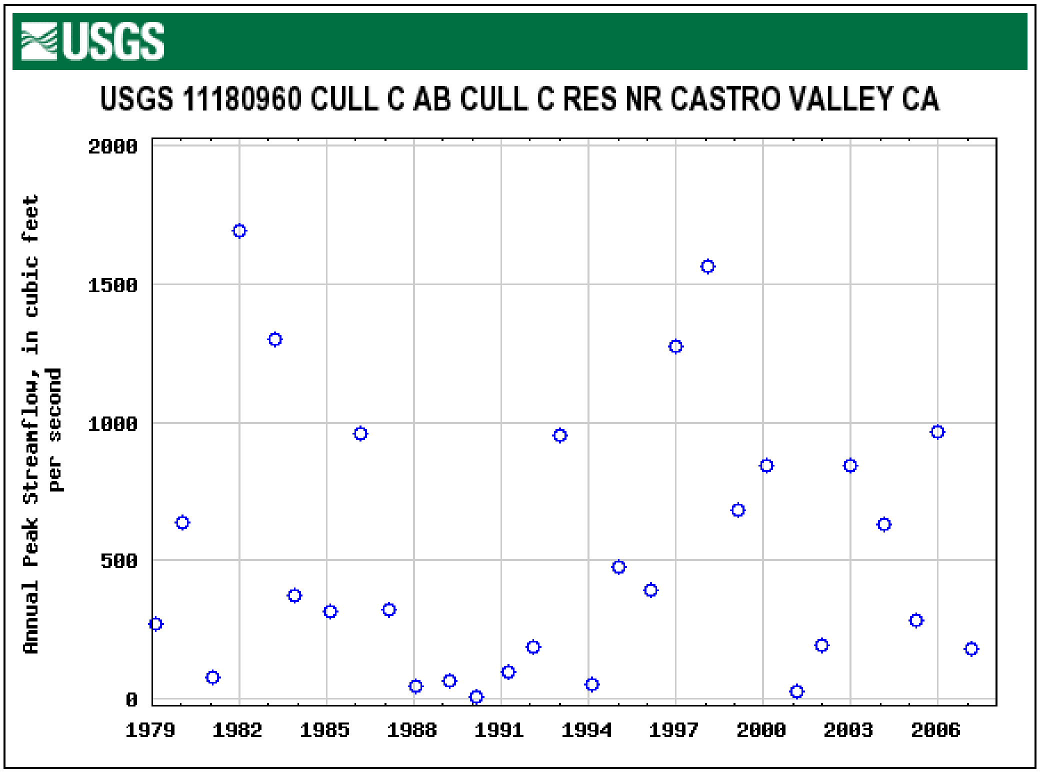
Alameda County, California
Hydrologic Unit Code 18050004
Latitude 37°43'04", Longitude 122°03'12" NAD27
Drainage area 5.79 square miles

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1979	Feb. 21, 1979	2.92	274	1993	Jan. 13, 1993	6.14	953
1980	Jan. 13, 1980	4.28	638	1994	Feb. 19, 1994	1.98	50
1981	Jan. 28, 1981	2.07	79	1995	Jan. 09, 1995	4.50	477
1982	Jan. 05, 1982	8.71	1,690	1996	Feb. 21, 1996	4.14	391
1983	Mar. 13, 1983	7.36	1,300	1997	Jan. 02, 1997	7.16	1,270
1984	Nov. 24, 1983	4.32	373	1998	Feb. 03, 1998	8.21	1,560
1985	Feb. 08, 1985	4.08	315	1999	Feb. 07, 1999	4.99	683
1986	Feb. 18, 1986	6.15	956	2000	Feb. 13, 2000	5.57	841
1987	Feb. 13, 1987	4.11	322	2001	Feb. 23, 2001		30[1,2]
1988	Jan. 16, 1988	2.41	46	2002	Dec. 30, 2001	2.87	197
1989	Mar. 25, 1989	2.58	67	2003	Dec. 16, 2002	5.92	842
1990	Feb. 16, 1990	1.41	7.2[E]	2004	Feb. 25, 2004	4.36	634
1991	Mar. 26, 1991	2.47	99	2005	Mar. 23, 2005	2.82	287
1992	Feb. 12, 1992	3.09	186	2006	Dec. 31, 2005	5.62	967
				2007	Feb. 26, 2007	2.31	182

- 1 -- Discharge is a Maximum Daily Average
- 2 -- Discharge is an Estimate
- E -- Only Annual Maximum Peak available for this year

Appendix G: Peak discharge data for gages used in regional analysis.

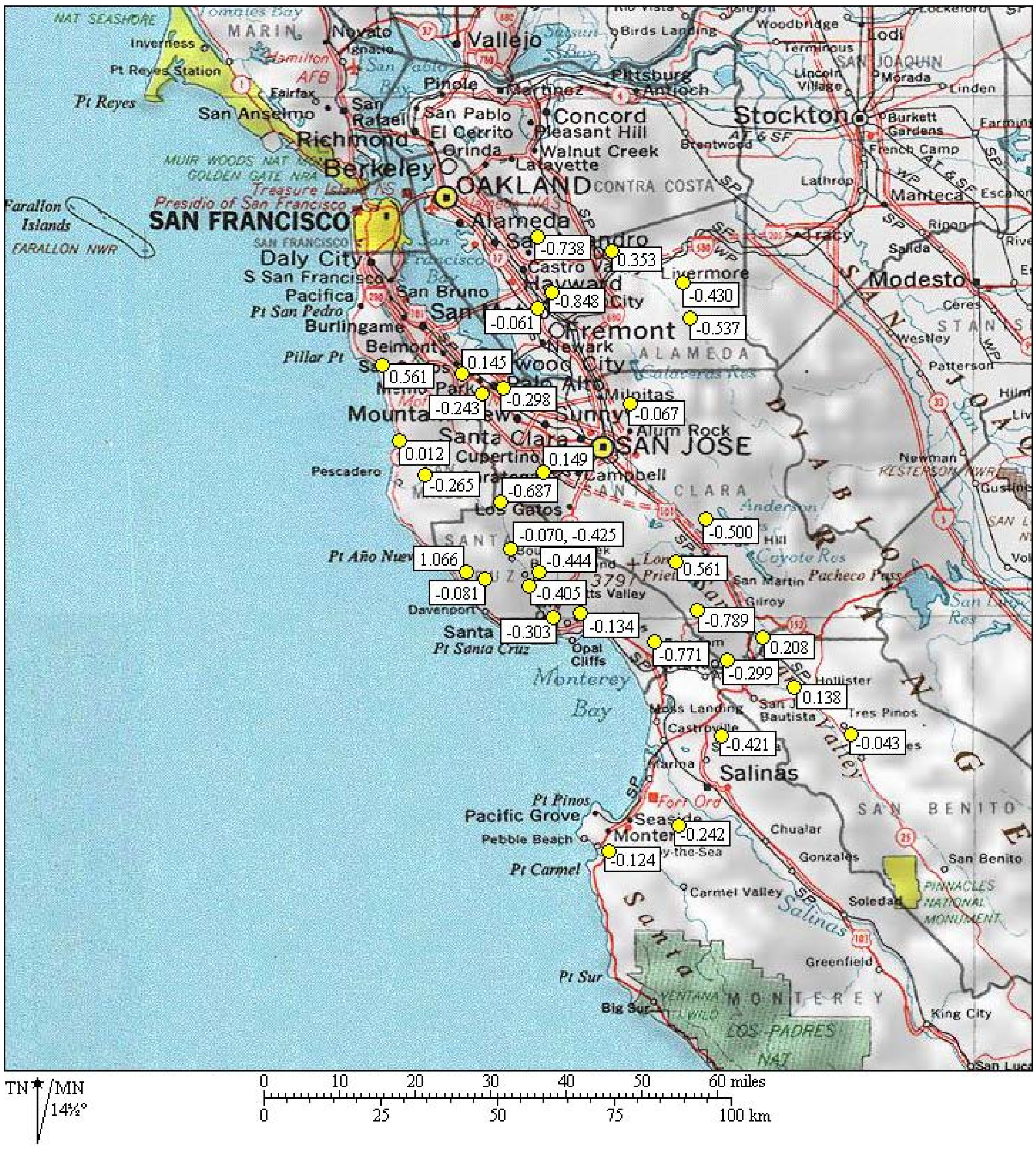
11180960 (continued)
Cull Creek above Cull C Reservoir near Castro Valley, CA



Appendix H: Stations used in regional skew analysis for developing a generalized skew coefficient to be weighted with Scott Creek above Little Creek 11161900

Appendix H: Stations used in regional skew analysis for developing a generalized skew coefficient to be weighted with Scott Creek above Little Creek 11161900

Gaging station location and skew

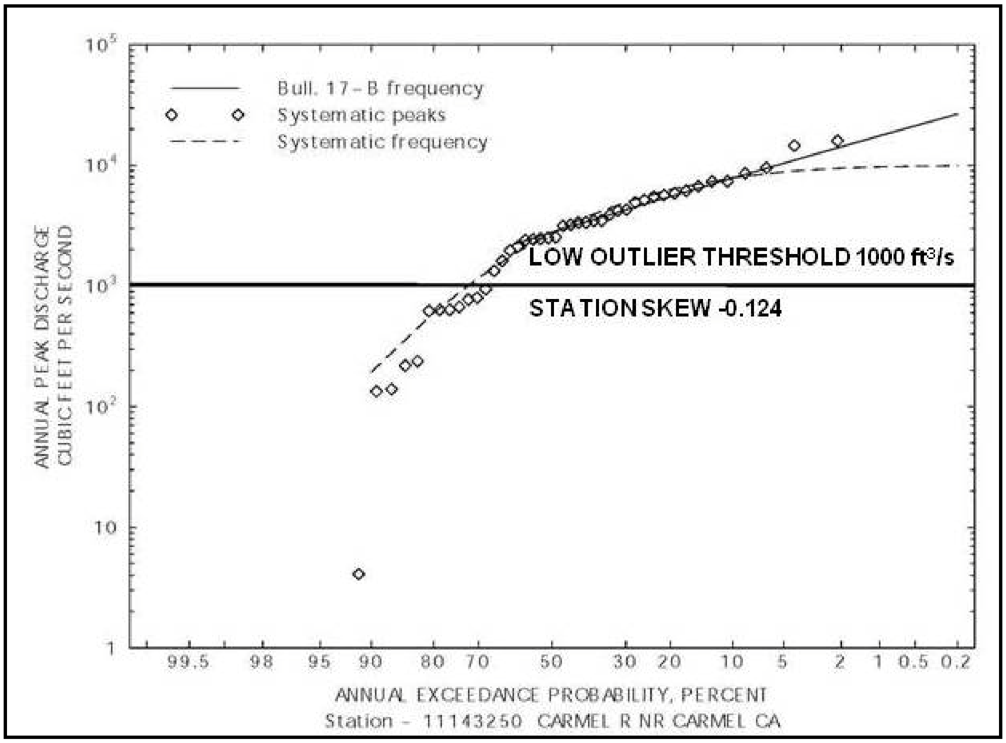


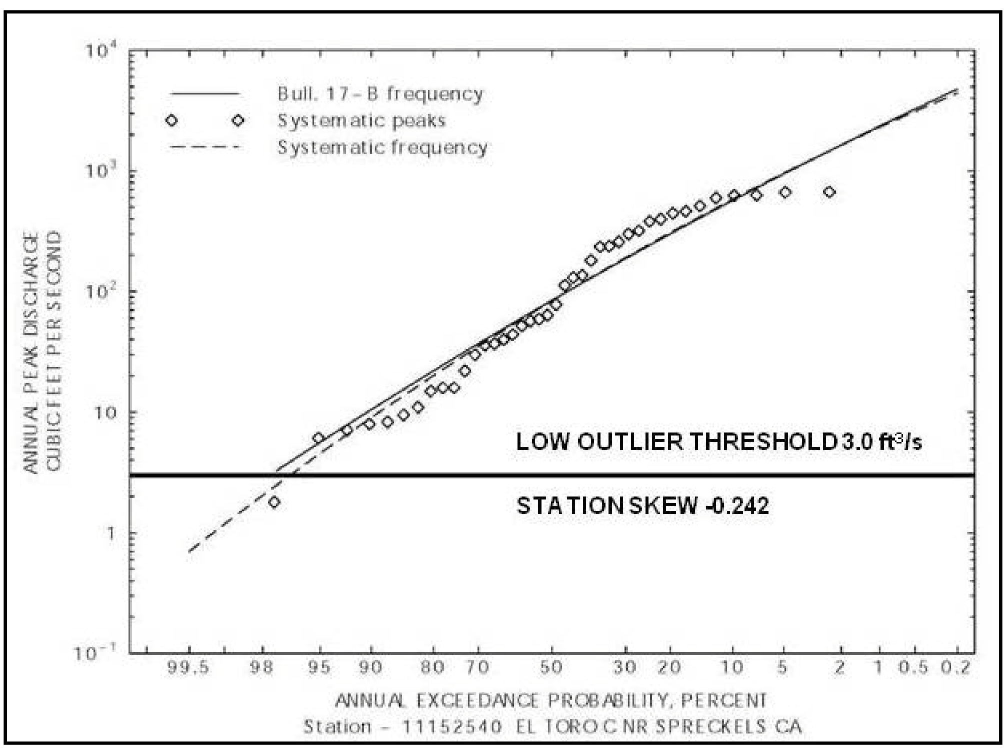
Appendix H: Stations used in regional skew analysis for developing a generalized skew coefficient to be weighted with Scott Creek above Little Creek near Davenport 11161900

*** not used in final analysis**

STAT NO.	STATION NAME	NAD27 LAT	NAD27 LONG	PERIOD OF RECORD	NO. PEAKS IN RECORD	WY NOT USED (REG, URB, AUTO LOW)	UNADJUSTED STAT SKEW	LOW OUT THRESHOLD	HIGH OUT THRESHOLD	PEAKS REMOVED USING 17B	NO. PEAKS USED	STATION SKEW	LOW OUT THRESHOLD	ADDITONAL PEAKS REMOVED	NO. PEAKS USED IN FINAL ANALYSIS	STATION SKEW	Cb	FINAL STAT SKEW
11143250	Carmel R nr Carmel	36 32 21	121 52 46	1963 2008	46		-0.870	93	57,259	1976, 77, 88, 89	42	-0.870	1000	1964, 66, 68, 71, 72, 85 87, 90, 94, 2002, 07	31	-0.104	1.194	-0.124
11152540	El Toro Ck nr Speckels	36 35 00	121 42 50	1962 2001	40		-0.326	1	6,071		40	-0.326	3	1964	39	-0.210	1.154	-0.242
11152600	Gabilan Ck nr Salinas	36 45 21	121 36 34	1971 2008	38	1982	-0.362	9	3,473		37	-0.362			37	-0.362	1.162	-0.421
*11152900	Cedar Ck nr Bell Station	37 03 00	121 19 35	1962 1982	21		-1.857	109	4,458	1968, 72, 77, 76	17	-0.367	120	1971	16	0.181	1.375	0.249
11153700	Pajaro R nr Gilroy	36 56 54	121 30 39	1960 1981	22		-0.958	4	145,282		22	-0.958	100	1961, 68, 72, 76, 77	17	0.154	1.353	0.208
11153900	Uvas Ck ab Uvas Res, nr Morgan Hill	37 05 34	121 43 02	1962 1982	21		-1.848	1,152	7,703	1972, 76, 77	18	-0.180	1500	1966, 71	18	0.421	1.333	0.561
*11154000	Uvas Ck nr Morgan Hill	37 04 00	121 41 30	1931 1957	27		-0.392	230	24,445		27	-0.392	500	1931, 48	25	-0.020	1.240	-0.025
11154100	Bodfish Ck nr Gilroy	37 00 15	121 39 58	1960 1982	23		-1.036	27	3,409	1976, 77	21	-0.614	27		21	-0.614	1.286	-0.789
11157500	Tres Pinos Ck nr Tres Pinos	36 45 57	121 17 55	1938 1940 1983 1997 2008	57	1938	-0.524	3	121,374		56	-0.524	20	1947, 61, 2007	53	-0.039	1.113	-0.043
11158600	San Benito R at Hwy 156 nr Hollister	36 51 07	121 25 44	1971 2008	38	2002	-0.650	0	763,945		37	-0.650	95	1976, 77, 81, 88, 89 90, 2007	30	0.115	1.200	0.138
11159000	Pajaro R at Chittenden	36 54 01	121 35 48	1938 1940 2008	70	1938	-0.924	47	175,353	1961, 77	67	-0.807	300	1948, 68, 72, 76, 88 89, 90	60	-0.272	1.100	-0.299
11159200	Corralitos Ck at Freedom	36 56 22	121 46 10	1956 2007	52	1978- 2007	-0.836	34	14,212		22	-0.836	200	1961, 66, 72, 76, 77	17	-0.436	1.353	-0.590
*11159690	Aptos Ck nr Aptos	37 00 06	121 54 18	1972 1983	12		-0.643	7	13,428		12	-0.643			12	-0.643	1.500	-0.965
*11159700	Aptos Ck at Aptos	36 58 35	121 54 05	1959 1972	14		-0.895	15	8,245		14	-0.895	100	1961, 66, 72	11	-0.249	1.545	-0.385
11160000	Soquel Ck at Soquel	36 59 29	121 57 17	1951 2008	59		-0.718	279	26,746	1961, 76, 77	56	-0.275	400	1972	55	-0.154	1.109	-0.171
11160020	San Lorenzo R nr Boulder City	37 12 24	122 08 38	1969 1992 1997	25		-0.632	5	5,574		25	-0.632	20	1976, 77	23	-0.545	1.261	-0.687
11160060	Bear Ck at Boulder Ck	37 07 40	122 06 57	1978 1992 1997	16		-0.051	76	9,697		16	-0.051			16	-0.051	1.375	-0.070
11160070	Boulder Ck at Boulder Ck	37 07 36	122 07 18	1977 1992 1997	17		-0.309	181	5,105	1977	16	-0.309			16	-0.309	1.375	-0.425
11160300	Zayante Ck at Zayante	37 05 10	122 02 45	1958 1992 1997	36		-0.884	15	32,308		36	-0.884	300	1961, 66, 72, 76, 77 81, 88, 89, 90	27	-0.363	1.222	-0.444
*11160430	Bean Ck ar Scotts Valley	37 03 19	122 02 25	1989 2007	19	2003	-0.844	52	5,807		18	-0.844			18	-0.844	1.333	-1.125
11160500	San Lorenzo R at Big Trees	37 02 40	122 04 17	1937 2008	72		-0.653	248	109,009		72	-0.653	2000	1939, 44, 47, 48, 61, 66 72, 76, 77, 88, 89, 90 2001, 07	58	-0.367	1.103	-0.405
11161500	Branciforte Ck at Santa Cruz	36 59 10	122 00 48	1941 1943 1953 1968	19		-0.230	189	11,870		19	-0.230			19	-0.230	1.316	-0.303
11161800	San Vicente Ck nr Davenport	37 03 19	122 10 52	1970 1983	14		-0.057	6	4,461		14	-0.057			14	-0.057	1.429	-0.081
11161900	Scott Creek above Little Creek	37 03 51	122 13 42		20		-0.393	72	11,723		20	-0.393	250	1939, 61, 66, 72	16	0.820	1.375	1.128
11162500	Pescadero Ck nr Pescadero	37 15 39	122 19 40	1952 2008	57		-0.740	130	33,399	1976, 77	55	-0.530	300	1961, 72	53	-0.238	1.113	-0.265
*11162540	Butano Ck nr Pescadero	37 14 01	122 21 56	1962 1974	13		-2.111	699	1,990	1966, 71, 72	10	-1.144			10	-1.144	1.600	-1.830
11162570	San Gregorio Ck at San Gregorio	37 19 33	122 23 08	1970 1995 1997 2002 2005 2008	32	1977	-0.602	600	11,085	1972, 76	29	0.003			29	0.003	1.207	0.004
11162630	Pilarcitos Ck at Half Moon Bay	37 28 00	122 25 59	1967 2008	42		-0.606	47	8,084		42	-0.606	300	1972, 77, 76, 81, 90 94, 2001, 07	34	0.475	1.176	0.559
11162800	Redwood Ck nr Menlo Park	37 26 58	122 13 57	1960 1997	38		-0.733	38	1,144	1961	37	-0.733	200	1961, 64, 65, 68, 72, 76 77, 79, 81, 84, 88, 89 90, 91, 94	23	0.115	1.261	0.145
*11162900	Sharon Ck nr Menlo Park	37 25 45	122 13 02	1959 1969	11		-0.543	20	120		11	-0.543	30	1959, 60, 61, 65	7	-0.265	1.857	-0.492
11164500	San Francisquito Ck at Stanford University	37 25 24	122 11 18	1932 1941 1951 2007	68		-1.048	201	14,105	1931, 39, 57, 61, 76, 77	62	-0.290	550	1954, 89, 90, 2007	58	-0.220	1.103	-0.243
11166000	Matadero Ck at Palo Alto	37 25 18	122 08 04	1953 1991	41	1993- 2007	-0.833	23	4,041		39	-0.833	60	1954, 57, 61	36	-0.255	1.167	-0.298
11169500	Saratoga Ck at Saratoga	37 15 16	122 02 18	1934 2007	75		-0.066	20	7,585		75	-0.066	105	1947, 76, 77, 89, 2007	70	0.137	1.086	0.149
11170000	Coyote Ck nr Madrone	37 10 06	121 38 55	1903 1905 1912 1917 1935	80	1936- 1987	-0.932	3	186,172		28	-0.932	2200	1908, 12, 18, 20, 24 25, 29, 31, 33, 34	18	-0.375	1.333	-0.500
*11171500	Coyote Ck nr Edenvale	37 16 15	121 47 47	1917 1934	18	1935- 1962	-0.825	7	150,673		18	-0.825	340	1924, 29, 31	15	-0.675	1.400	-0.945
11172100	Upper Penitencia Ck at San Jose	37 23 43	121 49 38	1958 1962 1987 1997	28		-1.305	45	4,781	1972, 76, 77	25	-0.285	150	1964, 66, 87	22	-0.053	1.273	-0.067
11176000	Arroyo Mocho nr Livermore	37 37 35	121 42 13	1964 2001	38		-0.371	4	13,728		38	-0.371			38	-0.371	1.158	-0.430
11176200	Arroyo Mocho nr Pleasanton	37 41 26	121 52 20	1963 1985	23		-0.076	39	8,879		23	-0.076	200	1964, 66, 72, 76, 77	18	0.265	1.333	0.353
11176400	Arroyo Valle Blw Lang Cyn nr Livermore	37 33 41	121 40 58	1964 2004	41	2005- 2007	-0.720	40	50,605	1976, 77	39	-0.646	450	1966, 72, 88, 89, 90, 94 2002	32	-0.452	1.188	-0.537
11180500	Dry Ck at Union City	37 36 22	122 01 22	1917 1919 1959 2007	52		-1.038	1	21,110		52	-1.038	20	1959, 61, 72, 76, 77 89, 90	47	-0.752	1.128	-0.848
11180700	Alameda Ck Flood Channel at Union City	37 35 09	122 02 50	1959 1989	49	1971 1990- 2007	-0.050	432	51,077	1961, 72	28	-0.050			28	-0.050	1.214	-0.061
*11180750	Alameda Ck at Union City	37 35 46	122 03 15	1959 1973	15		0.027	8	2,927	1961, 69	13	0.027	45	1968, 70, 72	10	0.130	1.600	0.208
11180960	Cull Ck ab Cull Ck Res nr Castro Valley	37 43 04	122 03 12	1979 2007	29		-0.606	19	6,328	1990	28	-0.606	230	1981, 88, 89, 91, 92, 94 2001, 02, 07	19	-0.561	1.316	-0.738

Appendix H: Stations used in regional skew analysis for developing a generalized skew coefficient to be weighted with Scott Creek above Little Creek 11161900





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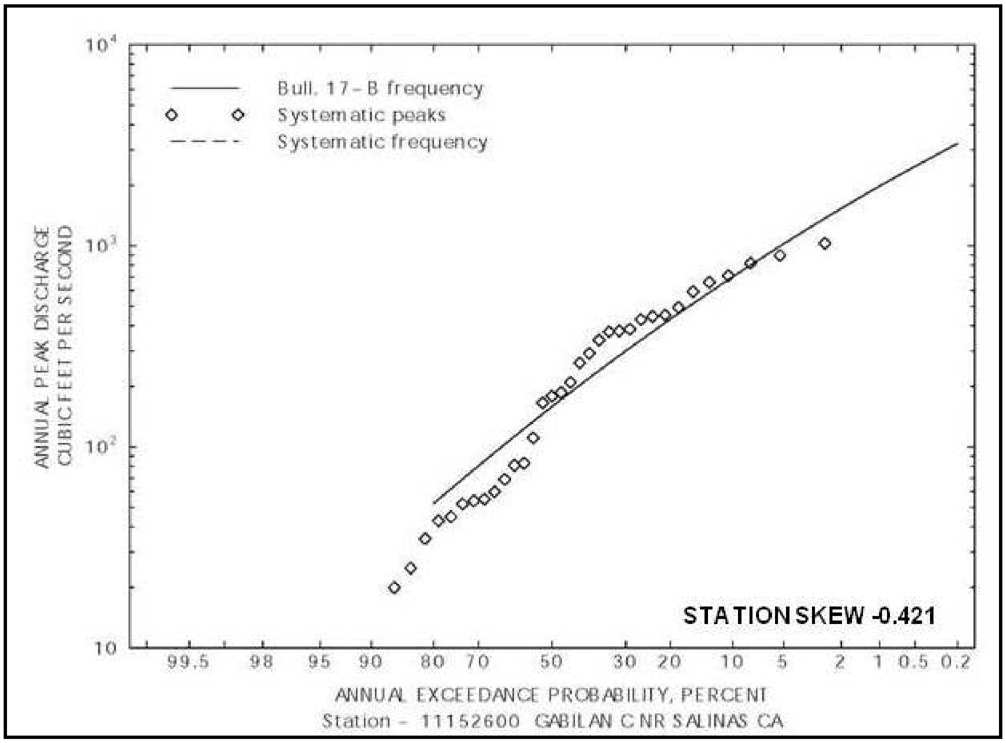

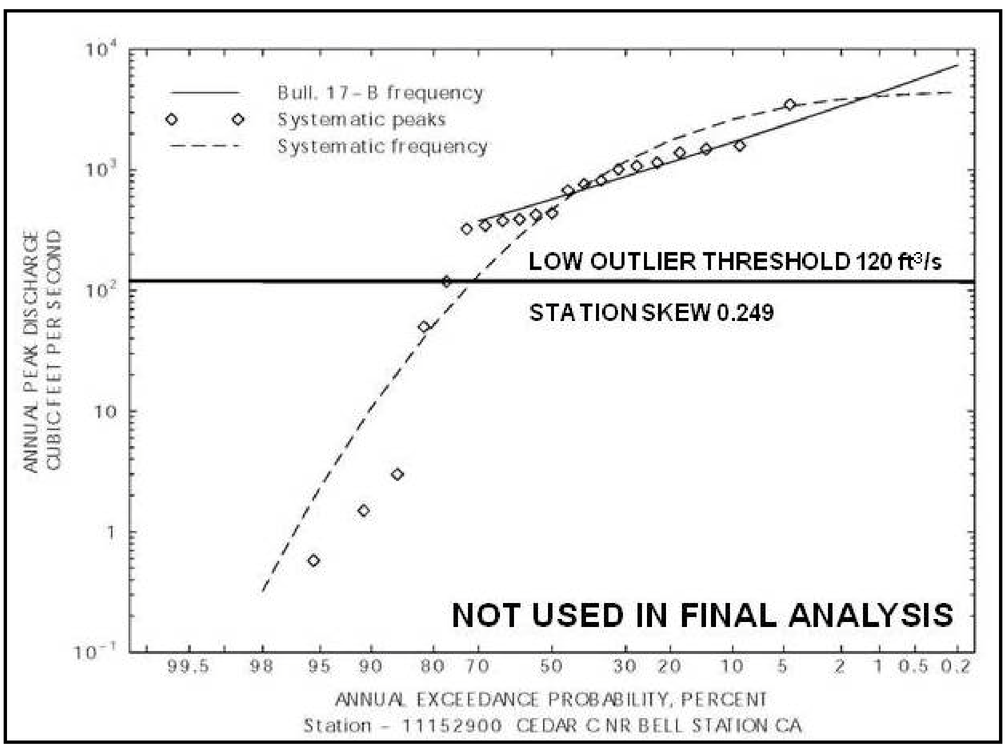

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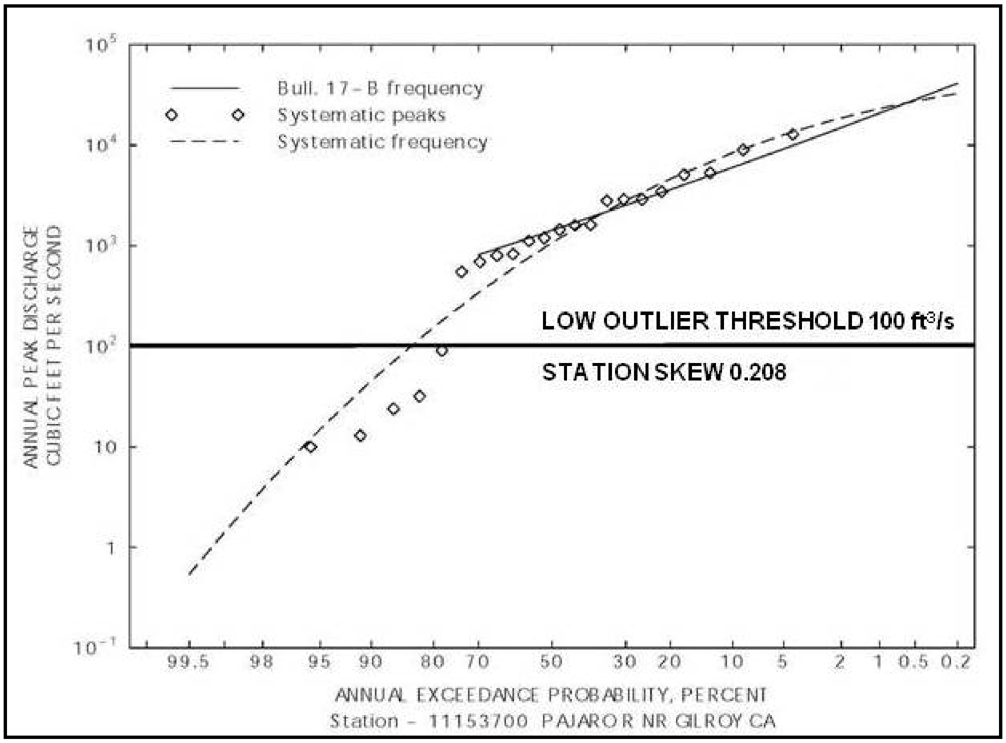

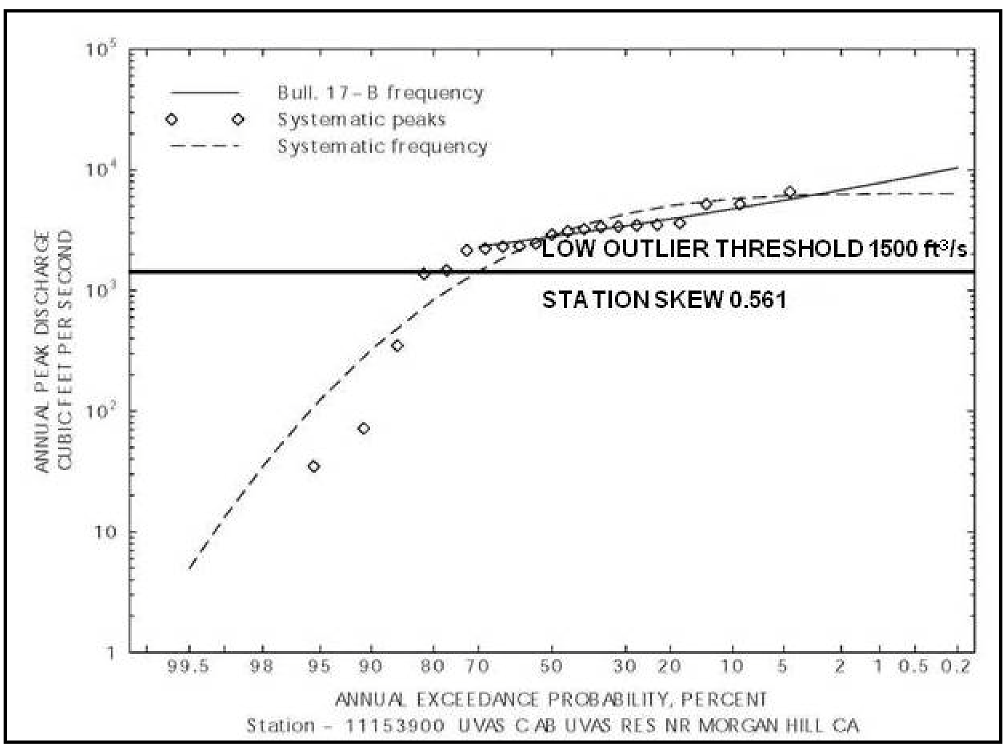

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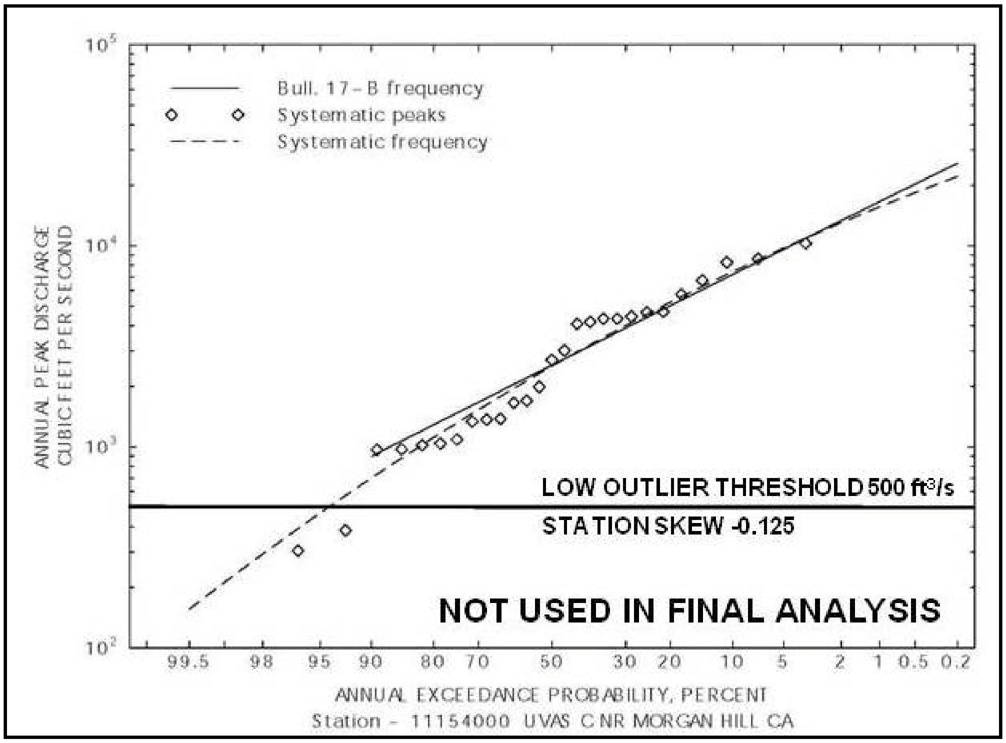

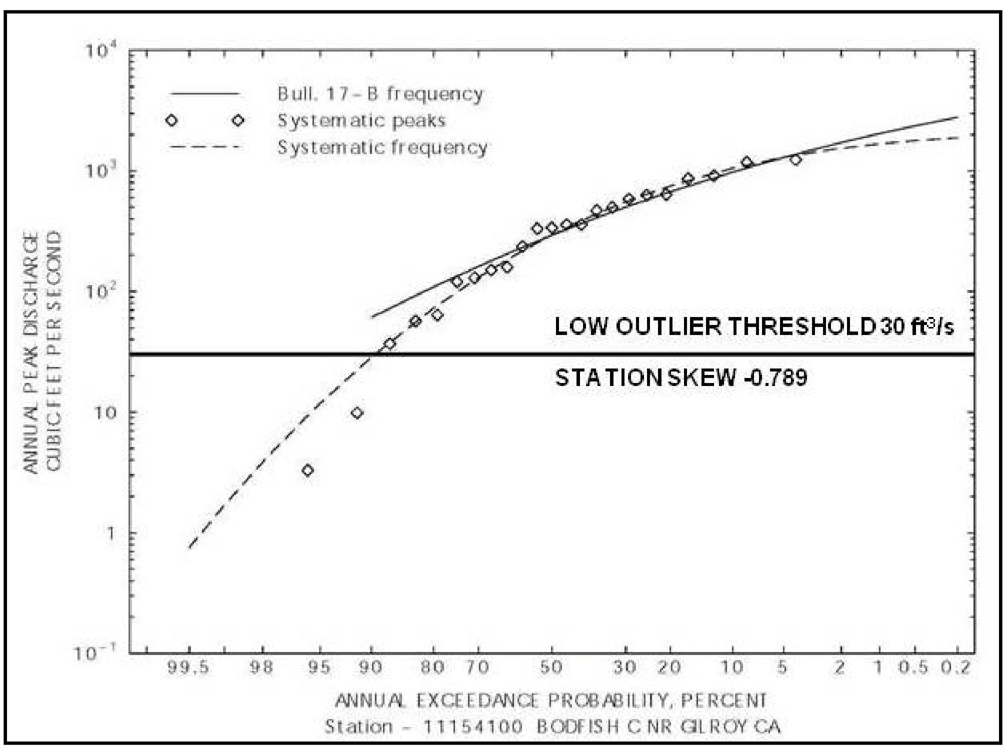

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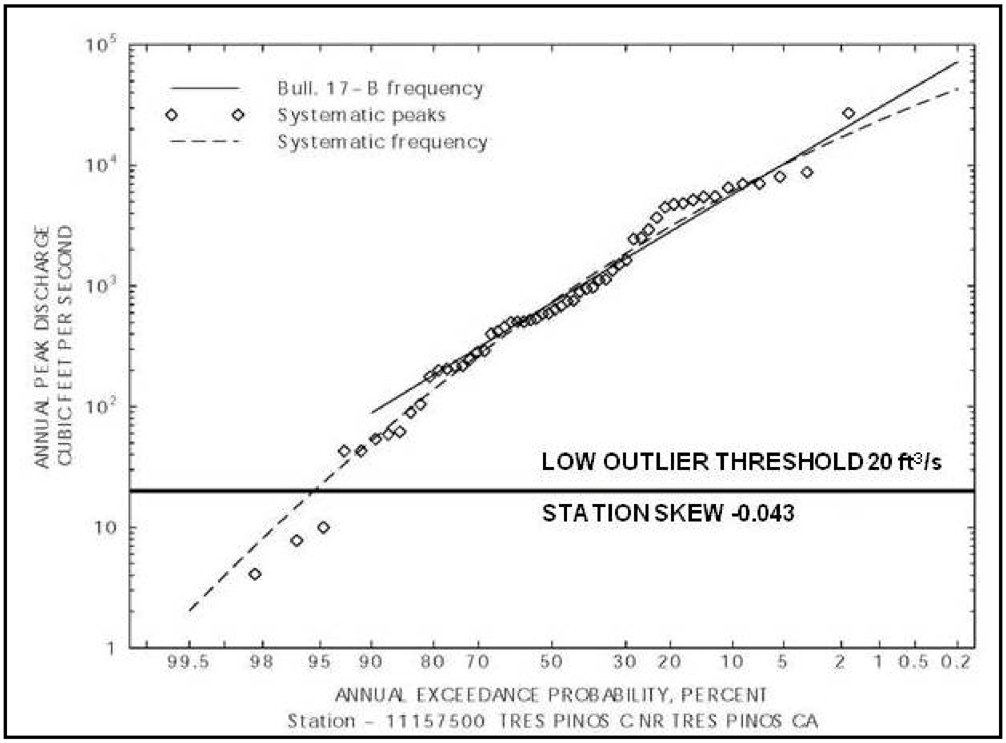

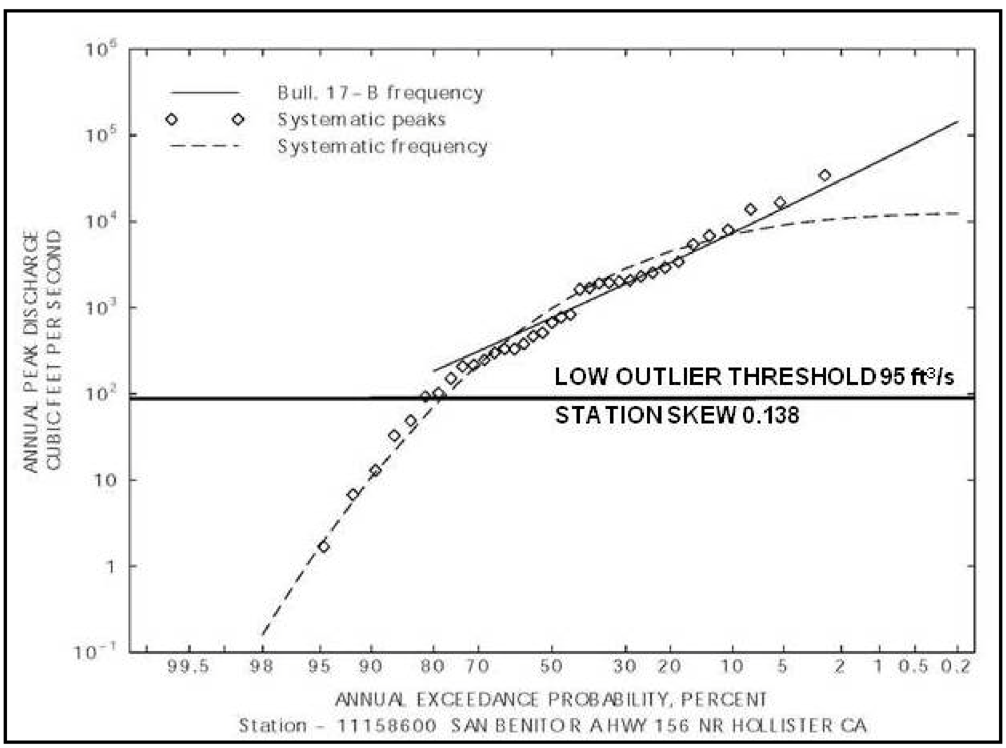

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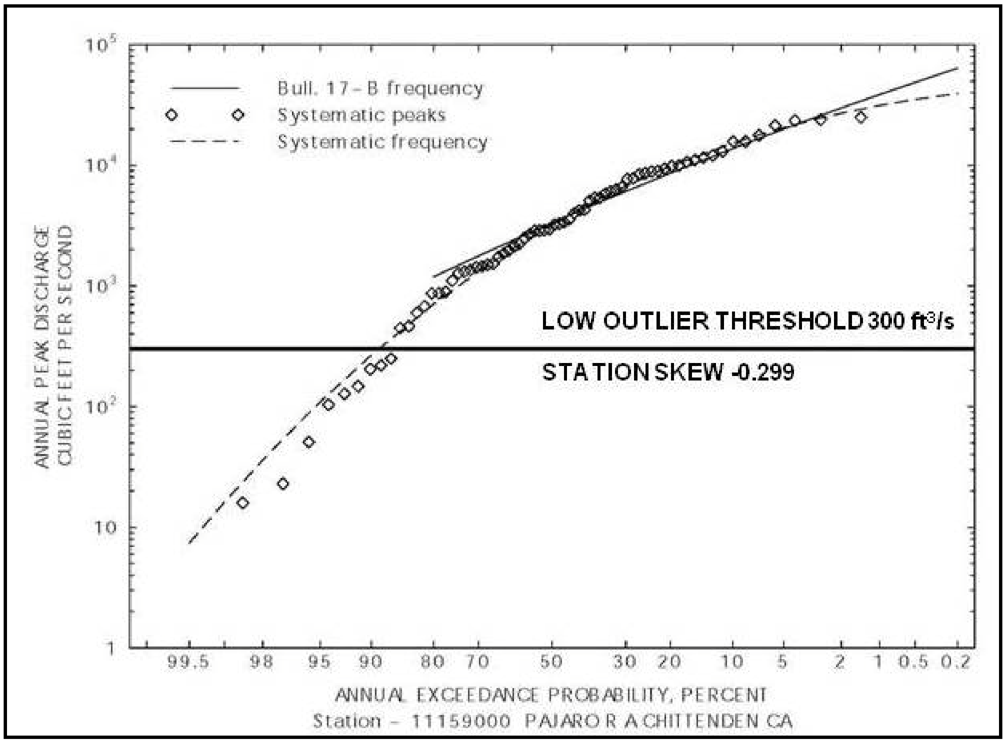

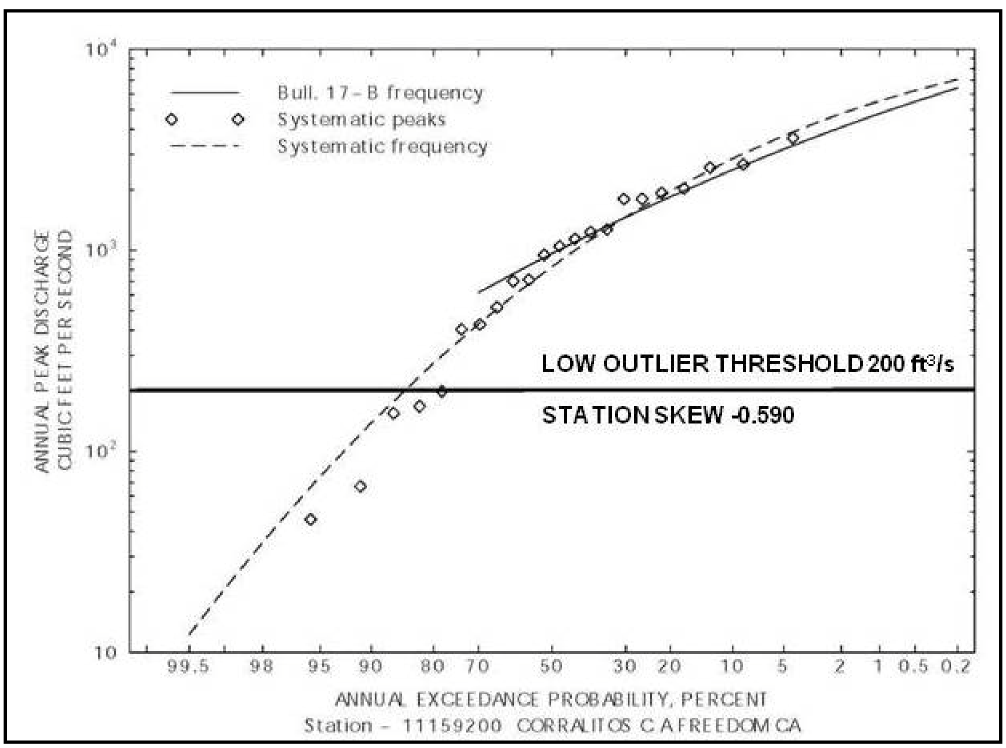

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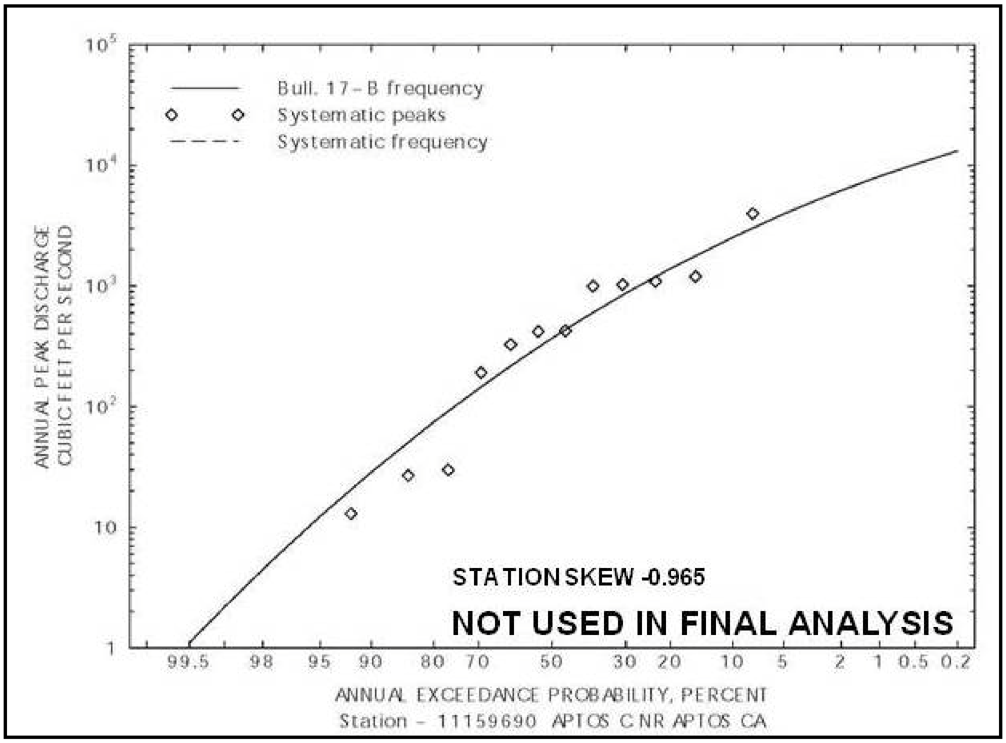

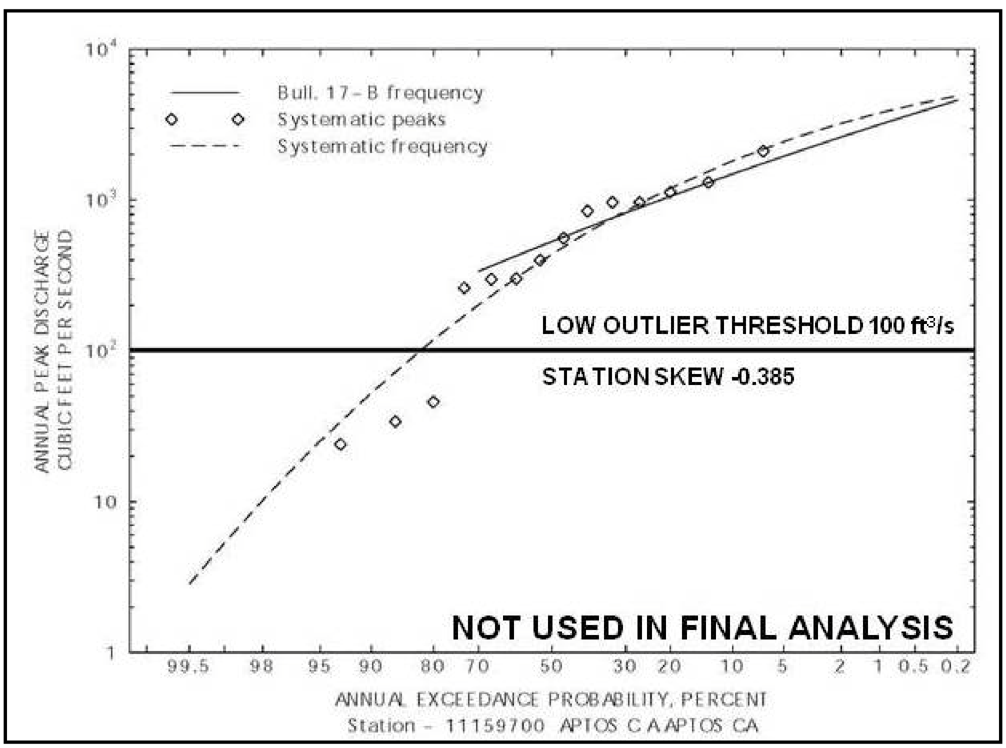

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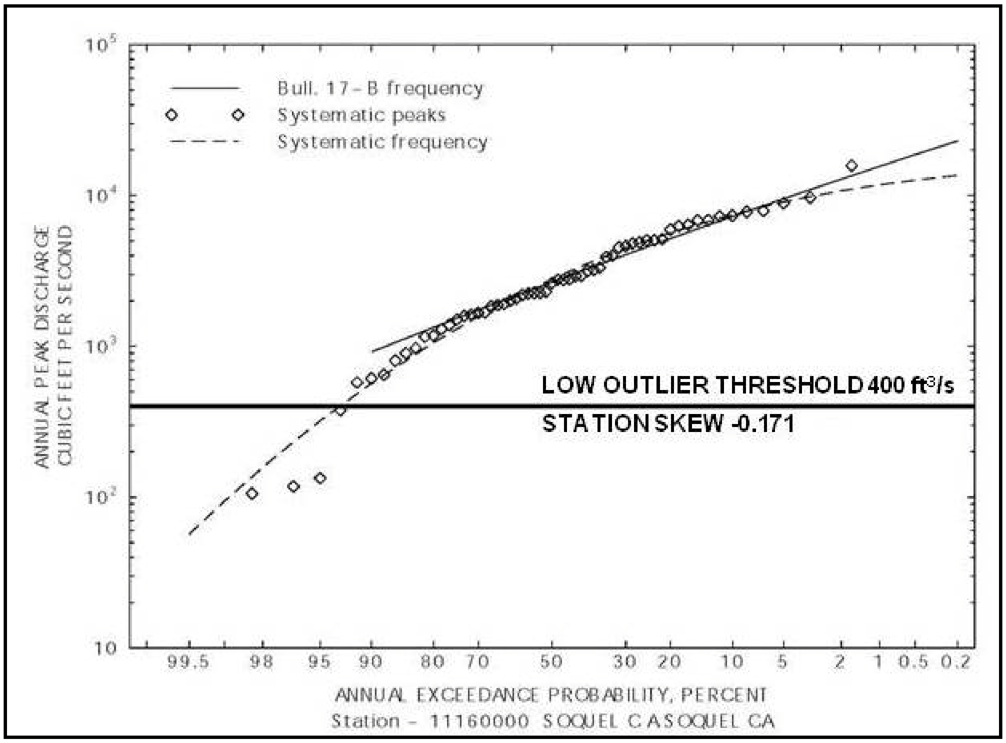

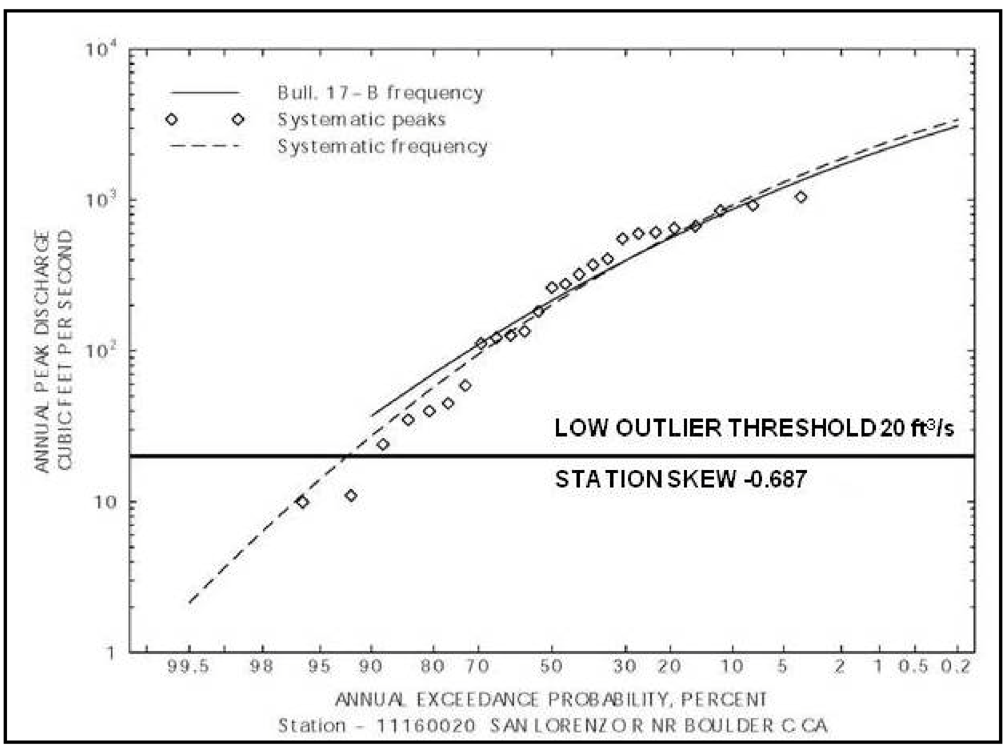

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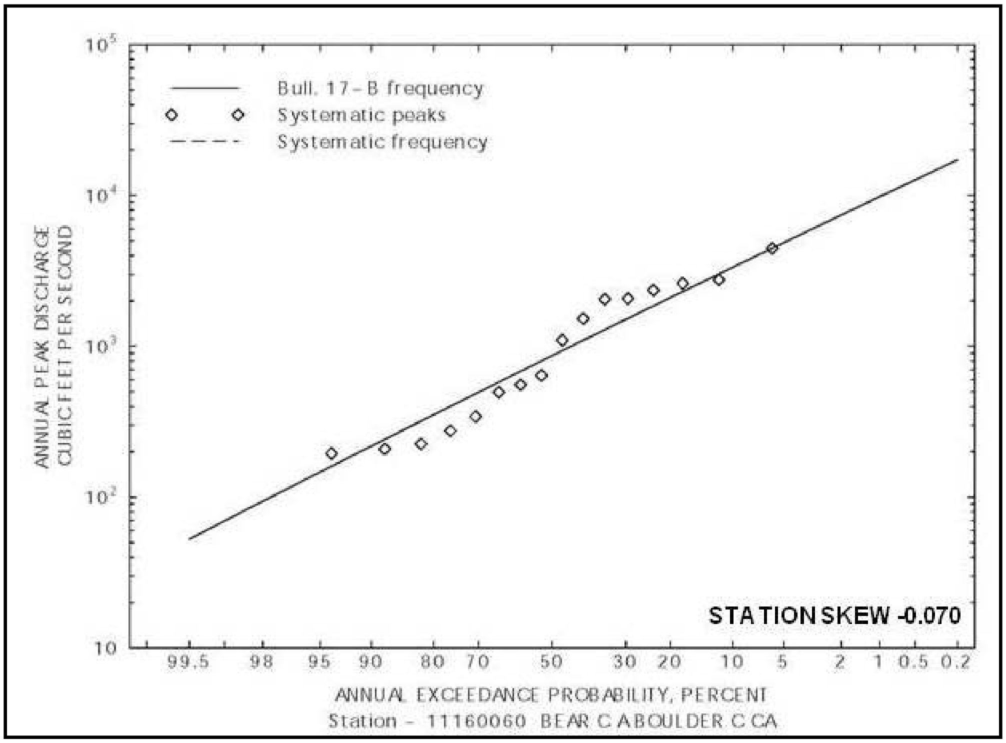

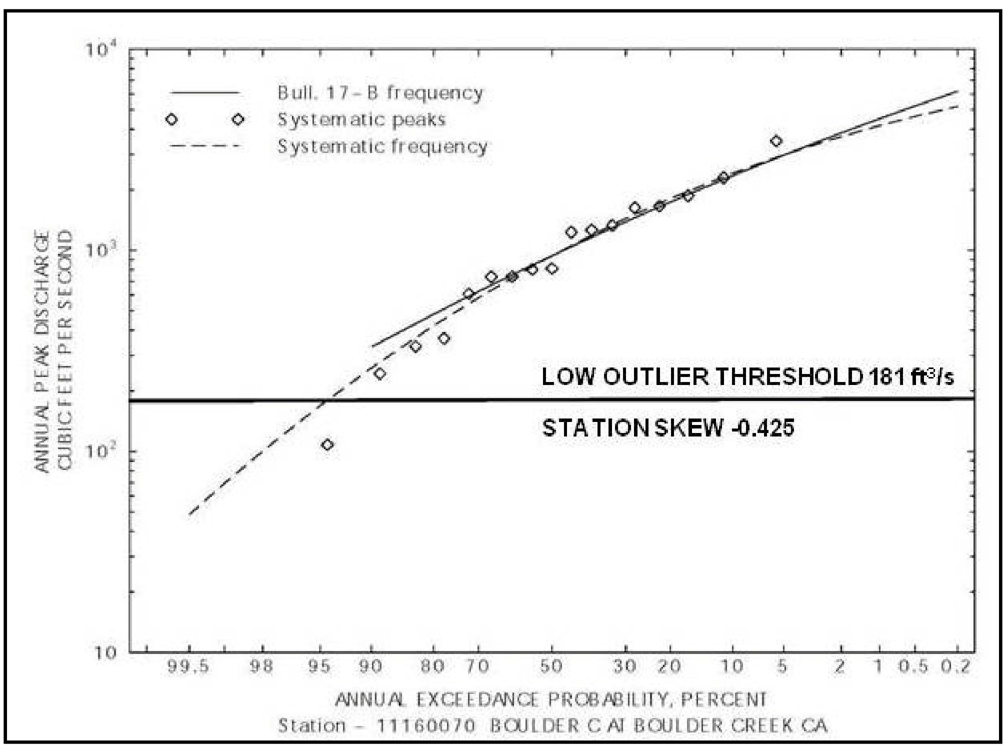

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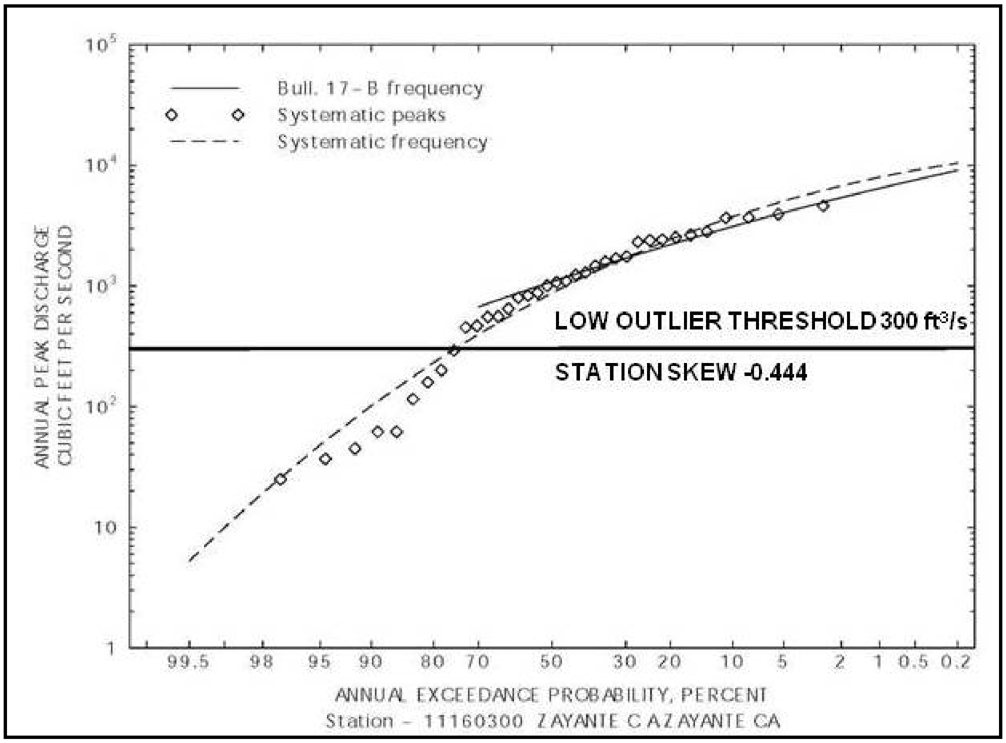

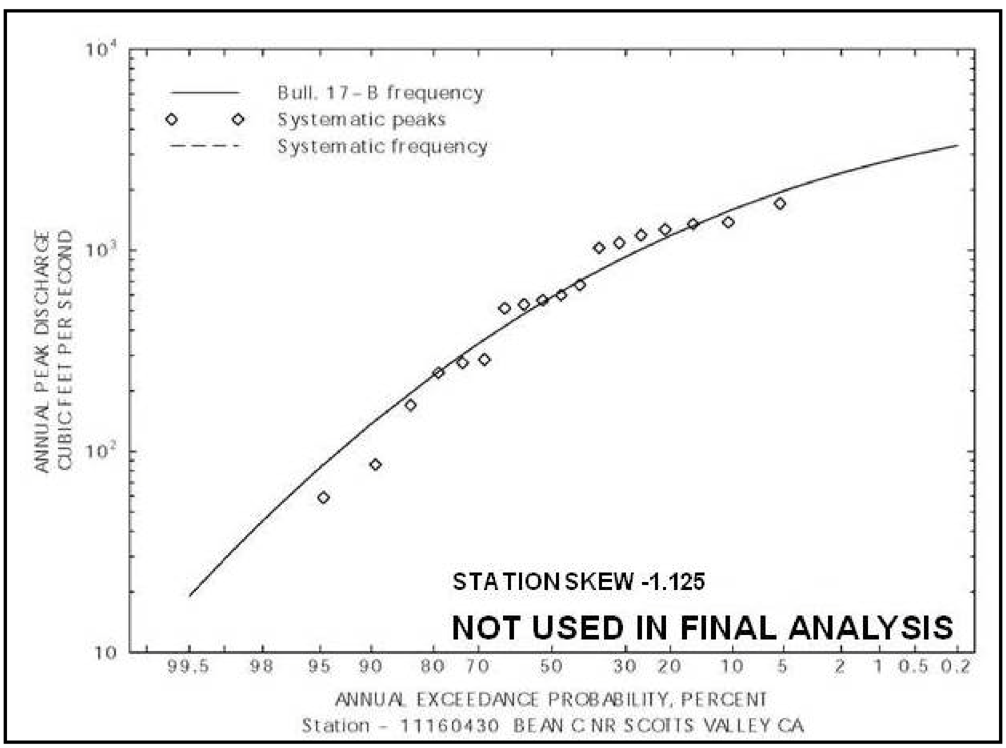

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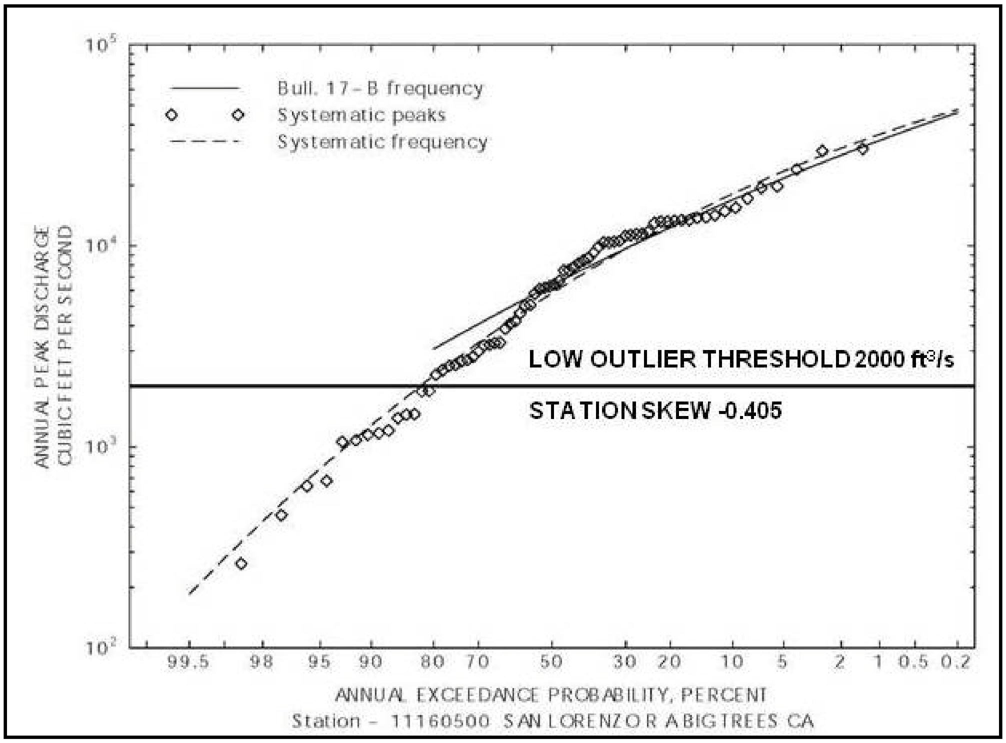

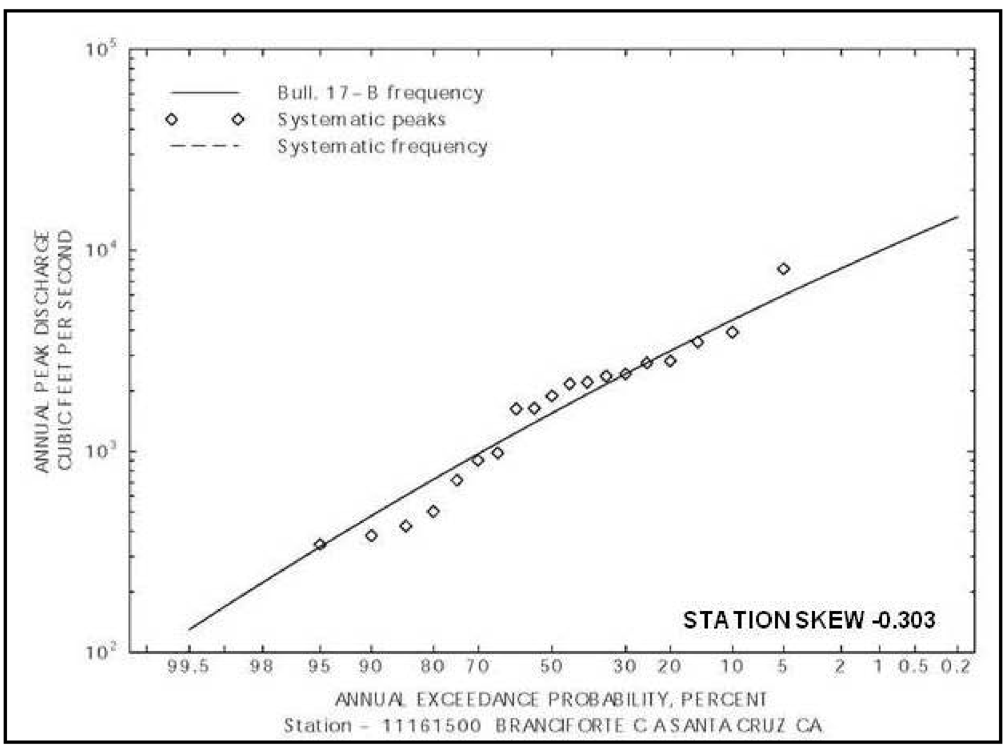

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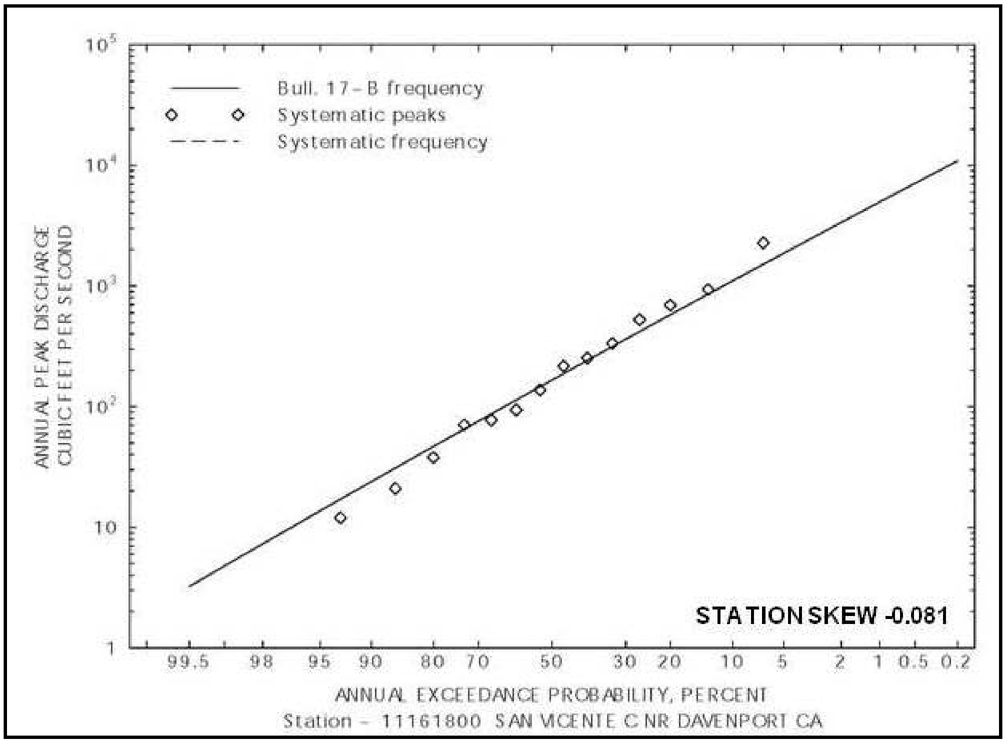

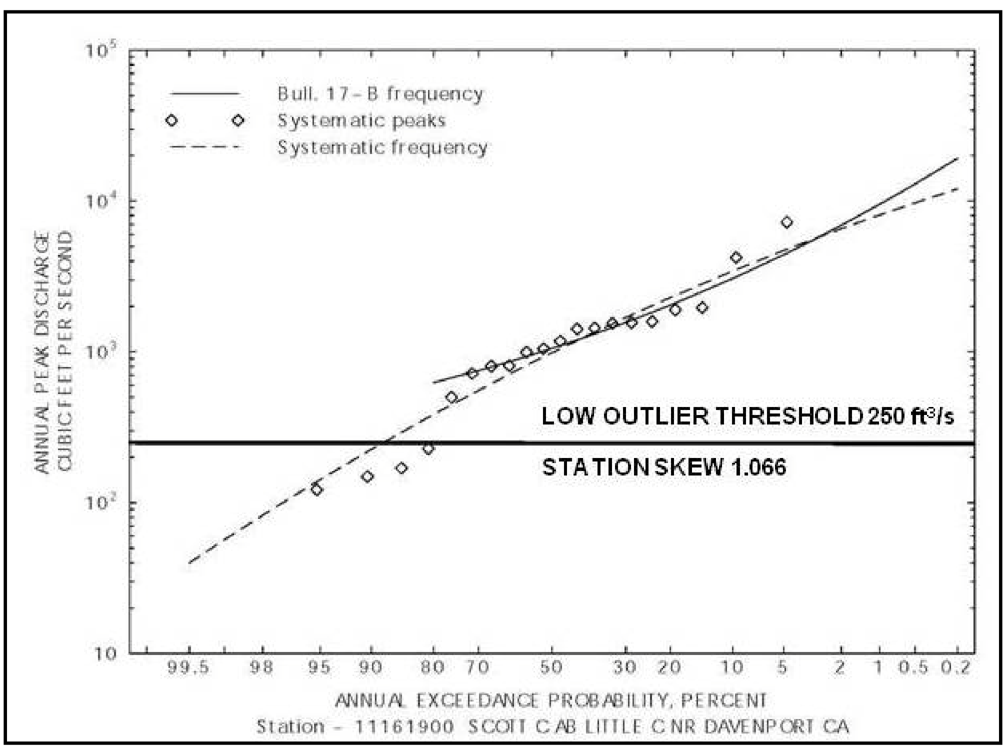

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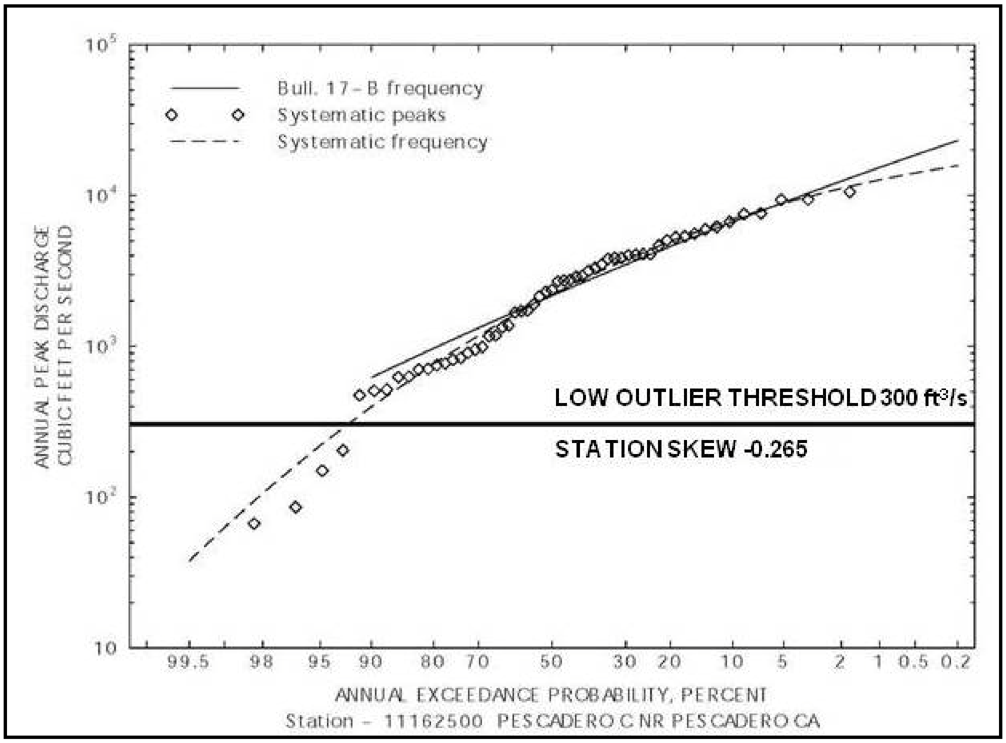

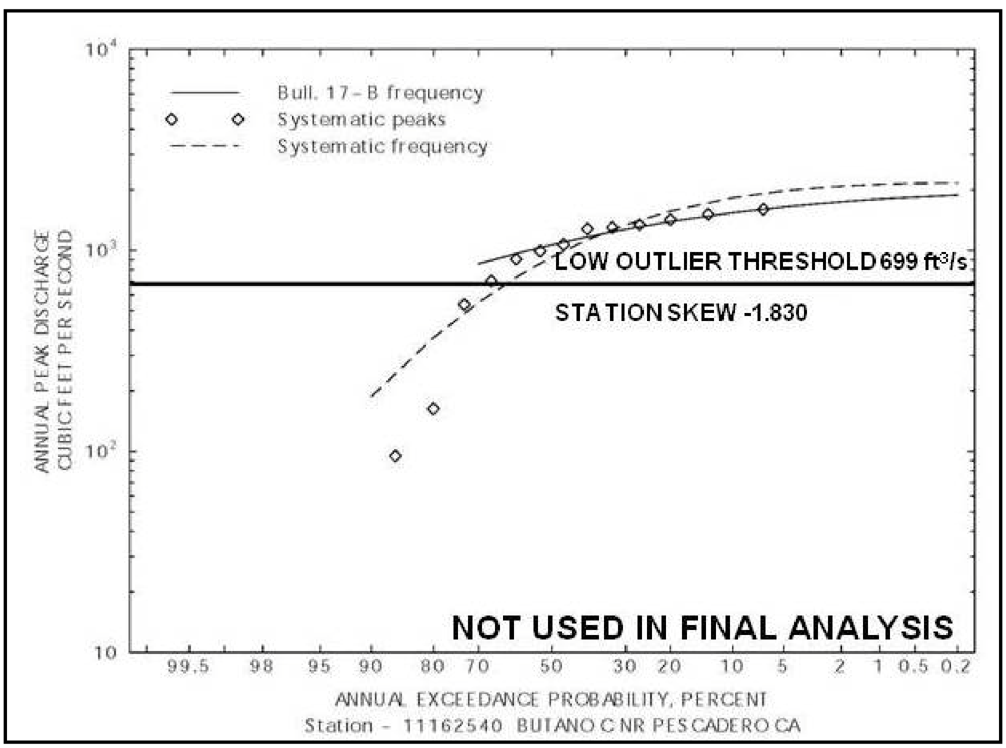

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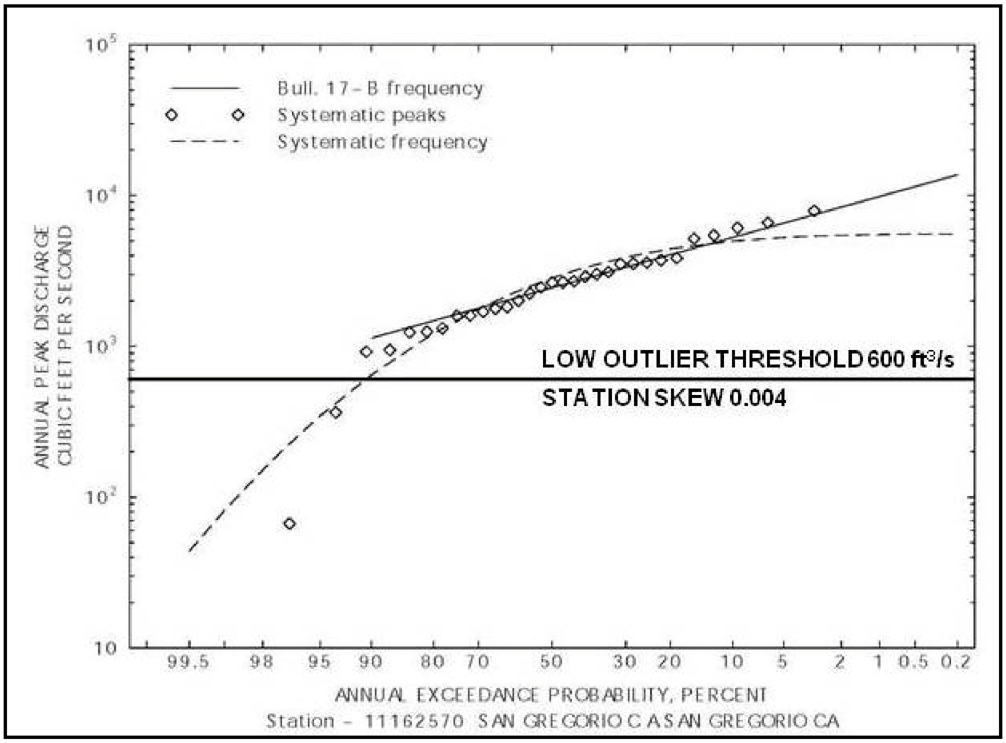

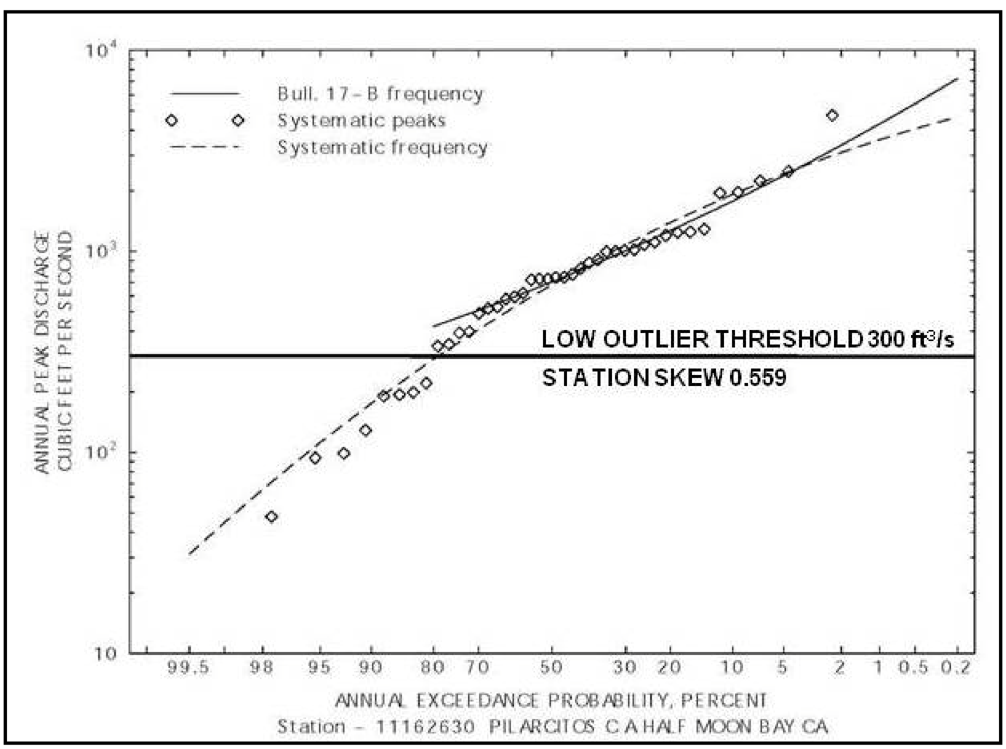

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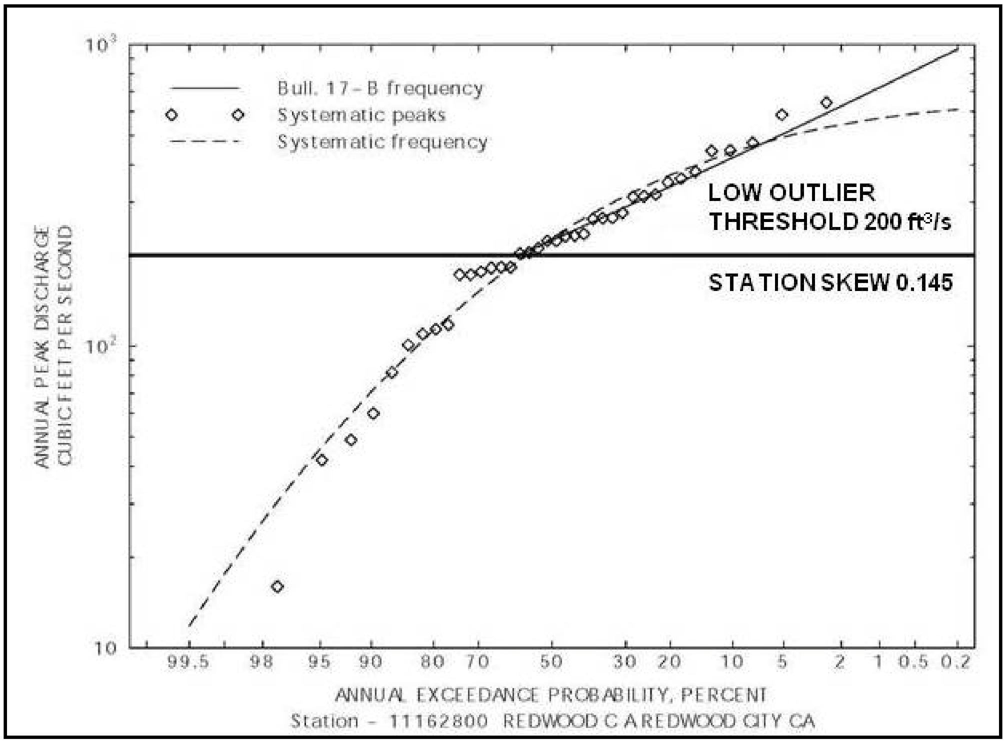

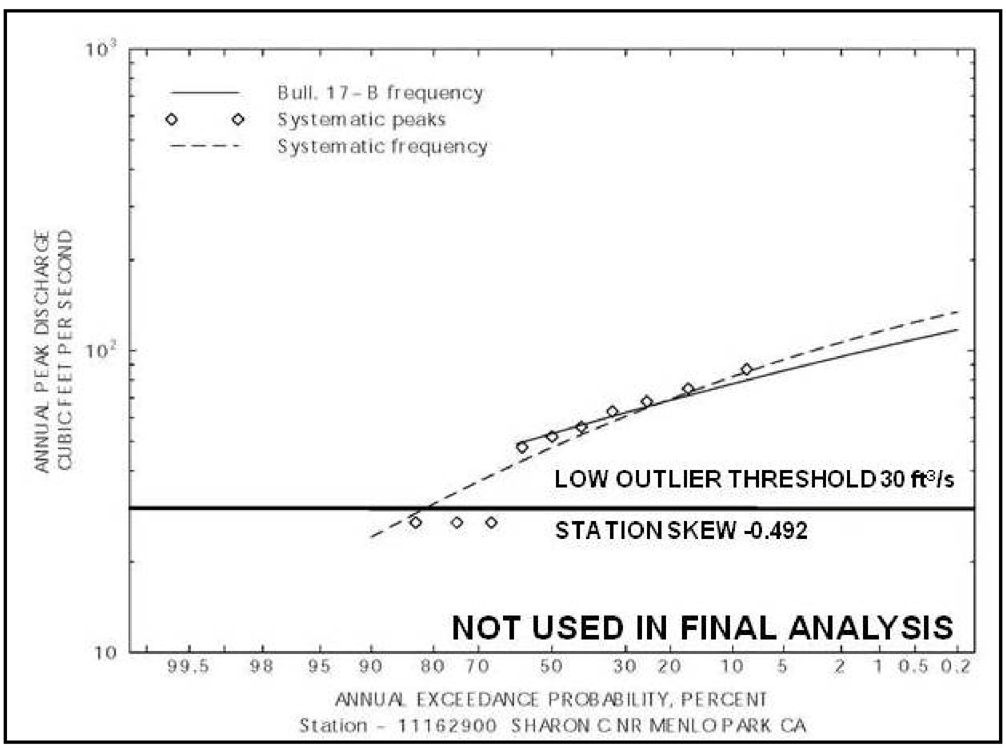

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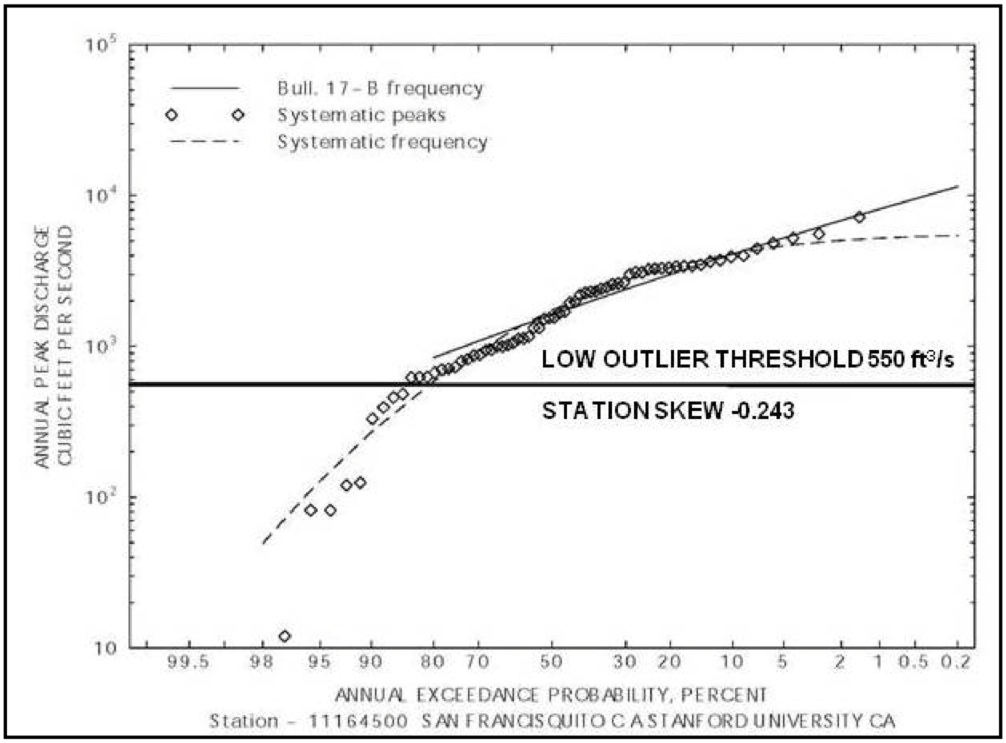
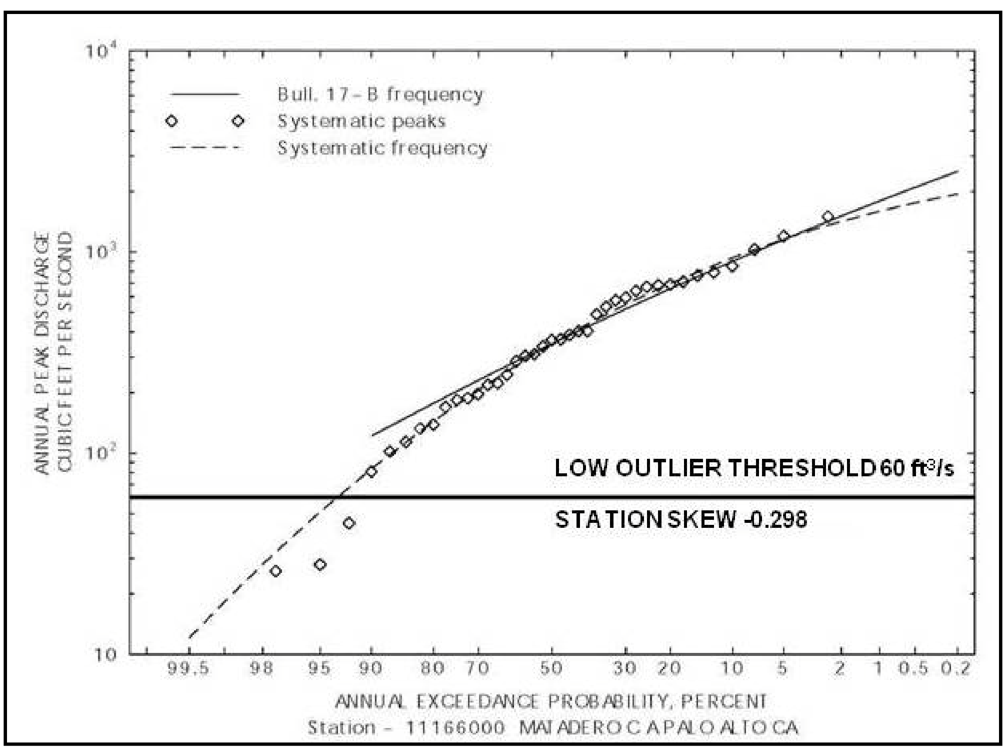
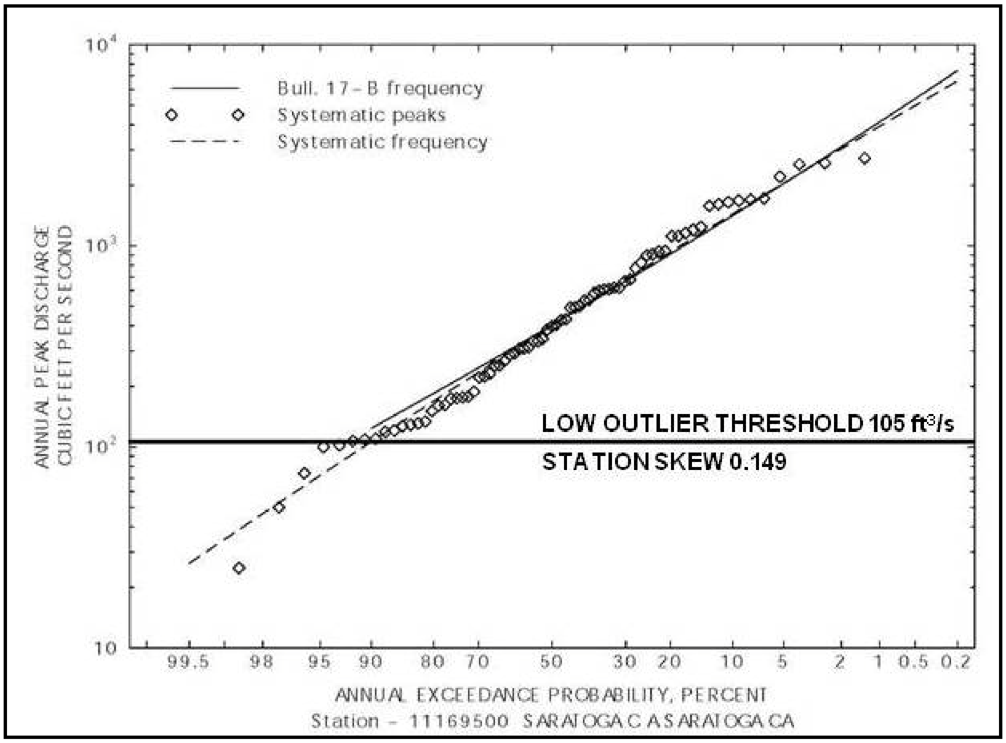
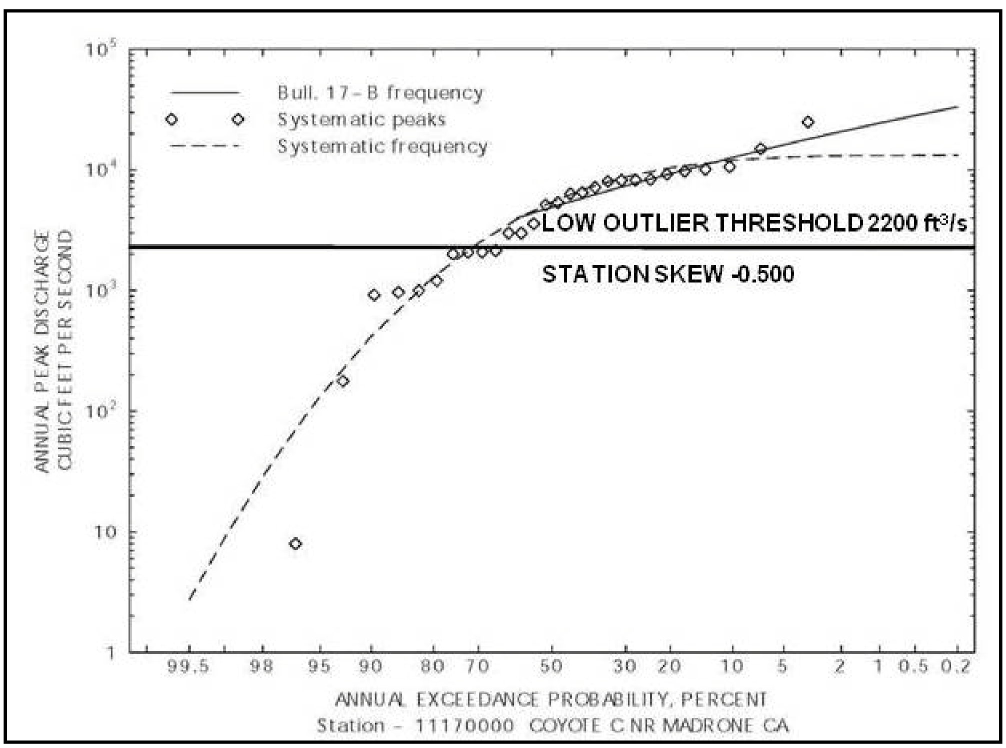


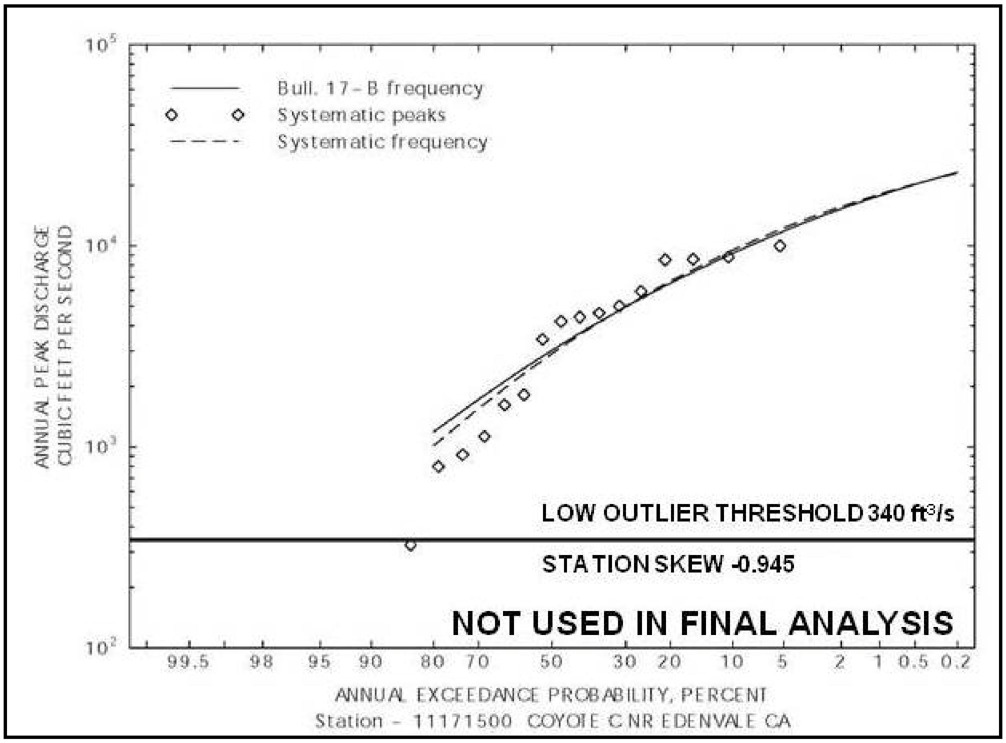


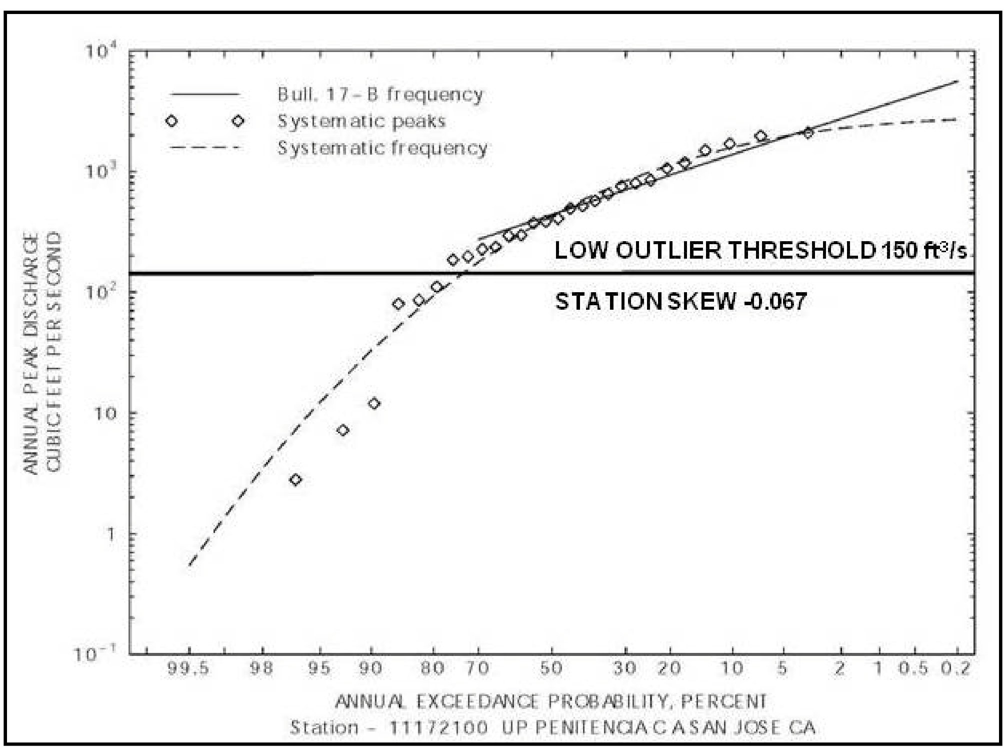
Appendix H: Stations used in regional skew analysis for developing a generalized skew coefficient to be weighted with Scott Creek above Little Creek 11161900



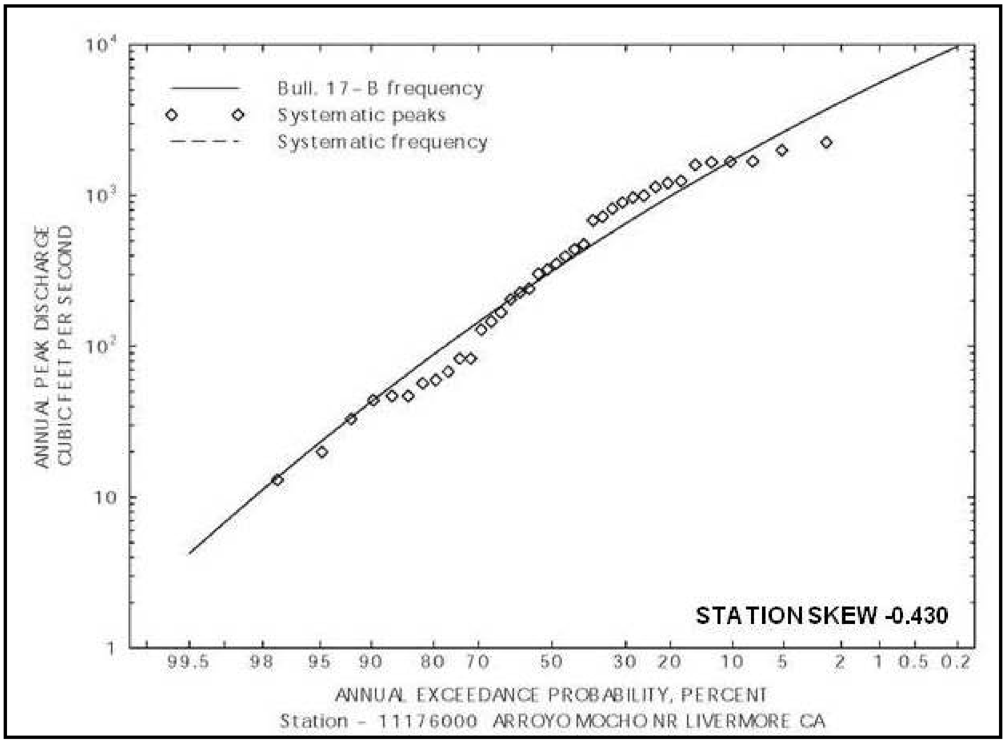


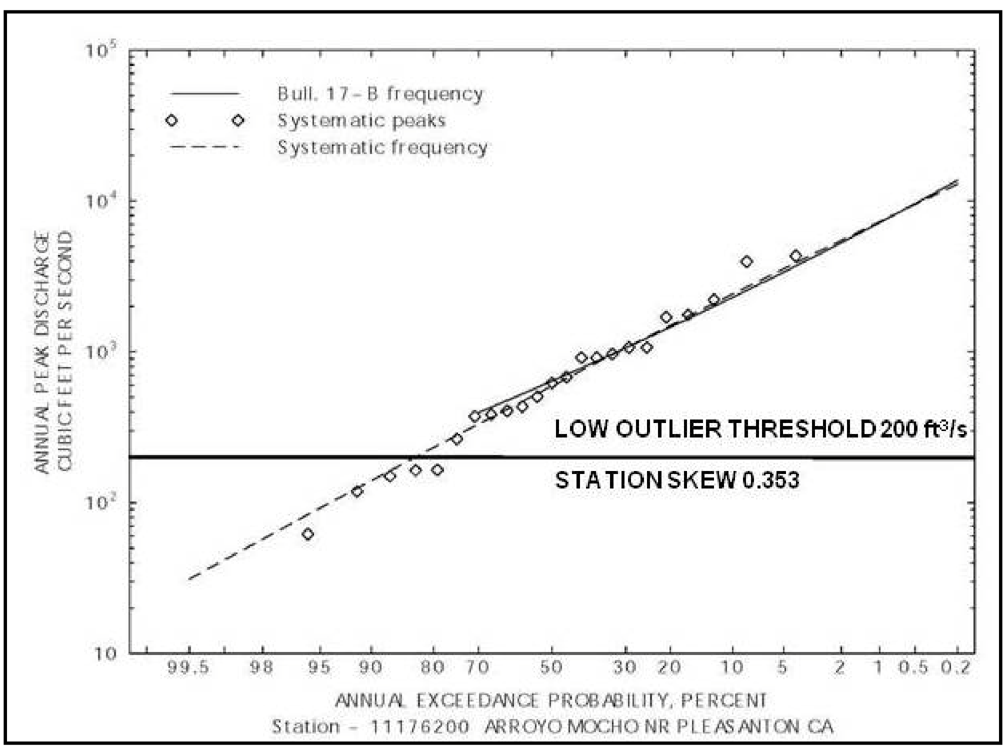
Appendix H: Stations used in regional skew analysis for developing a generalized skew coefficient to be weighted with Scott Creek above Little Creek 11161900



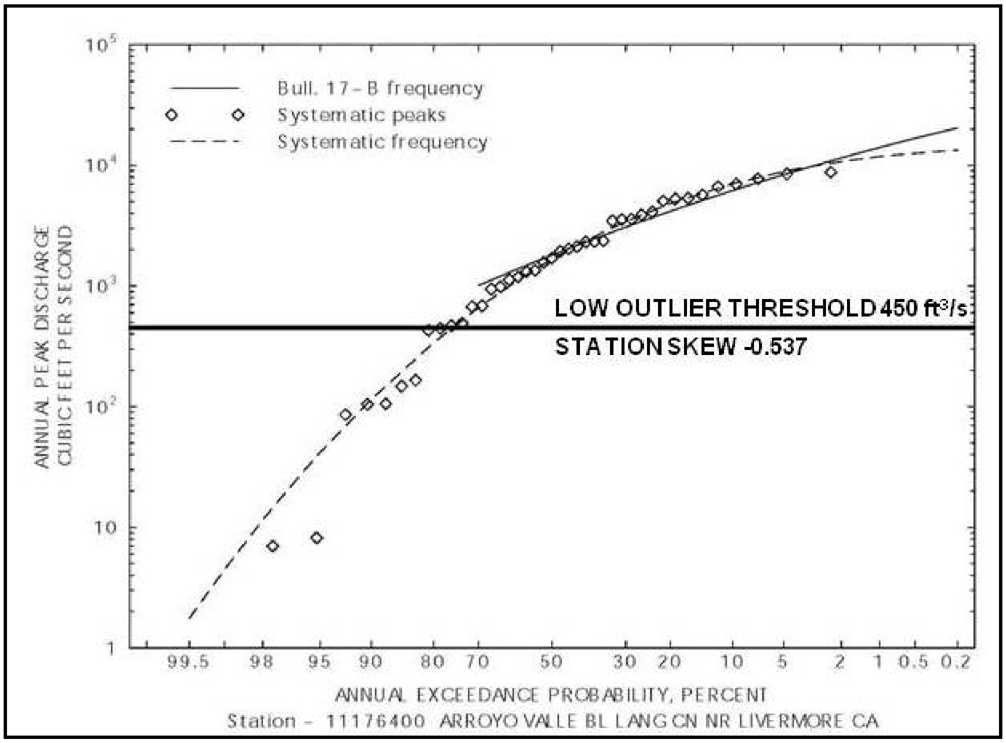


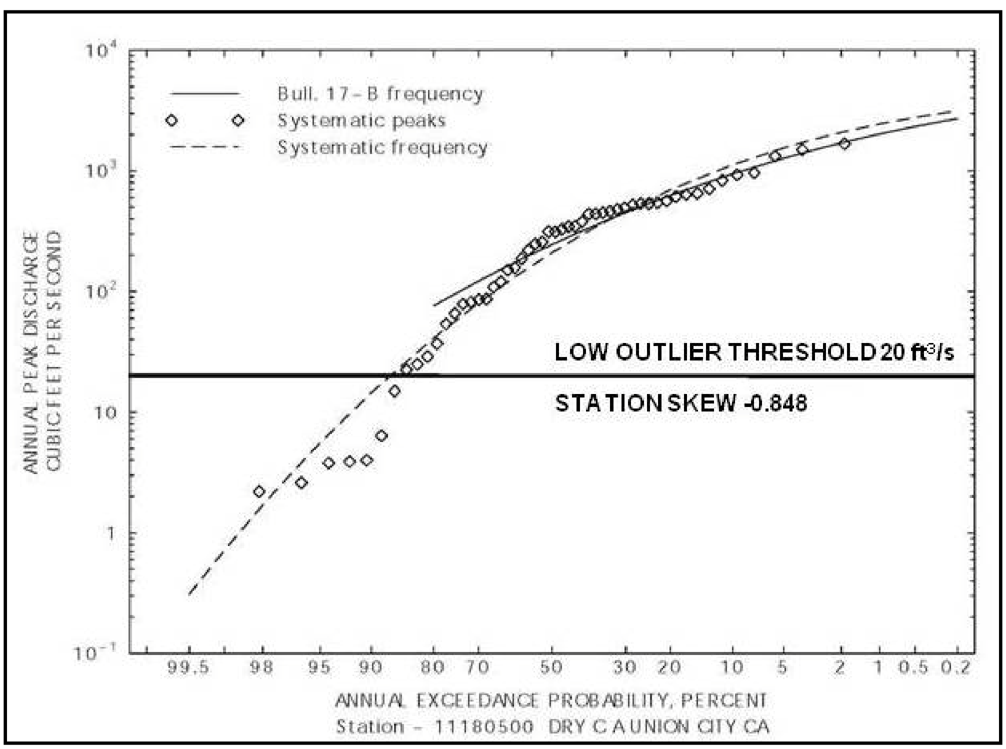
Appendix H: Stations used in regional skew analysis for developing a generalized skew coefficient to be weighted with Scott Creek above Little Creek 11161900



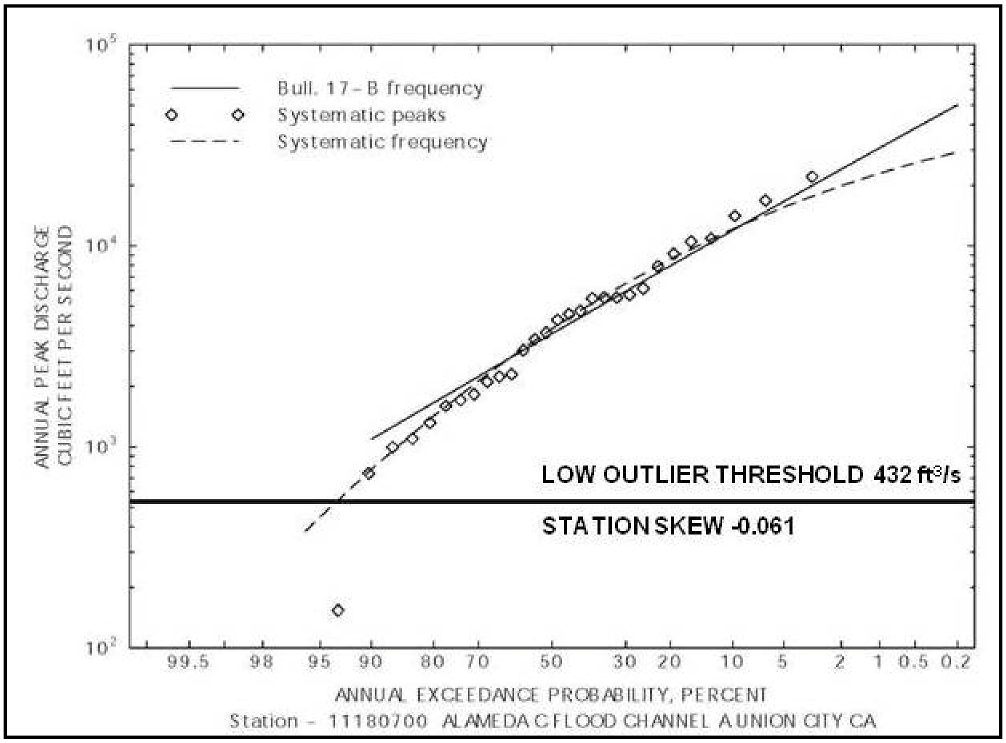


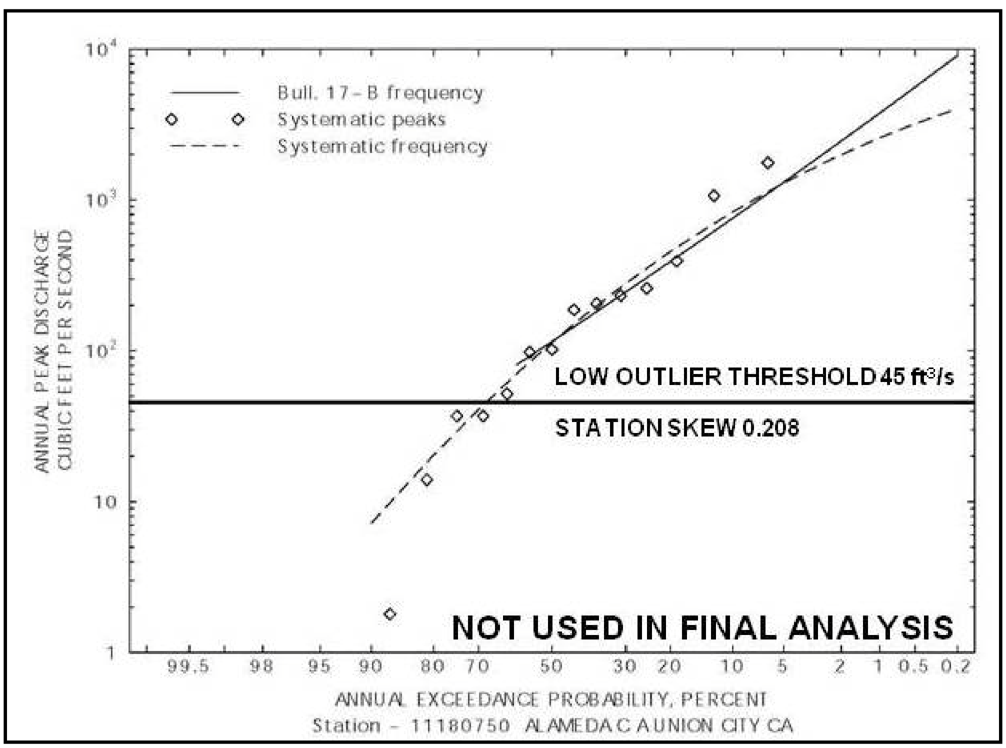
Appendix H: Stations used in regional skew analysis for developing a generalized skew coefficient to be weighted with Scott Creek above Little Creek 11161900



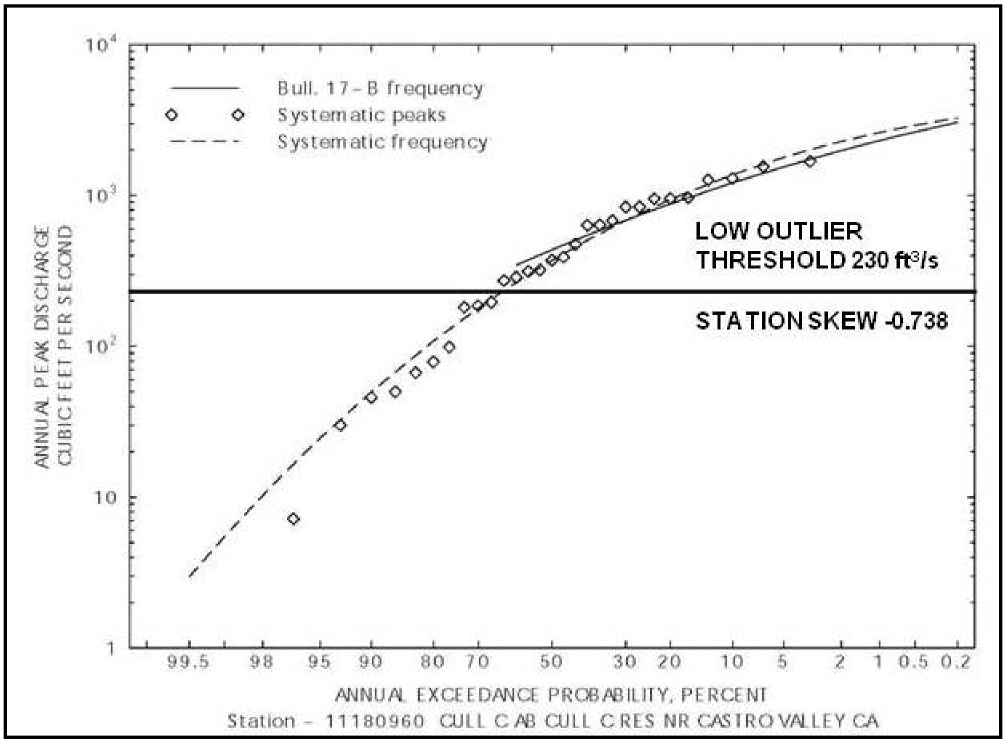


Appendix H: Stations used in regional skew analysis for developing a generalized skew coefficient to be weighted with Scott Creek above Little Creek 11161900





Appendix H: Stations used in regional skew analysis for developing a generalized skew coefficient to be weighted with Scott Creek above Little Creek 11161900



Appendix I: PEAKFQ frequency output using regional data

Appendix I: PEAKFQ frequency output using regional data

No low outlier threshold

```
                    U. S. GEOLOGICAL SURVEY
              ANNUAL PEAK FLOW FREQUENCY ANALYSIS
              Following Bulletin 17-B Guidelines
                        Program peakfq
                   (Version 4.1, February, 2002)

                 --- PROCESSING DATE/TIME ---

                     2009 APR 27 22:20:18

                  --- PROCESSING OPTIONS ---

               Plot option         = Graphics device
               Basin char output   = None
               Print option        = Yes
               Debug print         = No
               Input peaks listing = Long
               Input peaks format  = WATSTORE peak file

                    U. S. GEOLOGICAL SURVEY
              ANNUAL PEAK FLOW FREQUENCY ANALYSIS
              Following Bulletin 17-B Guidelines
                        Program peakfq
                   (Version 4.1, February, 2002)

      Station - 11161900  SCOTT C AB LITTLE C NR DAVENPORT CA
                     2009 APR 27 22:20:18

              I N P U T   D A T A   S U M M A R Y

         Number of peaks in record            =       20
         Peaks not used in analysis           =        0
         Systematic peaks in analysis         =       20
         Historic peaks in analysis           =        0
         Years of historic record             =        0
         Generalized skew                     =   -0.240
         Standard error of generalized skew   =    0.200
         Skew option                          =   WEIGHTED
         Gage base discharge                  =      0.0
         User supplied high outlier threshold =   --
         User supplied low outlier criterion  =   --
         Plotting position parameter          =     0.00

 *********  NOTICE  --  Preliminary machine computations.        *********
 *********  User responsible for assessment and interpretation.  *********

   WCF134I-NO SYSTEMATIC PEAKS WERE BELOW GAGE BASE.                  0.0
   WCF195I-NO LOW OUTLIERS WERE DETECTED BELOW CRITERION.            72.0
   WCF163I-NO HIGH OUTLIERS OR HISTORIC PEAKS EXCEEDED HHBASE.     11723.0
```

Appendix I: PEAKFQ frequency output using regional data

No low outlier threshold (continued)

Station - 11161900 SCOTT C AB LITTLE C NR DAVENPORT CA
2009 APR 27 22:20:18

ANNUAL FREQUENCY CURVE PARAMETERS -- LOG-PEARSON TYPE III

	FLOOD BASE		LOGARITHMIC		
	DISCHARGE	EXCEEDANCE PROBABILITY	MEAN	STANDARD DEVIATION	SKEW
SYSTEMATIC RECORD	0.0	1.0000	2.9633	0.4636	-0.393
BULL.17B ESTIMATE	0.0	1.0000	2.9633	0.4636	-0.259

ANNUAL FREQUENCY CURVE -- DISCHARGES AT SELECTED EXCEEDANCE PROBABILITIES

ANNUAL EXCEEDANCE PROBABILITY	BULL.17B ESTIMATE	SYSTEMATIC RECORD	'EXPECTED PROBABILITY' ESTIMATE	95-PCT CONFIDENCE LIMITS FOR BULL. 17B ESTIMATES LOWER	UPPER
0.9950	45.4	39.7	28.2	13.8	93.7
0.9900	62.7	56.6	43.7	21.3	122.1
0.9500	147.3	142.1	125.9	65.8	249.0
0.9000	227.9	225.4	207.2	115.6	362.7
0.8000	380.2	384.2	362.8	219.9	574.3
0.5000	962.2	985.3	962.2	642.3	1452.0
0.2000	2281.0	2289.0	2372.0	1507.0	3969.0
0.1000	3492.0	3424.0	3761.0	2211.0	6771.0
0.0400	5397.0	5117.0	6151.0	3222.0	11860.0
0.0200	7078.0	6535.0	8470.0	4052.0	16910.0
0.0100	8972.0	8065.0	11340.0	4941.0	23110.0
0.0050	11080.0	9700.0	14860.0	5889.0	30570.0
0.0020	14220.0	12010.0	20730.0	7233.0	42580.0
0.6667	603.1	(1.50-year flood)			
0.4292	1164.6	(2.33-year flood)			

Station - 11161900 SCOTT C AB LITTLE C NR DAVENPORT CA
2009 APR 27 22:20:18

I N P U T   D A T A   L I S T I N G

WATER YEAR	DISCHARGE	CODES	WATER YEAR	DISCHARGE	CODES
1937	1050.0		1965	1590.0	
1939	149.0		1966	229.0	
1940	7240.0		1967	1900.0	
1941	1440.0		1968	995.0	
1959	806.0		1969	1180.0	
1960	500.0		1970	1420.0	
1961	122.0		1971	810.0	
1962	1970.0		1972	170.0	
1963	1560.0		1973	1550.0	
1964	720.0		1982	4220.0	

Explanation of peak discharge qualification codes

Appendix I: PEAKFQ frequency output using regional data

No low outlier threshold (continued)

```
PEAKFQ  WATSTORE
 CODE     CODE   DEFINITION

   D        3    Dam failure, non-recurrent flow anomaly
   G        8    Discharge greater than stated value
   X       3+8   Both of the above
   L        4    Discharge less than stated value
   K      6 OR C  Known effect of regulation or urbanization
   H        7    Historic peak

     Station - 11161900  SCOTT C AB LITTLE C NR DAVENPORT CA
                     2009 APR 27 22:20:18


EMPIRICAL FREQUENCY CURVES -- WEIBULL PLOTTING POSITIONS

   WATER          RANKED       SYSTEMATIC      BULL.17B
    YEAR        DISCHARGE        RECORD        ESTIMATE

    1940          7240.0         0.0476         0.0476
    1982          4220.0         0.0952         0.0952
    1962          1970.0         0.1429         0.1429
    1967          1900.0         0.1905         0.1905
    1965          1590.0         0.2381         0.2381
    1963          1560.0         0.2857         0.2857
    1973          1550.0         0.3333         0.3333
    1941          1440.0         0.3810         0.3810
    1970          1420.0         0.4286         0.4286
    1969          1180.0         0.4762         0.4762
    1937          1050.0         0.5238         0.5238
    1968           995.0         0.5714         0.5714
    1971           810.0         0.6190         0.6190
    1959           806.0         0.6667         0.6667
    1964           720.0         0.7143         0.7143
    1960           500.0         0.7619         0.7619
    1966           229.0         0.8095         0.8095
    1972           170.0         0.8571         0.8571
    1939           149.0         0.9048         0.9048
    1961           122.0         0.9524         0.9524


                       U. S. GEOLOGICAL SURVEY
                  ANNUAL PEAK FLOW FREQUENCY ANALYSIS
                  Following Bulletin 17-B Guidelines
                            Program peakfq
                     (Version 4.1, February, 2002)


End PEAKFQ analysis.
  Stations processed :       1
  Number of errors   :       0
  Stations skipped   :       0
  Station years      :      20
```

Appendix I: PEAKFQ frequency output using regional data

Low outlier threshold of 250 ft^3/s

```
             U. S. GEOLOGICAL SURVEY
       ANNUAL PEAK FLOW FREQUENCY ANALYSIS
       Following Bulletin 17-B Guidelines
                 Program peakfq
            (Version 4.1, February, 2002)

          --- PROCESSING DATE/TIME ---

              2009 MAR 13 15:04:02

           --- PROCESSING OPTIONS ---

        Plot option         = Graphics device
        Basin char output   = None
        Print option        = Yes
        Debug print         = No
        Input peaks listing = Long
        Input peaks format  = WATSTORE peak file

             U. S. GEOLOGICAL SURVEY
       ANNUAL PEAK FLOW FREQUENCY ANALYSIS
       Following Bulletin 17-B Guidelines
                 Program peakfq
            (Version 4.1, February, 2002)

 Station - 11161900  SCOTT C AB LITTLE C NR DAVENPORT CA
              2009 MAR 13 15:04:02

       I N P U T   D A T A   S U M M A R Y

     Number of peaks in record           =       20
     Peaks not used in analysis          =        0
     Systematic peaks in analysis        =       20
     Historic peaks in analysis          =        0
     Years of historic record            =        0
     Generalized skew                    =   -0.240
     Standard error of generalized skew  =    0.200
     Skew option                         =   WEIGHTED
     Gage base discharge                 =      0.0
     User supplied high outlier threshold =   --
     User supplied low outlier criterion  =      250.0
     Plotting position parameter         =     0.00

 *********  NOTICE  --  Preliminary machine computations.        *********
 *********  User responsible for assessment and interpretation.  *********

   WCF134I-NO SYSTEMATIC PEAKS WERE BELOW GAGE BASE.                     0.0
  *WCF191I-USER LOW-OUTLIER CRITERION SUPERSEDES 17B.       250.0     72.0
   WCF198I-LOW OUTLIERS BELOW FLOOD BASE WERE DROPPED.          4    250.0
   WCF163I-NO HIGH OUTLIERS OR HISTORIC PEAKS EXCEEDED HHBASE.     10468.7
```

Appendix I: PEAKFQ frequency output using regional data

Low outlier threshold of 250 ft^3/s (continued)

Station - 11161900 SCOTT C AB LITTLE C NR DAVENPORT CA
2009 MAR 13 15:04:02

ANNUAL FREQUENCY CURVE PARAMETERS -- LOG-PEARSON TYPE III

	FLOOD BASE		LOGARITHMIC		
	DISCHARGE	EXCEEDANCE PROBABILITY	MEAN	STANDARD DEVIATION	SKEW
SYSTEMATIC RECORD	0.0	1.0000	2.9633	0.4636	-0.393
BULL.17B ESTIMATE	250.0	0.8000	3.0646	0.3143	-0.125

ANNUAL FREQUENCY CURVE -- DISCHARGES AT SELECTED EXCEEDANCE PROBABILITIES

ANNUAL EXCEEDANCE PROBABILITY	BULL.17B ESTIMATE	SYSTEMATIC RECORD	'EXPECTED PROBABILITY' ESTIMATE	95-PCT CONFIDENCE LIMITS FOR BULL. 17B ESTIMATES LOWER	UPPER
0.9950	--	39.7	--	--	--
0.9900	--	56.6	--	--	--
0.9500	--	142.1	--	--	--
0.9000	--	225.4	--	--	--
0.8000	--	384.2	--	--	--
0.5000	1178.0	985.3	1178.0	894.6	1555.0
0.2000	2142.0	2289.0	2203.0	1618.0	3116.0
0.1000	2904.0	3424.0	3065.0	2127.0	4564.0
0.0400	3991.0	5117.0	4398.0	2798.0	6879.0
0.0200	4884.0	6535.0	5595.0	3318.0	8964.0
0.0100	5844.0	8065.0	6996.0	3854.0	11360.0
0.0050	6875.0	9700.0	8642.0	4407.0	14090.0
0.0020	8349.0	12010.0	11280.0	5169.0	18250.0
0.6667	860.4	(1.50-year flood)			
0.4292	1340.4	(2.33-year flood)			

Station - 11161900 SCOTT C AB LITTLE C NR DAVENPORT CA
2009 MAR 13 15:04:02

I N P U T D A T A L I S T I N G

WATER YEAR	DISCHARGE	CODES	WATER YEAR	DISCHARGE	CODES
1937	1050.0		1965	1590.0	
1939	149.0		1966	229.0	
1940	7240.0		1967	1900.0	
1941	1440.0		1968	995.0	
1959	806.0		1969	1180.0	
1960	500.0		1970	1420.0	
1961	122.0		1971	810.0	
1962	1970.0		1972	170.0	
1963	1560.0		1973	1550.0	
1964	720.0		1982	4220.0	

Low outlier threshold of 250 ft^3/s (continued)

```
         Explanation of peak discharge qualification codes

       PEAKFQ  WATSTORE
        CODE     CODE   DEFINITION

          D        3    Dam failure, non-recurrent flow anomaly
          G        8    Discharge greater than stated value
          X       3+8   Both of the above
          L        4    Discharge less than stated value
          K      6 OR C  Known effect of regulation or urbanization
          H        7    Historic peak

            Station - 11161900  SCOTT C AB LITTLE C NR DAVENPORT CA
                            2009 MAR 13 15:04:02

   EMPIRICAL FREQUENCY CURVES -- WEIBULL PLOTTING POSITIONS
```

WATER YEAR	RANKED DISCHARGE	SYSTEMATIC RECORD	BULL.17B ESTIMATE
1940	7240.0	0.0476	0.0476
1982	4220.0	0.0952	0.0952
1962	1970.0	0.1429	0.1429
1967	1900.0	0.1905	0.1905
1965	1590.0	0.2381	0.2381
1963	1560.0	0.2857	0.2857
1973	1550.0	0.3333	0.3333
1941	1440.0	0.3810	0.3810
1970	1420.0	0.4286	0.4286
1969	1180.0	0.4762	0.4762
1937	1050.0	0.5238	0.5238
1968	995.0	0.5714	0.5714
1971	810.0	0.6190	0.6190
1959	806.0	0.6667	0.6667
1964	720.0	0.7143	0.7143
1960	500.0	0.7619	0.7619
1966	229.0	0.8095	0.8095
1972	170.0	0.8571	0.8571
1939	149.0	0.9048	0.9048
1961	122.0	0.9524	0.9524

```
                         U. S. GEOLOGICAL SURVEY
                     ANNUAL PEAK FLOW FREQUENCY ANALYSIS
                     Following Bulletin 17-B Guidelines
                              Program peakfq
                         (Version 4.1, February, 2002)


 End PEAKFQ analysis.
   Stations processed :       1
   Number of errors   :       0
   Stations skipped   :       0
   Station years      :      20


 CARD types 4, 2, and * are ignored
```

Appendix J: Gage locations, output data, and procedures for two-station comparison

Appendix J: Gage locations, output data, and procedures for two-station comparison

Appendix J: Gage locations, output data, and procedures for two-station comparison

[Calculations are based on equations and tables in attachment located at the end of Appendix J (from Appendix 7, Bulletin 17B, Interagency Advisory Committee on Water Data, 1982)]

List of Variables

N_1	Number of years when peak flows were concurrently recorded for long-term and short-term gaging stations (concurrent period)
N_2	Number of years when peak flows were recorded for the long-term gaging station but not recorded for the short-term gaging station (nonconcurrent period)
N_3	Number of years of peak-flow data for the short-term gaging station
N_e	Equivalent years of peak-flow data of the adjusted mean
Q_x	Peak flows for the long-term gaging station
X	Logarithm of peak flows for the long-term gaging station
$\bar{X}_1$	Mean logarithm of peak flows for the long-term gaging station for the concurrent period
$\bar{X}_2$	Mean logarithm of peak flows for the long-term gaging station for the nonconcurrent period
$\bar{X}_3$	Mean logarithm of peak flows for the long-term gaging station for the entire period
Q_y	Peak flows for the short-term gaging station
Y	Logarithm of peak flows for the short-term gaging station
$\bar{Y}$	Adjusted mean logarithm of peak flows for the short-term gaging station
$\bar{Y}_1$	Mean logarithm of peak flows for the short-term gaging station for the concurrent period
$\bar{Y}_3$	Mean logarithm of peak flows for the short-term gaging station for the entire period
Sx_1	Standard deviation of logarithm of peak flows for the long-term gaging station for the concurrent period
Sx_2	Standard deviation of logarithm of peak flows for the long-term gaging station for the nonconcurrent period
Sy	Adjusted standard deviation of logarithm of peak flows for the short-term gaging station
Sy_1	Standard deviation of logarithm of peak flows for the short-term gaging station for the concurrent period
Sy_3	Standard deviation of logarithm of peak flows for the short-term gaging station for the entire period
b	Slope of regression line
r	Correlation coefficient of the peak flows for the paired gaging stations for the concurrent period

Appendix J: Gage locations, output data, and procedures for two-station comparison

11157500
Descriptive statistics

N_1 = 16 (1937, 1940-41, 1959–60, 1962-65, 1967-1971, 1973, 1982)

N_2 = 36 (1942-46, 1949-58, 1966, 1972, 1974-81, 1983, 1958, 1997-2006, 2008)

N_3 = 16 (1937, 1940-1941, 1959–60, 1962-65, 1967-71, 1973, 1982)

N_e = 15.8

$\bar{X}_1$ = 3.0097

$\bar{X}_2$ = 2.9306

$\bar{X}_3$ = 2.9345

$\bar{Y}$ = 3.1452

$\bar{Y}_1$ = 3.1510

$\bar{Y}_3$ = 3.1510

Sx_1 = 0.7500

Sx_2 = 0.6629

Sy = 0.2859

Sy_1 = 0.2859

Sy_3 = 0.2859

Calculate b and r

Equation 7–1 b = 0.0896

Equation 7–2 r = 0.2350

Criterion and adjustment procedure for the mean

Equation 7–4 $r = 0.2350 < 0.2673 = r_{min}$

Because $r < r_{min}$, adjustment to the mean is not worthwhile.

Calculate Var($\bar{Y}$) and Var ($\bar{Y}_3$)

Equation 7–3 Var($\bar{Y}$) = 0.0052

Equation 7–5b $\bar{Y}$ = 3.1443

Equation 7–6 Var($\bar{Y}_3$) = 0.0051

If Var($\bar{Y}_3$) < Var($\bar{Y}$), then use $\bar{Y}_3$. Otherwise, use $\bar{Y}$.

0.0051 < 0.0052, therefore 3.1510 will be used

Appendix J: Gage locations, output data, and procedures for two-station comparison

11157500
Descriptive statistics continued

Final estimate of the mean

$\bar{Y}_3 = 3.1510$

Equivalent years of record for the mean

Equation 7–7 $N_e = 15.8$

Criterion and adjustment procedure for the standard deviation

Equation 7–9 $|r| = 0.2350 < 0.5213 = r_{min}$

Because $r < r_{min}$, adjustment to the standard deviation is not worthwhile.

where A = -8.7260, B = 1.7598, C = 0.1663

Equation 7–8 $Var(Sy^2) = 0.000912$

Equation 7–10 $Sy^2 = 0.0804$

$Sy = 0.2835$

Equation 7–11 $Var(Sy_3^2) = 0.000891$

If $Var(Sy_3^2) < Var(Sy^2)$, use Sy_3. Otherwise, use Sy.

0.000891 < 0.000912, therefore 0.2859 will be used

Final estimate of standard deviation

$Sy_3 = 0.2859$

Appendix J: Gage locations, output data, and procedures for two-station comparison

11157500 Tres Pinos Creek Near Tres Pinos, CA
11161900 Scott Creek above Little Creek near Davenport, CA

		Log10(LR)			Log10(SR)			Log10(LR)			Log10(SR)			Log10(LR)
	Mean	2.93455			3.15099			3.00971			3.15099			2.93063
	Std Dev	0.67499			0.28588			0.75004			0.28588			0.66286
	Median	2.87448			3.15533			3.02362			3.15533			2.82002
	Years	51			16			16			16			36
Non concurren			Non-concurrent years:											
		WARNING: If any (below) are > | 10% | data may not be normally distributed												
35		2.09%			-0.14%			-0.46%			-0.14%			3.92%

Long Record data			Short Record data			Concurrent Years						data		
WY	LR -Q	Log10(LR)	WY	SR-Q	Log10(SR)	WY	LR -Q	Log10(LR)	WY	SR-Q	Log10(SR)	WY	LR -Q	Log10(LR)
1937			1937	1050	3.02119	1937	9910	3.99607	1937	1050	3.02119			
1938														
1939														
1940	4500	3.65321	1940	7240	3.85974	1940	4500	3.65321	1940	7240	3.85974			
1941	8060	3.90634	1941	1440	3.15836	1941	8060	3.90634	1941	1440	3.15836			
1942	896	2.95231										1942	896	2.95231
1943	2520	3.40140										1943	2520	3.40140
1944												1944	506	
1945	749	2.87448										1945	749	2.87448
1946	400	2.60206										1946	400	2.60206
1947														
1948														
1949	525	2.72016										1949	525	2.72016
1950	218	2.33846										1950	218	2.33846
1951	642	2.80754										1951	642	2.80754
1952	4840	3.68485										1952	4840	3.68485
1953	247	2.39270										1953	247	2.39270
1954	292	2.46538										1954	292	2.46538
1955	217	2.33646										1955	217	2.33646
1956	4750	3.67669										1956	4750	3.67669
1957	54	1.73239										1957	54	1.73239
1958	5490	3.73957										1958	5490	3.73957
1959	283	2.45179	1959	806	2.90634	1959	283	2.45179	1959	806	2.90634			
1960	593	2.77305	1960	500	2.69897	1960	593	2.77305	1960	500	2.69897			
1961														
1962	978	2.99034	1962	1970	3.29447	1962	978	2.99034	1962	1970	3.29447			
1963	43	1.63347	1963	1560	3.19312	1963	43	1.63347	1963	1560	3.19312			
1964	43	1.63347	1964	720	2.85733	1964	43	1.63347	1964	720	2.85733			
1965	1650	3.21748	1965	1590	3.20140	1965	1650	3.21748	1965	1590	3.20140			
1966	1350	3.13033										1966	1350	3.13033
1967	1140	3.05690	1967	1900	3.27875	1967	1140	3.05690	1967	1900	3.27875			
1968	420	2.62325	1968	995	2.99782	1968	420	2.62325	1968	995	2.99782			
1969	5520	3.74194	1969	1180	3.07188	1969	5520	3.74194	1969	1180	3.07188			
1970	759	2.88024	1970	1420	3.15229	1970	759	2.88024	1970	1420	3.15229			
1971	206	2.31387	1971	810	2.90849	1971	206	2.31387	1971	810	2.90849			
1972	178	2.25042										1972	178	2.25042
1973	6540	3.81558	1973	1550	3.19033	1973	6540	3.81558	1973	1550	3.19033			
1974	1520	3.18184										1974	1520	3.18184
1975	5180	3.71433										1975	5180	3.71433
1976	586	2.76790										1976	586	2.76790
1977	90	1.95424										1977	90	1.95424
1978	7060	3.84880										1978	7060	3.84880
1979	951	2.97818										1979	951	2.97818
1980	3690	3.56703										1980	3690	3.56703
1981	105	2.02119										1981	105	2.02119
1982	2940	3.46835	1982	4220	3.62531	1982	2940	3.46835	1982	4220	3.62531			
1983	8790	3.94399										1983	8790	3.94399
1984														
1985														
1986														
1987														
1988														
1989														
1990														
1991														
1992														
1993														
1994														
1995														
1996														
1997	7030	3.84696										1997	7030	3.84696
1998	27200	4.43457										1998	27200	4.43457
1999	505	2.70329										1999	505	2.70329
2000	200	2.30103										2000	200	2.30103
2001	458	2.66087										2001	458	2.66087
2002	59	1.77085										2002	59	1.77085
2003	680	2.83251										2003	680	2.83251
2004	1120	3.04922										2004	1120	3.04922
2005	2460	3.39094										2005	2460	3.39094
2006	538	2.73078										2006	538	2.73078
2007														
2008	500	2.69897										2008	500	2.69897

Appendix J: Gage locations, output data, and procedures for two-station comparison

11159000
Descriptive statistics

N_1 = 14 (1937, 1940-41, 1959-65, 1967-73, 1982)

N_2 = 46 (1942-58, 1966, 1972, 1974-81, 1983-2008)

N_3 = 16 (1937, 1940-1941, 1959–60, 1962-65, 1967-71, 1973, 1982)

N_e = 17.3

$\bar{X}_1$ = 3.7217

$\bar{X}_2$ = 3.5773

$\bar{X}_3$ = 3.6110

$\bar{Y}$ = 3.1226

$\bar{Y}_1$ = 3.1712

$\bar{Y}_3$ = 3.1510

Sx_1 = 0.3837

Sx_2 = 0.4613

Sy = 0.2859

Sy_1 = 0.3013

Sy_3 = 0.2859

Calculate b and r

Equation 7–1 b = 0.4391

Equation 7–2 r = 0.5593

Criterion and adjustment procedure for the mean

Equation 7–4 $r = 0.5593 > 0.2887 = r_{min}$

Because $r > r_{min}$, adjustment to the mean is worthwhile.

Calculate Var($\bar{Y}$) and Var ($\bar{Y}_3$)

Equation 7–3 Var($\bar{Y}$) = 0.0052

Equation 7–5b $\bar{Y}$ = 3.1226

Equation 7–6 Var($\bar{Y}_3$) = 0.00511

If Var($\bar{Y}_3$) < Var($\bar{Y}$), then use $\bar{Y}_3$. Otherwise, use $\bar{Y}$.

0.00511 < 0.0052, therefore 3.1510 will be used

Appendix J: Gage locations, output data, and procedures for two-station comparison

11159000
Descriptive statistics continued

Final estimate of the mean

$\bar{Y}_3 = 3.1510$

Equivalent years of record for the mean

Equation 7–7 $N_e = 17.3$

Criterion and adjustment procedure for the standard deviation

Equation 7–9 $|r| = 0.5593 > 0.5554 = r_{min}$

Because $r > r_{min}$, adjustment to the standard deviation is worthwhile.

where A = -12.0441, B = 2.6336, C = 0.3335

Equation 7–8 $Var(Sy^2) = 0.0013$

Equation 7–10 $Sy^2 = 0.0999$

$Sy = 0.3161$

Equation 7–11 $Var(Sy_3^2) = 0.00089$

If $Var(Sy_3^2) < Var(Sy^2)$, use Sy_3. Otherwise, use Sy.

0.00089 < 0.0013, therefore 0.2859 will be used

Final estimate of standard deviation

$Sy_3 = 0.2859$

Appendix J: Gage locations, output data, and procedures for two-station comparison

11159000 Pajaro River at Chittenden, CA
11161900 Scott Creek above Little Creek near Davenport, CA

	Log10(LR)	Log10(SR)	Log10(LR)	Log10(SR)	Log10(LR)
Mean	3.61098	3.15099	3.72165	3.17120	3.57729
Std Dev	0.44559	0.28588	0.38372	0.30127	0.46131
Median	3.61526	3.15533	3.82627	3.17435	3.57730
Years	60	16	14	14	46

Non concurren: 44

Non-concurrent years:
WARNING: If any (below) are > | 10% | data may not be normally distributed

	Log10(LR)	Log10(SR)	Log10(LR)	Log10(SR)	Log10(LR)
	-0.12%	-0.14%	-2.73%	-0.10%	0.00%

Long Record data			Short Record data			Concurrent Years						data		
WY	LR -Q	Log10(LR)	WY	SR-Q	Log10(SR)	WY	LR -Q	Log10(LR)	WY	SR-Q	Log10(SR)	WY	LR -Q	Log10(LR)
1937			1937	1050	3.02119									
1938														
1939														
1940	9880	3.99476	1940	7240	3.85974	1940	9880	3.99476	1940	7240	3.85974			
1941	11100	4.04532	1941	1440	3.15836	1941	11100	4.04532	1941	1440	3.15836			
1942	5390	3.73159										1942	5390	3.73159
1943	9000	3.95424										1943	9000	3.95424
1944	6080	3.78390										1944	6080	3.78390
1945	10700	4.02938										1945	10700	4.02938
1946	1500	3.17609										1946	1500	3.17609
1947	896	2.95231										1947	896	2.95231
1949	1980	3.29667										1949	1980	3.29667
1950	1430	3.15534										1950	1430	3.15534
1951	7810	3.89265										1951	7810	3.89265
1952	10000	4.00000										1952	10000	4.00000
1953	2870	3.45788										1953	2870	3.45788
1954	682	2.83378										1954	682	2.83378
1955	871	2.94002										1955	871	2.94002
1956	24000	4.38021										1956	24000	4.38021
1957	1110	3.04532										1957	1110	3.04532
1958	23500	4.37107										1958	23500	4.37107
1959	3390	3.53020	1959	806	2.90634	1959	3390	3.53020	1959	806	2.90634			
1960	2880	3.45939	1960	500	2.69897	1960	2880	3.45939	1960	500	2.69897			
1962	2910	3.46389	1962	1970	3.29447	1962	2910	3.46389	1962	1970	3.29447			
1963	11600	4.06446	1963	1560	3.19312	1963	11600	4.06446	1963	1560	3.19312			
1964	1460	3.16435	1964	720	2.85733	1964	1460	3.16435	1964	720	2.85733			
1965	3300	3.51851	1965	1590	3.20140	1965	3300	3.51851	1965	1590	3.20140			
1966	1320	3.12057										1966	1320	3.12057
1967	7720	3.88762	1967	1900	3.27875	1967	7720	3.88762	1967	1900	3.27875			
			1968	995	2.99782									
1969	17800	4.25042	1969	1180	3.07188	1969	17800	4.25042	1969	1180	3.07188			
1970	5820	3.76492	1970	1420	3.15229	1970	5820	3.76492	1970	1420	3.15229			
1971	874	2.94151	1971	810	2.90849	1971	874	2.94151	1971	810	2.90849			
1973	8610	3.93500	1973	1550	3.19033	1973	8610	3.93500	1973	1550	3.19033			
1974	5400	3.73239										1974	5400	3.73239
1975	3230	3.50920										1975	3230	3.50920
1978	9420	3.97405										1978	9420	3.97405
1979	2130	3.32838										1979	2130	3.32838
1980	8890	3.94890										1980	8890	3.94890
1981	2680	3.42813										1981	2680	3.42813
1982	12100	4.08279	1982	4220	3.62531	1982	12100	4.08279	1982	4220	3.62531			
1983	15800	4.19866										1983	15800	4.19866
1984	4240	3.62737										1984	4240	3.62737
1985	1360	3.13354										1985	1360	3.13354
1986	13100	4.11727										1986	13100	4.11727
1987	1870	3.27184										1987	1870	3.27184
1991	2960	3.47129										1991	2960	3.47129
1992	1540	3.18752										1992	1540	3.18752
1993	6630	3.82151										1993	6630	3.82151
1994	600	2.77815										1994	600	2.77815
1995	21500	4.33244										1995	21500	4.33244
1996	8430	3.92583										1996	8430	3.92583
1997	15800	4.19866										1997	15800	4.19866
1998	25100	4.39967										1998	25100	4.39967
1999	4300	3.63347										1999	4300	3.63347
2000	6320	3.80072										2000	6320	3.80072
2001	1280	3.10721										2001	1280	3.10721
2002	2240	3.35025										2002	2240	3.35025
2003	2510	3.39967										2003	2510	3.39967
2004	3560	3.55145										2004	3560	3.55145
2005	4010	3.60314										2005	4010	3.60314
2006	5110	3.70842										2006	5110	3.70842
2007	449	2.65225										2007	449	2.65225
2008	1750	3.24304										2008	1750	3.24304

Appendix J: Gage locations, output data, and procedures for two-station comparison

11160000
Descriptive statistics

N_1 = 14 (1937, 1959–60, 1962-65, 1967-71, 1973, 1982)

N_2 = 41 (1951–58, 1974–81, 1983–2007)

N_3 = 16 (1937, 1940-1941, 1959–60, 1962-65, 1967-71, 1973, 1982)

N_e = 50.3

$\bar{X}_1 = 3.5420$

$\bar{X}_2 = 3.4197$

$\bar{X}_3 = 3.4508$

$\bar{Y} = 3.0215$

$\bar{Y}_1 = 3.0998$

$\bar{Y}_3 = 3.1510$

$Sx_1 = 0.2637$

$Sx_2 = 0.3513$

$Sy = 0.2889$

$Sy_1 = 0.2299$

$Sy_3 = 0.2859$

Calculate b and r

Equation 7–1 $b = 0.8590$

Equation 7–2 $r = 0.9854$

Criterion and adjustment procedure for the mean

Equation 7–4 $r = 0.9854 > 0.2887 = r_{min}$

Because $r > r_{min}$, adjustment to the mean is worthwhile.

Calculate Var($\bar{Y}$) and Var ($\bar{Y}_3$)

Equation 7–3 $Var(\bar{Y}) = 0.0010$

Equation 7–5b $\bar{Y} = 3.0215$

Equation 7–6 $Var(\bar{Y}_3) = 0.00511$

If $Var(\bar{Y}_3) < Var(\bar{Y})$, then use $\bar{Y}_3$. Otherwise, use $\bar{Y}$.

0.00511 > 0.0010, therefore 3.0215 will be used

Appendix J: Gage locations, output data, and procedures for two-station comparison

11160000
Descriptive statistics continued

Final estimate of the mean

$\bar{Y}$ = 3.0215 (from equation 7–5b)

Equivalent years of record for the mean

Equation 7–7 $N_e = 50.3$

Criterion and adjustment procedure for the standard deviation

Equation 7–9 $|r| = 0.9854 > 0.5552 = r_{min}$

Because $r > r_{min}$, adjustment to the standard deviation is worthwhile.

where A = -11.0248, B = 2.4132, C = 0.3039

Equation 7–8 $Var(Sy^2) = 0.0001$

Equation 7–10 $Sy^2 = 0.0834$

$Sy = 0.2888$

Equation 7–11 $Var(Sy_3^2) = 0.000891$

If $Var(Sy_3^2) < Var(Sy^2)$, use Sy_3. Otherwise, use Sy.

0.000891 > 0.0001, therefore 0.2888 will be used

Final estimate of standard deviation

Sy = 0.2888 (from equation 7–10)

Appendix J: Gage locations, output data, and procedures for two-station comparison

11160000 Soquel Creek near Soquel, CA
11161900 Scott Creek above Little Creek near Davenport, CA

		Log10(LR)			Log10(SR)			Log10(LR)			Log10(SR)			Log10(LR)
	Mean	3.45081			3.15099			3.54200			3.09984			3.41967
	Std Dev	0.33322			0.28588			0.26369			0.22987			0.35128
	Median	3.44248			3.15533			3.50581			3.11209			3.36361
	Years	55			16			14			14			41
Non concurren			Non-concurrent years:											
		WARNING: If any (below) are > | 10% | data may not be normally distributed												
39		0.24%			-0.14%			1.03%			-0.39%			1.67%

Long Record data			Short Record data			Concurrent Years						data		
WY	LR -Q	Log10(LR)	WY	SR-Q	Log10(SR)	WY	LR -Q	Log10(LR)	WY	SR-Q	Log10(SR)	WY	LR -Q	Log10(LR)
1937	5950	3.77452	1937	1050	3.02119	1937	5950	3.77452	1937	1050	3.02119			
			1940	7240	3.85974									
			1941	1440	3.15836									
1951	7800	3.89209										1951	7800	3.89209
1952	4910	3.69108										1952	4910	3.69108
1953	4630	3.66558										1953	4630	3.66558
1954	1180	3.07188										1954	1180	3.07188
1955	578	2.76193										1955	578	2.76193
1956	15800	4.19866										1956	15800	4.19866
1957	2010	3.30320										1957	2010	3.30320
1958	5080	3.70586										1958	5080	3.70586
1959	2770	3.44248	1959	806	2.90634	1959	2770	3.44248	1959	806	2.90634			
1960	2240	3.35025	1960	500	2.69897	1960	2240	3.35025	1960	500	2.69897			
1961														
1962	2940	3.46835	1962	1970	3.29447	1962	2940	3.46835	1962	1970	3.29447			
1963	7950	3.90037	1963	1560	3.19312	1963	7950	3.90037	1963	1560	3.19312			
1964	1390	3.14301	1964	720	2.85733	1964	1390	3.14301	1964	720	2.85733			
1965	3180	3.50243	1965	1590	3.20140	1965	3180	3.50243	1965	1590	3.20140			
1966	805	2.90580										1966	805	2.90580
1967	6410	3.80686	1967	1900	3.27875	1967	6410	3.80686	1967	1900	3.27875			
1968	2190	3.34044	1968	995	2.99782	1968	2190	3.34044	1968	995	2.99782			
1969	3230	3.50920	1969	1180	3.07188	1969	3230	3.50920	1969	1180	3.07188			
1970	3920	3.59329	1970	1420	3.15229	1970	3920	3.59329	1970	1420	3.15229			
1971	1300	3.11394	1971	810	2.90849	1971	1300	3.11394	1971	810	2.90849			
1972														
1973	4530	3.65610	1973	1550	3.19033	1973	4530	3.65610	1973	1550	3.19033			
1974	1880	3.27416										1974	1880	3.27416
1975	1840	3.26482										1975	1840	3.26482
1976														
1977														
1978	4010	3.60314										1978	4010	3.60314
1979	974	2.98856										1979	974	2.98856
1980	2630	3.41996										1980	2630	3.41996
1981	1160	3.06446										1981	1160	3.06446
1982	9700	3.98677	1982	4220	3.62531	1982	9700	3.98677	1982	4220	3.62531			
1983	7290	3.86273										1983	7290	3.86273
1984	1680	3.22531										1984	1680	3.22531
1985	2270	3.35603										1985	2270	3.35603
1986	8900	3.94939										1986	8900	3.94939
1987	2270	3.35603										1987	2270	3.35603
1988	649	2.81224										1988	649	2.81224
1989	1670	3.22272										1989	1670	3.22272
1990	1590	3.20140										1990	1590	3.20140
1991	2070	3.31597										1991	2070	3.31597
1992	2770	3.44248										1992	2770	3.44248
1993	2800	3.44716										1993	2800	3.44716
1994	900	2.95424										1994	900	2.95424
1995	7370	3.86747										1995	7370	3.86747
1996	3330	3.52244										1996	3330	3.52244
1997	6850	3.83569										1997	6850	3.83569
1998	4810	3.68215										1998	4810	3.68215
1999	1910	3.28103										1999	1910	3.28103
2000	5150	3.71181										2000	5150	3.71181
2001	1510	3.17898										2001	1510	3.17898
2002	1630	3.21219										2002	1630	3.21219
2003	6870	3.83696										2003	6870	3.83696
2004	5060	3.70415										2004	5060	3.70415
2005	2930	3.46687										2005	2930	3.46687
2006	6280	3.79796										2006	6280	3.79796
2007	614	2.78817										2007	614	2.78817
2008	2310	3.36361										2008	2310	3.36361

Appendix J: Gage locations, output data, and procedures for two-station comparison

11160500
Descriptive statistics

N_1 = 16 (1937, 1940-41, 1959–60, 1962-65, 1967-71, 1973, 1982)

N_2 = 42 (1938, 1942-43, 1945-46, 1949-58, 1974-75, 1978-81, 1983-87, 1991-2000, 2002-06, 2008)

N_3 = 16 (1937, 1940-1941, 1959–60, 1962-65, 1967-71, 1973, 1982)

N_e = 20.0

$\bar{X}_1$ = 3.8748

$\bar{X}_2$ = 3.8694

$\bar{X}_3$ = 3.8709

$\bar{Y}$ = 3.1493

$\bar{Y}_1$ = 3.1510

$\bar{Y}_3$ = 3.1510

Sx_1 = 0.3827

Sx_2 = 0.2966

Sy = 0.2704

Sy_1 = 0.2859

Sy_3 = 0.2859

Calculate b and r

Equation 7–1 b = 0.4282

Equation 7–2 r = 0.5732

Criterion and adjustment procedure for the mean

Equation 7–4 $r = 0.5732 > 0.2673 = r_{min}$

Because $r > r_{min}$, adjustment to the mean is worthwhile.

Calculate Var($\bar{Y}$) and Var ($\bar{Y}_3$)

Equation 7–3 Var($\bar{Y}$) = 0.0038

Equation 7–5b $\bar{Y}$ = 3.1493

Equation 7–6 Var($\bar{Y}_3$) = 0.00511

If Var($\bar{Y}_3$) < Var($\bar{Y}$), then use $\bar{Y}_3$. Otherwise, use $\bar{Y}$.

0.00511 > 0.0038, therefore 3.1493 will be used.

Appendix J: Gage locations, output data, and procedures for two-station comparison

11160500
Descriptive statistics continued

Final estimate of the mean

$\overline{Y} = 3.1493$

Equivalent years of record for the mean

Equation 7–7 $N_e = 20.0$

Criterion and adjustment procedure for the standard deviation

Equation 7–9 $|r| = 0.5732 > 0.5215 = r_{min}$

Because $r > r_{min}$, adjustment to the standard deviation is worthwhile.

where A = -9.7517, B = 1.9645, C = 0.1870

Equation 7–8 $Var(Sy^2) = 0.000872$

Equation 7–10 $Sy^2 = 0.0731$

$Sy = 0.2704$

Equation 7–11 $Var(Sy_3^2) = 0.000891$

If $Var(Sy_3^2) < Var(Sy^2)$, use Sy_3. Otherwise, use Sy.

0.000891 > 0.000872, therefore 0.2704 will be used

Final estimate of standard deviation

Sy = 0.2704 (from equation 7–10)

Appendix J: Gage locations, output data, and procedures for two-station comparison

11160500 San Lorenzo River at Big Trees, CA
11161900 Scott Creek above Little Creek near Davenport, CA

		Log10(LR)			Log10(SR)			Log10(LR)			Log10(SR)			Log10(LR)
	Mean	3.87089			3.15099			3.87483			3.15099			3.86939
	Std Dev	0.31912			0.28588			0.38270			0.28588			0.29663
	Median	3.92007			3.15533			3.93369			3.15533			3.88781
	Years	58			16			16			16			42
Non concurren			Non-concurrent years:											
		WARNING: If any (below) are > | 10% | data may not be normally distributed												
42		-1.25%			-0.14%			-1.50%			-0.14%			-0.47%

Long Record data			Short Record data			Concurrent Years						data		
WY	LR -Q	Log10(LR)	WY	SR-Q	Log10(SR)	WY	LR -Q	Log10(LR)	WY	SR-Q	Log10(SR)	WY	LR -Q	Log10(LR)
1937	9910	3.99607	1937	1050	3.02119	1937	9910	3.99607	1937	1050	3.02119			
1938	13800	4.13988										1938	13800	4.13988
1939														
1940	24000	4.38021	1940	7240	3.85974	1940	24000	4.38021	1940	7240	3.85974			
1941	15500	4.19033	1941	1440	3.15836	1941	15500	4.19033	1941	1440	3.15836			
1942	13400	4.12710										1942	13400	4.12710
1943	13900	4.14301										1943	13900	4.14301
1944														
1945	13200	4.12057										1945	13200	4.12057
1946	2810	3.44871										1946	2810	3.44871
1947														
1948														
1949	3880	3.58883										1949	3880	3.58883
1950	6190	3.79169										1950	6190	3.79169
1951	10600	4.02531										1951	10600	4.02531
1952	14900	4.17319										1952	14900	4.17319
1953	9250	3.96614										1953	9250	3.96614
1954	2710	3.43297										1954	2710	3.43297
1955	3300	3.51851										1955	3300	3.51851
1956	30400	4.48287										1956	30400	4.48287
1957	2560	3.40824										1957	2560	3.40824
1958	17200	4.23553										1958	17200	4.23553
1959	6690	3.82543	1959	806	2.90634	1959	6690	3.82543	1959	806	2.90634			
1960	2990	3.47567	1960	500	2.69897	1960	2990	3.47567	1960	500	2.69897			
1961														
1962	6090	3.78462	1962	1970	3.29447	1962	6090	3.78462	1962	1970	3.29447			
1963	13000	4.11394	1963	1560	3.19312	1963	13000	4.11394	1963	1560	3.19312			
1964	2660	3.42488	1964	720	2.85733	1964	2660	3.42488	1964	720	2.85733			
1965	8450	3.92686	1965	1590	3.20140	1965	8450	3.92686	1965	1590	3.20140			
1966														
1967	1040	3.01703	1967	1900	3.27875	1967	1040	3.01703	1967	1900	3.27875			
1968	8720	3.94052	1968	995	2.99782	1968	8720	3.94052	1968	995	2.99782			
1969	11500	4.06070	1969	1180	3.07188	1969	11500	4.06070	1969	1180	3.07188			
1970	8190	3.91328	1970	1420	3.15229	1970	8190	3.91328	1970	1420	3.15229			
1971	2530	3.40312	1971	810	2.90849	1971	2530	3.40312	1971	810	2.90849			
1972														
1973	11800	4.07188	1973	1550	3.19033	1973	11800	4.07188	1973	1550	3.19033			
1974	4220	3.62531										1974	4220	3.62531
1975	5040	3.70243										1975	5040	3.70243
1976														
1977														
1978	11300	4.05308										1978	11300	4.05308
1979	5080	3.70586										1979	5080	3.70586
1980	10500	4.02119										1980	10500	4.02119
1981	2410	3.38202										1981	2410	3.38202
1982	29700	4.47276	1982	4220	3.62531	1982	29700	4.47276	1982	4220	3.62531			
1983	13400	4.12710										1983	13400	4.12710
1984	6290	3.79865										1984	6290	3.79865
1985	3290	3.51720										1985	3290	3.51720
1986	19800	4.29667										1986	19800	4.29667
1987	3220	3.50786										1987	3220	3.50786
1988														
1989														
1990														
1991	4100	3.61278										1991	4100	3.61278
1992	10400	4.01703										1992	10400	4.01703
1993	6430	3.80821										1993	6430	3.80821
1994	2290	3.35984										1994	2290	3.35984
1995	14200	4.15229										1995	14200	4.15229
1996	5790	3.76268										1996	5790	3.76268
1997	11400	4.05690										1997	11400	4.05690
1998	19400	4.28780										1998	19400	4.28780
1999	3200	3.50515										1999	3200	3.50515
2000	7550	3.87795										2000	7550	3.87795
2001														
2002	7880	3.89653										2002	7880	3.89653
2003	13200	4.12057										2003	13200	4.12057
2004	11200	4.04922										2004	11200	4.04922
2005	4620	3.66464										2005	4620	3.66464
2006	13300	4.12385										2006	13300	4.12385
2007														
2008	7570	3.87910										2008	7570	3.87910

Appendix J: Gage locations, output data, and procedures for two-station comparison

11162500
Descriptive statistics

N_1 = 15 (1937, 1959-60, 1962-71, 1973, 1982)

N_2 = 39 (1952–58, 1974-75, 1978–81, 1983–2008)

N_3 = 16 (1937, 1940-41, 1959–60, 1962-71, 1973, 1982)

N_e = 23.2

$\bar{X}_1 = 3.4243$

$\bar{X}_2 = 3.3621$

$\bar{X}_3 = 3.3677$

$\bar{Y} = 3.0737$

$\bar{Y}_1 = 3.0998$

$\bar{Y}_3 = 3.1510$

$Sx_1 = 0.3425$

$Sx_2 = 0.3914$

$Sy = 0.2429$

$Sy_1 = 0.2299$

$Sy_3 = 0.2859$

Calculate b and r

Equation 7–1 $b = 0.5095$

Equation 7–2 $r = 0.7591$

Criterion and adjustment procedure for the mean

Equation 7–4 $r = 0.7591 > 0.5068 = r_{min}$

Because $r > r_{min}$, adjustment to the mean is worthwhile.

Calculate Var($\bar{Y}$) and Var ($\bar{Y}_3$)

Equation 7–3 $Var(\bar{Y}) = 0.0023$

Equation 7–5b $\bar{Y} = 3.0737$

Equation 7–6 $Var(\bar{Y}_3) = 0.00511$

If $Var(\bar{Y}_3) < Var(\bar{Y})$, then use $\bar{Y}_3$. Otherwise, use $\bar{Y}$.

0.00511 > 0.0023, therefore 3.0737 will be used

Appendix J: Gage locations, output data, and procedures for two-station comparison

11162500
Descriptive statistics continued

Final estimate of the mean

$\bar{Y}$ = 3.0737 (from equation 7–5b)

Equivalent years of record for the mean

Equation 7–7 $N_e = 23.2$

Criterion and adjustment procedure for the standard deviation

Equation 7–9 $|r| = 0.7591 > 0.5552 = r_{min}$

Because $r > r_{min}$, adjustment to the standard deviation is worthwhile.

where A = -10.6171, B = 2.3251, C = 0.2920

Equation 7–8 $Var(Sy^2) = 0.0010$

Equation 7–10 $Sy^2 = 0.0590$

$Sy = 0.2429$

Equation 7–11 $Var(Sy_3^2) = 0.002825$

If $Var(Sy_3^2) < Var(Sy^2)$, use Sy_3. Otherwise, use Sy.

0.002825 > 0.0010, therefore 0.2429 will be used

Final estimate of standard deviation

Sy = 0.2429 (from equation 7–10)

Appendix J: Gage locations, output data, and procedures for two-station comparison

11162500 Pescadero Creek near Pescadero, CA
11161900 Scott Creek above Little Creek near Davenport, CA

		Log10(LR)			Log10(SR)			Log10(LR)			Log10(SR)			Log10(LR)
	Mean	3.36775			3.15099			3.42434			3.09984			3.36208
	Std Dev	0.38162			0.28588			0.34248			0.22987			0.39141
	Median	3.44012			3.15533			3.45007			3.11209			3.44248
	Years	54			16			14			14			39
Non concurren			Non-concurrent years:											
		WARNING: If any (below) are > | 10% | data may not be normally distributed												
38		-2.10%			-0.14%			-0.75%			-0.39%			-2.34%

Long Record data			Short Record data			Concurrent Years						data		
WY	LR -Q	Log10(LR)	WY	SR-Q	Log10(SR)	WY	LR -Q	Log10(LR)	WY	SR-Q	Log10(SR)	WY	LR -Q	Log10(LR)
1937	5950	3.77452	1937	1050	3.02119	1937	5950	3.77452	1937	1050	3.02119			
1938														
1939														
1940			1940	7240	3.85974									
1941			1941	1440	3.15836									
1952	3870	3.58771										1952	3870	3.58771
1953	4030	3.60531										1953	4030	3.60531
1954	953	2.97909										1954	953	2.97909
1955	840	2.92428										1955	840	2.92428
1956	9420	3.97405										1956	9420	3.97405
1957	908	2.95809										1957	908	2.95809
1958	7630	3.88252										1958	7630	3.88252
1959	1380	3.13988	1959	806	2.90634	1959	1380	3.13988	1959	806	2.90634			
1960	816	2.91169	1960	500	2.69897	1960	816	2.91169	1960	500	2.69897			
1961														
1962	1720	3.23553	1962	1970	3.29447	1962	1720	3.23553	1962	1970	3.29447			
1963	6700	3.82607	1963	1560	3.19312	1963	6700	3.82607	1963	1560	3.19312			
1964	1170	3.06819	1964	720	2.85733	1964	1170	3.06819	1964	720	2.85733			
1965	3310	3.51983	1965	1590	3.20140	1965	3310	3.51983	1965	1590	3.20140			
1966	626	2.79657												
1967	4100	3.61278	1967	1900	3.27875	1967	4100	3.61278	1967	1900	3.27875			
1968	2740	3.43775	1968	995	2.99782	1968	2740	3.43775	1968	995	2.99782			
1969	2900	3.46240	1969	1180	3.07188	1969	2900	3.46240	1969	1180	3.07188			
1970	2300	3.36173	1970	1420	3.15229	1970	2300	3.36173	1970	1420	3.15229			
1971	770	2.88649	1971	810	2.90849	1971	770	2.88649	1971	810	2.90849			
1972														
1973	5380	3.73078	1973	1550	3.19033	1973	5380	3.73078	1973	1550	3.19033			
1974	2370	3.37475										1974	2370	3.37475
1975	1740	3.24055										1975	1740	3.24055
1976														
1977														
1978	4060	3.60853										1978	4060	3.60853
1979	1900	3.27875										1979	1900	3.27875
1980	2940	3.46835										1980	2940	3.46835
1981	631	2.80003										1981	631	2.80003
1982	9400	3.97313	1982	4220	3.62531	1982	9400	3.97313	1982	4220	3.62531			
1983	7550	3.87795										1983	7550	3.87795
1984	2150	3.33244										1984	2150	3.33244
1985	1680	3.22531										1985	1680	3.22531
1986	5270	3.72181										1986	5270	3.72181
1987	702	2.84634										1987	702	2.84634
1988	475	2.67669										1988	475	2.67669
1989	751	2.87564										1989	751	2.87564
1990	508	2.70586										1990	508	2.70586
1991	1180	3.07188										1991	1180	3.07188
1992	4100	3.61278										1992	4100	3.61278
1993	5060	3.70415										1993	5060	3.70415
1994	991	2.99607										1994	991	2.99607
1995	6210	3.79309										1995	6210	3.79309
1996	3180	3.50243										1996	3180	3.50243
1997	3870	3.58771										1997	3870	3.58771
1998	10600	4.02531										1998	10600	4.02531
1999	2700	3.43136										1999	2700	3.43136
2000	4660	3.66839										2000	4660	3.66839
2001	710	2.85126										2001	710	2.85126
2002	2770	3.44248										2002	2770	3.44248
2003	5600	3.74819										2003	5600	3.74819
2004	3810	3.58092										2004	3810	3.58092
2005	1340	3.12710										2005	1340	3.12710
2006	5980	3.77670										2006	5980	3.77670
2007	518	2.71433										2007	518	2.71433
2008	3490	3.54283										2008	3490	3.54283

Appendix J: Gage locations, output data, and procedures for two-station comparison

11164500
Descriptive statistics

N_1 = 16 (1937, 1940-41,1959-60, 1962-65, 1967-1971, 1973, 1982)

N_2 = 43 (1932-36, 1938, 1951-1958, 1961, 1966, 1972, 1974-81, 1983-2006)

N_3 = 16 (1937, 1940-41,1959-60, 1962-65, 1967-1971, 1973, 1982)

N_e = 21.9

$\bar{X}_1$ = 3.2834

$\bar{X}_2$ = 3.2120

$\bar{X}_3$ = 3.2685

$\bar{Y}$ = 3.1281

$\bar{Y}_1$ = 3.1510

$\bar{Y}_3$ = 3.1510

Sx_1 = 0.2688

Sx_2 = 0.4462

Sy = 0.3527

Sy_1 = 0.2859

Sy_3 = 0.2859

Calculate b and r

Equation 7–1 b = 0.6836

Equation 7–2 r = 0.6427

Criterion and adjustment procedure for the mean

Equation 7–4 $r = 0.6427 > 0.2673 = r_{min}$

Because $r > r_{min}$, adjustment to the mean is worthwhile.

Calculate Var($\bar{Y}$) and Var ($\bar{Y}_3$)

Equation 7–3 Var($\bar{Y}$) = 0.0037

Equation 7–5b $\bar{Y}$ = 3.1408

Equation 7–6 Var($\bar{Y}_3$) = 0.00511

If Var($\bar{Y}_3$) < Var($\bar{Y}$), then use $\bar{Y}_3$. Otherwise, use $\bar{Y}$.

0.00511 > 0.0037, therefore 3.1281 will be used

11164500
Descriptive statistics continued

Final estimate of the mean

$\bar{Y}$ = 3.1281

Equivalent years of record for the mean

Equation 7–7 $N_e = 21.9$

Criterion and adjustment procedure for the standard deviation

Equation 7–9 $|r| = 0.6427 > 0.5215 = r_{min}$

Because $r > r_{min}$, adjustment to the standard deviation is worthwhile.

where A = -9.9224, B = 1.9986, C = 0.1904

Equation 7–8 $Var(Sy^2) = 0.0008$

Equation 7–10 $Sy^2 = 0.1242$

$Sy = 0.3524$

Equation 7–11 $Var(Sy_3^2) = 0.000891$

If $Var(Sy_3^2) < Var(Sy^2)$, use Sy_3. Otherwise, use Sy.

0.000891 > 0.000833, therefore 0.3524 will be used

Final estimate of standard deviation

Sy = 0.3524 (from equation 7–10)

Appendix J: Gage locations, output data, and procedures for two-station comparison

11164500 San Francisquito Creek at Stanford University, CA
11161900 Scott Creek above Little Creek near Davenport, CA

		Log10(LR)			Log10(SR)			Log10(LR)			Log10(SR)			Log10(LR)
	Mean	3.26848			3.15099			3.28345			3.15099			3.21200
	Std Dev	0.28996			0.28588			0.26877			0.28588			0.44618
	Median	3.31855			3.15533			3.37187			3.15533			3.29003
	Years	58			16			16			16			43
Non concurrent			Non-concurrent years:											
		WARNING: If any (below) are > | 10% | data may not be normally distributed												
42		-1.51%			-0.14%			-2.62%			-0.14%			-2.37%

Long Record data			Short Record data			Concurrent Years						data		
WY	LR -Q	Log10(LR)	WY	SR-Q	Log10(SR)	WY	LR -Q	Log10(LR)	WY	SR-Q	Log10(SR)	WY	LR -Q	Log10(LR)
1932	1160	3.064458										1932	1160	3.064458
1933	730	2.863323										1933	730	2.863323
1934	670	2.826075										1934	670	2.826075
1935	1560	3.193125										1935	1560	3.193125
1936	1660	3.220108										1936	1660	3.220108
1937	2620	3.418301	1937	1050	3.02119	1937	2620	3.41830	1937	1050	3.02119			
1938	1330	3.123852										1938	1330	3.123852
1940	3100	3.49136	1940	7240	3.85974	1940	3100	3.49136	1940	7240	3.85974			
1941	2410	3.38202	1941	1440	3.15836	1941	2410	3.38202	1941	1440	3.15836			
1951	3650	3.56229										1951	3650	3.56229
1952	2320	3.36549										1952	2320	3.36549
1953	1950	3.29003										1953	1950	3.29003
1955	797	2.90146										1955	797	2.90146
1956	5560	3.74507										1956	5560	3.74507
1958	4460	3.64933										1958	4460	3.64933
1959	868	2.93852	1959	806	2.90634	1959	868	2.93852	1959	806	2.90634			
1960	1020	3.00860	1960	500	2.69897	1960	1020	3.00860	1960	500	2.69897			
1961												1961	12	1.07918
1962	996	2.99826	1962	1970	3.29447	1962	996	2.99826	1962	1970	3.29447			
1963	3270	3.51455	1963	1560	3.19312	1963	3270	3.51455	1963	1560	3.19312			
1964	948	2.97681	1964	720	2.85733	1964	948	2.97681	1964	720	2.85733			
1965	1120	3.04922	1965	1590	3.20140	1965	1120	3.04922	1965	1590	3.20140			
1966	880	2.94448										1966	880	2.94448
1967	4000	3.60206	1967	1900	3.27875	1967	4000	3.60206	1967	1900	3.27875			
1968	1130	3.05308	1968	995	2.99782	1968	1130	3.05308	1968	995	2.99782			
1969	2300	3.36173	1969	1180	3.07188	1969	2300	3.36173	1969	1180	3.07188			
1970	3110	3.49276	1970	1420	3.15229	1970	3110	3.49276	1970	1420	3.15229			
1971	1000	3.00000	1971	810	2.90849	1971	1000	3.00000	1971	810	2.90849			
1972	700	2.84510										1972	700	2.84510
1973	3390	3.53020	1973	1550	3.19033	1973	3390	3.53020	1973	1550	3.19033			
1974	3410	3.53275										1974	3410	3.53275
1975	2190	3.34044										1975	2190	3.34044
1978	2470	3.39270										1978	2470	3.39270
1979	1330	3.12385										1979	1330	3.12385
1980	3300	3.51851										1980	3300	3.51851
1981	626	2.79657										1981	626	2.79657
1982	5220	3.71767	1982	4220	3.62531	1982	5220	3.71767	1982	4220	3.62531			
1983	3420	3.53403										1983	3420	3.53403
1984	1700	3.23045										1984	1700	3.23045
1985	2270	3.35603										1985	2270	3.35603
1986	3480	3.54158										1986	3480	3.54158
1987	1540	3.18752										1987	1540	3.18752
1988	712	2.85248										1988	712	2.85248
1991	626	2.79657										1991	626	2.79657
1992	2580	3.41162										1992	2580	3.41162
1993	3010	3.47857										1993	3010	3.47857
1994	824	2.91593										1994	824	2.91593
1995	3320	3.52114										1995	3320	3.52114
1996	1520	3.18184										1996	1520	3.18184
1997	3250	3.51188										1997	3250	3.51188
1998	7200	3.85733										1998	7200	3.85733
1999	2640	3.42160										1999	2640	3.42160
2000	3930	3.59439										2000	3930	3.59439
2001	621	2.79309										2001	621	2.79309
2002	1060	3.02531										2002	1060	3.02531
2003	3730	3.57171										2003	3730	3.57171
2004	1980	3.29667										2004	1980	3.29667
2005	940	2.97313										2005	940	2.97313
2006	4840	3.68485										2006	4840	3.68485

Appendix J: Gage locations, output data, and procedures for two-station comparison

11169500
Descriptive statistics

N_1 = 16 (1937, 1940-41,1959-60, 1962-65, 1967-1971, 1973, 1982)

N_2 = 54 (1934-37, 1939-40, 1943-58, 1961, 1966, 1972, 1974-2008)

N_3 = 16 (1937, 1940-41,1959-60, 1962-65, 1967-1971, 1973, 1982)

N_e = 19.1

$\bar{X}_1$ = 2.7778

$\bar{X}_2$ = 2.6166

$\bar{X}_3$ = 2.6535

$\bar{Y}$ = 3.0827

$\bar{Y}_1$ = 3.1510

$\bar{Y}_3$ = 3.1510

Sx_1 = 0.2678

Sx_2 = 0.4199

Sy = 0.3121

Sy_1 = 0.2859

Sy_3 = 0.2859

Calculate b and r

Equation 7–1 $b = 0.5494$

Equation 7–2 $r = 0.5145$

Criterion and adjustment procedure for the mean

Equation 7–4 $r = 0.5145 > 0.2673 = r_{min}$

Because $r > r_{min}$, adjustment to the mean is worthwhile.

Calculate Var($\bar{Y}$) and Var ($\bar{Y}_3$)

Equation 7–3 Var($\bar{Y}$) = 0.0043

Equation 7–5b $\bar{Y}$ = 3.0827

Equation 7–6 Var($\bar{Y}_3$) = 0.00511

If Var($\bar{Y}_3$) < Var($\bar{Y}$), then use $\bar{Y}_3$. Otherwise, use $\bar{Y}$.

0.00511 > 0.0043, therefore 3.0827 will be used

Appendix J: Gage locations, output data, and procedures for two-station comparison

11169500
Descriptive statistics continued

Final estimate of the mean

$\bar{Y}$ = 3.0827

Equivalent years of record for the mean

Equation 7–7 $N_e = 19.1$

Criterion and adjustment procedure for the standard deviation

Equation 7–9 $|r| = 0.5145 > 0.5218 = r_{min}$

Because $r < r_{min}$, adjustment to the standard deviation is not worthwhile.

where A = -11.8024, B = 2.3739, C = 0.2284

Equation 7–8 $Var(Sy^2) = 0.000832$

Equation 7–10 $Sy^2 = 0.0974$

$Sy = 0.3121$

Equation 7–11 $Var(Sy_3^2) = 0.000891$

If $Var(Sy_3^2) < Var(Sy^2)$, use Sy_3. Otherwise, use Sy.

0.000891 > 0.000832, therefore 0.3121 will be used

Final estimate of standard deviation

Sy = 0.3121 (from equation 7–10)

Appendix J: Gage locations, output data, and procedures for two-station comparison

11169500 Saratoga Creek above Saratoga, CA
11161900 Scott Creek above Little Creek near Davenport, CA

		Log10(LR)			Log10(SR)			Log10(LR)			Log10(SR)			Log10(LR)
	Mean	2.65345			3.15099			2.77783			3.15099			2.61660
	Std Dev	0.39458			0.28588			0.26776			0.28588			0.41994
	Median	2.63245			3.15533			2.78030			3.15533			2.53208
	Years	70			16			16			16			54
Non concurren			Non-concurrent years:											
		WARNING: If any (below) are > | 10% | data may not be normally distributed												
54		0.80%			-0.14%			-0.09%			-0.14%			3.34%

Long Record data			Short Record data			Concurrent Years						data		
WY	LR -Q	Log10(LR)	WY	SR-Q	Log10(SR)	WY	LR -Q	Log10(LR)	WY	SR-Q	Log10(SR)	WY	LR -Q	Log10(LR)
1934	314	2.49693										1934	314	2.49693
1935	254	2.404834										1935	254	2.404834
1936	268	2.428135										1936	268	2.428135
1937	910	2.959041										1937	910	2.959041
1938	611	2.786041	1937	1050	3.02119	1937	611	2.78604	1937	1050	3.02119			
1939	110	2.041393										1939	110	2.041393
1940	2540	3.40483										1940	2540	3.40483
1941	608	2.78390	1940	7240	3.85974	1940	608	2.78390	1940	7240	3.85974			
1942	620	2.79239	1941	1440	3.15836	1941	620	2.79239	1941	1440	3.15836			
1943	1650	3.21748										1943	1650	3.21748
1944	175	2.24304										1944	175	2.24304
1945	898	2.95328										1945	898	2.95328
1946	287	2.45788										1946	287	2.45788
1948	134	2.12710										1948	134	2.12710
1949	293	2.46687										1949	293	2.46687
1950	222	2.34635										1950	222	2.34635
1951	826	2.91698										1951	826	2.91698
1952	1240	3.09342										1952	1240	3.09342
1953	494	2.69373										1953	494	2.69373
1954	232	2.36549										1954	232	2.36549
1955	107	2.02938										1955	107	2.02938
1956	2730	3.43616										1956	2730	3.43616
1957	225	2.35218										1957	225	2.35218
1958	772	2.88762										1958	772	2.88762
1959	683	2.83442	1959	806	2.90634	1959	683	2.83442	1959	806	2.90634			
1960	178	2.25042	1960	500	2.69897	1960	178	2.25042	1960	500	2.69897			
1961	129	2.11059										1961	129	2.11059
1962	432	2.63548	1962	1970	3.29447	1962	432	2.63548	1962	1970	3.29447			
1963	1160	3.06446	1963	1560	3.19312	1963	1160	3.06446	1963	1560	3.19312			
1964	338	2.52892	1964	720	2.85733	1964	338	2.52892	1964	720	2.85733			
1965	535	2.72835	1965	1590	3.20140	1965	535	2.72835	1965	1590	3.20140			
1966	151	2.17898										1966	151	2.17898
1967	583	2.76567	1967	1900	3.27875	1967	583	2.76567	1967	1900	3.27875			
1968	598	2.77670	1968	995	2.99782	1968	598	2.77670	1968	995	2.99782			
1969	1120	3.04922	1969	1180	3.07188	1969	1120	3.04922	1969	1180	3.07188			
1970	406	2.60853	1970	1420	3.15229	1970	406	2.60853	1970	1420	3.15229			
1971	255	2.40654	1971	810	2.90849	1971	255	2.40654	1971	810	2.90849			
1972	127	2.10380										1972	127	2.10380
1973	1580	3.19866	1973	1550	3.19033	1973	1580	3.19866	1973	1550	3.19033			
1974	345	2.53782										1974	345	2.53782
1975	398	2.59988										1975	398	2.59988
1978	2580	3.41162										1978	2580	3.41162
1979	307	2.48714										1979	307	2.48714
1980	1610	3.20683										1980	1610	3.20683
1981	161	2.20683										1981	161	2.20683
1982	1720	3.23553	1982	4220	3.62531	1982	1720	3.23553	1982	4220	3.62531	1982		
1983	1700	3.23045										1983	1700	3.23045
1984	426	2.62941										1984	426	2.62941
1985	177	2.24797										1985	177	2.24797
1986	1680	3.22531										1986	1680	3.22531
1987	174	2.24055										1987	174	2.24055
1988	109	2.03743										1988	109	2.03743
1990	119	2.07555										1990	119	2.07555
1991	336	2.52634										1991	336	2.52634
1992	493	2.69285										1992	493	2.69285
1993	665	2.82282										1993	665	2.82282
1994	121	2.08279										1994	121	2.08279
1995	1200	3.07918										1995	1200	3.07918
1996	539	2.73159										1996	539	2.73159
1997	944	2.97497										1997	944	2.97497
1998	2210	3.34439										1998	2210	3.34439
1999	383	2.58320										1999	383	2.58320
2000	502	2.70070										2000	502	2.70070
2001	162	2.20952										2001	162	2.20952
2002	310	2.49136										2002	310	2.49136
2003	131	2.11727										2003	131	2.11727
2004	620	2.79239										2004	620	2.79239
2005	188	2.27416										2005	188	2.27416
2006	1120	3.04922										2006	1120	3.04922
2008	936	2.97128										2008	936	2.97128

Appendix J: Gage locations, output data, and procedures for two-station comparison

*

Appendix 7

TWO STATION COMPARISON

INTRODUCTION

The procedure outlined herein is recommended for use in adjusting the logarithmic mean and standard deviation of a short record on the basis of a regression analysis with a nearby long-term record. The theoretical basis for the equations provided herein were developed by Matalas and Jacobs (29).

The first step of the procedure is to correlate observed peak flows for the short record with concurrent observed peak flows for the long record. The regression and correlation coefficients, respectively, can be computed by the following two equations:

$$b = \frac{\Sigma X_1 Y_1 - \Sigma X_1 \Sigma Y_1 / N_1}{\Sigma X_1^2 - (\Sigma X_1)^2 / N_1} \qquad (7\text{-}1)$$

$$r = b \frac{S_{x_1}}{S_{y_1}} \qquad (7\text{-}2)$$

where the terms are defined at the end of this Appendix.

If the correlation coefficient defined by equation 7-2 meets certain criteria, then improved estimates of the short record mean and standard deviation can be made. Both of these statistics can be improved when the variance of that statistic is reduced. As each statistic is evaluated separately, only one adjustment may be worthwhile. The criterion and adjustment procedure for each statistic are discussed separately. In each discussion, two cases are considered: (1) entire short record contained in the long record, (2) only part of the short record contained in the long record. The steps for case 2 include all of those for case 1 plus an additional one.

*

7-1

Appendix J: Gage locations, output data, and procedures for two-station comparison

* CRITERION AND ADJUSTMENT PROCEDURE FOR MEAN

The variance of the adjusted mean ($\overline{Y}$) can be determined by equation 7-3:

$$\mathrm{Var}(\overline{Y}) = \frac{\left(S_{y_1}\right)^2}{N_1} \left[1 - \frac{N_2}{N_1 + N_2} \left(r^2 - \frac{(1-r^2)}{(N_1-3)} \right) \right] \quad (7\text{-}3)$$

Since $(S_{y_1})^2/N_1$ is the variance of $\overline{Y}_1$, the short-record mean, $\overline{Y}$ will be a better estimate of the true mean than $\overline{Y}_1$ if the term $r^2 - \frac{1-r^2}{N_1-3}$ in equation 7-3 is positive. Solving this relationship for r yields equation 7-4. If the correlation coefficient satisfies equation 7-4,

$$r > 1/(N_1 - 2)^{1/2} \quad (7\text{-}4)$$

then an adjustment to the mean is worthwhile. The right side of this inequality represents the minimum critical value of r. Table 7-1 contains minimum critical values of r for various values of N_1. The adjusted logarithmic mean can be computed using equation 7-5a or 7-5b.

$$\overline{Y} = \overline{Y}_1 + \frac{N_2}{N_1+N_2} \left[b \quad (\overline{X}_2 - \overline{X}_1) \right] \quad (7\text{-}5a)$$

$$\overline{Y} = \overline{Y}_1 + b(\overline{X}_3 - \overline{X}_1) \quad (7\text{-}5b)$$

Equation 7-5b saves recomputing a new $\overline{X}_2$ at the long record station for each short record station that is being correlated with the long record station. While the adjusted mean from equation 7-5a or 7-5b may be an improved estimate of the mean obtained from the concurrent period, it may not be an improvement over the entire short record mean in case 2. It is necessary to compare the variance of the adjusted mean (equation 7-3) to the variance of the mean $(\overline{Y}_3)$ for the entire short record period (N_3). Compute the variance of the mean $\overline{Y}_3$ using equation 7-6:

$$\mathrm{Var}(\overline{Y}_3) = \frac{\left(S_{y_3}\right)^2}{N_3} \quad (7\text{-}6)$$ *

7-2

Appendix J: Gage locations, output data, and procedures for two-station comparison

* where S_{y_3} is the standard deviation of the logarithms of flows for the short record site for the period N_3. If the variance of equation 7-6 is smaller than the variance of $\overline{Y}$ given in equation 7-3, then use $\overline{Y}_3$ as the final estimate of the mean. Otherwise, use the value of $\overline{Y}$ computed in equation 7-5a or 7-5b.

EQUIVALENT YEARS OF RECORD FOR THE MEAN

As illustrated in equations 7-3 and 7-6, the variance of the mean is inversely proportional to the record length at the site. Using equation 7-3 it can be shown that the equivalent years of record, N_e, for the adjusted mean is:

$$N_e = \frac{N_1}{1 - \frac{N_2}{N_1+N_2}\left(r^2 - \frac{(1-r^2)}{(N_1-3)} \right)} \qquad (7\text{-}7)$$

It may be seen from equation 7-7 that when there is no correlation ($r=0$), then N_e is less than N_1. This indicates that the correlation technique can actually decrease the equivalent years of record unless r satisfies equation 7-4. For perfect correlation ($r=1$), then $N_e = N_1 + N_2$, the total record length at the long record site.

Although N_e is actually the equivalent years of record for the mean, it is recommended that N_e be used as an estimate of the equivalent years of record for the various exceedance probability floods in the computation of confidence limits and in applying the expected probability adjustment.

CRITERION AND ADJUSTMENT PROCEDURE FOR THE STANDARD DEVIATION

The variance of the adjusted variance S_y^2 (square of the standard deviation) can be determined by equation 7-8:

*

Appendix J: Gage locations, output data, and procedures for two-station comparison

*

$$Var(S_y^2) = \frac{2(S_{y_1})^4}{N_1-1} + \frac{N_2(S_{y_1})^4}{(N_1+N_2-1)^2}\left[Ar^4 + Br^2 + C\right] \quad (7\text{-}8)$$

where A, B, and C are defined below and the other terms are defined at the end of the appendix. In equation 7-8, $2(S_{y_1})^4/(N_1-1)$ is the variance of $S_{y_1}^2$ (the short-record variance). If the second term in equation 7-8 is negative, then the variance of S_y^2 will be less than the variance of $S_{y_1}^2$. Solving this relationship for r yields the following equation:

$$|r| > \left[\frac{-B \pm \sqrt{B^2-4AC}}{2A}\right]^{1/2} \quad (7\text{-}9)$$

where

$$A = \frac{(N_2+2)(N_1-6)(N_1-8)}{(N_1-3)(N_1-5)} - \frac{8(N_1-4)}{(N_1-3)} - \frac{2N_2(N_1-4)^2}{(N_1-3)^2} + \frac{N_1N_2(N_1-4)^2}{(N_1-3)^2(N_1-2)} + \frac{4(N_1-4)}{(N_1-3)}$$

$$B = \frac{6(N_2+2)(N_1-6)}{(N_1-3)(N_1-5)} + \frac{2(N_1^2-N_1-14)}{(N_1-3)} + \frac{2N_2(N_1-4)(N_1-5)}{(N_1-3)^2} - \frac{2(N_1-4)(N_1+3)}{} - \frac{2N_1N_2(N_1-4)^2}{}$$

$_1-3)^2(N_1-2)$ (N_1-3) (N.

$\frac{)}{-5)} - \frac{(N_1+1)(2N_1+N_2-2)}{N_1-1}$

$$C = \frac{2(N_1+1)}{N_1-3} + \frac{3(N_2+2}{(N_1-3)(N_1}$$

$\frac{)(N_1+1)}{3)} + \frac{N_1N_2(N_1-4)^2}{(N_1-3)^2(N_1-2)}$

$$+ \frac{2N_2(N_1-4)}{(N_1-3)^2} + \frac{2(N_1-4}{(N_1-}$$

7-4

Appendix J: Gage locations, output data, and procedures for two-station comparison

*The right side of the inequality (7-9) represents the minimum critical value of r. Table 7-1 gives approximate minimum critical values of r for various values of N_1. The table values are an approximation as they are solutions of equation 7-9 for a constant N_2. The variations in N_2 only affect the table values slightly.

If the correlation coefficient satisfies equation 7-9, then the adjusted variance can be computed by equation 7-10:

$$S_y^2 = \frac{1}{(N_1+N_2-1)}\left[(N_1-1)S_{y_1}^2 + (N_2-1)b^2 S_{x_2}^2 + \frac{N_2(N_1-4)(N_1-1)}{(N_1-3)(N_1-2)}(1-r^2)S_{y_1}^2 + \frac{N_1N_2}{N_1+N_2}b^2(\overline{X}_2-\overline{X}_1)^2\right] \quad (7\text{-}10)$$

The adjusted standard deviation S_y equals the square root of the adjusted variance in equation 7-10. The third term in brackets in equation 7-10 is an adjustment factor to give an unbiased estimate of S_y^2. This adjustment is equivalent to adding random noise to each estimated value of flow at the short-term site.

While the adjusted variance from equation 7-10 may be an improved estimate of the variance (standard deviation) obtained from the concurrent period, it may not be an improvement over the entire short record variance (standard deviation) in case 2. It is necessary to compare the variance of the adjusted variance (equation 7-8) to the variance of the variance ($S_{y_3}^2$) for the entire period (N_3). Compute the variance of the short-record variance ($S_{y_3}^2$) using equation 7-11.

$$\mathrm{Var}\left(S_{y_3}^2\right) = \frac{2\left(S_{y_3}\right)^4}{N_3 - 1} \quad (7\text{-}11)$$

*

7-5

*

where all terms are previously defined. If the variance of equation 7-11 is smaller than the variance of S_y^2 given in equation 7-8, then use S_{y_3} as the final estimate of the standard deviation. Otherwise, use the value of S_y determined from equation 7-10.

FURTHER CONSIDERATIONS

The above equations were developed under the assumption that the concurrent observations of flows at the short and long-term sites have a joint normal probability distribution with a skewness of zero. When this assumption is seriously violated, the above equations are not exact and this technique should be used with caution. In addition, the reliability of r depends on the length of the concurrent period, N_1. To obtain a reliable estimate of r, N_1 should be at least 10 years.

Notice that it is not necessary to estimate the actual annual peaks from the regression equation but only the adjusted logarithmic mean and standard deviation. The adjusted skew coefficient should be computed by weighting the generalized skew with the skew computed from the short record site as described in Section V.B.4.

*

Appendix J: Gage locations, output data, and procedures for two-station comparison

* TABLE 7-1 MINIMUM r VALUES FOR IMPROVING MEAN OR STANDARD DEVIATION ESTIMATES

CONCURRENT RECORD	MEAN	STANDARD DEVIATION
10	0.35	0.65
11	0.33	0.62
12	0.32	0.59
13	0.30	0.57
14	0.29	0.55
15	0.28	0.54
16	0.27	0.52
17	0.26	0.50
18	0.25	0.49
19	0.24	0.48
20	0.24	0.47
21	0.23	0.46
22	0.22	0.45
23	0.22	0.44
24	0.21	0.43
25	0.21	0.42
26	0.20	0.41
27	0.20	0.41
28	0.20	0.40
29	0.19	0.39
30	0.19	0.39
31	0.19	0.38
32	0.18	0.37
33	0.18	0.37
34	0.18	0.36
35	0.17	0.36

*

7-9

Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek

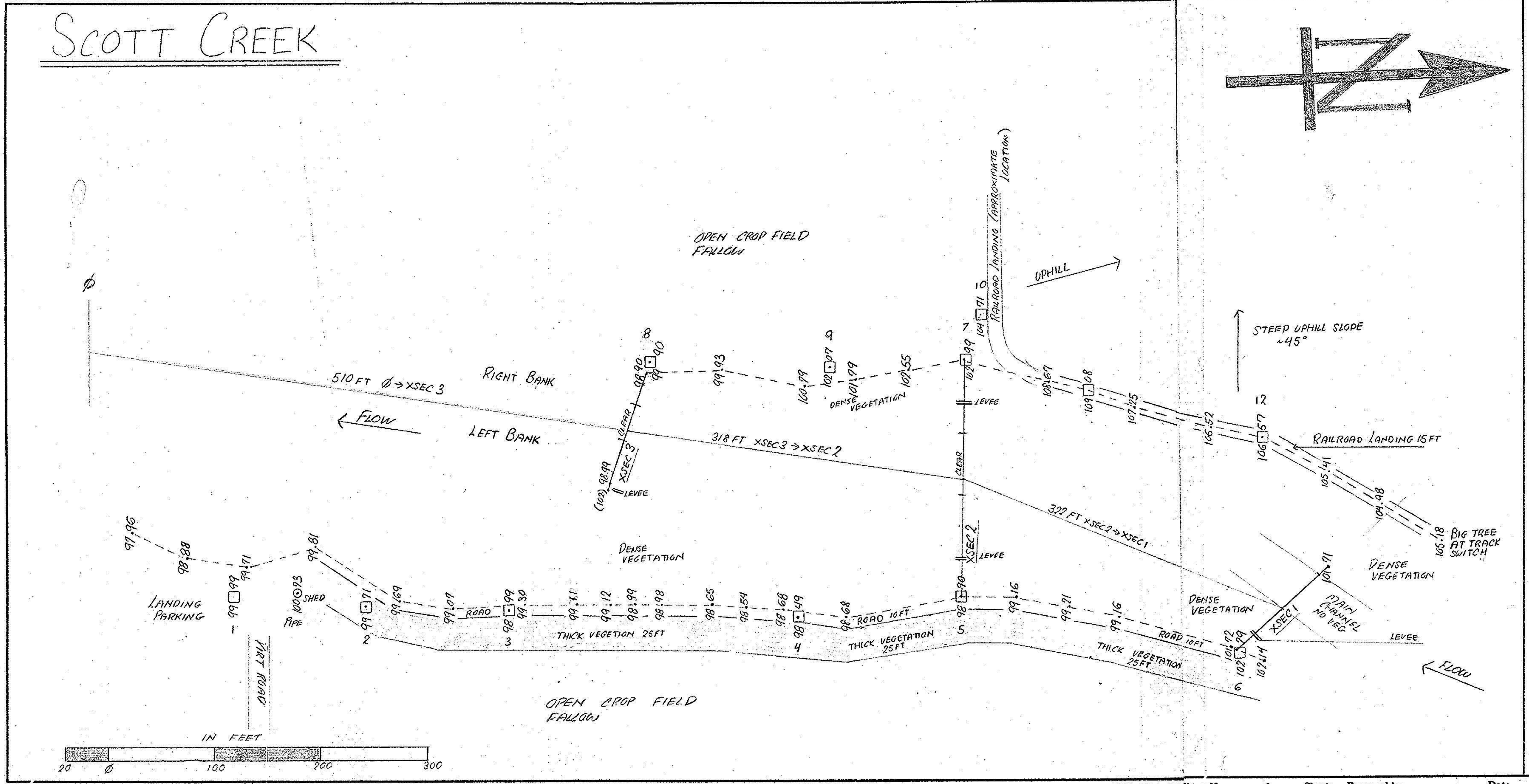
9-218-D
(March 1949)
Sketch Form—Double

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

File ....

)
n—Double

UNITED STATES DEPARTMENT OF THE IN
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION



Sheet No. .... of .... Sheets. Prepared by SCRUDATO Date .... Checked by .... Date ....

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GPO 895-17

Sheet No. .... of .... Sheets. Prepared by .... Date ....

Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek

STA	AZIM	ROD	STADIA	ELEV	DIST
⊼@⊡1	99.99 + [4.54] = 104.53 = HI				
L.B.	214°40'	6.57	7.13 / 6.00	97.96	113
do.	223°00'	5.65	5.92 / 5.37	98.88	55
do.	297°40'	4.82	4.98 / 4.68	99.71	30
Disch Pipe	359°20'	3.80	4.11 / 3.50	100.73	61
L.B.	331°20'	4.72	5.17 / 4.28	99.81	89
⊡2	[illegible]°10' − 180°00' ✓ 186°10'	4.82	5.45 / 4.21	99.71	124
⊼@⊡2	99.71 + [5.33] = 105.04				
⊡1	186°10'	5.02	5.63 / 4.41	100.02	122
BS + ⊡1 =	5.02 + 99.99 = 105.01				
	HI = 105.02				
L.B.	355°00'	5.33	5.49 / 5.17	99.69	32
do.	3°00'	5.95	6.36 / 5.54	99.07	82

① J L DARLING CORP TACOMA WA 98424-1017 www.RiteintheRain.com No. 302

10/15/08

Arbitrary elev of ⊡1 = 99.99

Set azimuth 0.0° to Mag North

edge of dense thicket @ edge of road

working in upstream direction

Sharp bend in discharge elbow for permanent recovery point

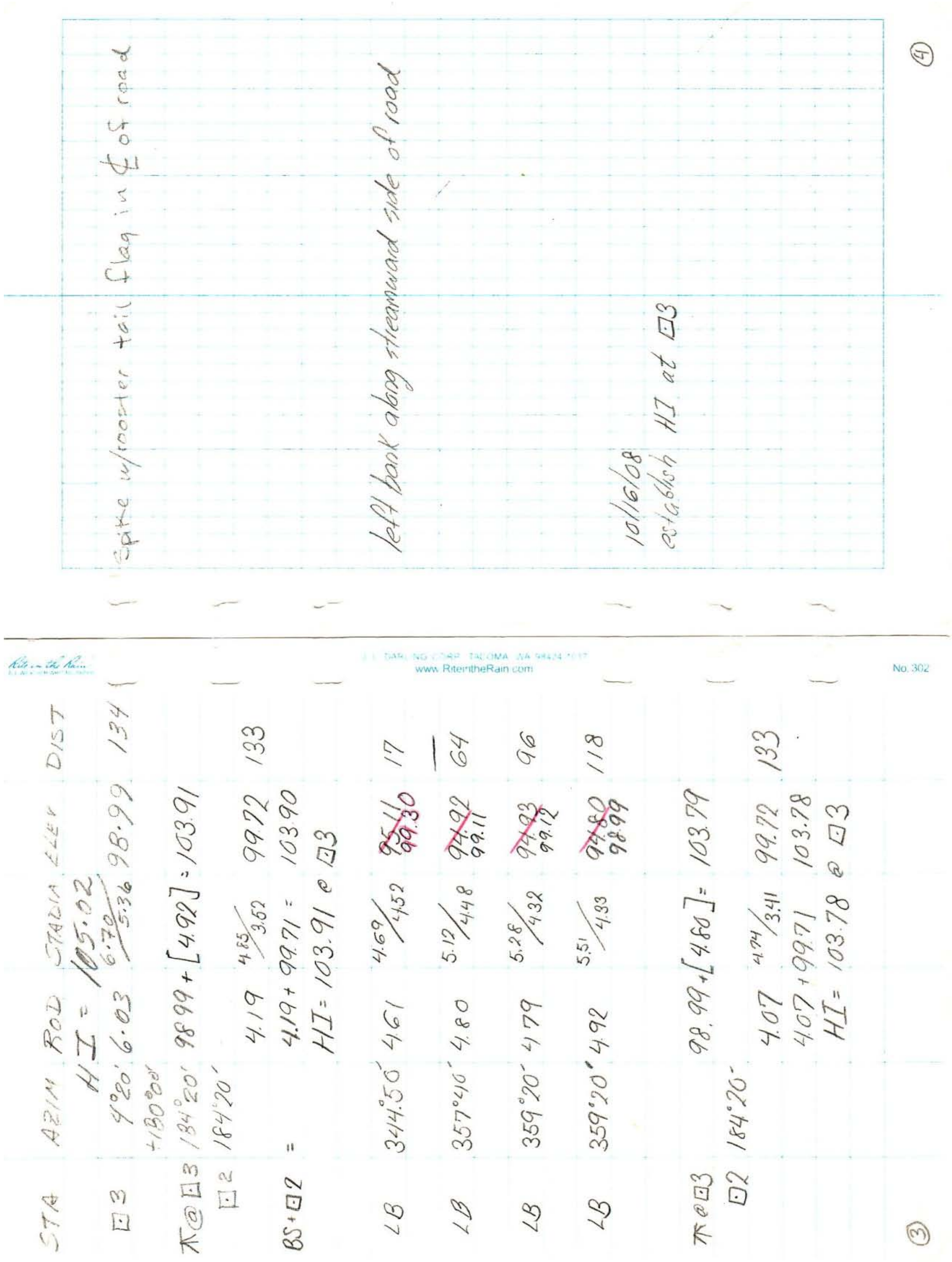
edge of dense thicket @ edge of road

spike set in road ℄, w/rooster tail flag

TAKE AVERAGE OF 105.04 AND 105.01

②

Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek



STA	AZIM	ROD	STADIA	ELEV	DIST
	HI = 105.02				
⊡3	4°20' +180°00'	6.03	6.70/5.36	98.99	134
⊼@⊡3	184°20'	98.99 + [4.92] = 103.91			
⊡2	184°20'	4.19	4.85/3.52	99.72	133
BS+⊡2	=	4.19 + 99.71 =		103.90	
		HI = 103.91 @ ⊡3			
LB	344°50'	4.61	4.69/4.52	~~95.11~~ 99.30	17
LB	357°40'	4.80	5.12/4.48	~~94.92~~ 99.11	64
LB	359°20'	4.79	5.28/4.32	~~94.93~~ 99.12	96
LB	359°20'	4.92	5.51/4.33	~~94.80~~ 98.99	118
⊼@⊡3		98.99 + [4.80] = 103.79			
⊡2	184°20'	4.07	4.74/3.41	99.72	133
		4.07 + 99.71		103.78	
		HI = 103.78 @ ⊡3			

③

Spike w/rooster tail flag in ℄ of road

left bank along streamward side of road

10/16/08
establish HI at ⊡3

④

Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek

Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek

STA	AZIM	ROD	STADIA	ELEV	DIST	Remarks
⊼ @ ⊡5		99.48 + [4.35] =		103.83		
⊡4	174°50'	5.32	5.85/4.80	103.81	105	98.49 ⊡4 + 5.32
		HI = 103.82 @ ⊡5				
LB	3°10'	4.66	4.93/4.41	99.16	52	along streamward side of road
LB	7°30'	4.61	5.12/4.10	99.21	102	
LB	9°20'	4.66	5.42/3.92	99.16	150	
LB	12°50'	2.10	3.40/0.81	101.72	259	ground at ⊡6
⊡6	12°50'	1.53	2.85/0.23	102.29	263	1-inch wooden stake with nail
	+180 = 192°50'					
⊼ @ ⊡6		102.29 + [4.39] =		106.68		
⊡5	192°50'	7.20	—/5.90	106.68	260	99.48 ⊡5 + 7.20; no upper stadia due to veg; 7.2 - 5.9 = 1.3 1.3×2 = 2.6 DISTANCE = 260
		HI = 106.68 @ ⊡6				
LB	24°40'	4.54	4.68/4.40	102.14	28	in veg and off road - high point

Rite in the Rain — All-Weather Writing Paper
J. L. DARLING CORP TACOMA, WA 98424-1017 www.RiteintheRain.com
No. 302
⑦ ⑧

Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek

STA	AZIM	ROD	STADIA	ELEV	DIST	
	HI = 106.68 @ ⊡6					Upstream cross-section #1
R/ 115	320°10'	4.97	5.56/4.40	101.71	116	NOAA fish area woods/crest of bank
110		8.6		98.08		right to left bank/char
105		5.1		101.58		edge of woods and vines (115-105)
100		10.5		96.18		
93		11.15		95.53		REW
90		11.7		94.98		Thalweg
77		11.12		95.56		LEW
65		11.1		95.58		
55		7.8		98.88		perimeter of tree line
36		7.4		99.28		
22		4.4		102.28		top of natural levee in woods
Ø				101.72		ground at stake

Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek

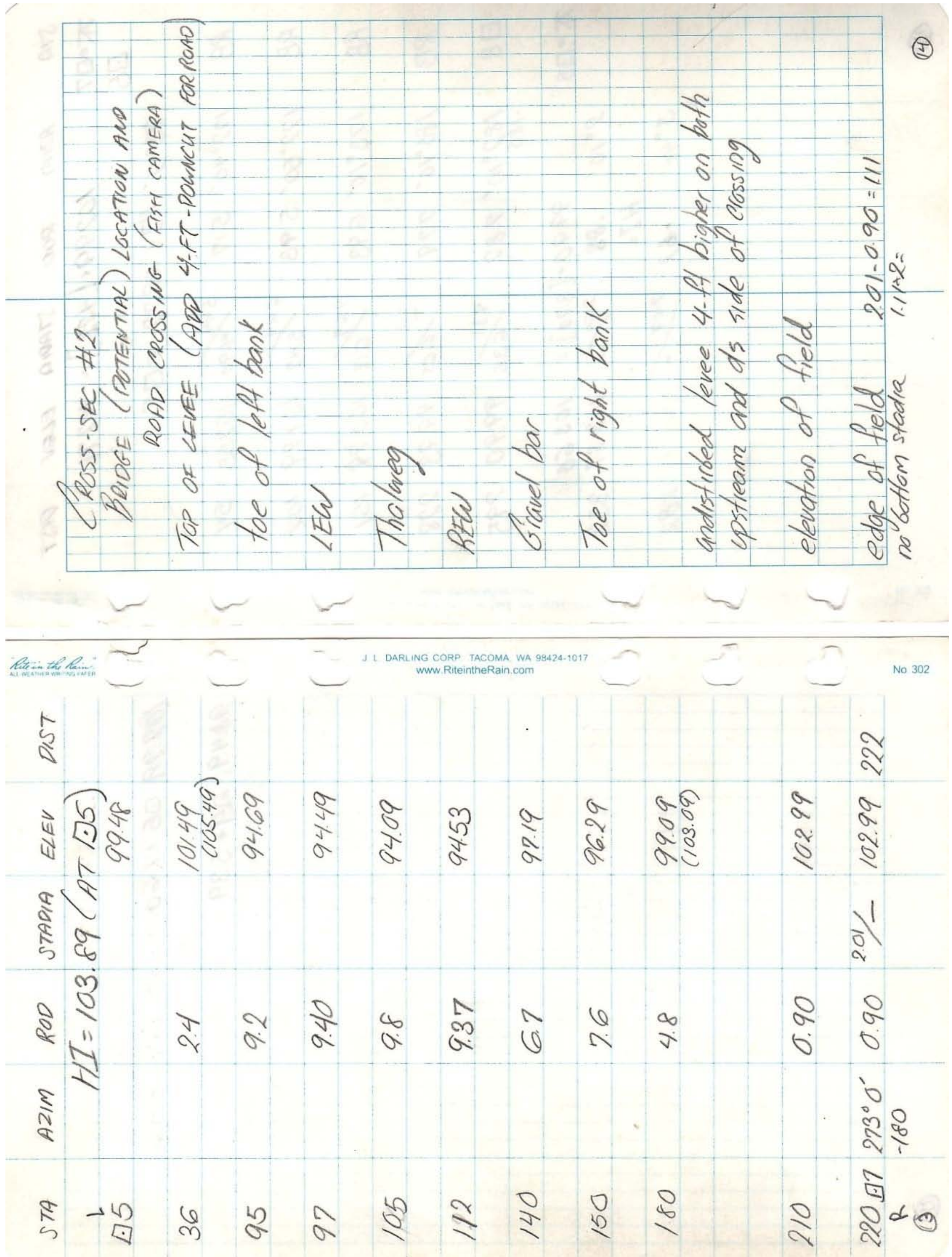
STA	AZIM	ROD	STADIA	ELEV	DIST
⊼ @ ⊡5		99.48 + [4.41] =		103.89	
⊡6	-180				
	12°50'	1.60	2.90/6.30	103.89	260
⊡4	175°10'	5.39	5.91/4.87	103.86	104

HI = 103.89 @ ⊡5

102.29 ⊡6 + 1.60

98.49 ⊡4 + 5.39

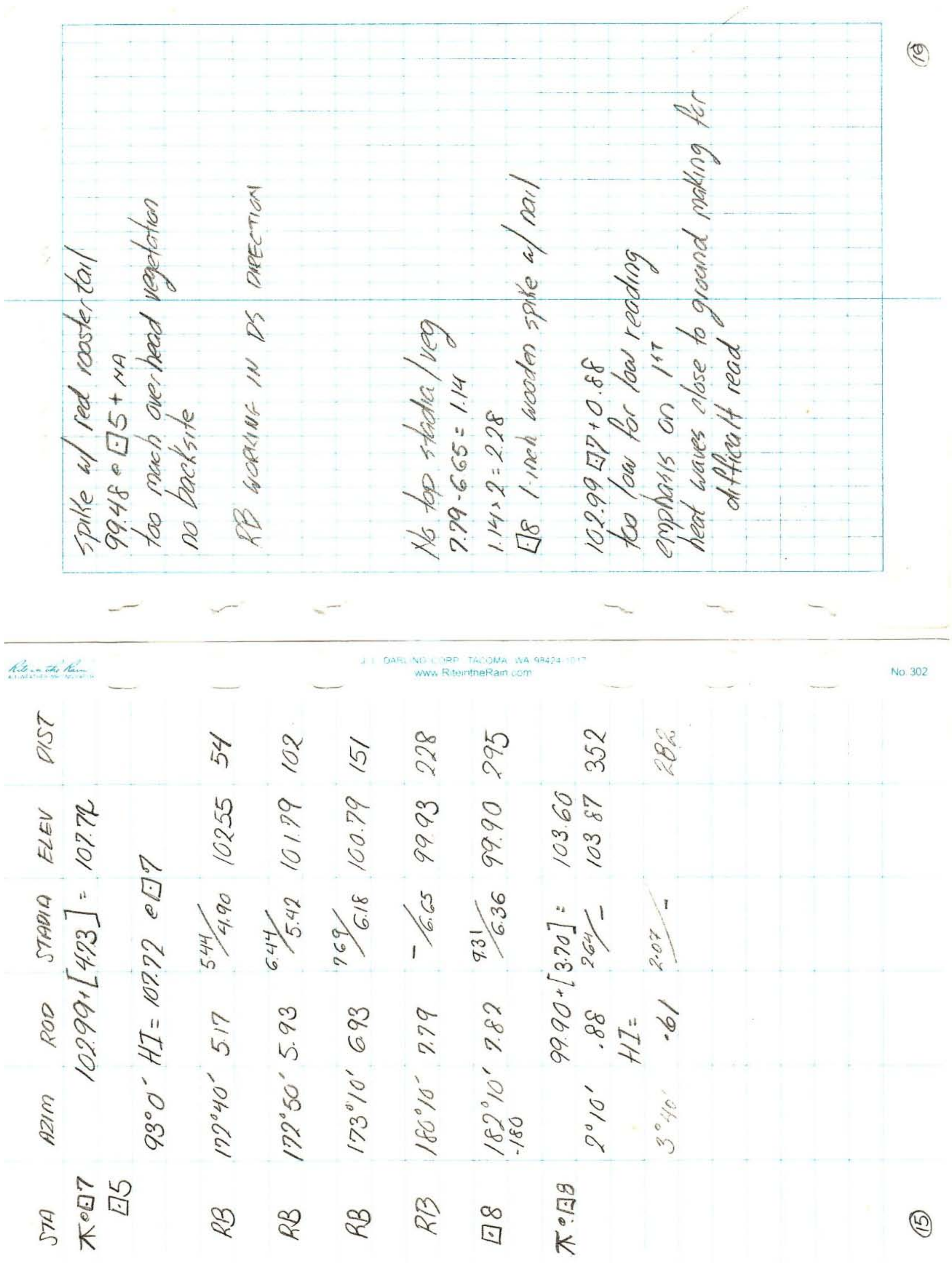
Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek



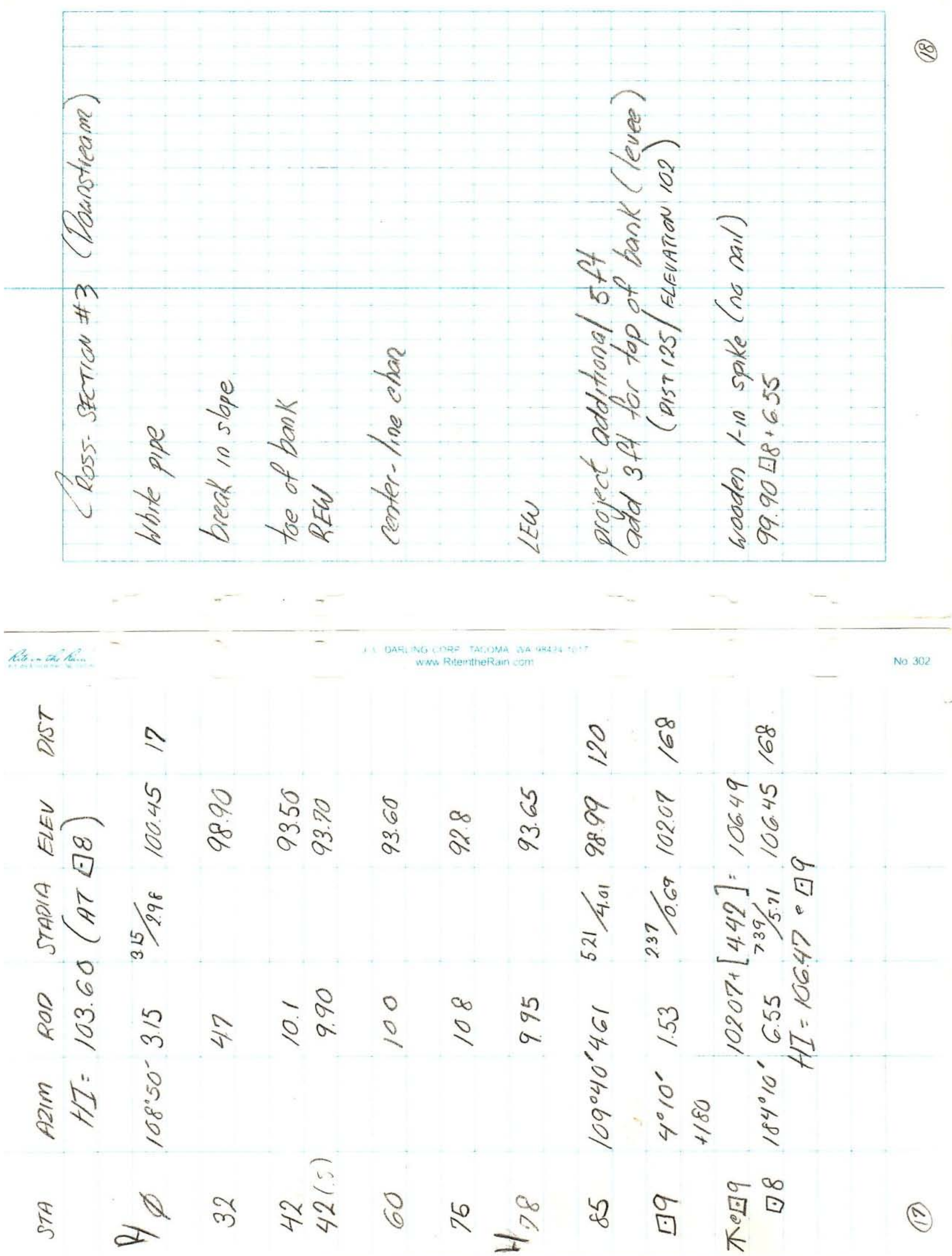
STA	AZIM	ROD	STADIA	ELEV	DIST	
	HI = 103.89 (AT ⊡5)					CROSS-SEC #2
⊡5				99.48		BRIDGE (POTENTIAL) LOCATION AND ROAD CROSSING (FISH CAMERA)
36		2.4		101.49 (105.49)		TOP OF LEVEE (ADD 4-FT-DOWNCUT FOR ROAD)
95		9.2		94.69		toe of left bank
97		9.40		94.49		LEW
105		9.8		94.09		Thalweg
112		9.37		94.53		REW
140		6.7		97.19		Gravel bar
150		7.6		96.29		Toe of right bank
180		4.8		99.09 (103.09)		undisturbed levee 4-ft higher on both upstream and ds side of crossing
210		0.90		102.99		elevation of field
220 ⊡7	273°0' -180	0.90	201/—	102.99	222	edge of field 201-0.90=111 1.1*2= no bottom stadia

(3) (4)

Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek



Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek



STA	AZIM	ROD	STADIA	ELEV	DIST
	HI = 103.60 (AT ⊡8)				
R ∅	108°50′	3.15	3.15/2.98	100.45	17
32		4.7		98.90	
42		10.1		93.50	
42(?)		9.90		93.70	
60		10.0		93.60	
75		10.8		92.8	
H 78		9.95		93.65	
85	109°40′	4.61	5.21/4.01	98.99	120
⊡9	4°10′ +180	1.53	2.37/0.69	102.07	168
⊼@⊡9		102.07+[4.42] =		106.49	
⊡8	184°10′	6.55	7.39/5.71	106.45	168
		HI = 106.47 @ ⊡9			

(17)

CROSS-SECTION #3 (Downstream)

White pipe

break in slope

toe of bank
REW

center-line chan

LEW

project additional 5 ft
add 3 ft for top of bank (levee)
(DIST 125 / ELEVATION 102)

wooden 1-in spike (no nail)
99.90 ⊡8 + 6.55

(18)

Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek

STA	AZIM	ROD	STADIA	ELEV	DIST
		HI = 106.47 (AT □9)			
□10	343°40′ −180 00	1.76	2.51/1.02	104.71	149
⊼ @ □10	163·40	[5.30] + 104.71 = 110.01 = HI			
□9		7.96	8.71/7.22		149
		7.96 + 102.07 = 110.03			
		HI = 110.02 (AT □10)			
□11	37°50′ +180	0.94	1.56/0.32	109.08	124
⊼ @ □11		109.08 + [4.97] = 114.05			
□10	217°50′	9.33	9.95/8.71	114.04	124
		HI = 114.04 @ □11			
RB	195°30′	5.37	5.57/5.18	108.67	39
RB	23°0′	6.79	6.99/6.53	107.25	46
RB	19°10′	7.52	8.56/7.36	106.52	120

(19)

levels in upstream direction along RR track
track is uppermost bank
right bank from tractor crossing to
end of reach

Spike w/red rooster tail flag in soil

Spike in railroad

104.71 □10 + 9.33

RB Top along streamward side of RR
RR landing a consistant 15 ft

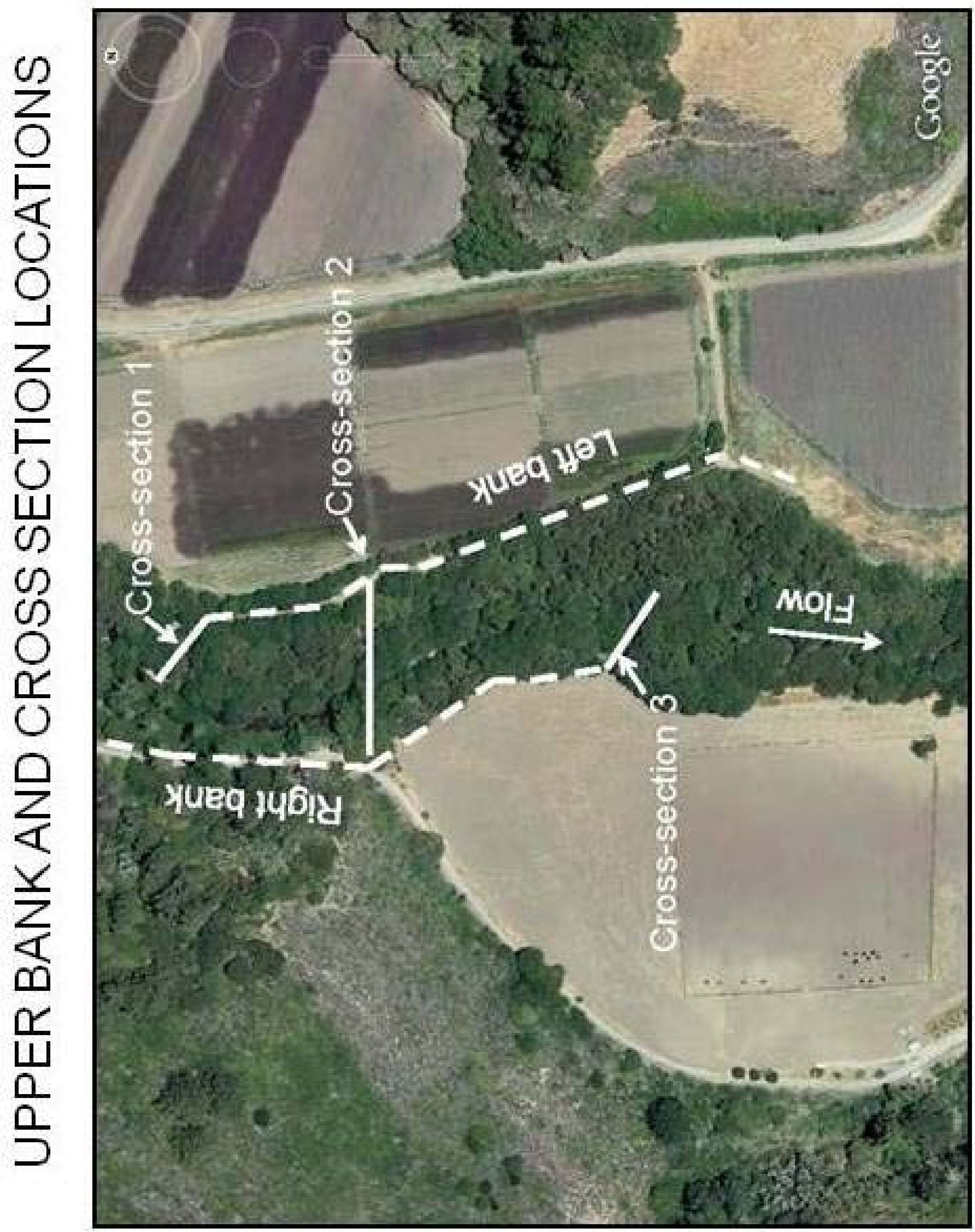
Rod moved - changed value

(20)

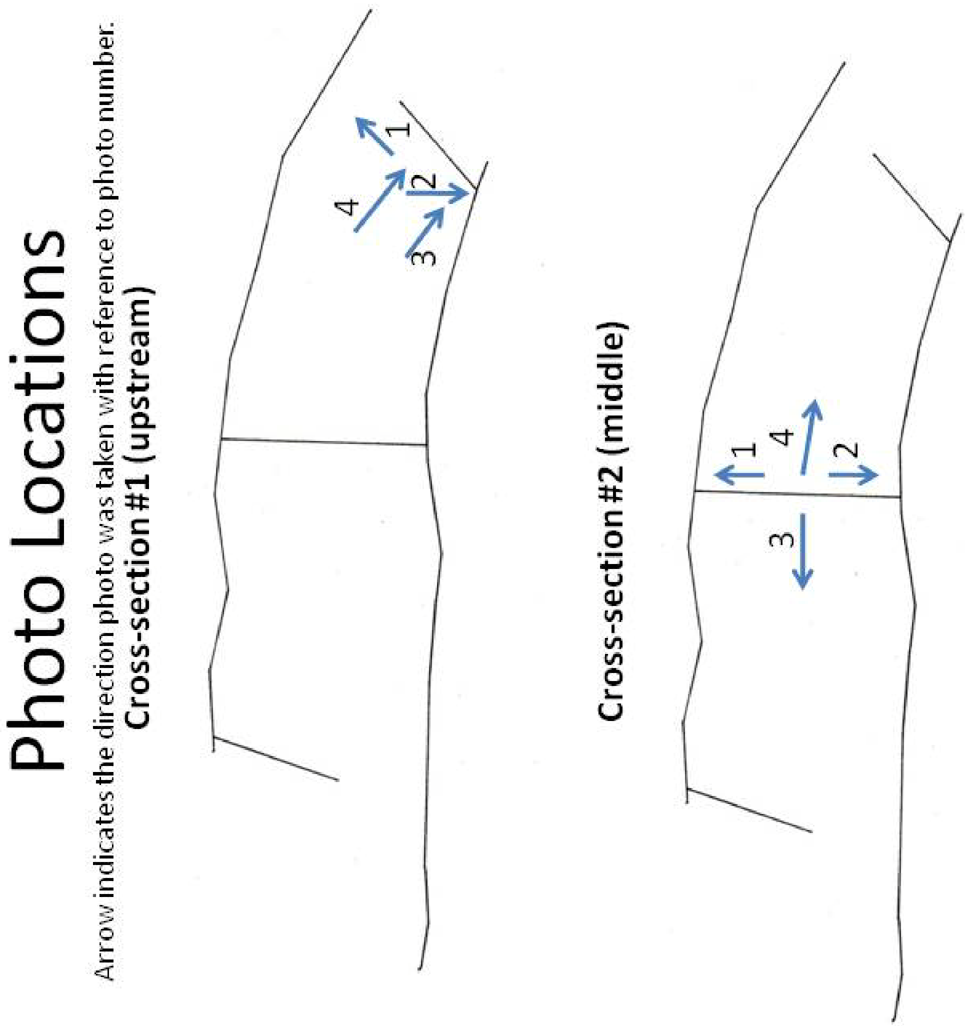
Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek

STA	AZIM	ROD	STADIA	ELEV	DIST
	HI = 114.04				
RB	19°10'	7.52	8.25/7.11	106.52	164
⊡12	17°30'	7.47	8.31/6.64	106.57	167
	+180				
⊼ ⊙ ⊡12		106.57 +	[4.96]	111.53	
⊡11	197°30'	2.42	3.26/1.59	111.50	167
		HI = 111.52 @ ⊡12			
RB	30°20'	6.11	6.46/5.76	105.41	70
RB	31°40'	6.54	7.19/5.90	104.98	129
RB	32°30'	6.34	7.32/5.38	105.18	194

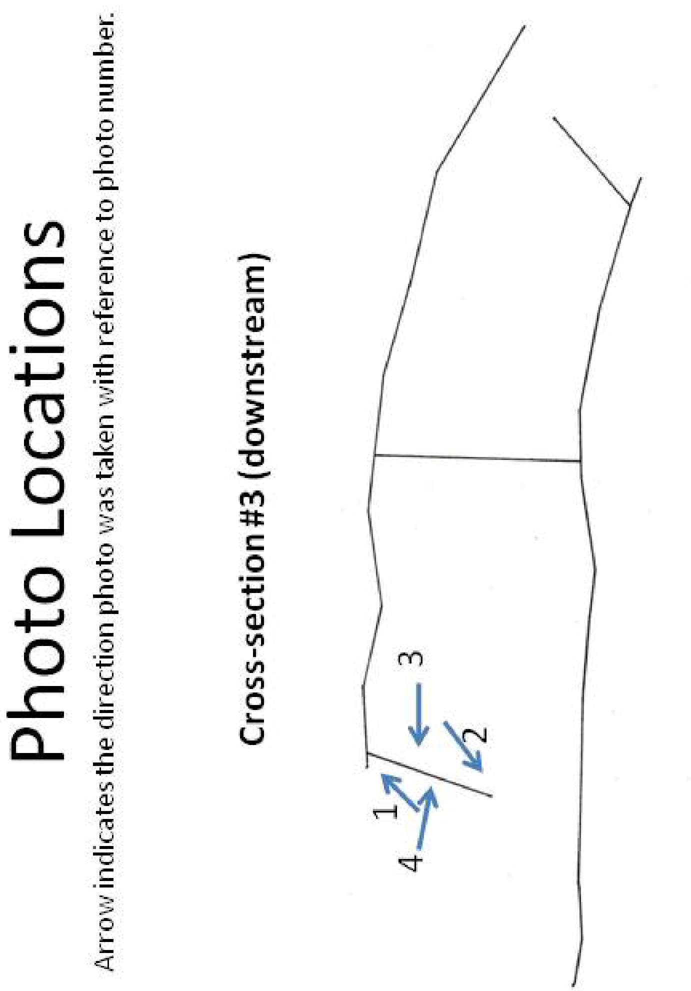
Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek



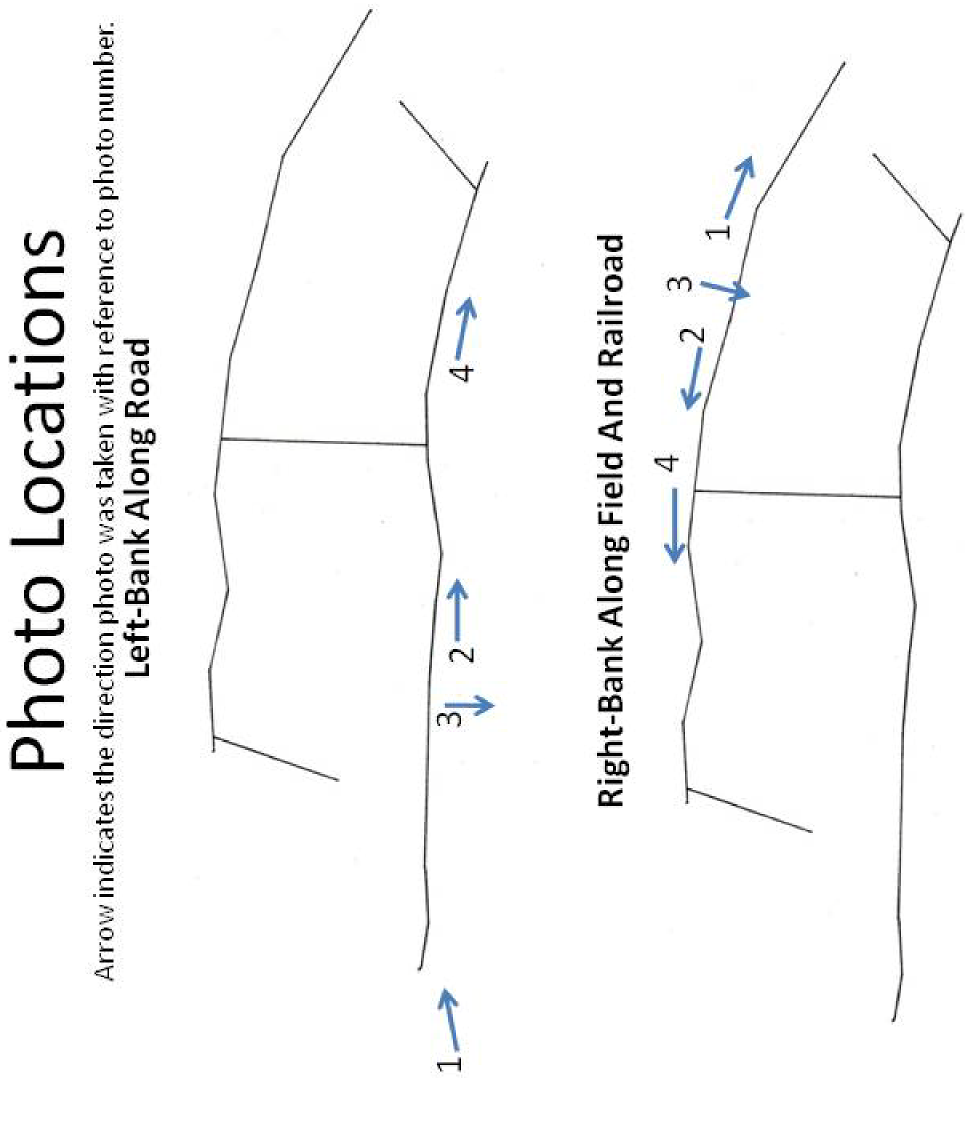
Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek



Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek



Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek



Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek

Cross-section #1

(Photo 1). Right bank.

(Photo 2). Left bank.

Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek

Cross-section #1

(Photo 3). Looking upstream.

(Photo 4). Looking upstream. Rod directly below height of levee.

Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek

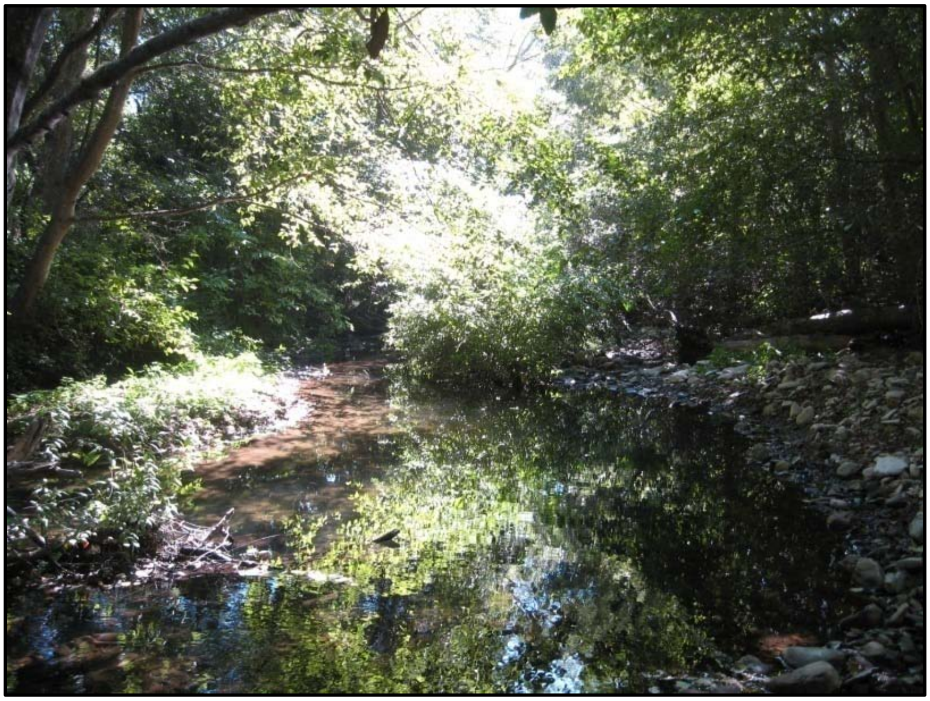
Cross-section #2 (middle of reach at road crossing and proposed gage location)

(Photo 1). Right bank.

(Photo 2). Left bank.

Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek

Cross-section #2 (middle of reach at road crossing and proposed gage location)



(Photo 3). Looking downstream.

(Photo 4). Looking upstream.

Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek

Cross-section #3 (downstream)

(Photo 1). Right bank.

(Photo 2). Left bank.

Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek

Cross-section #3 (downstream)

(Photo 3). Looking downstream.

(Photo 4). Looking upstream.

Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek

Left Bank Along Road

(Photo 1). Downstream near Hub 1.

(Photo 2). Looking upstream along road.

Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek

Left Bank Along Road

(Photo 3). Looking east from road out to agricultural field.

(Photo 4). Looking upstream north of cross-section 2.

Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek

Right bank along field and road.

(Photo 1). Looking upstream along upstream section of profile.

(Photo 2). Looking downstream along upstream section of profile

Appendix K: Site sketch, transit-stadia notes and photos of Lower Scott Creek

Right bank along field and road.

(Photo 3). Looking down into channel at upper right bank from upstream profile.

(Photo 4). Looking downstream from Hub 7

Appendix L: Slope Area Program (SAP) output for indirect measurement of discharge at Lower Scott Creek

Appendix L: Slope Area Program (SAP) output for indirect measurement of discharge at Lower Scott Creek

```
SAC -USGS slope-area program Ver 97-01                                 page  1

SCOTT CREEK DISCHARGE BEFORE BANK OVERFLOW
Scott Creek Slope Area Computation



                             DISCHARGE COMPUTATIONS
                          Reach
             dH,fall  length  Discharge  Spread    HF     CX      RC      RX  ER
               (ft)     (ft)     (cfs)     (%)    (ft)
 SEC1 - SEC2   1.03     322.      3097.     28   1.279  0.871  0.000 -0.390  @
 SEC2 - SEC3   0.83     318.      2096.      0   0.552  1.000  0.503  0.000  @

 SEC1 - SEC3   1.86     640.      2506.      9   1.626  0.955  0.244 -0.201

Definitions:
  Spread, the percent difference between discharge computed with no expansion
      loss (k=0) and discharge computed with full expansion loss (k=1.0), divided
      by the discharge computed with full expansion loss
  HF, friction head- HF = sum of Q*Q*L/(K1*K2) over subreaches; Q, discharge;
      L, reach length; K1, upstream section conveyance;
      K2, downstream section conveyance
  CX, the computed discharge divided by the discharge computed with no expansion
      loss (k=0)
  RC, velocity head change in contracting section divided by friction head
  RX, velocity head change in expanding section divided by friction head
  ER, warnings, *-fall < 0.5ft, @-conveyance ratio exceeded, #-reach too short
      error, 1-negative or 0 fall
  ******, terms that can not be computed because of strong expansion in reach

                              CROSS  SECTION  PROPERTIES
--------------------------------------------------------------------------------
  I.D. SEC3                   Velocity head    0.90ft    Discharge     2506.cfs
   Ref.distance      510.ft            Q/K    0.0032        Alpha 1.147

  Sub  Water                  Top   Wetted   Hydraulic   Conveyance
 area surface   n     Area   width perimeter   radius   x 0.001       Vel.    F
  no. el.(ft)       (sq.ft)   (ft)   (ft)       (ft)     (cfs)   %   (fps)
    1  100.44 0.210      0.4     1.0    1.2      0.29      0.001   0.  0.2  0.05
    2  100.44 0.035    327.1    54.0   57.7      5.67     44.282 100.  7.6  0.55
    3  100.44 0.210     24.6    32.0   32.0      0.77      0.147   0.  0.3  0.07
Total  100.44   ---     352.     87.    91.      3.87     44.430 100.  7.1  0.62
--------------------------------------------------------------------------------
Definitions:
  n, Manning's coefficient of roughness    Q/K = discharge/conveyance
  F, Froude number F = Ki*Q/(K*A sqrt(g*(Ai/TWi)); Q, discharge; A, total cross-
      section area; g, acceleration of gravity; Ai, sub-section area; TWi, sub-
      section top width
```

Appendix L: Slope Area Program (SAP) output for indirect measurement of discharge at Lower Scott Creek

SAC -USGS slope-area program Ver 97-01 page 2

SCOTT CREEK DISCHARGE BEFORE BANK OVERFLOW
Scott Creek Slope Area Computation

CROSS SECTION PROPERTIES

I.D. SEC2 Velocity head 0.51ft Discharge 2506.cfs
Ref.distance 828.ft Q/K 0.0019 Alpha 1.252

Sub area no.	Water surface el.(ft)	n	Area (sq.ft)	Top width (ft)	Wetted perimeter (ft)	Hydraulic radius (ft)	Conveyance x 0.001 (cfs)	%	Vel. (fps)	F
1	101.27	0.210	40.6	21.0	21.4	1.90	0.443	1.	0.5	0.06
2	101.27	0.035	432.4	80.0	80.7	5.36	56.373	99.	5.7	0.43
3	101.27	0.210	18.7	13.0	13.3	1.40	0.166	0.	0.4	0.06
Total	101.27	---	492.	114.	115.	4.26	56.981	100.	5.1	0.43

I.D. SEC1 Velocity head 0.83ft Discharge 2506.cfs
Ref.distance 1150.ft Q/K 0.0035 Alpha 1.493

Sub area no.	Water surface el.(ft)	n	Area (sq.ft)	Top width (ft)	Wetted perimeter (ft)	Hydraulic radius (ft)	Conveyance x 0.001 (cfs)	%	Vel. (fps)	F
1	102.30	0.210	81.8	33.0	33.3	2.45	1.056	2.	0.8	0.09
2	102.30	0.035	329.5	60.0	65.2	5.05	41.280	97.	7.4	0.56
3	102.30	0.210	7.2	24.0	24.0	0.30	0.023	0.	0.2	0.06
Total	102.30	---	418.	117.	123.	3.41	42.359	100.	6.0	0.56

Definitions:
n, Manning's coefficient of roughness Q/K = discharge/conveyance
F, Froude number F = Ki*Q/(K*A sqrt(g*(Ai/TWi)); Q, discharge; A, total cross-section area; g, acceleration of gravity; Ai, sub-section area; TWi, sub-section top width

Appendix L: Slope Area Program (SAP) output for indirect measurement of discharge at Lower Scott Creek

```
SAC -USGS slope-area program Ver 97-01

Echo input data file

T1 Scott Creek Slope Area Computation
XS   SEC3 510
GR        149,100.44 151,99.0 158,93.7 161,92.8 176,93.6
GR        194,93.7 195,93.5 204,98.9 236,100.44
GR        436,100.45
N         0.210 0.035 0.210
SA        150. 204.
HP 4 SEC3 100.44
XS   SEC2 828
GR        59,101.27 80,97.4 95,94.7 97,94.5 105,94.1
GR        112,94.5 140,97.2 150,96.3 160,98.4 173,101.27
N         0.210 0.035 0.210
SA        80. 160.
HP 4 SEC2 101.27
XS   SEC1 1150
GR        22,102.30 36,99.3 55,98.9 65,95.6 77,95.6
GR        90,95.0 93,95.5 100,96.2 105,101.6 110,98.1
GR        115,101.7 139,102.30
N         0.210 0.035 0.210
SA        55. 115.
HP 4 SEC1 102.30
```

Appendix M: Design criteria for manned and bank operated cableways, and vendor specifications for equipment

Appendix M: Design criteria for manned and bank operated cableways, and vendor specifications for equipment

Design specifications for the construction of a manned cableway at Lower Scott Creek.

All cableway design specifications were determined using *Techniques of Water-Resources Investigations of the United States Geological Survey, Chapter A21, Stream-Gaging Cableways* by C. Russell Wagner. This publication can be located on the Internet at http://pubs.usgs.gov/twri/twri3-a21/.

The design is developed for a cableway spanning a distance of 220 feet in length, with 10 feet of vertical clearance between the bottom of the cable car on a loaded cable and the water surface of a 100 year flood.

SOIL CHARACTERISTCS

- Soil Type A, Medium and dense sand

CABLE

- 6 X 19 independent wire rope core (IWRC) extra improved plow steel (EIP) (or EEIP if available) right-regular-lay galvanized wire rope.
- Cable diameter 7/8 inch.
- Breaking strength 71,600 lb for EIP
- Design Load 14,300 lb for EIP, 15,800 for EEIP
- Standard design load of 2250 lb for loaded cable. This is suitable for most conditions and designed for safe operations with two people in the cable car, with forces to failure in suspension systems.

DESIGN FACTOR

- Design factor of 5 due to the long service life of the cableway (greater than 50 years)

Appendix M: Design criteria for manned and bank operated cableways, and vendor specifications for equipment

DESIGN SAG

- Unloaded sag of 2 percent of the span distance (4.4 feet). This design sag is defined as the vertical distance between the low point in a cable measured from a straight line between the two points of support.

LOADED SAG

- Loaded sag of 7.0 feet from Figure 3 of Chapter A21
- Can also be computed using the following formula:
  (S(WS + 2P)) / 8D

  Where S = Span in feet
  W = Cable weight per foot (from manufacturer's catalog)
  P = Concentrated load at center of span
  H = Horizontal component of tension

SUPPORT STRUCTURES

- Two galvanized steel A-frames (left and right bank) mounted on a concrete footing.
- Height of each A-frame should be 26 feet on the left-bank and 22 feet on the right bank to allow 10 feet of vertical clearance at peak discharge.

A-FRAME FOOTINGS

- Galvanized anchor bolts with a minimum diameter of 3/4 inch in an L or J shape. Galvanization should meet ASTM specification A-153, and should extend into the concrete a minimum distance of 30 times the bolt diameter. A ¾ inch anchor bolt therefore needs to extend 22.5 inches into the concrete.
- Concrete must meet ACI-318 (American Concrete Institute, 1984) and ASTM specification C-94. Concrete must have compressive strength of 3,000 lb/in^2.
- Use of reinforced steel to reduce cracking
- Must extend at least 6 inches above the ground to 4 feet below the ground.
- Single footing area of 6 ft^2 or combined footing with a width of 2.5 feet and an S of 1.5 feet (S=distance from the leg to the end of the footing).

PLATFORM, WALKWAY, AND LADDER

- Must meet Occupational Safety and Health Act (OSHA) guidelines contained in 29 CFR (Code of Federal Regulations), pts. 1910.23 and 1910.27.

Appendix M: Design criteria for manned and bank operated cableways, and vendor specifications for equipment

CONCRETE MASS ANCHORS

- Concrete must meet ACI-318 (American Concrete Institute, 1984) and ASTM C-94 specifications.
- Minimum compression strength of 3,000 lb/in^2
- Reinforced steel must have minimum yield strength of 40,000 lb/in^2.
- Anchorage dimension for 45 degree cable is as follows:

  Length = 7.0 feet
  Width = 5.50 feet
  Depth = 6.00 feet
  Concrete quantity of 8.6 yd^3.

CABLE CAR

- Sit-down car for two field personnel. Dimensions are 60 inches long, 21.0 inches wide, and 60 inches in height.

Appendix M: Design criteria for manned and bank operated cableways, and vendor specifications for equipment

HORNET

CABLEWAY GAUGING SYSTEM

Designed & Manufactured By Hydrological Services Pty Ltd

- Fully Controlled System
- Portable 12 VDC powered Hoist can be used on multiple cableways
- No Maintenance Required
- Used with Acoustic Doppler Current Profilers and Mechanical Current Meters
- Radio Controlled Hoist, up to 1 Km (0.62 miles) range.
- Wireless Remote Control

Specifications

DRIVE CONTROLLER

Enclosure	IP65 Stainless Steel 600 x 600 x 300 mm, (24" x 24" 12")
Switching Frequency	2- 16 KHz
Power Requirement	0.8 KW, 110 VAC / 220 VAC (2 separate models) (1000 Watt Generator or Mains Power)
Overload Capacity	150% for 60 S
Interlock	Ultrasonic proximity set to 0.5m
Inclinometer	± 45° measurement

ELECTRIC MOTOR

Motor Body	IP65, Geared Motor
Speed	Up to 1 m/s (3.2 ft/s)
Distance Measurement	0.01m/0.01ft resolution
Output Torque	32 Nm
Safety Factor	1.8
Power Requirement	0.75 KW 110 VAC / 220 VAC

HOIST

Lifting Capacity:	100 Kg/220 lbs (135Kg/300 lbs also available)
Power Requirement	- 2 x 12 VDC Batteries, 38Ah - 2 x 40 Amp Fuses - 2 x Safety Cut off Switch
Cable	40m, 1/8" Stainless Steel Cable

REMOTE CONTROL (WIRELESS)

Controls	- Raise / Lower Control+ Battery Voltage monitoring Forward/Reverse + Speed control
LCD	16 char x 2 line with backlighting
Radio Frequency	- Frequencies available * USA 902.5-914.5 MHz * AUS 915.5-927.5 MHz (26 channels @ 1 MHz spacing) - Operating Range * 1 Km (0.62 miles)
Indicators	- LED for Comms and fault indication
Outputs (Not Implemented)	Current Meter Output – OC Sounder for current meter pulses
Power Source	3xNiMh 2.5Ah AA batteries with built-in charger

NCS International — Certified Quality Management System — ISO9001 —

Hydrological Services Pty Ltd
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2170 Sydney, Australia
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Box 332 Liverpool BC 1871
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Fax: +612 9602 6971
Email: sales@hydrologicalservices.com
Web: www.hydrologicalservices.com

Appendix M: Design criteria for manned and bank operated cableways, and vendor specifications for equipment

Description

WHAT IS THE HORNET?

The Hornet has been developed to perform river and stream discharge measurements from fixed cableways using an Acoustic Doppler Current Profiler (ADCP). The Hornet is an ideal solution for retro fitting to an existing manned cableway system, thus minimising the personal injury risk associated with this type of gauging.

HOW DOES THE HORNET OPERATES?

The Hornet is operated from the bank of the stream. Using a wireless remote control (see Figure 1), which incorporates the latest state of art electronics and Radio Controlled Systems, the operator can manoeuvre the ADCP by the push of a switch to traverse across the span to be measured. Once into position, the meter is lowered to commence measurement.

The Control System operates an electric motor fitted with incremental encoder to drive the carriage and hoist from the operating side to the far side of the river and back to the start point (see Figure 2-3). The operator uses the Remote Controlled Hoist to raise and lower the ADCP to and out of the water. (See Figure 2-3).

Prior to Discharge Measurements:

The Hornet takes a few minutes to set up and become operational.

The operator needs to do the following:

a) Attach the Hoist to the Carriage
b) Attach the Stabilising Weight and the ADCP to the Hoist
c) Switch power on to operate the Hoist
d) Connect to 1000Watt Generator or Mains to power Control System

To Commence Discharge Measurements:

Once the system is ready to use, the operator can lower the ADCP in the water, and carry out accurate measurements.

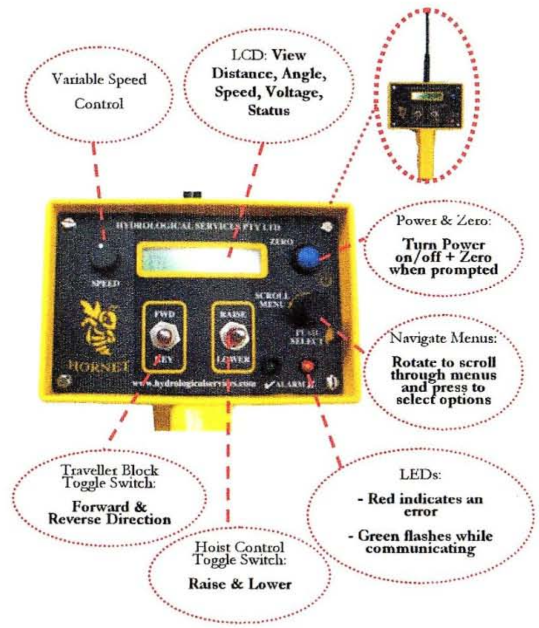

Figure 1: Wireless Remote Control

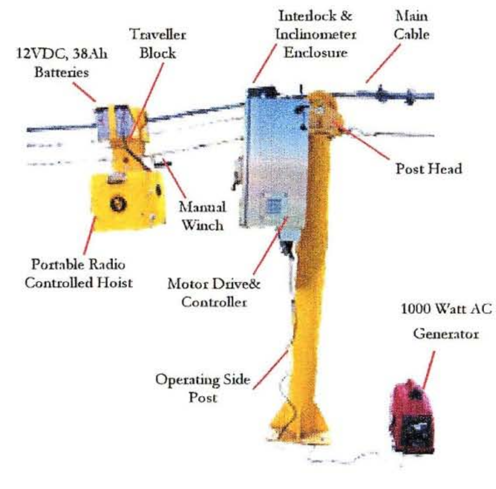

Figure 2: Operating Side

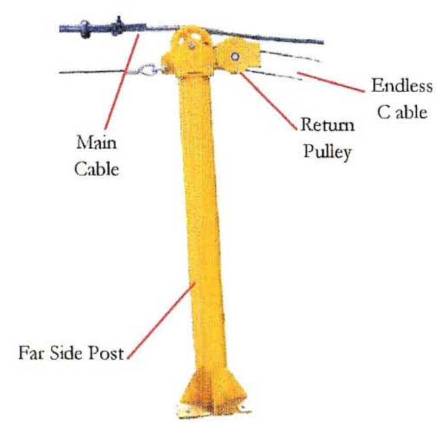

Figure 3: Far Side

Appendix M: Design criteria for manned and bank operated cableways, and vendor specifications for equipment

STREAM SYSTEMS TECHNOLOGY CENTER

STREAM NOTES

To Aid in Securing Favorable Conditions of Water Flows

Rocky Mountain Research Station **April 2000**

How to Build a Bank-Operated Cableway to Measure Stream Discharge and Sediment

by James J. Paradiso

A hand-operated cableway with a traveling block system has been used on the Nez Perce National Forest in Idaho since 1977. The installation allows hydrographers to safely collect streamflow and sediment data during high flow conditions when wading measurements are impractical or extremely dangerous. Because it is operated from the bank, the cableway system provides a safe, low-cost, and effective method to acquire streamflow and sediment data year-round. The hand-operated cableway is a safe alternative to manned cable cars at sites not easily gaged by boat or bridges during high flows.

Cable measurements are performed whenever the stream or river to be gaged has flows that make gaging via the wading method impossible, impractical, or unsafe. The general rule is to avoid wading in the water any time the product of velocity (feet per second) and the depth of the water (in feet) exceeds 10. Temporary bridges and platforms are one alternative for reducing the risk of accidents and to avoid endangering hydrographers during high flow conditions. Platforms, however, are generally limited to relatively small streams. This cableway system offers distinct advantages over the use of temporary bridges because it can span medium-sized streams up to 100 feet wide.

This cableway system is generally limited to streams less than 100 feet wide. The sounding reel cable length limits the operating width. Present installations on the Nez Perce Forest are typically on 50-60 feet wide streams. Peak flow measurements have been made of discharges approaching 1,000 cfs and velocities as high as 9.2 feet per second.

Rocky Mountain Research Station General Technical Report RMRS-GTR-44, ***A Bank-Operated Traveling-Block Cableway for Stream Discharge and Sediment Measurements***, describes the system. The Stream Systems Technology Center supported the development of this 36-page publication. It describes the construction and use of the cableway system including figures describing parts and dimensions, installation methods, site selection, calibration, and field operation. The publication includes complete plans for building the device. Plans may also be downloaded in Auto-CAD format from the STREAM Web site (www.stream.fs.fed.us).

The system consists of six main parts (Figure 1). An upright steel post is installed on each bank. On the shore with easy access, a pulley-driven housing is mounted atop the post. On the far shore the post supports a pulley, the tailhold. Operated with a hand crank, the

STREAM NOTES *is produced quarterly by the Stream Systems Technology Center, Rocky Mountain Research Station, Fort Collins, Colorado.*

The PRIMARY AIM *is to exchange technical ideas and transfer technology among scientists working with wildland stream systems.*

CONTRIBUTIONS *are voluntary and will be accepted at any time. They should be typewritten, single-spaced, and limited to two pages. Graphics and tables are encouraged.*

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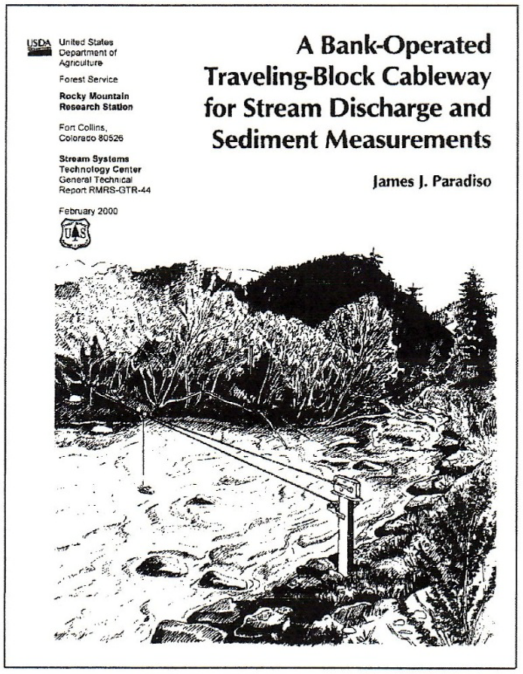
Appendix M: Design criteria for manned and bank operated cableways, and vendor specifications for equipment



USDA United States Department of Agriculture

Forest Service

Rocky Mountain Research Station

Fort Collins, Colorado 80526

Stream Systems Technology Center General Technical Report RMRS-GTR-44

February 2000

A Bank-Operated Traveling-Block Cableway for Stream Discharge and Sediment Measurements

James J. Paradiso

pulley-drive controls the movement of a looped cable that is stretched between the posts. A traveling block rides on the upper cable loop and is attached to the lower cable loop. Suspended from this traveling block, the hydrographer's equipment (current meter, suspended sediment or bedload sampler) may be positioned and lowered anywhere in the cross-section.

A standard sounding reel, such as an A-55 or B-56, is attached to fittings on the near post (Figure 2). The cable from the sounding reel is used to suspend the measuring equipment, such as a current meter. The cable is supported by the lower pulley of the traveling block. Using the sounding reel, the equipment may be raised and lowered as needed for data collection. Thus, the horizontal position of the current meter is controlled by the cable crank, while the vertical movement is controlled by the sounding reel.

The cableway can be constructed from parts manufactured at a machine shop, with additional parts from a hardware store. Installation also requires readily available construction supplies including concrete, cable, cable clamps, and turnbuckles.

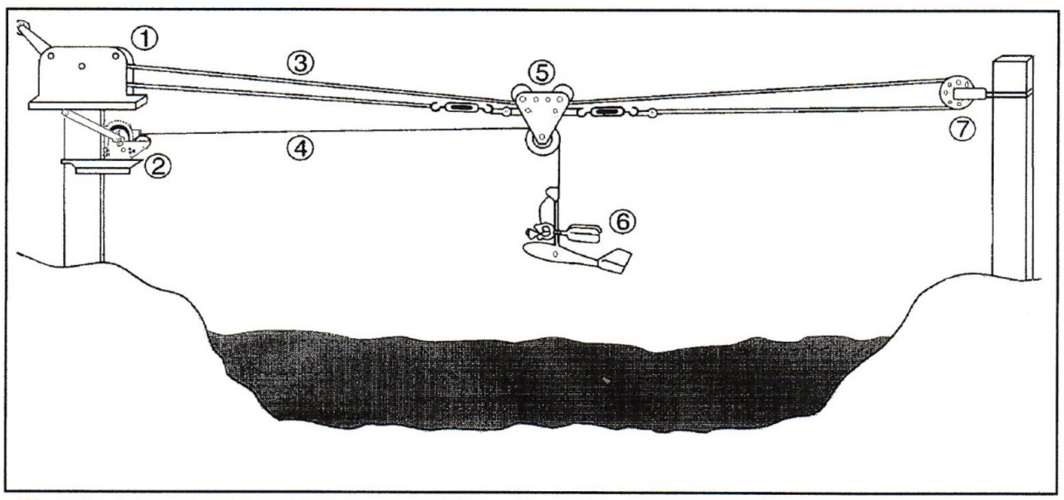


Figure 1. Schematic of the cableway system with sounding reel and current meter in use. (1) near post with pulley housing, (2) sounding reel, (3) cableway cable, (4) sounding reel cable, (5) traveling block, (6) current meter, and (7) tailhold on far post. The traveling block rides on the upper span of the main cable. The ends of the main cable are attached to the traveling block, controlling its movement. Measuring equipment is suspended from the traveling block with the sounding reel cable.

STREAM SYSTEMS TECHNOLOGY CENTER

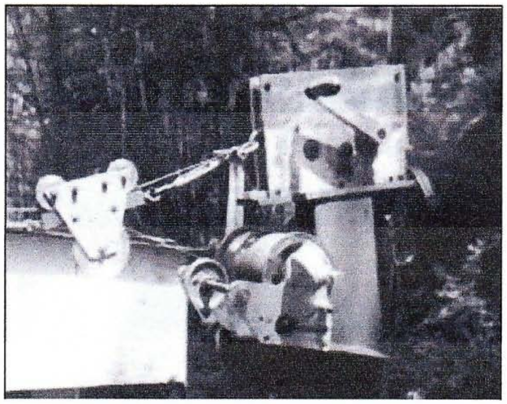


Figure 2. Key components of the cableway. Traveling block, sounding reel, and crank-pulley mechanism. The pulley housing remains on site between measurements, but the sounding reel is removed to deter vandalism.

The origin of the hand-operated cableway equipment described in this publication is obscure. It was not developed by the Nez Perce National Forest. A description and a photograph of a similar cableway appears in the U.S. Bureau of Reclamation's 1967 ***Water Measurements Manual***. Mechanical drawings of the cableway system dated to the 1970s were obtained from the Lolo National Forest and the Montana Department of Natural Resources and modified slightly.

Similar bank-operated cableway systems are in use across the country. Each has advantages and disadvantages with respect to ease of installation, use, portability, and cost. Several types are mentioned to provide a sense of what is available.

A simple, inexpensive cableway is used on the Clearwater National Forest. It uses a boat winch to replace the crank-pulley drive housing and attaches the cable to trees, rocks, or other available structures. A portable system has also been used by the Pacific Southwest Experiment Station. Instead of permanent posts, tripods with guylines support the equipment making it ideal for remote locations.

A variation of the cableway discussed here has been designed by the U.S. Geological Survey. It uses a static line to suspend the equipment from the traveling block, a hand-operated tow cable and pulleys to position it across the river, and a sounding reel to control vertical motion similar to our design. A 100-foot span version (excluding the sounding reel) is commercially available. Another USGS-based design uses the B-56 sounding reel modified so that vertical and horizontal control is achieved using one reel handle.

For larger installations, double drum winches may be purchased. Heavy-duty versions of this type can be used to span larger rivers. Commercially available systems range in cost from $2,500 to $10,000 depending on features.

Installation of the cableway is easiest when the stream can be waded. On-site installation time for one person is approximately four hours to set the posts and two hours to install the pulley mechanisms, cable, and carriage. The use of concrete will require a drying period between each of these steps.

The entire installation, excluding the cost of the sounding reel, is less than $2,500. For this relatively small investment, it is possible to construct a cableway that will allow safe and efficient data collection for medium-sized streams during dangerous high flow conditions.

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Readers can download copies of General Technical Report RMRS-GTR-44, ***A Bank-Operated Traveling-Block Cableway for Stream Discharge and Sediment Measurements***, from the STREAM Web site (www.stream.fs.fed.us) FTP download area.

You may also order copies by sending your mailing information in label form along with the publication title and number through one of the following media:
Telephone: (970) 498-1392; (970) 498-1396 (FAX)
E-mail: rschneider@fs.fed.us
Mail: Publications Distribution, Rocky Mountain Research Station, 240 West Prospect Road, Fort Collins, CO 80526-2098.

STREAM SYSTEMS TECHNOLOGY CENTER

Appendix M: Design criteria for manned and bank operated cableways, and vendor specifications for equipment

RICKLY HYDROLOGICAL COMPANY

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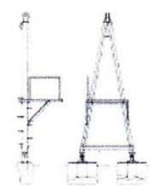
Acoustic Doppler Meters
Winches & Travellerways

Cableways & Accessories

USGS Cableway A-Frame Steelwork

USGS Cableway A-Frame Steelwork



The USGS has standardized on a basic design with three galvanized A-frame sizes. These are fabricated from A-36 structural steel and galvanized to A-123 specifications. A-Frame fabrication is welded wide flange I-beams sized per USGS specifications. Concrete anchor foundation design requirements are available. All necessary components are supplied including fasteners and concrete anchor bolts. Pipe or tubular section designs are discouraged because interior section corrosion inspection is impossible. These A-frame designs are for spans up to 1000 feet long.

106-030	6 ft. x 14 ft. A-frame
106-032	10 ft. x 24 ft. A-frame
106-035	14 ft. x 36 ft. A-frame

RICKLY HYDROLOGICAL COMPANY

1700 JOYCE AVENUE COLUMBUS, OH 43219 U.S. Only: 1-800-561-9677 PHONE: 1-614.297.9877 FAX: 1-614.297.9878 sales@rickly.com

Appendix N: Stream reach inventory sheet and corresponding Rosgen rating

Appendix N: Stream reach inventory sheet and corresponding Rosgen rating

LEVEL III: ASSESSMENT OF STREAM CONDITION AND DEPARTURE

CHANNEL STABILITY (PFANKUCH) EVALUATION AND STREAM CLASSIFICATION SUMMARY (LEVEL III)

Reach Location__________ Date__________ Observers__________

Stream Type __________

	Category	EXCELLENT	
UPPER BANKS	1 Landform Slope	Bank Slope Gradient <30%	2
	2 Mass Wasting	No evidence of past or future mass wasting.	3
	3 Debris Jam Potential	Essentially absent from immediate channel area.	2
	4 Vegetative Bank Protection	90%+ plant density. Vigor and variety suggest a deep dense soil binding root mass.	3
LOWER BANKS	5 Channel Capacity	Ample for present plus some increases. Peak flows contained. W/D ratio <7.	1
	6 Bank Rock Content	65%+ with large angular boulders. 12"+ common.	2
	7 Obstructions to Flow	Rocks and logs firmly imbedded. Flow pattern without cutting or deposition. Stable bed.	2
	8 Cutting	Little or none. Infreq. raw banks less than 6".	4
	9 Deposition	Little or no enlargement of channel or pt. bars.	4
BOTTOM	10 Rock Angularity	Sharp edges and corners. Plane surfaces rough.	1
	11 Brightness	Surfaces dull, dark or stained. Gen. not bright.	1
	12 Consolidation of Particles	Assorted sizes tightly packed or overlapping.	2
	13 Bottom Size Distribution	No size change evident. Stable mater. 80-100%	4
	14 Scouring and Deposition	<5% of bottom affected by scour or deposition.	6
	15 Aquatic Vegetation	Abundant Growth moss-like, dark green perennial. In swift water too.	1
		TOTAL	

	Category	GOOD	
UPPER BANKS	1 Landform Slope	Bank Slope Gradient 30-40%	4
	2 Mass Wasting	Infrequent. Mostly healed over. Low future potential.	6
	3 Debris Jam Potential	Present, but mostly small twigs and limbs.	4
	4 Vegetative Bank Protection	70-90% density. Fewer species or less vigor suggest less dense or deep root mass.	6
LOWER BANKS	5 Channel Capacity	Adequate. Bank overflows rare. W/D ratio 8-15	2
	6 Bank Rock Content	40-65%. Mostly small boulders to cobbles 6-12"	4
	7 Obstructions to Flow	Some present causing erosive cross currents and minor pool. filling. Obstructions newer and less firm.	4
	8 Cutting	Some, intermittently at outcurves and constrictions. Raw banks may be up to 12"	6
	9 Deposition	Some new bar increase, mostly from coarse gravel.	8
BOTTOM	10 Rock Angularity	Rounded corners and edges, surfaces smooth, flat.	2
	11 Brightness	Mostly dull, but may have <35% bright surfaces.	2
	12 Consolidation of Particles	Moderately packed with some overlapping.	4
	13 Bottom Size Distribution	Distribution shift light. Stable material 50-80%.	8
	14 Scouring and Deposition	5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools.	12
	15 Aquatic Vegetation	Common. Algae forms in low velocity and pool areas. Moss here too.	2
		TOTAL	

	Category	FAIR	
UPPER BANKS	1 Landform Slope	Bank slope gradient 40-60%	6
	2 Mass Wasting	Frequent or large, causing sediment nearly year long.	9
	3 Debris Jam Potential	Moderate to heavy amounts, mostly larger sizes.	6
	4 Vegetative Bank Protection	<50-70% density. Lower vigor and fewer species from a shallow, discontinuous root mass.	9
LOWER BANKS	5 Channel Capacity	Barely contains present peaks. Occasional overbank floods. W/D ratio 15 to 25.	3
	6 Bank Rock Content	20-40% with most in the 3-6" diameter class.	6
	7 Obstructions to Flow	Moder. frequent, unstable obstructions move with high flows causing bank cutting and pool filling.	6
	8 Cutting	Significant. Cuts 12-24" high. Root mat overhangs and sloughing evident	12
	9 Deposition	Moder. deposition of new gravel and course sand on old and some new bars.	12
BOTTOM	10 Rock Angularity	Corners and edges well rounded in two dimensions.	3
	11 Brightness	Mixture dull and bright, ie 35-65% mixture range.	3
	12 Consolidation of Particles	Mostly loose assortment with no apparent overlap.	6
	13 Bottom Size Distribution	Moder. change in sizes. Stable materials 20-50%	12
	14 Scouring and Deposition	30-50% affected. Deposits & scour at obstructions, constrictions, and bends. Some filling of pools.	18
	15 Aquatic Vegetation	Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick.	3
		TOTAL	

TABLE 6-7. Channel stability evaluation *(Pfankuch, 1975)* with a conversion of the channel stability rating to a reach condition by stream type.

Appendix N: Stream reach inventory sheet and corresponding Rosgen rating

LEVEL III: ASSESSMENT OF STREAM CONDITION AND DEPARTURE

CHANNEL STABILITY (PFANKUCH) EVALUATION AND STREAM CLASSIFICATION SUMMARY (LEVEL III)

	Category	POOR	
UPPER BANKS	1 Landform Slope	Bank Slope Gradient 60%+	8
	2 Mass Wasting	Frequent or large causing sediment nearly year long or imminent danger of same.	12
	3 Debris Jam Potential	Moder. to heavy amounts, predom. larger sizes.	8
	4 Vegetative Bank Protection	<50% density, fewer species and less vigor indicate poor, discontinuous and shallow root mass.	12
LOWER BANKS	5 Channel Capacity	Inadequate. Overbank flows common. W/D ratio >25	4
	6 Bank Rock Content	<20% rock fragments of gravel sizes, 1-3" or less.	8
	7 Obstructions to Flow	Sediment traps full, channel migration occurring.	
	8 Cutting	Almost continuous cuts, some over 24" high. Failure of overhangs frequent.	16
	9 Deposition	Extensive deposits of predom. fine particles. Accelerated bar development.	16
BOTTOM	10 Rock Angularity	Well rounded in all dimensions, surfaces smooth.	4
	11 Brightness	Predom. bright, 65%+ exposed or scoured surfaces.	4
	12 Consolidation of Particles	No packing evident. Loose assortment easily moved.	8
	13 Bottom Size Distribution	Marked distribution change. Stable materials 0-20%.	16
	14 Scouring and Deposition	More than 50% of the bottom in a state of flux or change nearly year long.	24
	15 Aquatic Vegetation	Perennial types scarce or absent. Yellow-green, short term bloom may be present.	4
		TOTAL	

Stream Width ____________ x avg. depth ____________ x mean velocity __________ = Q ____________ cfs

Gauge Ht ____________ Reach Gradient ____________ Stream Order ____________ Sinuosity Ratio ____________

Width $_{bkf}$ ____________ Depth $_{bkf}$ ____________ W/D Ratio ____________ Discharge (Q_{bkf}) ____________

Drainage Area ____________ Valley Gradient ____________ Stream Length ____________ Valley Length ____________

Sinuosity ____________ Entrenchment Ratio ____________ Length Meander (Lm) ____________ Belt Width ____________

Sediment Supply	Stream Bed Stability	Width/Depth Ratio Condition
Extreme ________	Aggrading ________	Normal ________
Very High ________	Degrading ________	High ________
High ________	Stable ________	Very High ________
Moderate ________		
Low ________		

Stream Type [ ]

Pfankuch Rating [ ]

TOTAL SCORE for Reach E____ = G____ + F____ + P____ =

Remarks ____

from table — Reach Condition [ ]

CONVERSION OF STABILITY RATING TO REACH CONDITION BY STREAM TYPE*

Stream Type	A1	A2	A3	A4	A5	A6	B1	B2	B3	B4	B5	B6
GOOD	38-43	38-43	54-90	60-95	60-95	50-80	38-45	38-45	40-60	40-64	48-68	40-60
FAIR	44-47	44-47	91-129	96-132	96-142	81-110	46-58	46-58	61-78	65-84	69-88	61-78
POOR	48+	48+	130+	133+	143+	111+	59+	59+	79+	85+	89+	79+
Stream Type	C1	C2	C3	C4	C5	C6	D3	D4	D5	D6		
GOOD	38-50	38-50	60-85	70-90	70-90	60-85	85-107	85-107	85-107	67-98		
FAIR	51-61	51-61	86-105	91-110	91-110	86-105	108-132	108-132	108-132	99-125		
POOR	62+	62+	106+	111+	111+	106+	133+	133+	133+	126+		
Stream Type	DA3	DA4	DA5	DA6	E3	E4	E5	E6				
GOOD	40-63	40-63	40-63	40-63	40-63	50-75	50-75	40-63				
FAIR	64-86	64-86	64-86	64-86	64-86	76-96	76-96	64-86				
POOR	87+	87+	87+	87+	87+	97+	97+	87+				
Stream Type	F1	F2	F3	F4	F5	F6	G1	G2	G3	G4	G5	G6
GOOD	60-85	60-85	85-110	85-110	90-115	80-95	40-60	40-60	85-107	85-107	90-112	85-107
FAIR	86-105	86-105	111-125	111-125	116-130	96-110	61-78	61-78	108-120	108-120	113-125	108-120
POOR	106+	106+	126+	126+	131+	111+	79+	79+	121+	121+	126+	121+

**Generalized relations ... need additional Level IV data to expand data base for validation.*

TABLE 6-7. Channel stability Evaluation (Pfankuch, 1975)

Appendix N: Stream reach inventory sheet and corresponding Rosgen rating

Stability Survey completed at reference reach completed 370 feet downstream of Edgar J. Carnegie Railroad Bridge by M.C. Scrudato on 4/30/09.

SCRUDATO
REFERENCE REACH 4/30/09

Pfankuch D.J. 1975. Stream reach inventory and channel stability evaluation. USDA Forest Service Northern Region, Montana.

UPPER BANKS	EXCELLENT		GOOD		FAIR		POOR	
Landform slope	Bank slope gradient <30%	2	Bank slope gradient 30-40%	4	Bank slope gradient 40-60%	6	Bank slope gradient >60%	(8)
Mass-wasting (existing or potential)	No evidence of post or any potential for future mass-wasting into channel.	3	Infrequent and/or very small. Mostly healed over. Low future potential.	6	Moderate frequency and size, with some raw spots eroded by water during high flows.	(9)	Frequent or large, causing sediment OR imminent danger of same.	12
Debris jam potential (floatable objects)	Essentially absent from immediate channel area.	2	Present but mostly small twigs and limbs.	(4)	Present, volume and size are both increasing,	6	Moderate to heavy amounts, mainly larger sizes.	8
Vegetative bank protection	>90% plant density. Vigor and variety suggests a deep, dense, soil binding root mass.	3	70-90% density. Fewer plant species or lower vigor suggests a less dense or deep root mass.	(6)	50-70% density. Lower vigor and species form a somewhat shallow and discontinuous root mass.	9	<50% density plus fewer species and vigor indicate discontinuous and shallow root mass.	12
Channel capacity	Ample for present plus some increases. Peak flows contained. Width to Depth (W/D) ratio <7.	1	Adequate. Overbank flows rare. W/D ratio 8 to 15.	2	Barely contains present peaks. Occasional over-bank floods. W/D ratio 15 to 25.	3	Inadequate. Overbank flows common. W/D ratio >25.	(4)
LOWER BANKS								
Bank rock content	65% with large, angular boulders 30cm numerous.	2	40 to 65'%, mostly small boulders to cobbles 15-30cm.	4	20 to 401, with most in the 7.5-15cm diameter class.	(6)	<20% rock fragments of gravel sizes, 2.5-7.5 cm or less.	8
Obstructions (flow deflectors Sediment traps)	Rocks and old logs firmly embedded. Flow pattern without cutting or deposition. Pools and riffles stable.	(2)	Some present, causing erosive cross currents and minor pool filling. Obstructions and deflectors newer and less firm.	4	Moderately frequent, unstable obstructions and deflectors move with high water causing bank cutting and filling of pools.	6	Frequent obstructions and deflectors cause bank erosion. Sediment traps' full channel migration occurring.	8
Undercutting	Little or none evident. Infrequent raw banks <150cm high.	4	Some, intermittently at outcurves and constrictions. Raw banks <30cm.	(8)	Significant. Cuts 15-30cm high. Root mat overhangs and sloughing evident.	12	Almost continuous cuts, some >30cm high. Failure of overhangs	16
Deposition	Little or no enlargement of channel or point bars.	(4)	Some new increase in bar formation, mostly from coarse gravels.	8	Moderate deposition of new gravel and coarse sand on old and some new bars.	12	Extensive deposits of predominantly fine particles. Accelerated	16
STREAM BED								
Rock angularity	Sharp edges and corners, plane surfaces roughened.	(1)	Rounded corners and edges. Smooth and flat.	2	Corners and edges wel1 rounded in two dimensions.	3	Well rounded in all dimensions.	4
Brightness	Surfaces dull, darkened or stained. Not "bright".	(1)	Mostly dull, but may have up to 35% bright surfaces.	2	Mixture, 50-50% dull and bright i.e. 35-65%.	3	Predominantly bright, 65%, exposed surfaces.	4
Consolidation or particle packing	Assorted sizes tightly packed and/or overlapping.	2	Moderately packed with some overlapping.	(4)	Mostly a loose assortment with no apparent overlap.	6	No packing evident. Loose, easily moved.	8
Bottom size distribution & stable	No change in sizes evident. Stable materials 80-100%	(4)	Distribution shift slight. Stable materials 50-80%.	8	Moderate change in sizes. Stable materials 20-50%	12	Marked change. Stable materials 0-20%	16
Scouring and deposition	<5% of the bottom affected by scouring and deposition.	(6)	5-30% affected. Scour at constrictions and where steep. Pool deposition.	12	30-50% affected. Deposits and scour at obstructions, constrictions, and bends.	18	> 50% of bed in a state of flux or change nearly year-long.	24
Clinging aquatic vegetation (moss and algae)	Abundant, growth largely moss, dark green, perennial. In swift water too.	1	Common. Algal forms in low velocity and pool areas. Moss and swifter waters.	2	Present but spotty, mostly in backwater areas. Seasonal blooms	(3)	Perennial types scarce or absent. Yellow-green, short term bloom present.	4
COLUMN TOTALS		18		22		18		12

TOTAL = 70

Reach score of: <38 = Excellent, 39-76 = Good, 77-114 = Fair, 115+ = Poor

Appendix N: Stream reach inventory sheet and corresponding Rosgen rating

Stability Survey completed at reference reach completed 370 feet downstream of Edgar J. Carnegie Railroad Bridge by E.R. Houston on 4/30/09.

Downstream Reference Reach
4/30/09 ER Houston

Pfankuch D.J. 1975. Stream reach inventory and channel stability evaluation. USDA Forest Service Northern Region, Montana.

UPPER BANKS	EXCELLENT		GOOD		FAIR		POOR	
Landform slope	Bank slope gradient <30%	2	Bank slope gradient 30-40%	4	Bank slope gradient 40-60%	6	Bank slope gradient >60%	(8) LB
Mass-wasting (existing or potential)	No evidence of post or any potential for future mass-wasting into channel.	3	Infrequent and/or very small. Mostly healed over. Low future potential.	6	Moderate frequency and size, with some raw spots eroded by water during high flows.	9	Frequent or large, causing sediment OR imminent danger of same.	(12) LB
Debris jam potential (floatable objects)	Essentially absent from immediate channel area.	2	Present but mostly small twigs and limbs.	4	Present, volume and size are both increasing,	(6)	Moderate to heavy amounts, mainly larger sizes.	8
Vegetative bank protection	>90% plant density. Vigor and variety suggests a deep, dense, soil binding root mass.	3	70-90% density. Fewer plant species or lower vigor suggests a less dense or deep root mass.	6	50-70% density. Lower vigor and species form a somewhat shallow and discontinuous root mass.	9	<50% density plus fewer species and vigor indicate discontinuous and shallow root mass.	(12) L & RB
Channel capacity	Ample for present plus some increases. Peak flows contained. Width to Depth (W/D) ratio <7.	1	Adequate. Overbank flows rare. W/D ratio 8 to 15.	2	Barely contains present peaks. Occasional over-bank floods. W/D ratio 15 to 25.	(3)	Inadequate. Overbank flows common. W/D ratio >25.	4
LOWER BANKS								
Bank rock content	65% with large, angular boulders 30cm numerous.	2	40 to 65'%, mostly small boulders to cobbles 15-30cm.	(4)	20 to 401, with most in the 7.5-15cm diameter class.	6	<20% rock fragments of gravel sizes, 2.5-7.5 cm or less.	8
Obstructions (flow deflectors Sediment traps)	Rocks and old logs firmly embedded. Flow pattern without cutting or deposition. Pools and riffles stable.	(2)	Some present, causing erosive cross currents and minor pool filling. Obstructions and deflectors newer and less firm.	4	Moderately frequent, unstable obstructions and deflectors move with high water causing bank cutting and filling of pools.	6	Frequent obstructions and deflectors cause bank erosion. Sediment traps' full channel migration occurring.	8
Undercutting	Little or none evident. Infrequent raw banks <150cm high.	(4)	Some, intermittently at outcurves and constrictions. Raw banks <30cm.	8	Significant. Cuts 15-30cm high. Root mat overhangs and sloughing evident.	12	Almost continuous cuts, some >30cm high. Failure of overhangs	16
Deposition	Little or no enlargement of channel or point bars.	(4)	Some new increase in bar formation, mostly from coarse gravels.	8	Moderate deposition of new gravel and coarse sand on old and some new bars.	12	Extensive deposits of predominantly fine particles. Accelerated	16
STREAM BED								
Rock angularity	Sharp edges and corners, plane surfaces roughened.	1	Rounded corners and edges. Smooth and flat.	(2)	Corners and edges wel1 rounded in two dimensions.	3	Well rounded in all dimensions.	4
Brightness	Surfaces dull, darkened or stained. Not "bright".	(1)	Mostly dull, but may have up to 35% bright surfaces.	2	Mixture, 50-50% dull and bright i.e. 35-65%.	3	Predominantly bright, 65%, exposed surfaces.	4
Consolidation or particle packing	Assorted sizes tightly packed and/or overlapping.	2	Moderately packed with some overlapping.	4	Mostly a loose assortment with no apparent overlap.	(6)	No packing evident. Loose, easily moved.	8
Bottom size distribution & stable	No change in sizes evident. Stable materials 80-100%	(4)	Distribution shift slight. Stable materials 50-80%.	8	Moderate change in sizes. Stable materials 20-50%	12	Marked change. Stable materials 0-20%	16
Scouring and deposition	<5% of the bottom affected by scouring and deposition.	(6)	5-30% affected. Scour at constrictions and where steep. Pool deposition.	12	30-50% affected. Deposits and scour at obstructions, constrictions, and bends.	18	> 50% of bed in a state of flux or change nearly year-long.	24
Clinging aquatic vegetation (moss and algae)	Abundant, growth largely moss, dark green, perennial. In swift water too.	1	Common. Algal forms in low velocity and pool areas. Moss and swifter waters.	2	Present but spotty, mostly in backwater areas. Seasonal blooms	3	Perennial types scarce or absent. Yellow-green, short term bloom present.	(4)
COLUMN TOTALS		21		6		15		36

Reach score of: <38 = Excellent, 39-76 = Good, 77-114 = Fair, 115+ = Poor (78)

Appendix N: Stream reach inventory sheet and corresponding Rosgen rating

Stability Survey completed upstream of Edgar J. Carnegie Railroad Bridge at potential gage location by M.C. Scrudato on 4/30/09.

SCRUDATO
ABOVE BRIDGE 4/30/09

Pfankuch D.J. 1975. Stream reach inventory and channel stability evaluation. USDA Forest Service Northern Region, Montana.

UPPER BANKS	EXCELLENT		GOOD		FAIR		POOR	
Landform slope	Bank slope gradient <30%	2	Bank slope gradient 30-40%	4	Bank slope gradient 40-60%	(6)	Bank slope gradient >60% ON R	8
Mass-wasting (existing or potential)	No evidence of post or any potential for future mass-wasting into channel.	3	Infrequent and/or very small. Mostly healed over. Low future potential.	6	Moderate frequency and size, with some raw spots eroded by water during high flows.	(9)	Frequent or large, causing sediment OR imminent danger of same.	12
Debris jam potential (floatable objects)	Essentially absent from immediate channel area.	2	Present but mostly small twigs and limbs.	4	Present, volume and size are both increasing,	6	Moderate to heavy amounts, mainly larger sizes.	(8)
Vegetative bank protection	>90% plant density. Vigor and variety suggests a deep, dense, soil binding root mass.	3	70-90% density. Fewer plant species or lower vigor suggests a less dense or deep root mass.	(6)	50-70% density. Lower vigor and species form a somewhat shallow and discontinuous root mass.	9	<50% density plus fewer species and vigor indicate discontinuous and shallow root mass.	12
Channel capacity **LOWER BANKS**	Ample for present plus some increases. Peak flows contained. Width to Depth (W/D) ratio <7.	1	Adequate. Overbank flows rare. W/D ratio 8 to 15.	2	Barely contains present peaks. Occasional over-bank floods. W/D ratio 15 to 25.	3	Inadequate. Overbank flows common. W/D ratio >25.	(4)
Bank rock content	65% with large, angular boulders 30cm numerous.	2	40 to 65'%, mostly small boulders to cobbles 15-30cm.	4	20 to 401, with most in the 7.5-15cm diameter class.	(6)	<20% rock fragments of gravel sizes, 2.5-7.5 cm or less.	8
Obstructions (flow deflectors Sediment traps)	Rocks and old logs firmly embedded. Flow pattern without cutting or deposition. Pools and riffles stable.	2	Some present, causing erosive cross currents and minor pool filling. Obstructions and deflectors newer and less firm.	4	Moderately frequent, unstable obstructions and deflectors move with high water causing bank cutting and filling of pools.	6	Frequent obstructions and deflectors cause bank erosion. Sediment traps' full channel migration occurring.	(8)
Undercutting	Little or none evident. Infrequent raw banks <150cm high.	4	Some, intermittently at outcurves and constrictions. Raw banks <30cm.	8	Significant. Cuts 15-30cm high. Root mat overhangs and sloughing evident.	(12)	Almost continuous cuts, some >30cm high. Failure of overhangs	16
Deposition **STREAM BED**	Little or no enlargement of channel or point bars.	4	Some new increase in bar formation, mostly from coarse gravels.	8	Moderate deposition of new gravel and coarse sand on old and some new bars.	12	Extensive deposits of predominantly fine particles. Accelerated	(16)
Rock angularity	Sharp edges and corners, plane surfaces roughened.	1	Rounded corners and edges. Smooth and flat.	(2)	Corners and edges wel1 rounded in two dimensions.	3	Well rounded in all dimensions.	4
Brightness	Surfaces dull, darkened or stained. Not "bright".	1	Mostly dull, but may have up to 35% bright surfaces.	(2)	Mixture, 50-50% dull and bright i.e. 35-65%.	3	Predominantly bright, 65%, exposed surfaces.	4
Consolidation or particle packing	Assorted sizes tightly packed and/or overlapping.	2	Moderately packed with some overlapping.	(4)	Mostly a loose assortment with no apparent overlap.	6	No packing evident. Loose, easily moved.	8
Bottom size distribution & stable	No change in sizes evident. Stable materials 80-100%	4	Distribution shift slight. Stable materials 50-80%.	(8)	Moderate change in sizes. Stable materials 20-50%	12	Marked change. Stable materials 0-20%	16
Scouring and deposition	<5% of the bottom affected by scouring and deposition.	6	5-30% affected. Scour at constrictions and where steep. Pool deposition.	12	30-50% affected. Deposits and scour at obstructions, constrictions, and bends.	18	> 50% of bed in a state of flux or change nearly year-long.	(24)
Clinging aquatic vegetation (moss and algae)	Abundant, growth largely moss, dark green, perennial. In swift water too.	1	Common. Algal forms in low velocity and pool areas. Moss and swifter waters.	2	Present but spotty, mostly in backwater areas. Seasonal blooms	3	Perennial types scarce or absent. Yellow-green, short term bloom present.	4
COLUMN TOTALS		Ø		22		33		60

TOTAL = 115

Reach score of: <38 = Excellent, 39-76 = Good, 77-114 = Fair, 115+ = Poor

Appendix N: Stream reach inventory sheet and corresponding Rosgen rating

Stability Survey completed upstream of Edgar J. Carnegie Railroad Bridge at potential gage location by E.R. Houston on 4/30/09.

Scott's Cr abv RR bridge   ERH 04/30/2009
HOUSTON

Pfankuch D.J. 1975. Stream reach inventory and channel stability evaluation. USDA Forest Service Northern Region, Montana.

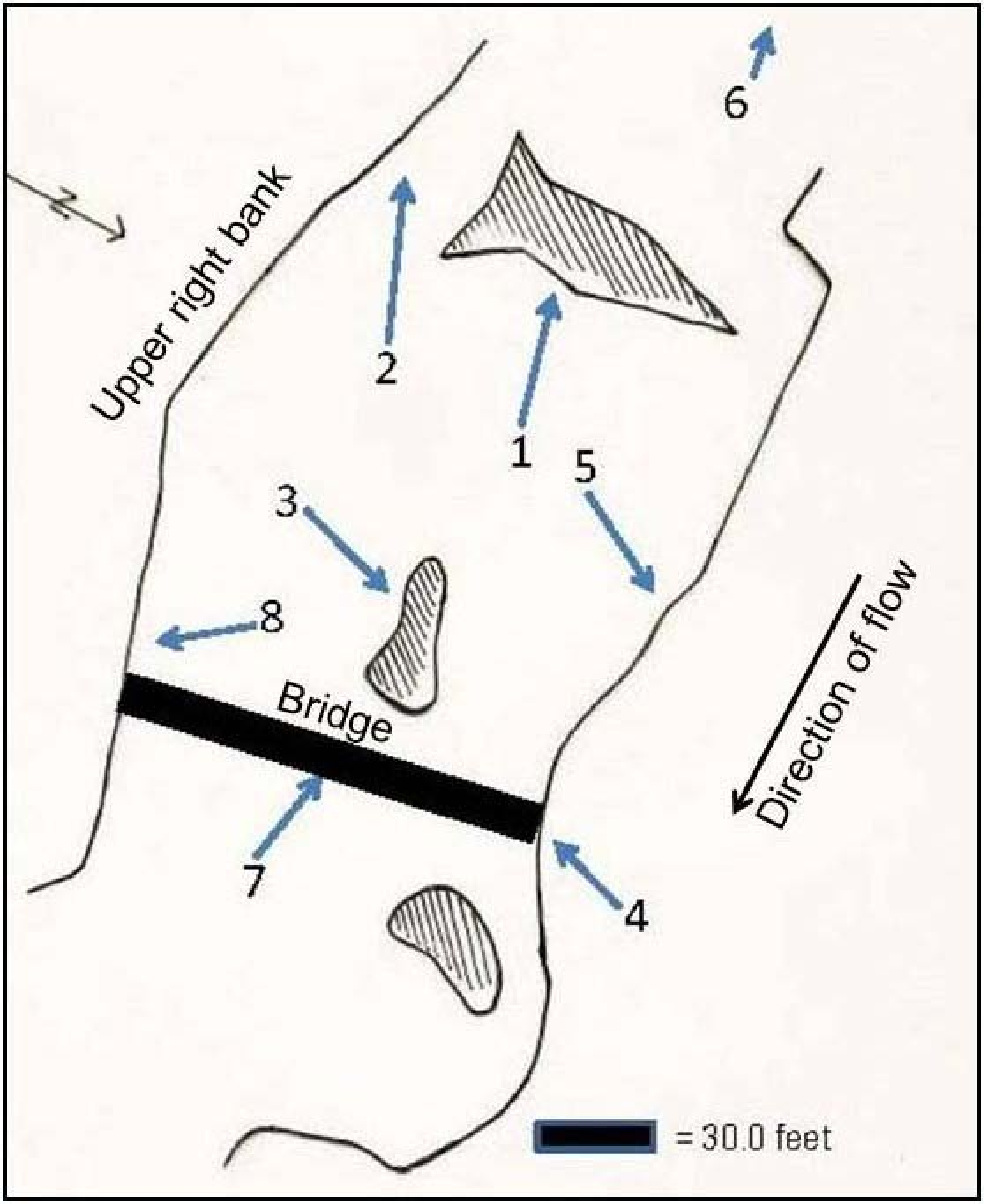
UPPER BANKS	EXCELLENT		GOOD		FAIR		POOR	
Landform slope	Bank slope gradient <30%	(2)	Bank slope gradient 30-40%	4	Bank slope gradient 40-60%	6	Bank slope gradient >60%	8
Mass-wasting (existing or potential)	No evidence of post or any potential for future mass-wasting into channel.	3	Infrequent and/or very small. Mostly healed over. Low future potential.	6	Moderate frequency and size, with some raw spots eroded by water during high flows.	(9)	Frequent or large, causing sediment OR imminent danger of same.	12
Debris jam potential (floatable objects)	Essentially absent from immediate channel area.	2	Present but mostly small twigs and limbs.	4	Present, volume and size are both increasing,	6	Moderate to heavy amounts, mainly larger sizes.	(8)
Vegetative bank protection	>90% plant density. Vigor and variety suggests a deep, dense, soil binding root mass.	(3)	70-90% density. Fewer plant species or lower vigor suggests a less dense or deep root mass.	6	50-70% density. Lower vigor and species form a somewhat shallow and discontinuous root mass.	9	<50% density plus fewer species and vigor indicate discontinuous and shallow root mass.	12
Channel capacity	Ample for present plus some increases. Peak flows contained. Width to Depth (W/D) ratio <7.	(1)	Adequate. Overbank flows rare. W/D ratio 8 to 15.	2	Barely contains present peaks. Occasional over-bank floods. W/D ratio 15 to 25.	3	Inadequate. Overbank flows common. W/D ratio >25.	4
LOWER BANKS								
Bank rock content	65% with large, angular boulders 30cm numerous.	2	40 to 65"%, mostly small boulders to cobbles 15-30cm.	(4)	20 to 401, with most in the 7.5-15cm diameter class.	6	<20% rock fragments of gravel sizes, 2.5-7.5 cm or less.	8
Obstructions (flow deflectors Sediment traps)	Rocks and old logs firmly embedded. Flow pattern without cutting or deposition. Pools and riffles stable.	2	Some present, causing erosive cross currents and minor pool filling. Obstructions and deflectors newer and less firm.	4	Moderately frequent, unstable obstructions and deflectors move with high water causing bank cutting and filling of pools.	6	Frequent obstructions and deflectors cause bank erosion. Sediment traps' full channel migration occurring.	(8)
Undercutting	Little or none evident. Infrequent raw banks <150cm high.	4	Some, intermittently at outcurves and constrictions. Raw banks <30cm.	8	Significant. Cuts 15-30cm high. Root mat overhangs and sloughing evident.	(12)	Almost continuous cuts, some >30cm high. Failure of overhangs	16
Deposition	Little or no enlargement of channel or point bars.	4	Some new increase in bar formation, mostly from coarse gravels.	8	Moderate deposition of new gravel and coarse sand on old and some new bars.	(12)	Extensive deposits of predominantly fine particles. Accelerated	16
STREAM BED								
Rock angularity	Sharp edges and corners, plane surfaces roughened.	1	Rounded corners and edges. Smooth and flat.	(2)	Corners and edges wel1 rounded in two dimensions.	3	Well rounded in all dimensions.	4
Brightness	Surfaces dull, darkened or stained. Not "bright".	1	Mostly dull, but may have up to 35% bright surfaces.	2	Mixture, 50-50% dull and bright i.e. 35-65%.	(3)	Predominantly bright, 65%, exposed surfaces.	4
Consolidation or particle packing	Assorted sizes tightly packed and/or overlapping.	2	Moderately packed with some overlapping.	(4)	Mostly a loose assortment with no apparent overlap.	6	No packing evident. Loose, easily moved.	8
Bottom size distribution & stable	No change in sizes evident. Stable materials 80-100%	4	Distribution shift slight. Stable materials 50-80%.	8	Moderate change in sizes. Stable materials 20-50%	(12)	Marked change. Stable materials 0-20%	16
Scouring and deposition	<5% of the bottom affected by scouring and deposition.	6	5-30% affected. Scour at constrictions and where steep. Pool deposition.	12	30-50% affected. Deposits and scour at obstructions, constrictions, and bends.	18	> 50% of bed in a state of flux or change nearly year-long.	(24)
Clinging aquatic vegetation (moss and algae)	Abundant, growth largely moss, dark green, perennial. In swift water too.	1	Common. Algal forms in low velocity and pool areas. Moss and swifter waters.	2	Present but spotty, mostly in backwater areas. Seasonal blooms	3	Perennial types scarce or absent. Yellow-green, short term bloom present.	(4)
COLUMN TOTALS		6		10		48		44

Reach score of: <38 = Excellent, 39-76 = Good, 77-114 = Fair, 115+ = Poor

~~110~~
TOTAL = 109

Appendix O: Survey and photos of Upper Scott Creek

Appendix O: Survey and photos of Upper Scott Creek



Appendix O: Survey and photos of Upper Scott Creek

(Photo 1). Upstream debris jam.

(Photo 2). Scour behind upstream debris jam on right bank.

Appendix O: Survey and photos of Upper Scott Creek

(Photo 3). Debris jam above bridge.

(Photo 4). Left bank wingwall and area of concern.

Appendix O: Survey and photos of Upper Scott Creek

(Photo 5). Evidence of incision and newly formed channel.

(Photo 6). Location of channel avulsion.

Appendix O: Survey and photos of Upper Scott Creek

(Photo 7). Edgar J. Carnegie Bridge.

(Photo 8). Scour and bank loss behind right bank wingwall protection.

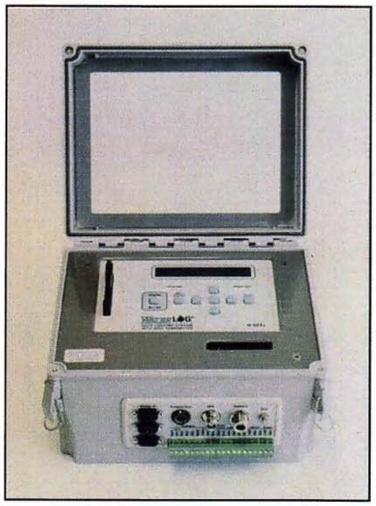
Appendix P: Design Analysis equipment specification sheets

Appendix P: Design Analysis equipment specification sheets

WATERLOG® SERIES

Model H-522+

Data Logger with Integrated
HDR GOES Transmitter



The *WATER*LOG® H-522+ Data Logger with Integrated HDR GOES Transmitter is a High Level Data Logger designed for remote operations with a built-in High Data Rate GOES Radio system with a keypad and display. This system allows any of the sensor readings to be transmitted over the GOES Radio system. It can transmit at 100, 300 or 1200 baud rates and has a built-in GPS.

KEY FEATURES

- Menu driven user interface
- Self-timed and random transmissions
- Configuration Query allows examination of set-up parameters
- Built-in key pad and easy-to-read display can be used for complete system configuration or to view measured values.
- Binary or ASCII data format
- Selectable data order
- Ability to transmit different data than what is logged to the internal memory
- Extensive built-in software
- Configuration and Control implemented by external device via RS-232 interface
- User programmable data rates of 100BPS, 300BPS or 1200BPS
- Time of day query retrieves GPS time
- Complex function software for special applications
- Two RS-232 Serial Ports for use with local terminals, modems, GOES Radios, remote displays, etc.
- Four analog inputs
- SDI-12 Master mode
- Two programmable digital inputs/outputs
- One event counter input (Tipping Bucket Rain Gauge)
- Frequency input (wind speed)
- Quadrature shaft encoder input
- Scalable and programmable 4-20 mA output
- Data logging capability using nonvolatile internal storage (16 Meg and up)
- Low standby power
- Sealed, corrosion-resistant, nonconductive enclosure
- Operating temperature range of -40° to 60°
- Simple RS-232 connection for downloading data, and programming with a laptop and/or PDA unit with no special software required
- XL Basic programming capabilities
- PCMCIA Flash Card port for easy data collection and Firmware updating

Appendix P: Design Analysis equipment specification sheets

SPECIFICATIONS

Performance

General Analog Input

Channels:	4 (Single Ended)
Ranges:	Programmable (Channel 1 Only)
Resolution:	16-Bit Resolution (1 Part in 65536)
Accuracy:	± 0.02%
Input Ranges:	0 to 5 Volts (All Channels) 0 to 500 mV (Additional Input Range Only Available on Channel 1)
Excitation	5.0V Switched, Ratiometric with 10mA (max load)
Accuracy	± 1.0 mV Over Load and Temperature Range

Frequency Input

Input Range:	1-10 KHz at ±75mVolts or greater 1-15 KHz at ±1Volt or greater
Input Amplitude:	± 5.0 Max
Accuracy:	± 0.1%
Resolution:	1/10000 * Reading

Counter Input

Type:	Switch closure or voltage pulse, Internal 50k pull up resistor, falling edge triggered.
Input Voltage:	0-5 Volts
Minimum Pulse Width:	5 mS
Input Frequency:	100Hz (max)

Digital I/O

Channels:	2, Independently configured for input or output
Input Voltage:	0-5 Volt
High Level:	3.5 V (min)
Low Level:	0.8 V (max)

Output Voltage

Low:	0.4 V (max)@ -5mA
High:	3.5 V (min)@+5mA

4-20 mA Output

Resolution:	4.0 μA

Data Storage

Type:	Non-Volatile FLASH
Size:	16 Mega Byte Minimum (Expandable)

Interface

SDI-12	SDI-12 Master Mode
Protocol:	SDI-12, 7-bit even parity, 1 stop bit
Baud Rate:	1200
RS-232	2 RS-232 Communication Ports
Protocol:	RS-232, 8-bit, no parity, 1 stop bit
Baud Rate:	Programmable

Power

Input Voltage:	10.0 to 16.0 Volts	
Input Current:	Sleep Mode:	4mA typical
	Active:	60 mA average
	Transmit	< 2.75 A
	Standby	< 4mA typical

Environment

Temperature

Extended Operating Range:	-40° to 60°C
Storage:	-40° to 80°C
Humidity	0-95% non-condensing

Miscellaneous

Options

Data Logging:	Data is stored internally to Nonvolatile Memory
GOES:	H-222 (1200 baud High Data Rate GOES Radio with built-in GPS)

Accessories (Supplied)

Cables/Connector:
- 9-pin D connector cable required for RS-232 communication available (H-350-RSC)
- 9-pin D Male to Male Gender Changer
- RS-232 Null Modem Adaptor
- Sensor Terminal Block

Frequency Coverage

100 and 300 BPS:	GOES Domestic Channels (1-199)
100 BPS:	International Channels (202-266)
1200 BPS:	HDR Domestic Channels (1-100)

Frequency Stability

Over Temperature:	± 0.4 PPM
Long Term:	± 1 PPM (including temperature)
Frequency Setting:	To an accuracy of 1 Hz under software control

Output Power

100 / 300:	6 Watts (nominal) Linear
1200:	9 Watts (nominal) Linear
Output Dependence:	50 Ohms, short and open circuit protected
Interface:	RS-232
Time Keeping:	< 0.5 seconds with embedded GPS Receiver
DC Power Input Voltage:	12 ± 1.8 V

Environment

Humidity:	90% non-condensing
Temperature Range:	
-Operating	-20° to +50° C (-40° to +122° F)
-Storage	-55° to +75° C (-67° to +167° F)

Mechanical Data

Enclosure:	Sealed, corrosion resistant fiberglass case with clear Lexan window
Mounting:	Hardware supplied for wall mounting

Miscellaneous

Certification: NOAA/NESDIS certified for self-timed and random GOES transmissions

Warranty

The *WATER*LOG® H-522+ is warranted against defects in materials and workmanship for one year from date of shipment.

Note

Specifications subject to change without prior notice due to on going commitment to product testing and improvement.
LR December 15, 2003

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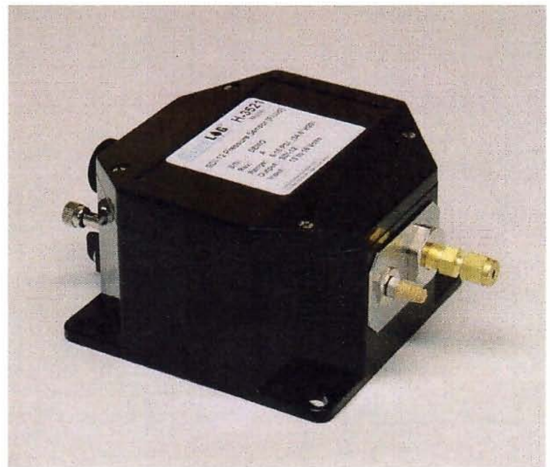
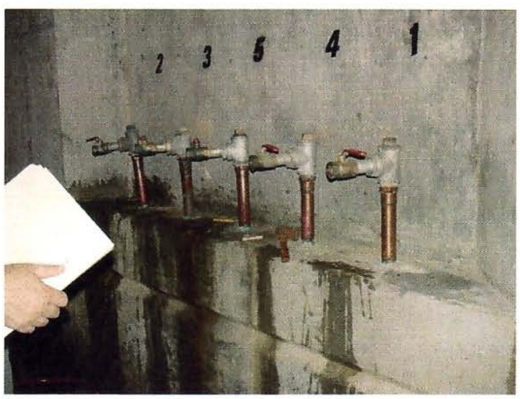
Appendix P: Design Analysis equipment specification sheets

WATERLOG®
SERIES

Model H-3521 “Fluid”

The *WATER*LOG® H-3521 “Fluid” is a SDI-12 compatible, NIST traceable pressure sensor. The sensor can directly measure water, antifreeze or other fluid pressure with an accuracy better than 0.05% FSO.





KEY FEATURES

- Directly measure water, glycol or fluid pressure
- Works with rain gauges, snow pillows, artesian wells, piezometers and water tanks
- Ideal for industrial applications such as monitoring culinary water pressure.
- Pressure accuracy is 0.05% full scale
- Accuracy over temperature range exceeds ±0.02 ft. of water
- Built-in temperature compensation
- Operating temperature range -30° to +60°C
- SDI-12 output provides measurement data in engineering units such as feet or meters
- Industrial outputs: 4-20mA and Modbus RTU
- Enclosure is nonconductive and corrosion proof
- Low current operation (150μA standby)
- Extended SDI-12 command for setting the Stage to the current water elevation or pressure

Appendix P: Design Analysis equipment specification sheets

SPECIFICATIONS

Accuracy
(Maximum percent of error in measurement)

Pressure: Less than or equal to 0.05% of full scale output (FSO) over temperature range referenced to a straight line stretched from zero PSI to maximum pressure

Temperature: Internal temperature ±1° C over temperature range

Resolution
(Smallest change detectable in output signal)

Pressure: 1 part in 1,000,000 (0.0001%)

Temperature: 1 part in 1,000,000 (0.0001%)

Linearity
Less than 0.05% deviation from a straight line referenced to end points

Pressure Hysteresis
Less than 0.02% of FSO

Long-term Stability
Accuracy drift is less than ±0.10% of FSO per year

Standard Ranges

Pressure	Depth	Accuracy
0 to 15 PSI	0 to 34.6 ft.	±0.017 ft.
0 to 30 PSI	0 to 69.20 ft	±0.035 ft.

Custom calibration ranges available up to 250 PSI

Pressure Overload
Less than 2 times the rated pressure

SDI-12 Output

Baud Rate: 1200

Protocol: SDI-12, 7-bit even parity, 1 stop bit

Output Voltage Levels:
- Min high level: 3.5 volts
- Max low level: 0.8 volts

4-20mA Output

Type: 4-20mA, optically isolated

Loop Voltage: 8.0V min, 35V max

Resolution: 4μA (12-bit DAC)

Modbus Output

Protocol: RTU

Port: RS-485

Baud Rate: Programmable (default=9600)

Response Time
SDI-12: 3-second measurement sequence (programmable)

Power Requirements

Voltage Input: 10 to 16.0 Volts DC

Supply Current:
- Sleep Mode 150μA max
- Active (measuring) 50mA max

Surge Protection: Built in, 1.5 KVA

Environmental

Operating Temperature: -30° C to 60° C

Compensated Range: -30° C to 60° C

Storage Temperature: -40° C to 80° C

Media Compatibility
Liquids and gases compatible with RTV, stainless steel and brass

Mechanical

Enclosure: Fiberglass

Size: 4.75" x 4.75" x 3.0" high

Pressure Inlet: 1/8" female NPT

Atmospheric Vent: Sintered bronze, #10-32

Connections

3-position terminal strip: Power, SDI-12

9-pin circular: Power , 4-20mA, RS-485 Modbus

Cables: Connector with 6-ft pigtail for 4-20mA and RS-485 is provided

The *WATER*LOG® H-3521 is warranted against defects in materials and workmanship for one year from date of shipment.

Notes
Specifications subject to change without prior notice due to ongoing commitment to product testing and improvement.

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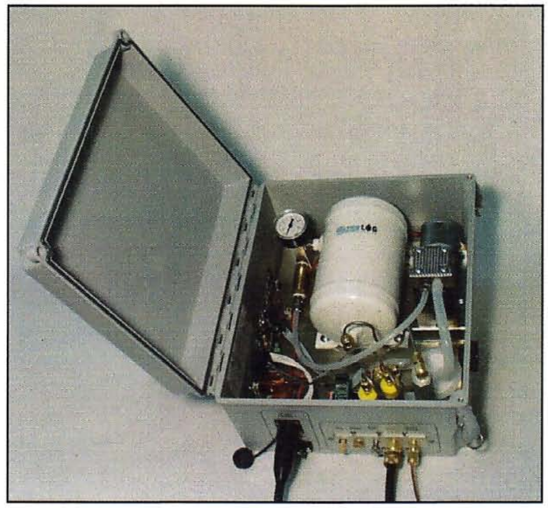
Appendix P: Design Analysis equipment specification sheets

WATERLOG® SERIES

Model H-355

The "*SMART-GAS*" System

The ***WATER*LOG®** H-355 "*SMART-GAS*" unit replaces the heavy, dangerous, high-pressure gas bottles, oil sight feeds, flow regulators, and leaky manifolds found in gas purge pressure measurement systems. It is reliable, light weight, and low power – suitable for deployment in the most remote locations.



KEY FEATURES

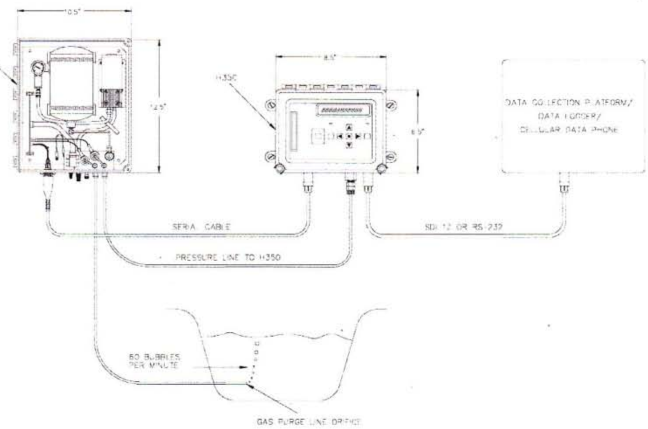
- A complete single unit replacement for gas purge bubbler systems
- Depths to 115 ft. (50 PSI)
- No needle valve or diaphragm problems
- No mercury
- No sight feed oil in orifice line
- No heavy, dangerous Nitrogen tank required
- Operation temperature -40° to +60° C offers both SDI-12 and RS-485 interfaces
- Automatic and/or controlled purge
- Dependable mass flow rate control (temperature compensated)
- Flow rates are selectable
- ISO 9000 qualified components approved for medical applications
- Automatic Bubble Control "ABC" Constant Bubbler Rate over wide stage range
- Low power operation (can be powered by 12-volt battery and solar panel)

Appendix P: Design Analysis equipment specification sheets

Suggested Application

Coupling the H-355 with a H-350, as shown, creates a robust full-function fluid level measuring system which can be applied to a variety of level measurement applications:

- Stream, lake, and well level monitoring and logging
- Safe, hazardous waste monitoring
- Cellular phone links for remote monitoring, full bidirectional setup, and data acquisition
- GOES Satellite Transmitter available
- Driven directly from H-350 or H-350XL™



Specifications

Environment

Standard Operating Range: -40° to 60°C
Storage: -50° to 80°C
It is recommended to install unit in weather shielded enclosure.

Gas Delivery

Particulars:	Microprocessor controlled unit
Gas Flow Technology:	Constant mass flow
Gas Flow Control:	Bubble rate is user selectable from 30 to 120 bubbles per minute based on 1/4 in. tubing orifice pointing down. Auto zero error controlled flow nozzle (patent application in process) **(NO NEEDLE VALVE PROBLEMS)**

Compressor

Type:	HI-REL medical grade ISO 9003 qualified piston compressor (NO BROKEN DIAPHRAGM PROBLEMS)
Operation:	Low duty cycle (7 hours typical runtime per year at 60 bubbles per minute flow rate into 12 ft. of stage-purges not included)

Purge Functions

Purge Pressure Level:	User Selectable 15 psi to 80 psi
Options:	• Manual • Internally sensed requirement • Automatic timed interval • Remote controlled

Interface

RS - 485 Electrical Specification

Protocol:	Flexible
Commands:	Half-duplex, 8-bit, no parity, 1stop bit
Baud rate:	9600

Power Requirements

Qualified for 12-volt battery operation

Two Supply Inputs:	Electronics supply via the RS-485 cable (10 to 16 volts) Compressor supply (10 to 16 volts)
24 hour average current draw:	6mA Based on a 60 bubbles per minute flow rate

Mechanical

Physical

Enclosure:	Sealed corrosion resistant fiberglass
Size:	10.0 in. wide x 12.0 in. long x 6.0 in. high
Weight:	12 lbs.
Mounting:	Hardware supplied for wall mounting
Pressure Outlet:	1/8 in. FNPT
Sensor Pressure Outlet:	1/8 in. FNPT
Reserve Tank Inlet:	1/8 in. FNPT (80 psi MAX) Pressure relief valve included

Miscellaneous

Ordering Information

H-355	Base model number
H-350XL™/355	Combination H-350XL™ pressure measurement system and H-355 "SMART-GAS" system

Warranty

The *WATER*LOG® H-355 is warranted against defects in materials and workmanship for one year from date of shipment.

Note

Specifications subject to change without prior notice due to ongoing commitment to product testing and improvement. LR June 11, 2003

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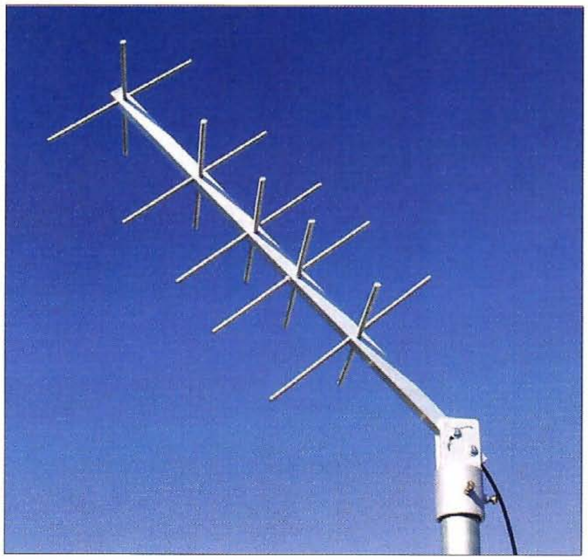
Appendix P: Design Analysis equipment specification sheets

WATERLOG® SERIES

Model H-223

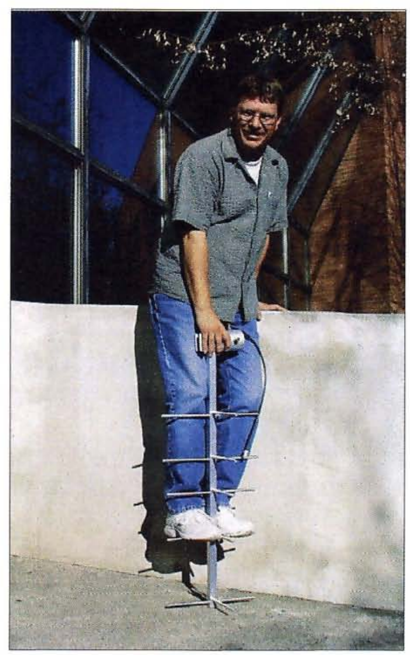
401.8 MHz GOES Satellite Antenna



The *WATER*LOG® H-223 is a rugged, high-gain Yagi antenna designed for use with fixed location GOES Satellite Data Collection Platforms. The antenna has two 5-element Yagi antennae mounted on an extruded aluminum boom. The dipole elements are driven from an internal impedance and phase matching circuit.

KEY FEATURES

- High gain
- Circular polarization compatible with GOES satellite
- Rugged, heavy duty construction
- Fully adjustable mount (0 - 90° elevation, 0 - 360° azimuth)
- Mount fits on a 2-in. pipe mast
- One-piece passive electrodes lock firmly into place with a unique ½-turn cam-lock mechanism
- Can be disassembled for easy transport and shipping



Rugged Construction

Appendix P: Design Analysis equipment specification sheets

SPECIFICATIONS

Electrical

Frequency:	401.8 MHz nominal
Gain:	11.0 dBd nominal
VSWR Range:	From 1 to 1.25
Axial Ratio:	<3dB
Polarization:	Right-Hand, Circular
Impedance:	Nominally 50 Ohms
Connector:	Type N Jack on 24 in. LMR-240 leadcable

Construction

Material:	Aluminum
Mount:	Fits on 2.0-in. pipe mast (2.40 in. OD max)
Boom:	1 in. square
Elements:	3/8 in. aluminum rod
Azimuth Adjustment:	360°
Elevation Adjustment:	0-90°
Size:	38 in. long x 14.75 in. wide x 14.75 in. high
Weight:	4.0 lbs. including mount
Shipping size:	4 in. x 4 in. x 48 in. long paperboard tube

PLEASE READ!!! *An important note about antennas.*

An antenna must be viewed as a system. This antenna system has either an input connector mounted directly on the antenna beam, or it has a connector at the end of a pigtail; which serves as the antenna Input. The output of this antenna is the electromagnetic energy wave that is beamed into free space.

It is important to understand this "pigtail" is part of the antenna system. So, just as you would not alter the length of any of the array elements on the beam, you must not alter the length of the "pigtail".

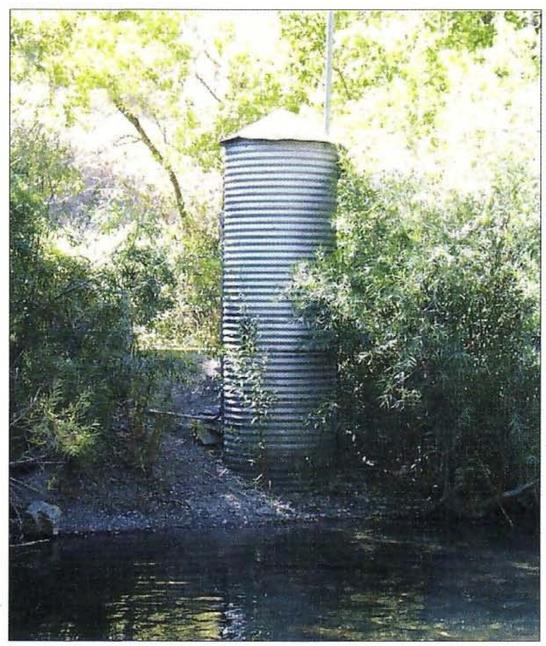
An H-223 is set up and checked at the factory to be within a certain range of impedance before it is shipped. This is done to minimize the VSWR for your installation. Yes, you can connect a 50 ohm cable you have to the H-223's pigtail connector without any problems, but DO NOT physically alter the connector or the length of the "pigtail" itself.

Warranty

The *WATER*LOG® H-223 is warranted against defects in materials and workmanship for one year from date of shipment.

Note

Specifications subject to change without prior notice due to on going commitment to product testing and improvement. LR July 28, 2003



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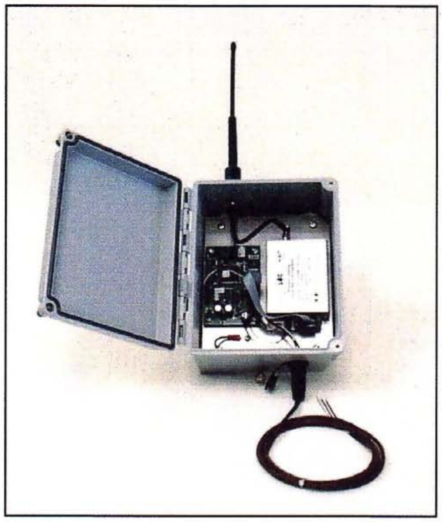
Appendix P: Design Analysis equipment specification sheets

WATERLOG® SERIES

Model H-424MS

Spread Spectrum
SDI-12 Radio Bridge



The ***WATER*LOG**® H-424MS is a spread spectrum SDI-12 radio bridge. Each unit contains a microprocessor control board and a spread spectrum telemetry radio. Spread spectrum technology is highly secure and has good interference immunity. The radio operates in the license-free, 900 MHz ISM Band eliminating the need for any FCC licensing, allowing the radio system to be used immediately.

KEY FEATURES

- The radio link is easy to use and works with any SDI-12 data recorder or sensor
- Radio link provides transparent, SDI-12 compliant communication between your data recorder and one or more remote sites
- All SDI-12 commands are supported, including manufacturer specific extended commands
- Each remote site can have multiple SDI-12 sensors
- The system uses modern direct sequence spread spectrum telemetry radios

Appendix P: Design Analysis equipment specification sheets

SPECIFICATIONS

Protocol

Master:	SDI-12
Slave:	SDI-12
Type:	Transparent SDI-12. Works with all SDI-12 commands including extended and V1.2 commands
Requirements:	Data logger must support multiple (3/3) SDI-12 breaks with retries.

Radio

Frequency Range:	902.5 to 927.5 MHz
Line of Sight:	5 plus miles - depending on antenna and site conditions.
Modulation Type:	Direct Sequence Spread Spectrum
RF Connector:	Reverse Type-TNC
Transmission Power:	500 mW (=27dBm)
Receive Sensitivity:	-100 dBm

SDI-12 Output

Baud Rate:	1200
Protocol:	SDI-12, 7-bit even parity, 1 stop bit
Output Voltage Levels:	
Minimum high level:	3.5 volts
Maximum low level:	0.8 volts

Environment

Humidity:	0 to 100%
Temperature Range:	
-Operating:	-40° to +60°C
-Storage:	-50° to +70°C

Power Requirements

Voltage Input:	9.6 to 18.0 Volts DC
Power Control:	Remote station uses programmable sleep/wake-up to detect carrier.

Current

Standby:	510μa (sleep)
Receive:	135 mA
Transmit:	800 mA
Average with power control:	Less than 2.0 mA

Mechanical

Enclosure:	Fiberglass, NEMA 4
Size:	8 in. x 6 in. x 4 in. with hinged screw cover

Connector

H-424:	Switchcraft EN3P4M (4-pin male)
Mate:	Switchcraft EN3C4F (4-pin female)

Warranty

The *WATER*LOG® H-424MS is warranted against defects in materials and workmanship for one year from date of shipment.

Note

Specifications subject to change without prior notice due to on going commitment to product testing and improvement.

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ENVIRONMENTAL PRODUCTS
A Division of Design Analysis Associates, Inc.

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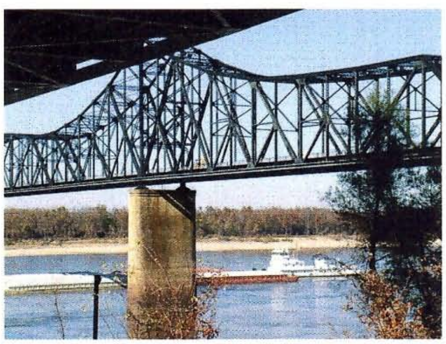
Appendix P: Design Analysis equipment specification sheets

WATERLOG® SERIES

Model H-3611

Family of SDI-12 Radar Water Level Sensors

The *WATER*LOG® H-3611 series radars are a family of SDI-12 water level sensors. Typical applications include non-contact measurement of river, lake and reservoir water level. The H-3611 family is easy to use and interface with any data recorder/logger that is SDI-12 compliant. The sensors measures *Stage* in units of Feet, Meters or other engineering units.



KEY FEATURES

- Non-contact level measurement eliminates the need for stilling wells and other infrastructure.
- Undamaged by ice, logs or debris
- ±3.0mm accuracy
- -40°C to +60 °C operation
- NEMA 4x enclosure is suitable for outdoor installations
- Stainless steel horn
- Frequency range - approx 26 Ghz
- No FCC licence required
- Built-in LCD display for monitor and setup
- Free *TofTool* (Time-of-Flight) Windows™ based graphic configuration and diagnostic tool. The graphical user interface aids documentation, maintenance and setup of the radar unit.
- Low current operation (8.0 mA typical standby)
- Continuous operation, no warmup or "lock on"
- Simple to install, use, and maintain
- Mounting enclosures, radio communication links and other accessories are available.

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SPECIFICATIONS

Measurement
Standard Range: 0.75 ft to 72 ft (0.3 m to 22 m)
Accuracy (including linearity, repeatability and hysteresis):
<32 ft (10 m): ±0.12 in (±3 mm)
>32 ft (10 m): ±0.03% of measuring range

Radar Unit
Frequency: ~26 GHz
Electromagnetic Compatibility:
Emission to EN 61326
Electrical Equipment Class B
Pulse Energy: 1mW max (1μW average)
Beam angle: 10° (3-in dia horn)
8° (4-in dia horn)

Measuring Distance	Beam Diameter (3-in Horn)
10 ft (3 m)	1.75 ft (0.5 2m)
20 ft (6 m)	3.50 ft (1.05m)
30 ft (9 m)	5.25 ft (1.57 m)
40 ft (12 m)	7.00 ft (2.1 m)
49 ft (15 m)	8.57 ft (2.62 m)
65 ft (20 m)	11.37 ft (3.50 m)

SDI-12 Output
Baud Rate: 1200
Protocol: SDI-12, 7-bit even parity, 1 stop bit
Output Voltage Levels:
Minimum high level: 3.5 volts
Maximum low level: 0.8 volts

Response Time
SDI-12 measurement sequence: 800mS (typ)
5 sec (max)

Power Requirements
Voltage Input: 10 to 16 Volts DC
Surge Protection: Built in, 1.5 KVA
Supply Current:
Sleep mode 7.6 mA typ
Active (measuring) 12 mA typ
Startup 18 mA max

Environmental
Operating Temperature: -40° C to +80° C
Storage Temperature: -40° C to +80° C
Temperature Sensitivity: average T_K: 2 mm/10 K,
max 5 mm over the entire temperature range -40° C to +80° C

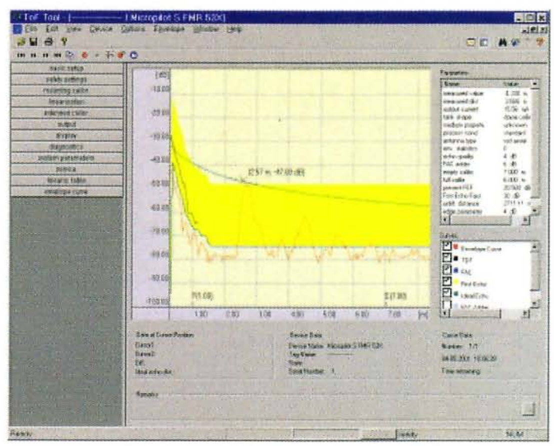
Mechanical
Rating: NEMA 4x
Housing::Aluminum, coated IP65
Horn size: 3-inch (L = 211mm, d = 75 mm) *standard*
4-inch (L = 282 mm, d = 95 mm) *optional*
Horn Material: 316L stainless steel
Internal Display: LCD with back light

Connections
+12V & SDI-12: Internal 3-position connector.
6-ft polyurethane pigtail is provided.

Cables: 6-ft cable with RS-232 connector for TofTool® is provided.

The *WATER*LOG® H-3611 series radars are warranted against defects in materials and workmanship for one year from date of shipment.

Notes
Specifications subject to change without prior notice due to ongoing commitment to product testing and improvement.



Free TofTool® Diagnostic Software

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