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TECHNICAL SERVICE CENTER
DENVER, COLORADO

UPPER GILA RIVER FLUVIAL GEOMORPHOLOGY STUDY

STABLE CHANNEL ANALYSIS NEW MEXICO

US Department of the Interior
Bureau of Reclamation

DECEMBER 13, 2002

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U.S. Department of the Interior
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Mission of the Bureau of Reclamation

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

STATE OF NEW MEXICO
NEW MEXICO ENVIRONMENT DEPARTMENT
SURFACE WATER QUALITY BUREAU

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The State of New Mexico and Reclamation are Cost Share Partners in the Upper Gila River Fluvial Geomorphology Study. The views or findings of Reclamation presented in this deliverable do not necessarily represent those of the State of New Mexico.

UPPER GILA RIVER FLUVIAL GEOMORPHOLOGY STUDY

STABLE CHANNEL ANALYSIS
NEW MEXICO

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The Fluvial Hydraulics & Geomorphology Team from the Technical Service Center is leading the Upper Gila Fluvial Geomorphology Study. The team consists of geomorphologists, engineers, and biologists. The members have expertise in water resources management, fluvial geomorphology, paleohydrology, hydraulics, sedimentation, photogrammetry, mapping, fisheries biology, wildlife biology, and riparian vegetation management.

The team members are:

- Dr. Daniel R. Levish, Geologist. (Paleohydrology, Fluvial Geomorphology)
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STUDY BACKGROUND

The State of New Mexico, Environment Department, Surface Water Quality Bureau (NMED-SWQB) is sponsoring the Upper Gila River Fluvial Geomorphology Study in New Mexico. The Bureau of Reclamation, under a Joint Powers Agreement (JPA) with the NMED, began the fluvial geomorphology study of the Gila River in New Mexico between the Arizona State line and Mogollon Creek, near Cliff, New Mexico in October 2000. This study complements an on-going Reclamation fluvial geomorphology study of the Gila River between San Carlos Reservation and the New Mexico – Arizona state line.

The Reclamation Study Manager is Mary Reece, Phoenix Area Office (PXAO). Co-Principal Investigators from the US Bureau of Reclamation Technical Service Center (USBR-TSC) in Denver, Colorado, are Dr. Daniel R. Levish, Fluvial Geomorphologist, and Dr. Rodney J. Wittler, Hydraulic Engineer.

The goal of this study is to diagnose the fluvial geomorphological attributes of the upper Gila River. These attributes are a function of the physical processes at work in the stream corridor. The stream corridor includes the mainstem of the Gila River at flood stage and the associated riparian area, as well as tributaries within the valley of the mainstem. The purpose of the study is to increase the awareness of these processes enabling improved local, state, and federal management of the stream corridor. The study includes background information gathering, field data collection, photographic analyses, and a variety of topographic, geomorphic, hydraulic, and hydrologic analyses. The study includes a qualitative assessment of the Gila River in the upper box.

The practical downstream limit of the study is the Arizona-New Mexico State line. The practical upstream boundary of the study is the Cliff, New Mexico area, and specifically USGS gage 09430500 Gila River near Gila, NM, at the Hooker Dam site, 1.6 miles upstream from Mogollon Creek, roughly 7 miles northeast of Gila, New Mexico. The length of river channel in the study area, measured from USGS 7.5 minute topographic maps is roughly 66.2 miles.

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STABLE CHANNEL ANALYSIS
NEW MEXICO

INTRODUCTION

This report presents an analysis of the channel stability of the Gila River in the Cliff-Gila valley in New Mexico. The stability analysis uses the RISAD module of the SAM analytical model to determine the relative stability of Sub-Reaches of the upper Gila River and tributaries.

The Hydraulics Laboratory of the Waterways Experiment Station (WES), US Army Corps of Engineers, Vicksburg, Mississippi, developed the SAM computer code. SAM is an integrated system of programs developed through the US Army Corps of Engineers Flood Control Channel Research Program. Using average hydraulic properties within the study reach, SAM calculates the stable channel slope and depth for twenty variations in width of the simplified (trapezoidal) channel section and hydraulics. SAM provides the computational capability to evaluate erosion, entrainment, transportation, and deposition in alluvial streams.

One measure of fluvial geomorphic stability is the competence of a river to transport its sediment load. A deficit or surplus in transport capacity is the measure of instability. The history of channel width adjustment is another indicator of stability. This report presents an analysis of current channel widths compared to stable widths predicted by the SAM analytical model. There is also a comparison to historical channel widths reported in the Catalog of Historical Changes (Klawon, 2002).

This report contains the following analyses:

1. Profile of the deepest points of the river in the analysis reach (Thalweg profile)
2. Boundary inventory in the analysis reach
3. Hydraulic and geologic control inventory in the analysis reach
4. Tributary inventory in the analysis reach
5. Effective discharge calculations
6. Profile of stream power in the analysis reach
7. Stepwise analysis of relative stability of selected Sub-Reaches of the river
8. Correlation of analyses

STUDY & ANALYSIS REACHES

This report analyzes a Sub-Reach of the Study Reach. The Study Reach is the Gila River channel from the Arizona-New Mexico State line to the Cliff, New Mexico area, specifically USGS gage 09430500 Gila River near Gila, NM, at the Hooker Dam site, 1.6 miles upstream from Mogollon Creek, roughly 7 miles northeast of Gila, New Mexico. The Analysis Reach includes 23.26 river miles of the upper Gila River.

STUDY REACH

Figure 1 shows the study area, study reach, and several landmarks, tributaries, towns, and highways. The analysis excludes the Red Rock Valley due to lack of complete photogrammetric control. The Virden Valley is similar to the upper reach studied in the Stable Channel Analysis – Arizona (Wittler, 2001).

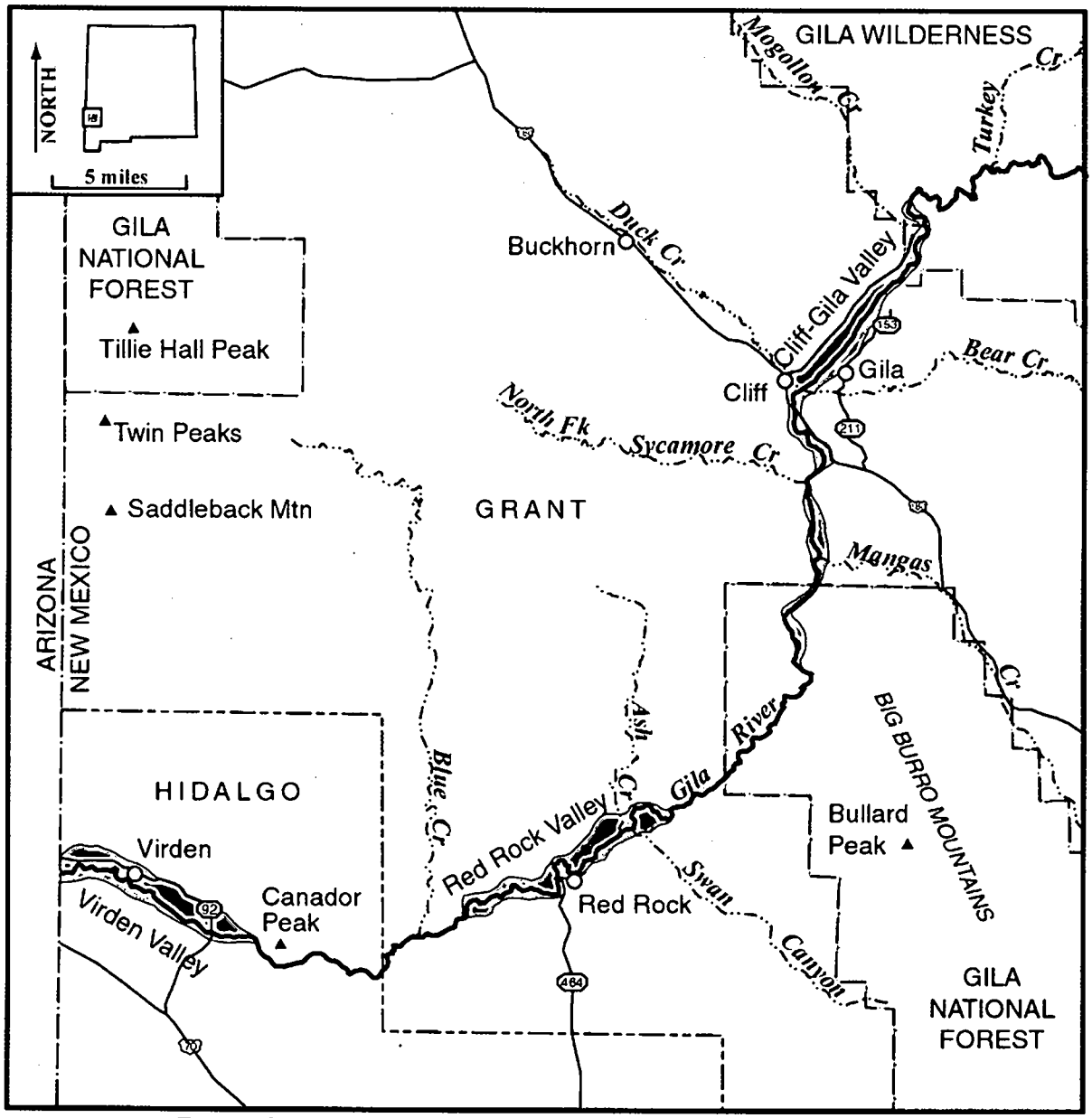

Figure 1. Study area between the New Mexico state line and USGS gage 09430500.

ANALYSIS REACH

Figure 2 shows the Analysis Reach between USGS gage 09430500, Gila River at Gila, and Ira Canyon, in the Cliff-Gila Valley. The analysis models roughly 37,432 meters (23.26 miles) of channel. There are 15 relevant bed material samples, flagged in Figure 2, at least two irrigation or other diversion structures, and three bridges in the reach.

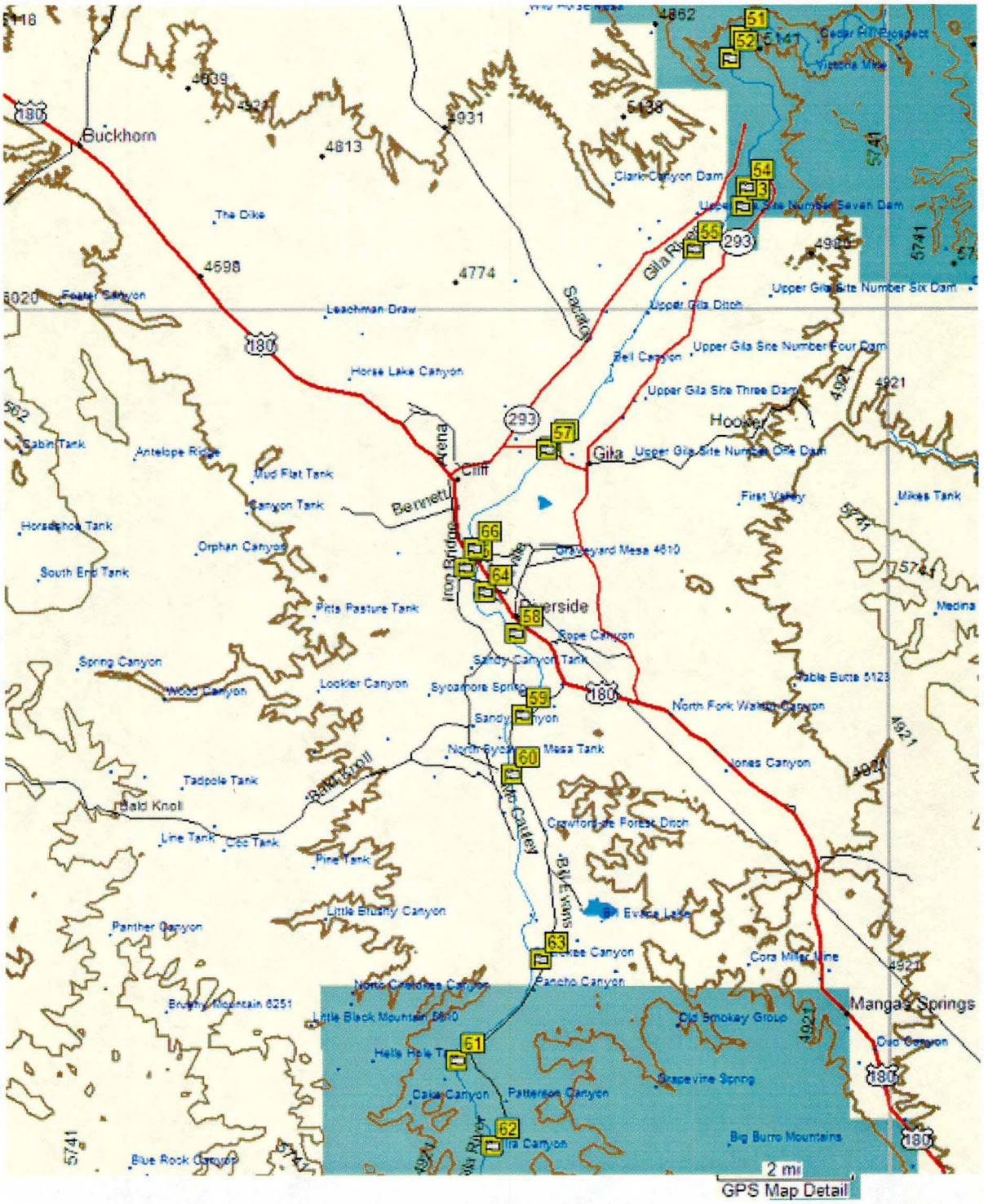

Figure 2. Analysis Reach. USGS gage 09430500, Gila River at Gila, is near sample 51, at top of figure.

STABLE CHANNEL CONCEPTS

BACKGROUND DEFINITIONS AND CONCEPTS

A river channel is stable if over time the riverbed is neither aggrading nor degrading. It is normal for banks to build, destabilize, collapse, and then rebuild, especially if the riverbed is stable. Most abnormal bank behavior is associated with instability in the bed or detachment of the river from its floodplain. Aggradation or degradation is the result of an unbalanced sediment budget, indicating that sediment is either transporting at a greater or lesser rate than supply.

Water discharge in the river is a function of the hydrology of the watershed. Sediment supply from the watershed uplands is a function of the soil conditions and hydrology in the watershed. Sediment supply from riverbanks is a function of the relative stability of the riverbanks. Water discharge in the river channel governs the transport of sediments and the relative stability of the banks.

Velocity of water discharge in the river is a function of discharge, channel shape, valley slope, sinuosity of the plan form of the channel, and the roughness of the river channel boundary, including the bed and banks. An alluvial river channel forms in alluvium, or eroded and transported sediment. Alluvium consists of different components -- sand, gravel, debris, and topsoil.

Stability of a river reach is dependent upon the following factors:

1) Valley, channel, and water surface slope (sinuosity of the plan form of the river)
2) Channel cross sectional dimensions (width and depth)
3) Roughness of the channel bed, banks, and over banks
4) Sediment supplied to the reach; transported through and out of the reach
5) Discharge into the reach; through the reach; out of the reach

Stability, according to Mackin (1948), "occurs when, over a period of time, the (river) slope is adjusted to provide, with available discharge and the prevailing channel characteristics, the velocity required to transport sediment supplied from the drainage basin." Lane (1953) defines stability as "an unlined earth channel which carries water, the banks and bed of which are not scoured objectionably by the moving water, and in which objectionable deposits of sediment do not occur." Chien (1955) contends "...the equilibrium state of an alluvial channel is attained by adjusting the dimensions of the cross section and the slope of the channel to the natural conditions imposed on the channel by the drainage basin."

CHARACTERIZING THE CHANNEL WITH A SINGLE DISCHARGE

Rivers have seasonal, annual, and episodic variations in discharge. It is useful, for the purpose of analysis, to derive a single discharge that characterizes the variation. Hydraulic Engineers and Fluvial Geomorphologists call this single discharge the channel forming or dominant discharge. There are several methods for determining the channel forming discharge. Some of those methods are:

1) Average discharge (arithmetic average of flows over time)
2) Bank Full discharge (calculated from the Manning equation)
3) Effective discharge (convolution of the flow duration and sediment transport curves)

This analysis calculates the effective discharge in four Sub-Reaches of the analysis reach, as well as on average, the analysis reach.

AVERAGE DISCHARGE

Averaging discharge over a period is the simplest method. This method is the also the least relevant to channel forming analyses. Average discharge considers only hydrologic response of the watershed reflected in the discharge in the channel.

BANK FULL DISCHARGE

According to Copeland (Copeland, 2000), "Bank-full discharge is the maximum discharge that the channel can convey without overflowing onto the floodplain. This discharge is considered to have morphological significance because it represents the breakpoint between the processes of channel formation and floodplain formation." Figure 3 shows the conceptual valley components of an alluvial stream, including the Active Stream Channel, flood plain, and terraces outside the 100-year floodplain.

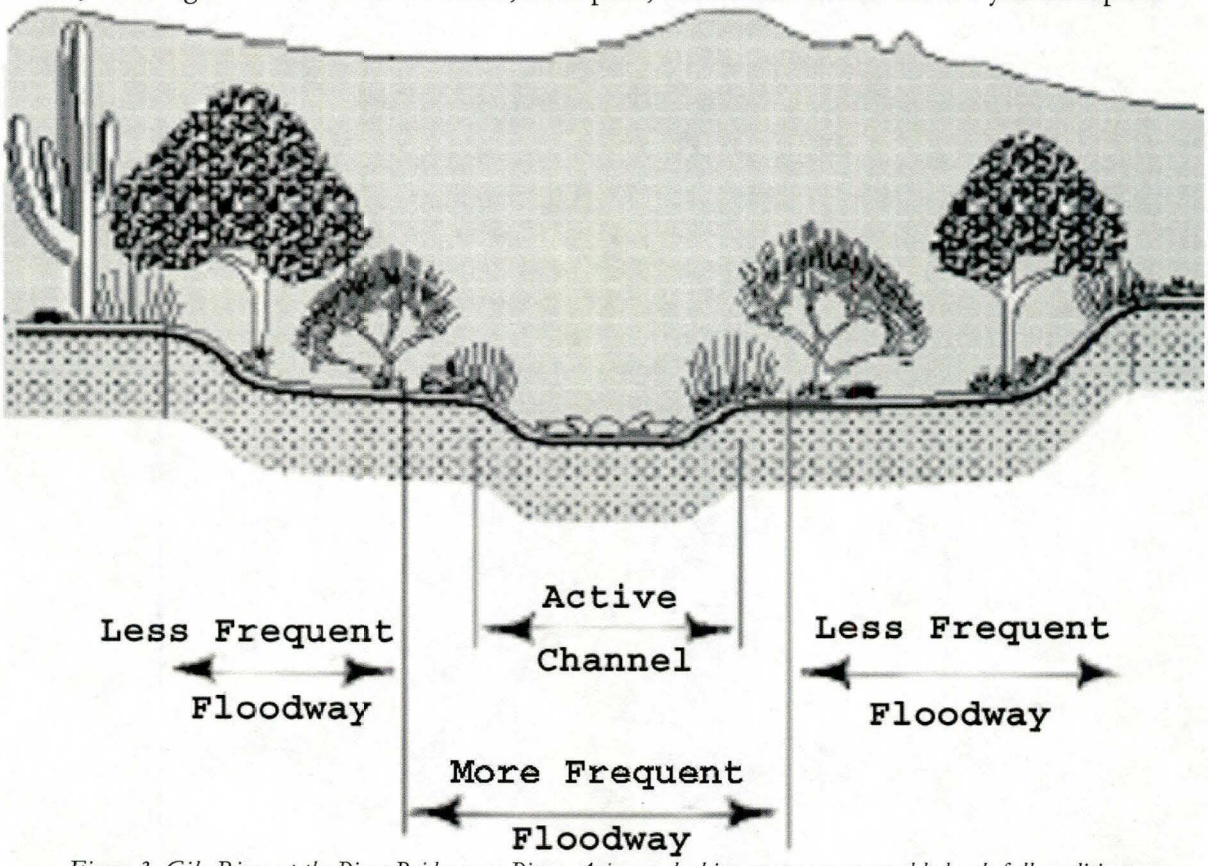

Figure 3. Gila River at the Pima Bridge near Pima, Arizona, looking upstream at roughly bank full conditions.

Knight, et. al., (1999) observed bank full width on several upper Gila streams, including the Gila River in the bird area, part of the analysis reach of this report, and correlated bank full width to drainage area. Figure 4 shows the correlation. The drainage area at the upstream end of the analysis reach is 1,864 mi², corresponding to their prediction of active stream channel bank full width of roughly 90 feet.

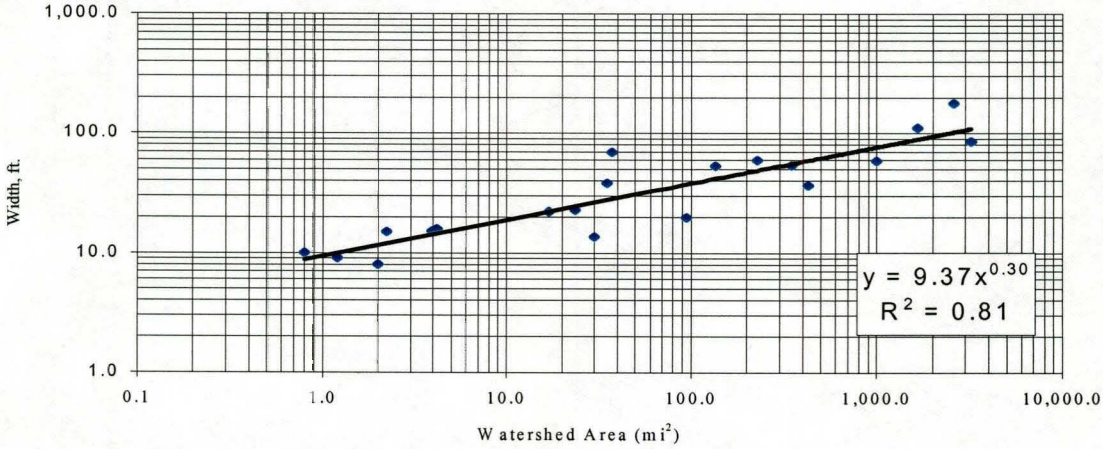

Figure 4. Bankfull width for various upper Gila water courses. (After Knight, 1999).

EFFECTIVE DISCHARGE

Figure 5 is a USGS illustration of the temporal distribution of suspended sediment transport over the course of several years at the Head of Safford Valley (USGS Gage 09448500).

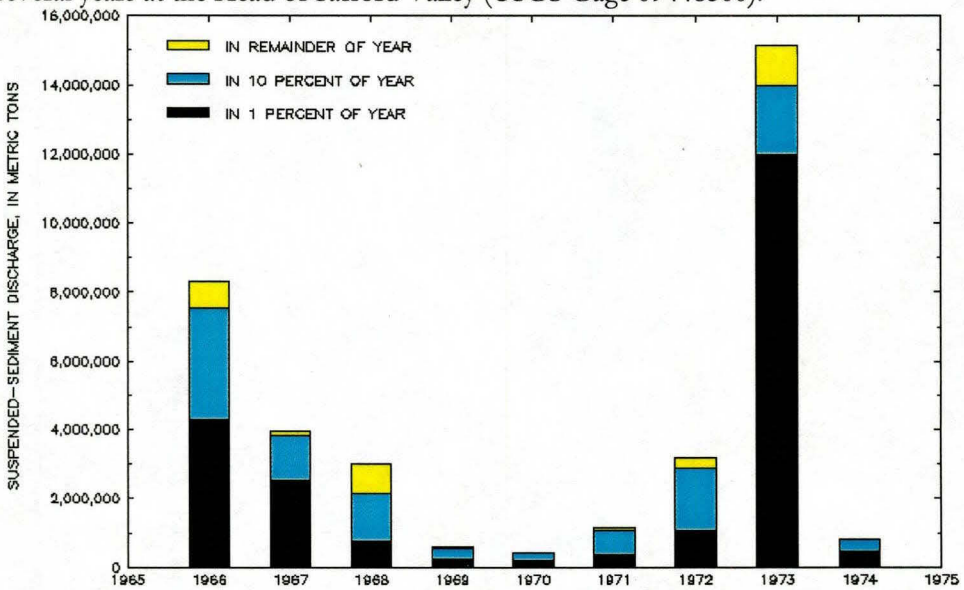

Figure 5. Gila River at Head of Safford Valley suspended sediment discharge (USGS, 2001).

In many years, a single storm may be responsible for transporting the majority of sediment transported during the entire year. The effective discharge accounts for this temporal variation in sediment transport as well as hydrological variation of the discharge. Andrews (1980) defines effective discharge as the discharge increment that transports the largest fraction of the annual sediment load over a period of years. The effective discharge incorporates the principle prescribed by Wolman and Miller (1960) that the channel-forming discharge is a function of both the magnitude and frequency of flow events. Convoluting the flow-duration curve and the bed material-sediment transport rating curve produces an estimate of the effective discharge.

Figure 6 (Andrews, 1980) shows how the effective discharge derives from the flow frequency and sediment transport curves. Smaller discharges may happen more frequently, but they carry less sediment. Larger discharges may transport more sediment, but they occur less frequently. However, it is possible that many smaller hydrologic events can transport as much sediment as those rare larger ones. For this reason, analysis of mean daily discharges as well as peak discharge events are critical to analyzing the effective discharge.

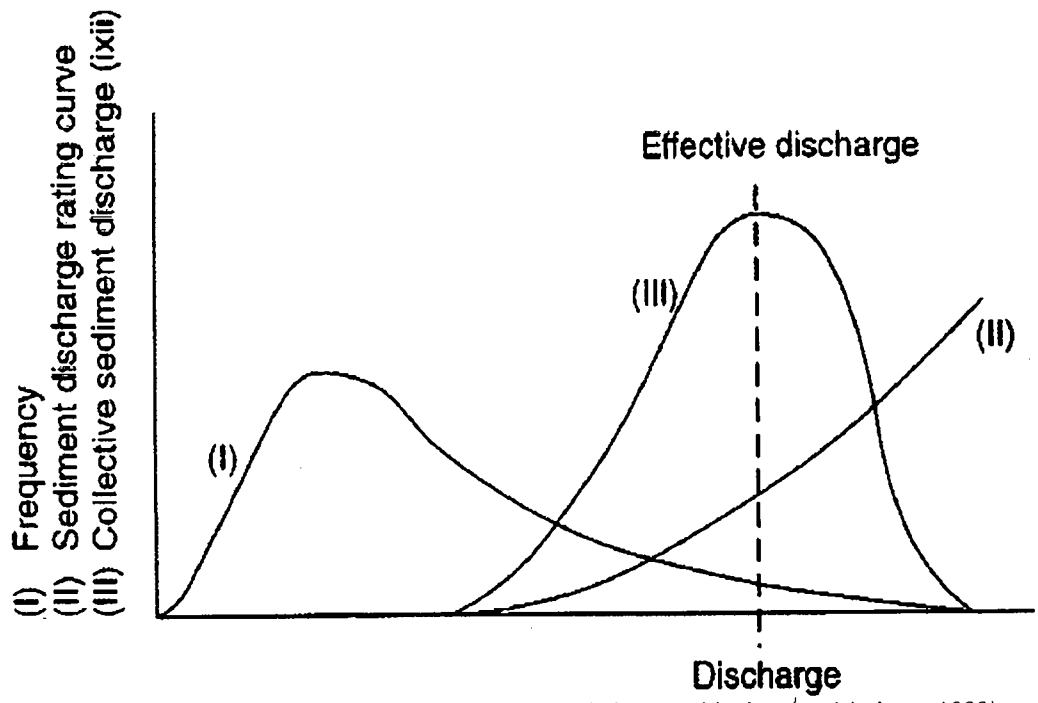

Figure 6. Convolution of flow duration, or frequency, and bed material load curves. (Andrews, 1980)

Watson (1999) presents "A Practical Guide to Effective Discharge Calculation." This guide is Appendix A of the *Demonstration Erosion Control, Design Manual*, produced by the U.S. Army, Engineer Research and Development Center, Vicksburg, Mississippi. This practical guide, and the *Reservoir Sedimentation* Technical Guideline for Bureau of Reclamation (Strand, 1982), provides the methodology used in this analysis for calculating the effective discharge.

SAM & RISAD

The SAM model is an integrated system of programs developed through the US Army Corps of Engineers Flood Damage Reduction and Stream Restoration Research Program to aid engineers in analyses associated with designing, operating, and maintaining flood control channels and stream restoration projects. SAM runs on PC computers and is primarily for the design of stable channels. The package satisfies the need for qualitative, easy-to-use methodology, especially for use in preliminary screening of alternatives where funds for more extensive investigations are not available. The Stable Channel Design Method for Gravel Bed Streams, named RISAD, is a Windows version of the SAM - Copeland Stable Channel Design option.

RISAD has additional equations for use in the design of gravel bed streams, utilizing the Meyer-Peter Mueller(MPM) gravel transport equation. RISAD provides a range of solutions for possible stable channel designs. The program computes width, depth, and slope of a stream given hydraulics, an inflowing sediment load, a bed material gradation, and a few geometric characteristics of the analysis reach. In the subsequent stability analysis, the effective discharge is used to calculate the range of stable solutions. The gravel bed sediment transport equations are not available in the SAM.hyd version of this option.

HYDROLOGIC INFLUENCES ON CHANNEL GEOMETRY

The focus of the stable channel analysis is the connectivity of the channel to its flood plain and investigation of channel width and slope as indicators of stability. Both observational evidence and the hydraulic analysis indicate that the majority of reaches of the Upper Gila River frequently access its flood plain during floods. Examples of channel types that do not have access include incised and/or leveed channels. In the past the Gila River has been extensively leveed. Reclamation's observations indicate that the current levee system is not functional, with few intact levees within the Analysis Reach. The primary effect of the current levee system in the Cliff-Gila Valley is to separate flow, shunting the river onto the flood plain (farm land) in multiple locations.

Reclamation's observations also lead us to conclude that the Gila River channel is not incised. Indications include reasonable bank heights, sloping, rather than vertical or perched banks, and successive stands of vegetation from grasses to large Cottonwood galleries in close proximity to the channel. In addition, inundation areas are readily visible on the orthophotographs, indicating recent episodes of the river flooding over its banks and accessing the flood plain.

Besides accessibility to the flood plain, channel width and slope are quantitative indicators of channel stability. The remainder of this Stable Channel Analysis focuses on the factors that drive these indicators.

HYDROLOGIC REGIME

Hydrologic regime influences channel width. The channel geometry, primarily the width, depth, and slope, adjusts to changes in the hydrology of the watershed. This is a natural process, partially reflected in the hydrologic record. Hydrologic regime fluctuations may be caused by processes similar to the now familiar El Nino, or drought, or other episodic changes in weather patterns.

Anthropogenic factors, such as farming, urbanization, levees, bridges, deforestation or devegetation, also impact the river, causing changes in the channel geometry, both locally and systemically. Other Tasks in this Fluvial Geomorphology Study, such as the *Catalog of Historical Changes*, *Geomorphic Map*, and *Geomorphic Analysis*, will shed more light on the impacts of these changes to the river and watershed. Changes in sediment supply, quantity and quality, can likewise result in changes in channel morphology. Examples include:

a. Bank stabilization
b. Tributary channelization
c. Grazing practices
d. Fire suppression
e. Invasive species

Width changes are an immediate concern to land owners, as the change in width, especially widening, consumes valuable land resources.

This *Stable Channel Analysis* focuses on analysis of channel hydraulics and sediment transport, and the corresponding proximity of the current channel geometry to the stable channel curves output by the SAM and RISAD analytical tools. The next section is a qualitative assessment of the relative frequency of large flows and historical channel width change. The following section describes the hydraulic and geologic controls present in the system.

FREQUENCY OF LARGE FLOODS

GAGING STATION DESCRIPTIONS

This section describes the USGS gaging stations that supplied data, such as daily mean discharges and peak discharges, for calculating the discharge exceedance or flow duration curves. The descriptions come from the USGS (USGS, 2001) web pages for each particular station.

STATION:--09432000 Gila River Below Blue Creek, near Virden NM

LOCATION. — Lat 32°38'53", Long 108°50'43" NAD27, Grant County, New Mexico

DRAINAGE AREA. — 3,203 square miles

GAGE. — Datum of gage is 3,875. feet above sea level NGVD29

STATION TYPE. — Surface Water

STATION DATA.

Data Type	Begin Date	End Date	Count
Real-time	This is a real-time site		
Peak streamflow	1997-09-22	1999-08-06	2
Daily streamflow	1927-07-01	2000-09-30	26603
Water Quality Samples	1987-03-25	2001-06-05	61

SITE OPERATION — Site is located in New Mexico; record is maintained by Arizona

STATION:--09431500 Gila River near Redrock, NM

LOCATION. — Lat 32°43'37", Long 108°40'30" NAD27, in Grant County, New Mexico , Hydrologic Unit 15040002.

DRAINAGE AREA. — 2,829.00 square miles

GAGE — Datum of gage is 4,090.00 feet above sea level NGVD29.

STATION TYPE. — Surface Water

STATION DATA.

Data Type	Begin Date	End Date	Count
Real-time	This is a real-time site		
Peak streamflow	1905-11-26	1999-08-05	66
Daily streamflow	1930-10-01	2001-09-30	23376
Water Quality Samples	1967-07-19	2001-08-22	474

SITE OPERATION — Site is located in New Mexico; record is maintained by New Mexico

STATION:--09430500 Gila River near Gila, NM

LOCATION. — Lat 33°03'40", Long 108°32'12" NAD27, in Grant County, New Mexico , Hydrologic Unit 15040001.

DRAINAGE AREA. — 1,864.00 square miles

GAGE. — Datum of gage is 4,654.80 feet above sea level NGVD29.

STATION TYPE. — Surface Water

STATION DATA.

Data Type	Begin Date	End Date	Count
Real-time	This is a real-time site		
Peak streamflow	1928-08-23	1999-08-06	72
Daily streamflow	1927-12-01	2001-09-30	26968
Water Quality Samples	1959-12-26	1976-11-25	131

SITE OPERATION. — Site is located in New Mexico; record is maintained by New Mexico

FLOW DURATION

Flow duration curves represent the cumulative probability of exceeding a mean daily discharge for a given period of record at a gaging station. The following flow duration curves come from analyzing the records of several gaging stations using the procedures outlined in the Demonstration Erosion Control, Design Manual (Watson, 1999), and the Reservoir Sedimentation Technical Guideline for Bureau of Reclamation (Strand, 1982).

The flow duration curve shows that Mogollon Creek is dry roughly 8% of the time, and the Gila River has historically larger flows. The divergence between the Gila @ Gila, Gila near Redrock, and Gila near Virden, at low flows is probably due to irrigation and other diversions that accumulate downstream, especially during dry periods of the year when tributary accretion is at a minimum. At higher flows, the curves converge, the differences are due to tributary accretion.

PEAK FLOWS IN THE STUDY REACH

Figure 8, Figure 9, and Figure 10 show the discharges during their periods of records for the Gila River near Gila, NM, the Gila River near Redrock, NM, and the Gila River below Blue Creek, Near Virden, NM. England (2002) reported these figures in *Flood Frequency, Flow Duration and Trends – New Mexico.*

Reclamation observes three distinct periods in the period of record, two periods of relatively high peak discharges, and one period of relative low peak discharges. The first period of high peak discharges is present at the onset of the records and extends into the 1920's. The period of low peak discharges extends from the 1930's to the mid-1960's. The second period of high peak discharges began in the mid-1960's and continues today.

HISTORICAL CHANGES IN CHANNEL WIDTH

Reclamation (Klawon, 2002) collected historical aerial photography of the Gila River, beginning in 1935 and continuing periodically through 2001. Klawon analyzed channel sections throughout the Analysis Reach, measuring *Active Channel Width* and *Flood Channel Width.* Klawon hypothesizes that the Gila River is bimodal, supporting both a *Active Channel Width* channel and a *Flood Channel Width* channel, each with distinct geomorphic and hydraulic properties. Figure 11 shows the historical channel width changes since 1935 (Klawon, 2002).

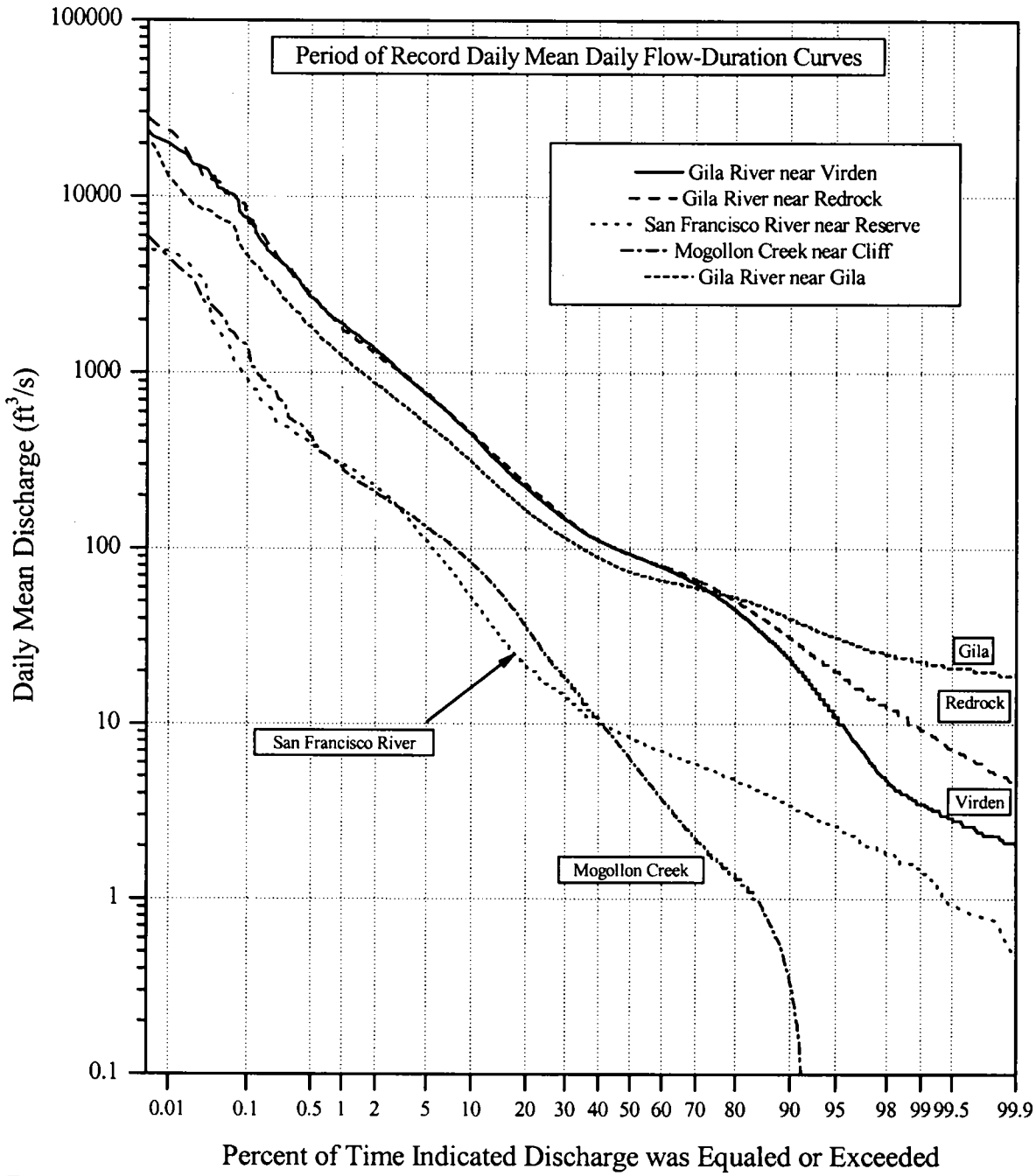

Figure 7. Period of record mean daily flow duration curves for five stations in the Upper Gila River basin. (England, 2002)

The *Active Channel Width* varies roughly between 61 and 137 meters (200 ft – 450 ft), while the *Flood Channel Width* varies between 183 and 282 meters (600 ft - 925 ft).

HYDRAULIC CONTROLS

A Hydraulic Control is any feature that determines a depth-discharge relationship (Henderson, 1966). This inventory counts two types of hydraulic controls, engineered and geologic. Engineered hydraulic controls include diversion dams and bridges. Geologic hydraulic controls are geologic features intersecting the Gila River that display a resistance to erosion over long periods, and in particular, govern a non-alluvial reach of the river.

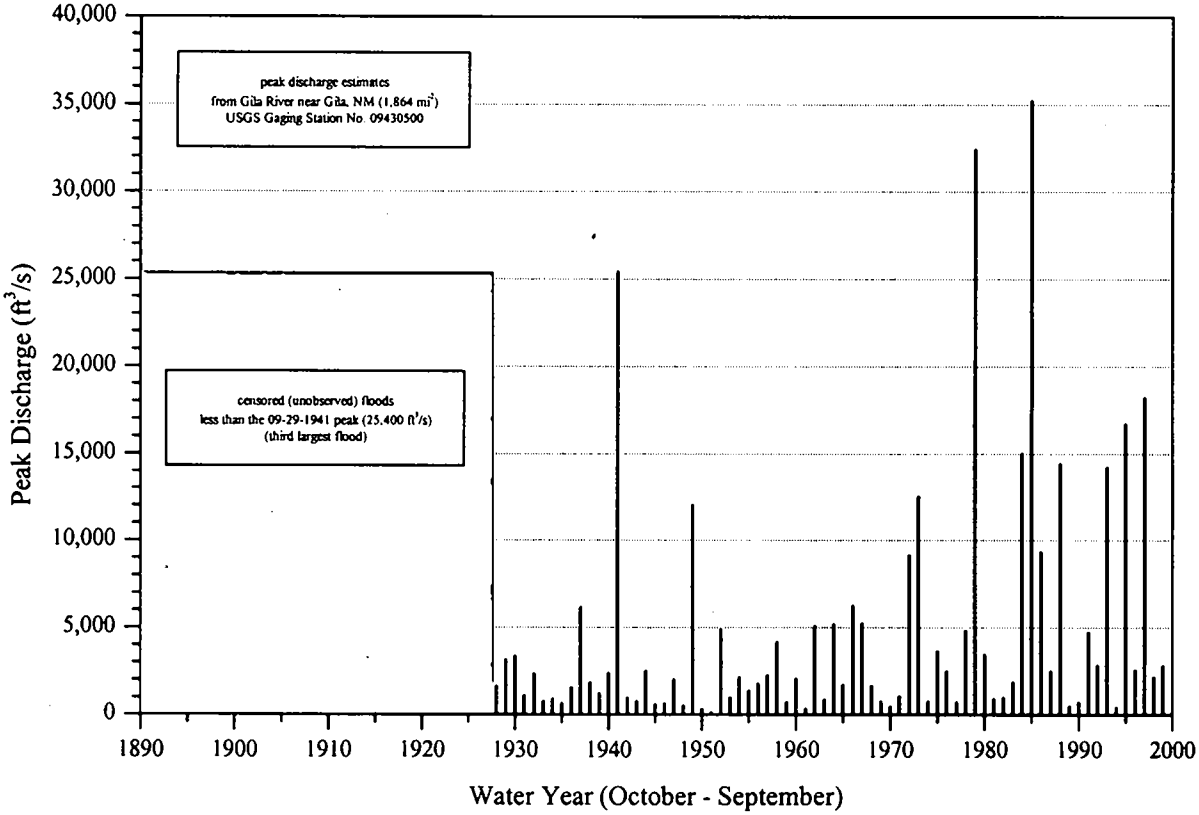

Figure 8. Peak discharges from 1928-2000 for Gila River near Gila, NM.

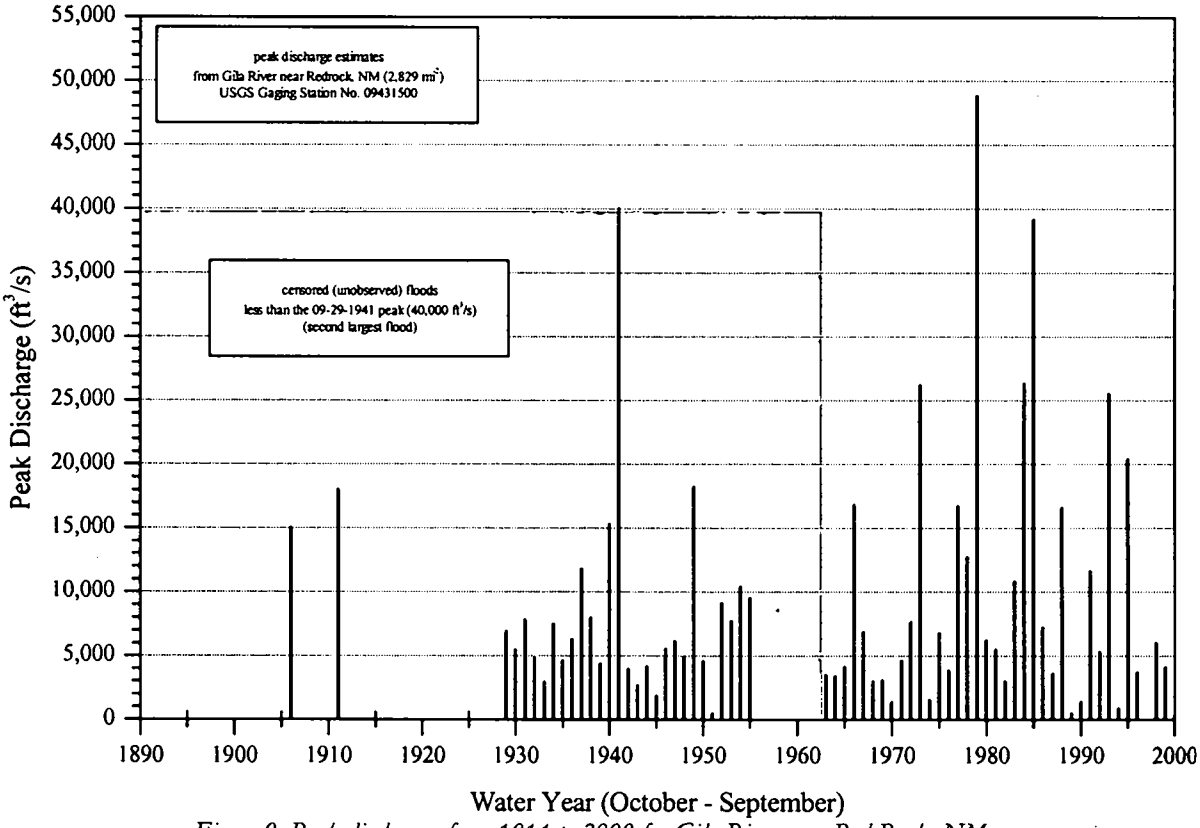

Figure 9. Peak discharges from 1914 to 2000 for Gila River near Red Rock, NM.

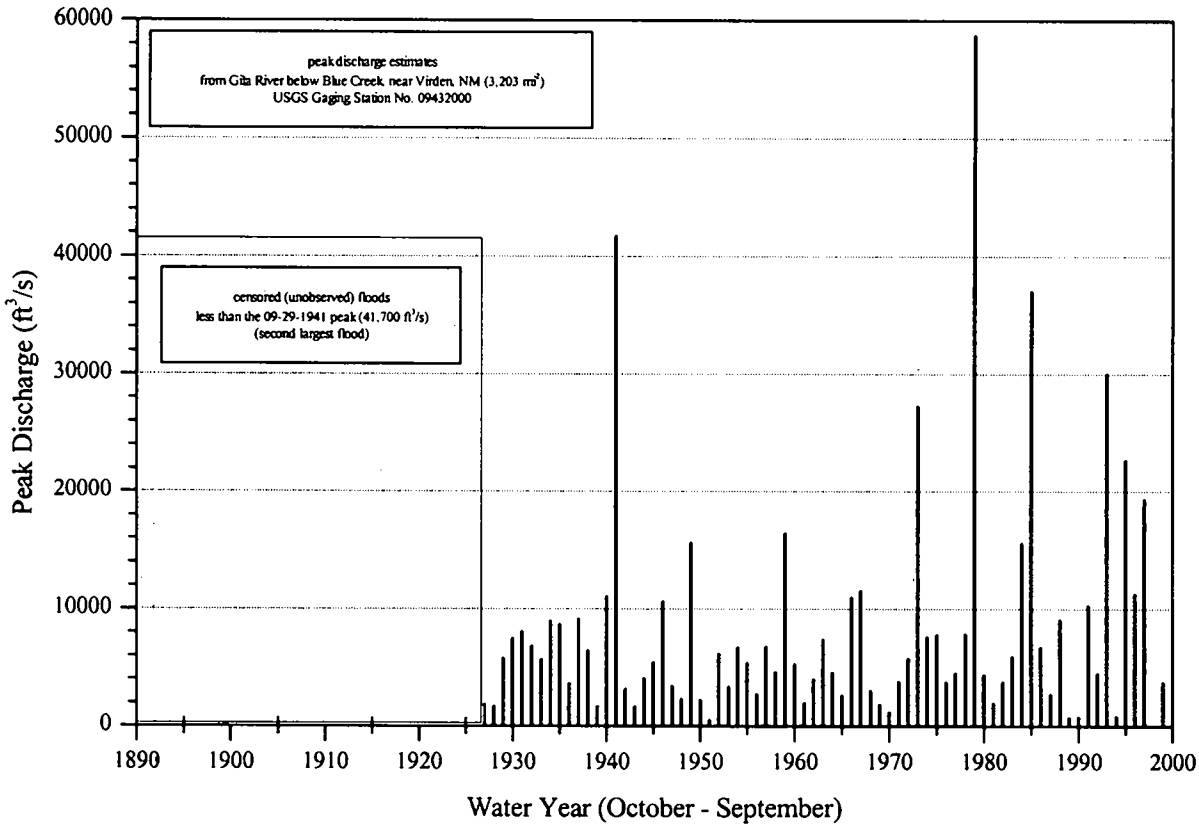

Figure 10. Peak discharges from 1927-2000 for Gila River Below Blue Creek, Near Virden, NM.

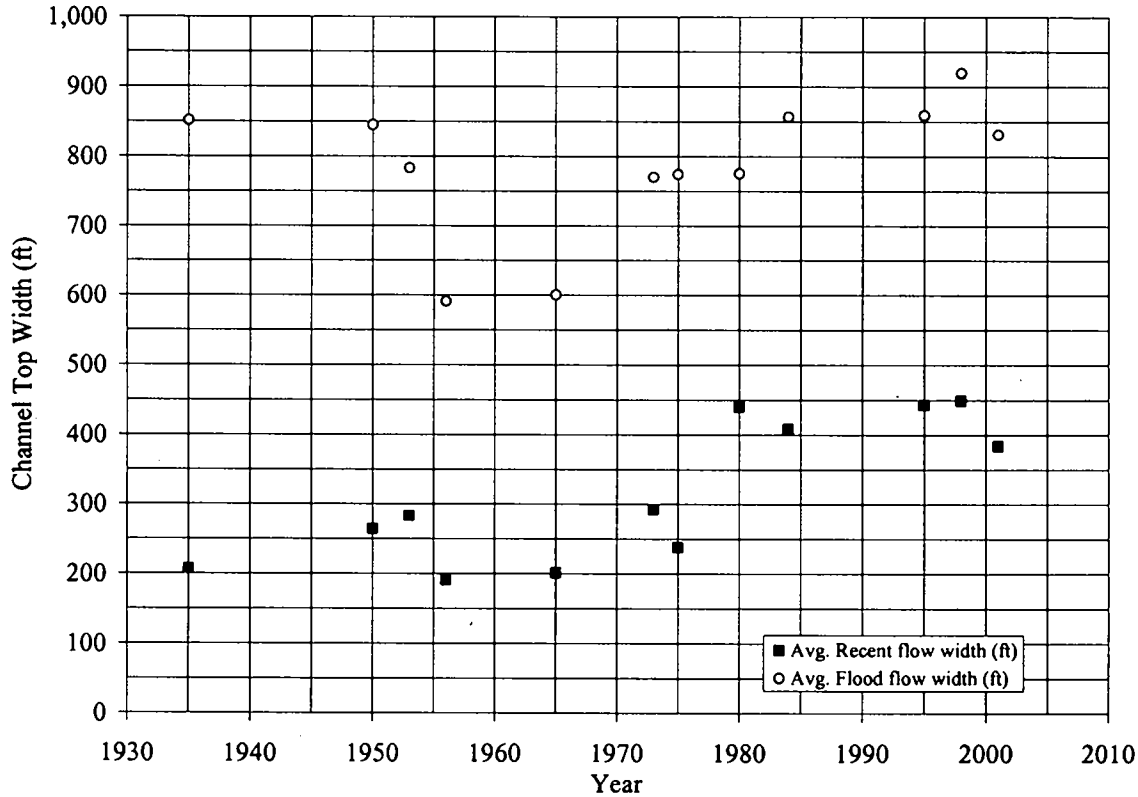

Figure 11. Historical channel width changes since 1935. (Klawon, 2002)

TRIBUTARY INVENTORY

Table 1 lists major tributaries to the Gila River in the analysis reach. Major tributaries are tributaries that are readily visible from the aerial photographs, contribute significant quantities of sediment during and after rainfall events, and have been observed by the study team to be hydraulically or geomorphologically significant to the study. The table lists the tributaries by Sub-Reach. The inventory includes bridges and diversions. The table also includes the rough location [Lat/Long (WGS 84)] of each feature. The names of the features follow from the USGS Topographic maps of the area.

Table 1. Tributary inventory with rough location (Lat/Long) of tributary confluence, diversion, or bridge. (From USGS Quadrangle maps)

Reach	Tributaries Entering Left Bank	Bridges/Diversions	Tributaries Entering Right Bank
IV			Mogollon Creek N33°02.767′, W108°31.808′ El. 4629
IV		Shelley Ditch Diversion N33°01.920′, W108°32.146′ El. 4629	
IV	Spar Canyon N33°01.466′, W108°32.250′ El. 4615		
IV			Miller Canyon N33°00.883′, W108°33.051′ El. 4590
III	Maldonado Canyon N33°00.452′, W108°33.392′ El. 4564		
III	Guerrero Canyon N33°00.235′, W108°33.566′ El. 4560		
III			Winn Canyon N32°59.743′, W108°33.952′ El. 4537
III	Garcia Canyon N32°59.497′, W108°34.074′ El. 4534		
III			Bell Canyon N32°59.271′, W108°34.297′ El. 4534
III	Northrup Canyon N32°58.270′, W108°35.076′ El. 4514		
III		Hwy 211 Bridge N32°58.144′, W108°35.236′ El. 4508	
III	Bear Creek N32°57.355′, W108°36.113′ El. 4485		
III			Duck Creek N32°57.224′, W108°36.493′ El. 4478
III			Lobo Creek N32°56.855′, W108°36.413′ El. 4478

Reach	Tributaries Entering Left Bank	Bridges/Diversions	Tributaries Entering Right Bank
III		Hwy 180 Bridge N32°56.731′, W108°36.423′ El. 4472	
III		Iron Bridge N32°56.400′, W108°36.378′ El. 4459	
II	Pope Canyon N32°55.372′, W108°35.421′ El. 4446		
II	Greenwood Canyon N32°54.862′, W108°35.372′ El. 4426		
I		Bill Evans Diversion N32°53.726′, W108°35.811′ El. 4416	
I			Sycamore Creek N32°53.412′, W108°35.821′ El. 4403
I			Dix Canyon N32°53.368′, W108°35.758′ El. 4403
I	Spring Canyon N32°52.522′, W108°35.664′ El. 4386		
I			Davis Canyon N32°51.903′, W108°35.539′ El. 4380
I	Mangas Creek N32°51.798′, W108°35.556′ El. 4383		
I			Cherokee Canyon N32°51.338′, W108°35.536′ El. 4386
I			Moonhull Canyon N32°49.759′, W108°36.736′ El. 4334
I	Patterson Canyon N32°49.355′, W108°36.218′ El. 4324		
I			Road Canyon N32°49.085′, W108°36.249′ El. 4320
I	Ira Canyon N32°48.810′, W108°36.165′ El. 4314		

ENGINEERED CONTROLS

Each of the diversion structures listed in Table 1 acts as a hydraulic control. The degree of hydraulic control may decrease as the stage, or discharge in the main channel, increases. The increasing role of channel and vegetation roughness at higher flows, as a percentage of total hydraulic roughness, ameliorates the effect of low diversion dams as controls. However, following observation of the diversion dams during the Field Data Collection Plan execution, Reclamation hypothesizes that all of the diversions

are significant hydraulic controls at even the highest discharges. The bridges act as hydraulic controls beginning below the effective discharge and up to the highest discharges.

GEOLOGIC CONTROLS

Figure 12 shows the longitudinal profile of Analysis Reach. The longitudinal profile illustrates the thalweg of the channel, the thalweg being the lowest point in the channel. The thalweg profile vividly shows abrupt changes in the bed of the channel, indicating probable hydraulic control points, either engineered or geologic. The discontinuities in the profile between RAS stations 23,000 and 18,000 are the three bridges in the Analysis Reach.

Tributary alluvial fans can also create hydraulic controls. Many of the variances in the longitudinal profile are due to these types of fluvial features. They can be transitory, depending upon the timing of peak flows in the tributaries and mainstem. Channelization of tributaries in the past may have resulted in the delivery of greater quantities of sediment to the river than historical rates or non-channelized tributaries, creating larger fans, and weighing upon the ability of the mainstem to transport the tributary sediment during intermediate and smaller floods.

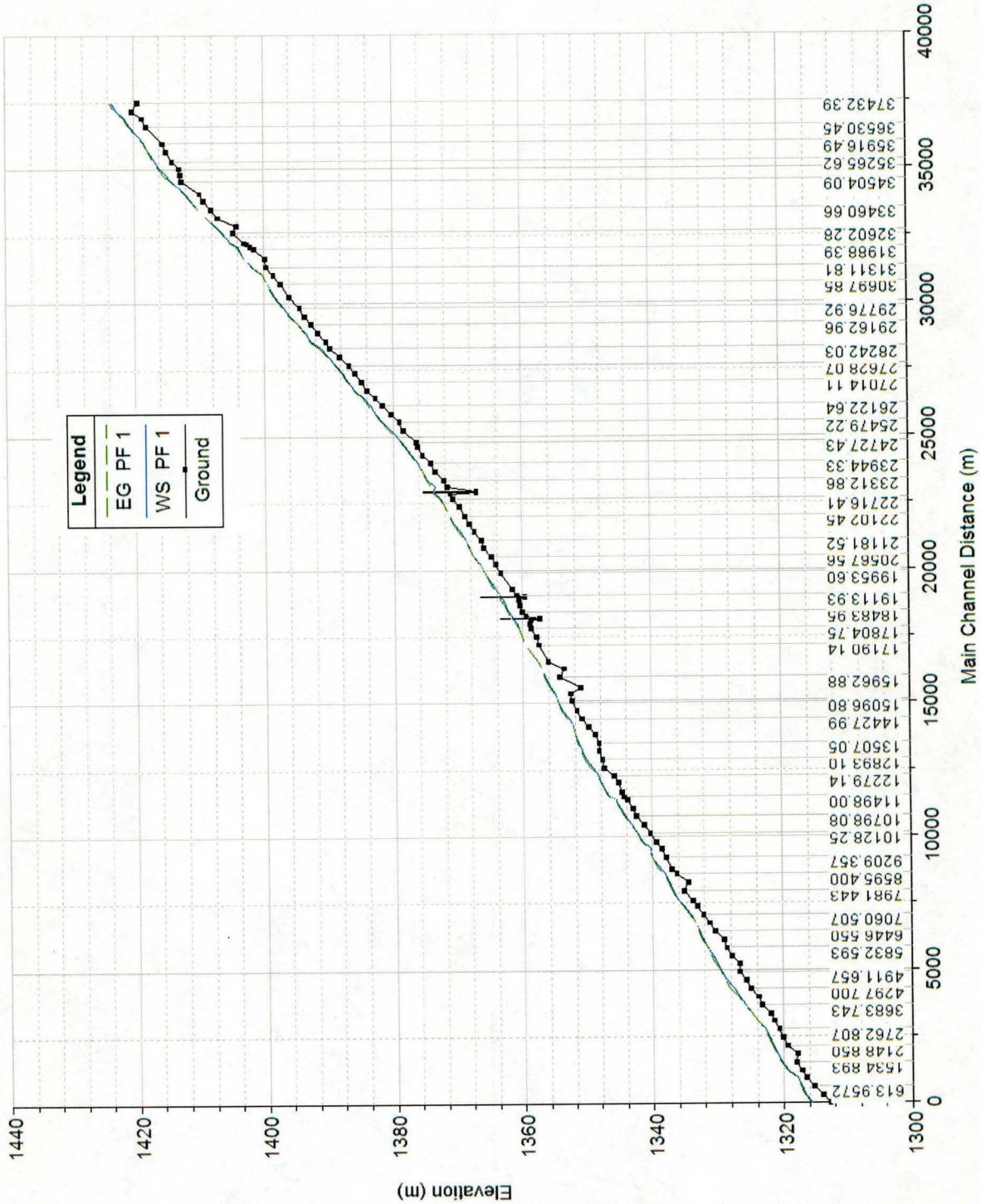

Figure 12. Longitudinal profile of thalweg, water surface, and energy grade line at 431.5 m^3/s (15,238 ft^3/s).

CHARACTERIZATION OF THE RIVER BED MATERIAL

BACKGROUND

Wittler and Levish (2001) describe the methods, purposes, and intentions of the bed material sampling plan for the Upper Gila Fluvial Geomorphology study. Wittler and Baca, of the Bureau of Reclamation Technical Service Center Water Resources Research Laboratory, collected the samples according to the procedures specified in the Field Data Collection Plan (Wittler & Levish, 2001). Appendix B tabulates all of the sediment samples collected by sample number, date, name, description, latitude, longitude, UTM northing, UTM easting, location in the stream, sample depth, and type, either grab or photographic. Photographic samples were collected in places where the largest particle sizes would not fit into the sample bag. In the numbering system, sample numbers alone generally indicate a grab sample, while a numeric sample number followed by an alphabetic modifier, e.g. 5A, indicates a photographic sample.

Photographic samples were collected first. Then, after removing the large surface particle, a volume of one to three times of the largest particle of finer particles beneath the large particle was collected into a plastic sample bag, using a hand trowel. Care was exercised to collect material immediately below the surface by keeping the walls of the excavation vertical. Photographs of the river in the upstream and downstream directions were also taken from the sample location. Samples were logged and transported to the laboratory for analysis. Figure 13 shows Photographic Sample 55-C, downstream of the current The Nature Conservancy farm, formerly known as the Seeds of Change farm, above Gila, NM.

The US Bureau of Reclamation Phoenix Area Office Materials Laboratory analyzed the grab samples following established Reclamation procedures. Wittler analyzed the photographic samples using the GoldSize program produced by Golder Associates of Seattle, Washington.

Figure 13. Photographic sample 55-C, downstream of the Seeds of Change farm, above Gila, NM. (Metric scale)

LOCATION MAP OF BED MATERIAL SAMPLING

The flag symbols on the map in Figure 14 indicate sampling locations of the bed material.

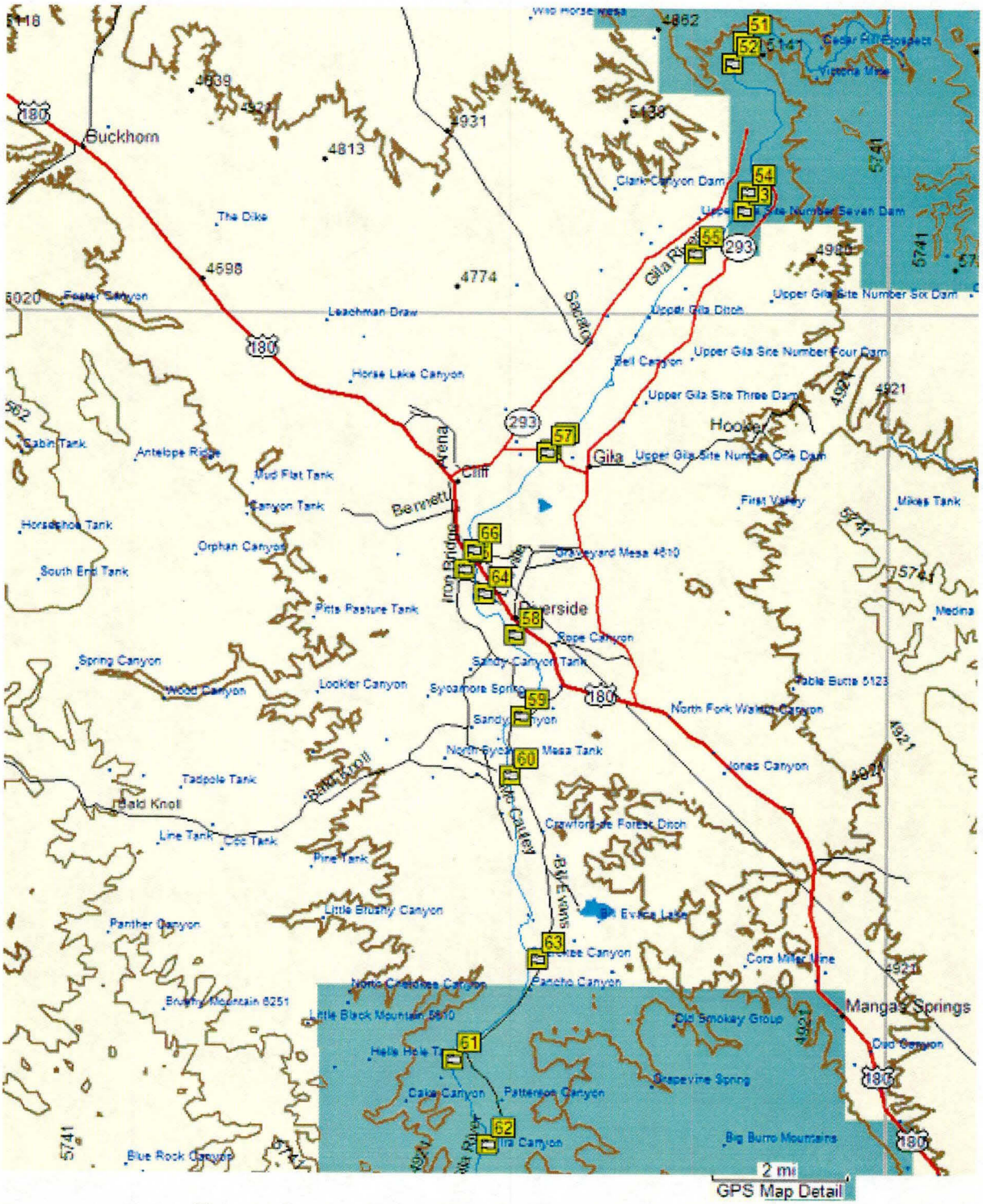

Figure 14. Location of bed material samples in the Cliff-Gila analysis reach.

BED MATERIAL SAMPLE ANALYSIS

The stable channel analysis and RISAD require a gradation of the bed material as well as a practical maximum size, D_{90}, and median size, D_{50}. After review of the sample locations and types in the Analysis Reach, 15 representative samples were selected for the analysis. Table 2 and Table 3 tabulate the size fractions of the 15 samples. Appendix B contains the sample locations and associated information.

Table 2. Size fractions for bed material samples in Analysis reach. (Part 1 of 2)

US Standard Sieve	Size (mm)	Sample Number								
		51	52	53	54	55	56	57	58	58A
3"	76.200	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	61.8%	100.0%
1- ½"	38.100	76.0%	76.6%	87.2%	90.9%	67.0%	62.8%	69.1%	57.3%	92.8%
¾"	19.050	63.1%	62.2%	47.7%	65.6%	39.2%	46.9%	48.4%	44.3%	71.7%
3/8"	9.525	53.2%	50.0%	35.4%	46.6%	30.3%	36.6%	36.0%	34.2%	55.4%
#4	4.750	42.6%	41.9%	27.5%	33.3%	23.6%	30.1%	26.7%	25.5%	41.3%
#8	2.360	33.1%	35.6%	21.3%	25.6%	19.3%	26.5%	19.8%	19.3%	31.3%
#16	1.180	22.2%	28.3%	14.7%	18.5%	14.0%	23.6%	13.1%	14.1%	22.9%
#30	0.600	13.4%	17.9%	9.7%	9.0%	10.6%	17.4%	6.4%	9.2%	14.9%
#50	0.300	5.2%	6.9%	4.8%	2.1%	7.1%	5.2%	2.1%	5.2%	8.4%
#100	0.150	2.4%	2.2%	1.9%	0.5%	3.7%	0.9%	0.7%	1.8%	2.9%
#200	0.075	1.6%	1.0%	0.8%	0.1%	2.1%	0.3%	0.2%	0.8%	1.3%
.037	0.037	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
.019	0.019	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
.009	0.009	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
.005	0.005	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
.002	0.002	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
.001	0.001	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 3. Size fractions for bed material samples in Analysis reach. (Part 2 of 2)

US Standard Sieve	Size (mm)	Sample Number									
		59	60	60A	61	62	63	63A	64	65	66
3"	76.200	100.0%	55.5%	100.0%	100.0%	100.0%	70.1%	100.0%	100.0%	100.0%	100.0%
1- ½"	38.100	81.7%	42.9%	77.4%	100.0%	82.5%	56.7%	80.9%	81.8%	70.6%	75.3%
¾"	19.050	64.9%	29.8%	53.7%	77.4%	55.8%	35.6%	50.8%	63.1%	47.8%	49.6%
3/8"	9.525	50.6%	21.8%	39.3%	60.1%	40.3%	26.4%	37.6%	50.9%	36.1%	38.6%
#4	4.750	37.1%	16.5%	29.8%	43.8%	30.3%	20.3%	29.0%	38.1%	28.3%	29.4%
#8	2.360	27.2%	13.8%	24.9%	31.7%	24.9%	16.2%	23.1%	31.1%	23.4%	22.3%
#16	1.180	17.4%	11.1%	20.0%	21.3%	20.6%	12.3%	17.5%	26.0%	16.8%	14.2%
#30	0.600	12.2%	7.4%	13.4%	13.3%	12.8%	8.9%	12.7%	17.2%	9.4%	9.4%
#50	0.300	9.1%	4.7%	8.4%	3.7%	6.6%	4.6%	6.5%	7.8%	4.4%	6.3%
#100	0.150	3.2%	3.3%	6.0%	0.6%	2.4%	1.3%	1.8%	4.0%	2.4%	2.2%
#200	0.075	0.6%	2.5%	4.5%	0.0%	1.1%	0.4%	0.5%	3.2%	1.1%	0.8%
.037	0.037	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
.019	0.019	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
.009	0.009	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
.005	0.005	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
.002	0.002	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
.001	0.001	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Figure 15 plots all of the bed material sample gradations. The median (D_{50}) ranges from roughly 6 mm to 30 mm. D_{90} ranges between 30 mm and 70 mm.

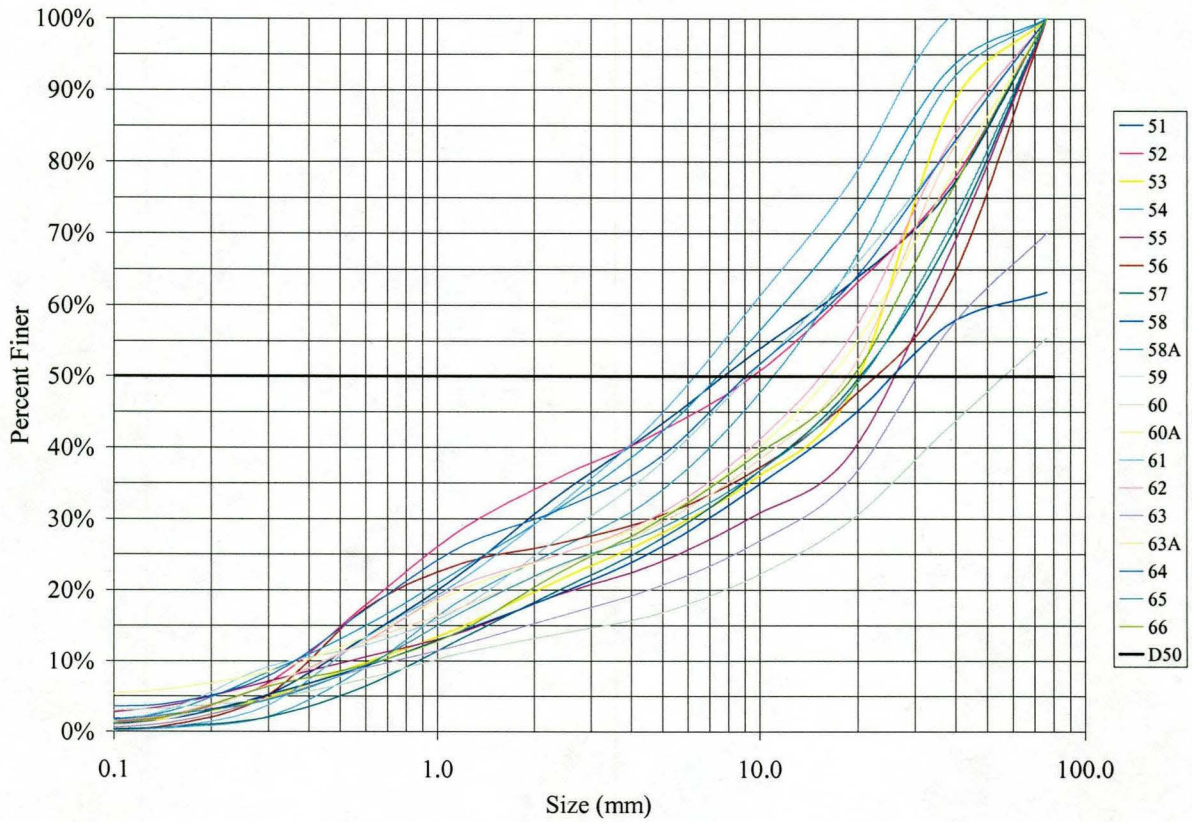

Figure 15. All gradations.

ANALYSIS SUB-REACHES

Figure 16 shows the plan view of the Analysis Reach. For analysis purposes, Reclamation split the Analysis Reach into four Sub-Reaches. Table 4 lists the HEC-RAS station delineations.

Figure 17 shows the median (D_{50}) and maximum (D_{90}) sizes plotted longitudinally in the Analysis Reach. Reclamation identified four Sub-Reaches based upon groupings of like-sized samples, and broke the Analysis Reach down accordingly.

Table 4. Sub-Reach delineations by HEC-RAS stationing.

Sub-Reach	Reach Station
I	0 - 12,000 m
II	12,000 m -18,500 m
III	18,500 m - 30,000 m
IV	> 30,000 m

Median size fractions in Sub-Reaches II and IV were relatively small compared to those in Sub-Reaches I and III. Table 5 lists the size fractions for the mean gradations in each of the four Sub-Reaches, as well as the mean gradation of the Analysis Reach (overall). There were 15 samples in the Analysis Reach.

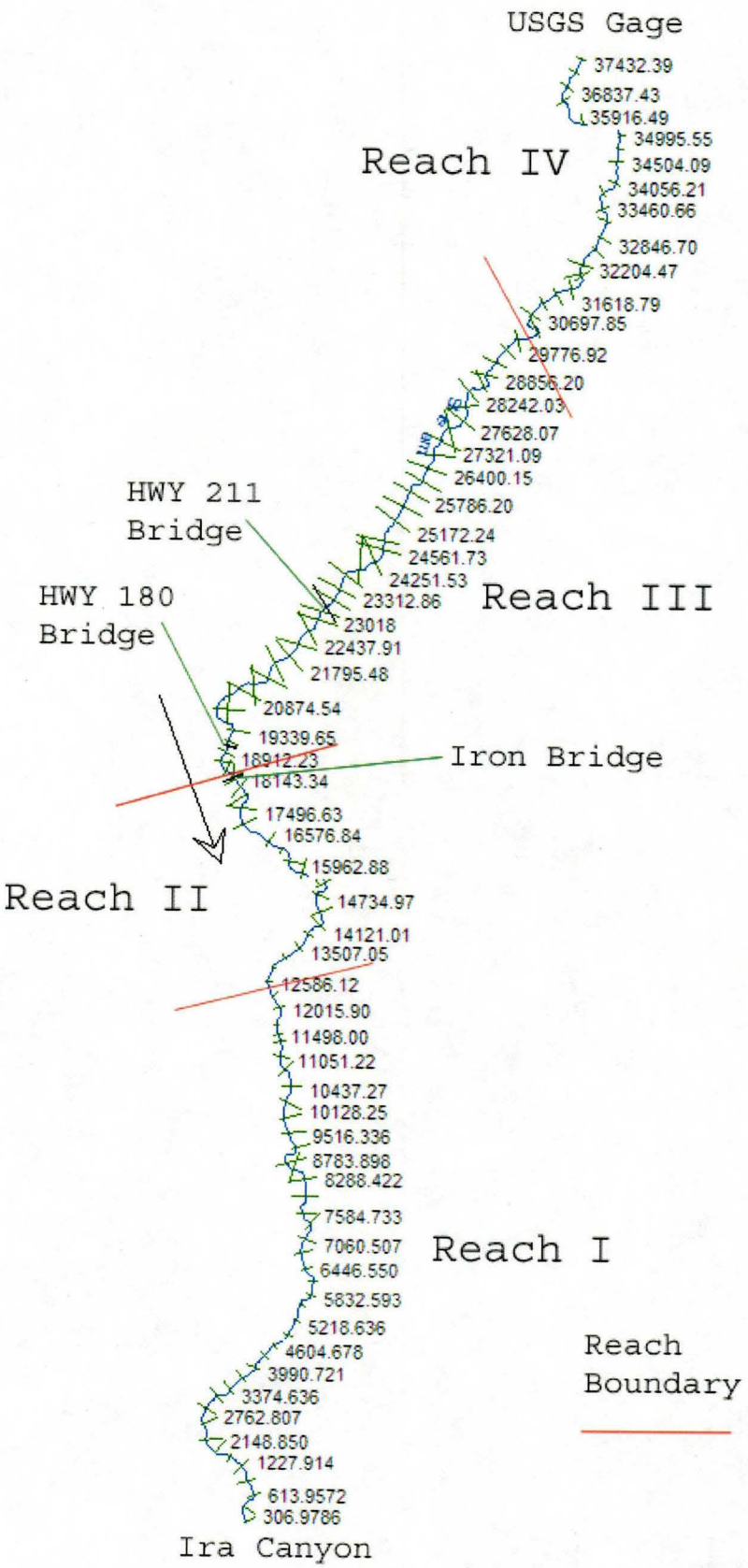

Figure 16. Sub-Reaches, in HEC-RAS stationing, with selected landmarks.

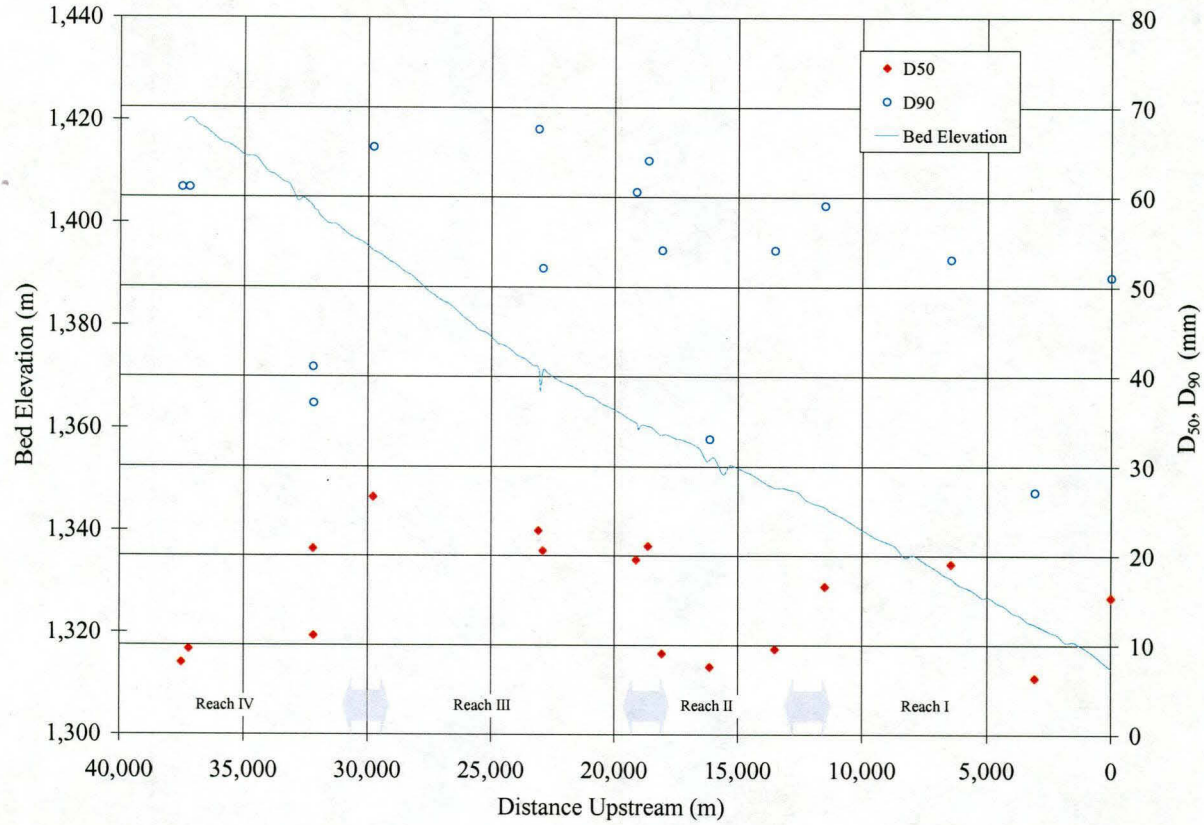

Figure 17. Median (D_{50}), maximum (D_{90}) particle sizes contrasted with bed elevation.

Figure 18 plots the four mean Sub-Reach gradations, and the overall Analysis Reach mean gradation, tabulated in Table 5.

Table 5. Mean Sub-Reach gradations, with Analysis Reach mean gradation (overall).

US Standard Sieve	Size (mm)	Reach				
		Reach I	Reach II	Reach III	Reach IV	Overall
3"	76.200	100.0%	100.0%	100.0%	100.0%	100.0%
1-1/2"	38.100	85.2%	85.4%	69.0%	82.7%	79.5%
3/4"	19.050	59.4%	66.5%	46.4%	59.6%	56.7%
3/8"	9.525	44.3%	52.3%	35.5%	46.3%	43.6%
#4	4.750	33.2%	38.8%	27.6%	36.3%	33.3%
#8	2.360	26.2%	29.9%	22.2%	28.9%	26.3%
#16	1.180	19.8%	22.1%	16.4%	20.9%	19.4%
#30	0.600	13.0%	14.8%	10.6%	12.5%	12.5%
#50	0.300	6.3%	8.4%	5.0%	4.8%	5.9%
#100	0.150	2.7%	3.4%	2.0%	1.7%	2.4%
#200	0.075	1.5%	1.7%	0.9%	0.9%	1.2%
.037	0.037	0.0%	0.0%	0.0%	0.0%	0.0%
.019	0.019	0.0%	0.0%	0.0%	0.0%	0.0%
.009	0.009	0.0%	0.0%	0.0%	0.0%	0.0%
.005	0.005	0.0%	0.0%	0.0%	0.0%	0.0%
.002	0.002	0.0%	0.0%	0.0%	0.0%	0.0%
.001	0.001	0.0%	0.0%	0.0%	0.0%	0.0%

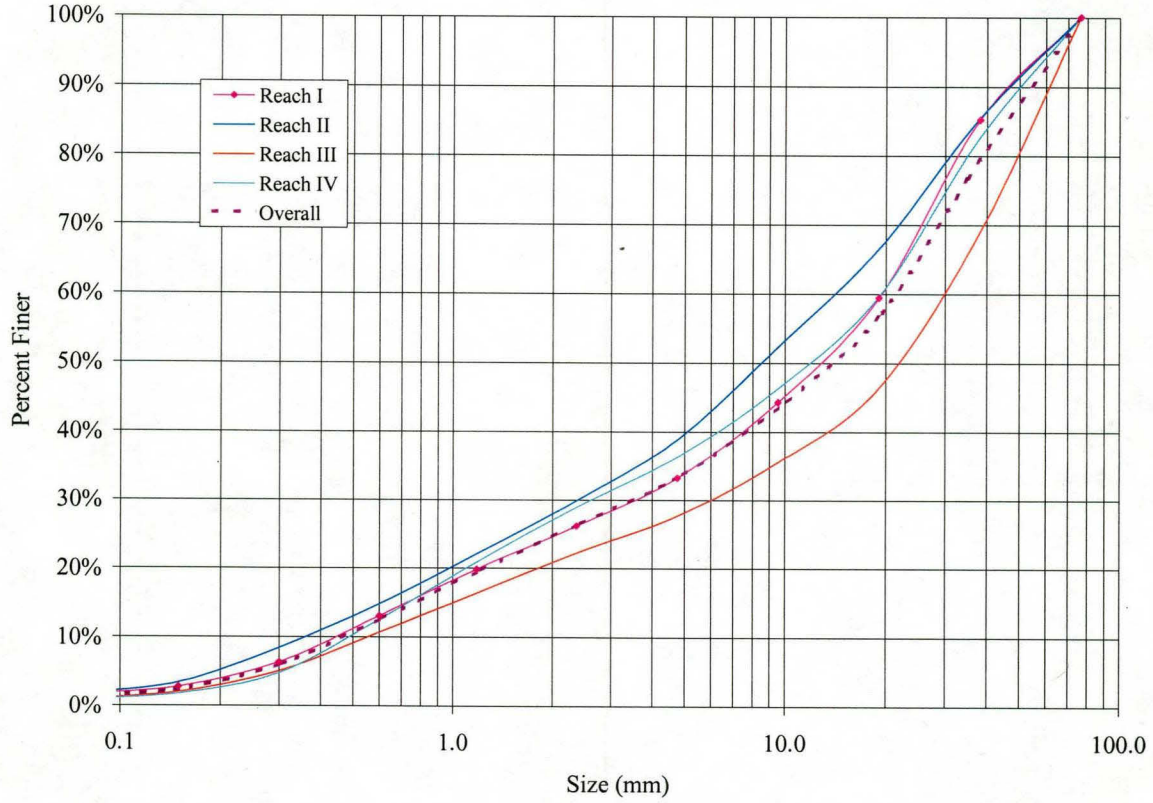

Figure 18. Mean Sub-Reach gradations.

Table 6 lists the mean median bed material size by Sub-Reach. The gradations in Table 5 and Table 6 are a portion of the input into the RISAD model.

Table 6. Mean bed-material median size by Sub-Reach with HEC-RAS stationing.

Reach	Sample Numbers	Mean D_{50}	Reach Station
I	60A, 61, 62, 63A	14.25 mm	0 - 12,000 m
II	58A, 59, 64	8.67 mm	12,000 m -18,500 m
III	55, 56, 57, 65	22.00 mm	18,500 m - 30,000 m
IV	51, 52, 53, 54	8.75 mm	> 30,000 m

STABLE CHANNEL ANALYSIS

The Stable Channel Analysis consists of three parts. First is modeling and computation of the hydraulics of the Gila River in the Analysis Reach. Second is computing the sediment transport capacity in the same reach. Third is the estimation of the channel forming discharge.

As reported previously, Klawon (2002) hypothesizes that the Gila River is bimodal, supporting both a *Active Channel Width* channel and a *Flood Channel Width* channel, each with distinct geomorphic and hydraulic properties. This *Stable Channel Analysis* appears to support this hypothesis. Results presented in the following sections show an effective discharge of between 8.86 m^3/s (313 ft^3/s) and 18.94 m^3/s (669 ft^3/s).

Reclamation (England, 2002) reports that the three highest recorded peaks of the Gila River near Gila, NM, are 997 m^3/s (35,200 ft^3/s) on 12/28/1984, 917 m^3/s (32,400 ft^3/s) on 12/18/1978, and 719 m^3/s (25,400 ft^3/s) 09/29/1941. These peak flows are between five and ten-times greater than the calculated effective discharge. This difference supports the theory of a bi-modal channel, with this analysis focusing on the *Active Channel Width* channel postulated by Klawon (2002).

HYDRAULICS

Reclamation used HEC-RAS to model the hydraulics of the Analysis reach. The U.S. Army Corps of Engineers Hydrologic Engineering Center (HEC) computer program HEC-RAS (River Analysis System), Version 3.01, calculates water surface profiles for both steady and unsteady gradually varied flow. The system models a full network of channels, a dendritic system, or a single river reach.

Spatial geometry for the hydraulic modeling came from the Digital Terrain Models (DTM) and photogrammetry produced in Tasks 5 and 6, Orthophotography and Topography, of the Upper Gila River Fluvial Geomorphology Study – New Mexico. Reclamation used Microstation CADD and InRoads software programs to develop design surfaces from this data and create the geometry for the hydraulic model. Cross sections were constructed at intervals of approximately 300 meters (1000 feet) along the project reach. The cross sections were checked against the aerial photographs and orthophotographs to insure accuracy of the ground terrain. In addition, three bridges were hydraulically modeled to more accurately predict river velocities in those portions of the project reach.

HEC-RAS uses a local coordinate system for measuring the channel distance and thus the cross sectional stationing. In each modeling reach, HEC-RAS begins at Cross Section 1, and measures upstream along the centerline of the channel beginning at Station 0. Each cross-section contains a station. The cross-section name may differ from the station distance. The stationing in HEC-RAS does not relate to other stationing systems, and is simply a measure of the accumulated distance between center points of each cross section.

Channel roughness coefficients were estimated using photographs from Barnes (USGS, 1987). Rivers with similar x-section widths and characteristic D_{50} were selected as guides for this case. The main channel was assigned a Manning roughness, *n*, of 0.032. The left and right overbanks were assigned a Manning roughness of 0.080. At the modeled bridges, the main channel Manning roughness was changed to 0.025. This value better represents the physics of increased velocities through the bridge sections and accounts for concrete and steel at the piers and abutments.

Reclamation used HEC-RAS to model three bridges in the Analysis Reach: 1) Hwy 180 Bridge, 2) Hwy 211 Bridge, and 3) Iron Bridge. Reclamation developed bridge geometry for the Hwy 180 Bridge from as-built drawings, final approval date July 24, 1967, provided by the New Mexico State Highway

Department and NMED-SWQB. Reclamation supplemented cross-sectional geometry at the bridges with New Mexico State Highway and Transportation Department bridge inspection data dated March 4, 2001. Reclamation developed the bridge geometry for the Hwy 211 Bridge from New Mexico State Highway Department as-built drawings dated June 14, 1973. Reclamation supplemented cross-sectional geometry with New Mexico State Highway and Transportation Department bridge inspection data dated March 17, 2001. Reclamation (Delcau, Wittler, and England) field surveyed the Iron Bridge in September 2002. Historical high water marks were not available for verification and calibration of the model. However, the model seems to produce reasonable results based on field observations and geomorphic evaluations.

Reclamation modeled a series of discharges, using HEC-RAS, from Reclamation's (England, 2002) flow duration analysis. Table 7 lists the modeled discharges. Appendix A contains Plates illustrating the location of the HEC-RAS cross-sections overlaid on the orthophotographs.

Table 7. Discharges modeled in HEC-RAS.

Q m^3/s	Q ft^3/s
431.55	15,240
203.03	7,170
70.23	2,480
35.11	1,240
18.94	669
8.86	313
4.70	166
3.26	115
2.52	89
2.10	74

The HEC-RAS model indicates that the current levee system is not functional, with few intact levees within the Analysis Reach. The primary effect of the current levee system in the Cliff-Gila Valley is to separate flow.

SEDIMENT TRANSPORT CAPACITY

Sediment transport capacity is the maximum estimated amount of sediment that can be transported in any given reach. It is not necessarily the actual sediment transported by known hydrological events. If transport capacity estimates match measured values, then the capacity is the actual transport of the river.

Analysis of the bed material samples presented in Characterization of the River Bed Material section indicates four distinct hydraulic reaches for the stable channel analysis. The average D_{50}: for reach I is 14.25 mm, for Reach II is 8.67 mm, for Reach III is 22.0 mm, and for Reach IV is 8.75 mm. These values are all in the range of medium to course gravel. Based on this data, two sediment transport equations for estimating transport capacity were analyzed. These are the Meyer-Peter and Muller (MPM) and a modified Yang equation. To compute sediment transport capacity, the average hydraulics were computed for each of the four reaches from the HEC-RAS output. Table 8, Table 9, Table 10, and Table 11 show the mean Sub-Reach hydraulic values.

Table 8. Average Hydraulics Reach I. (Sta. 0 – Sta. 11665)

Q Total	Min Ch El	W.S. Elev	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	W.P. Total	Hydr Depth	Hydr Radius	Froude # Chl
(m^3/s)	(m)	(m)	(m)	(m/m)	(m/s)	(m^2)	(m)	(m)	(m)	(m)	
431.55	1329.68	1331.95	1332.12	0.00321	1.76	266.69	289.79	290.73	1.00	0.99	0.55
203.03	1329.68	1331.45	1331.56	0.00324	1.42	151.27	207.25	207.94	0.79	0.79	0.52
70.23	1329.68	1330.89	1330.96	0.00364	1.15	65.63	126.02	126.42	0.57	0.56	0.51
35.11	1329.68	1330.63	1330.68	0.00414	0.99	39.31	98.76	99.03	0.44	0.44	0.50
18.94	1329.68	1330.45	1330.49	0.00424	0.86	24.78	77.01	77.20	0.36	0.36	0.48
8.86	1329.68	1330.26	1330.29	0.00445	0.75	13.79	52.77	52.89	0.29	0.28	0.47
4.70	1329.68	1330.14	1330.17	0.00486	0.65	8.65	40.36	40.45	0.23	0.23	0.47
3.26	1329.68	1330.08	1330.11	0.00536	0.61	6.57	34.07	34.15	0.20	0.20	0.47
2.52	1329.68	1330.05	1330.07	0.00544	0.58	5.42	29.91	29.97	0.19	0.19	0.46
2.10	1329.68	1330.02	1330.04	0.00561	0.55	4.75	27.63	27.69	0.18	0.18	0.46

Table 9. Average Hydraulics Reach II. (Sta. 12015 – Sta. 18483)

Q Total	Min Ch El	W.S. Elev	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	W.P. Total	Hydr Depth	Hydr Radius	Froude # Chl
(m^3/s)	(m)	(m)	(m)	(m/m)	(m/s)	(m^2)	(m)	(m)	(m)	(m)	
431.55	1353.16	1355.71	1355.87	0.00235	1.72	274.76	253.13	246.94	1.24	1.23	0.48
203.03	1353.16	1355.19	1355.29	0.00261	1.34	163.43	195.25	195.50	0.92	0.91	0.46
70.23	1353.16	1354.64	1354.70	0.00307	1.02	76.94	129.36	129.89	0.65	0.64	0.44
35.11	1353.16	1354.35	1354.40	0.00349	0.89	46.65	91.73	92.15	0.54	0.54	0.43
18.94	1353.16	1354.15	1354.19	0.00362	0.78	31.09	70.85	71.21	0.46	0.46	0.42
8.86	1353.16	1353.96	1353.99	0.00379	0.63	19.67	54.79	55.09	0.37	0.37	0.40
4.70	1353.16	1353.83	1353.85	0.00412	0.55	13.73	42.32	42.57	0.32	0.32	0.39
3.26	1353.16	1353.77	1353.79	0.00419	0.50	11.41	36.39	36.62	0.31	0.30	0.38
2.52	1353.16	1353.73	1353.75	0.00483	0.47	10.20	33.97	34.19	0.29	0.29	0.39
2.10	1353.16	1353.71	1353.72	0.00456	0.44	9.46	32.17	32.39	0.28	0.27	0.38

Table 10.Average Hydraulics Reach III. (Sta. 18726 – Sta. 30184)

Q Total	Min Ch El	W.S. Elev	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	W.P. Total	Hydr Depth	Hydr Radius	Froude # Chl
(m^3/s)	(m)	(m)	(m)	(m/m)	(m/s)	(m^2)	(m)	(m)	(m)	(m)	
431.55	1375.25	1377.66	1377.85	0.00329	1.88	315.16	485.10	466.35	0.83	0.83	0.56
203.03	1375.25	1377.20	1377.32	0.00352	1.49	165.49	267.84	253.83	0.88	0.87	0.53
70.23	1375.25	1376.68	1376.76	0.00384	1.14	77.48	124.48	124.30	0.69	0.68	0.50
35.11	1375.25	1376.43	1376.49	0.00419	0.96	51.50	91.30	91.56	0.57	0.57	0.49
18.94	1375.25	1376.26	1376.30	0.00449	0.84	37.52	72.58	72.79	0.48	0.48	0.48
8.86	1375.25	1376.08	1376.12	0.00508	0.73	26.45	55.39	55.56	0.40	0.39	0.48
4.70	1375.25	1375.96	1375.99	0.00568	0.64	20.66	44.50	44.63	0.34	0.34	0.47
3.26	1375.25	1375.91	1375.93	0.00572	0.58	18.40	39.55	39.67	0.31	0.31	0.46
2.52	1375.25	1375.87	1375.89	0.00567	0.55	17.08	36.14	36.26	0.30	0.30	0.45
2.10	1375.25	1375.85	1375.87	0.00562	0.53	16.31	33.65	33.76	0.29	0.29	0.45

Table 11. Average Hydraulics Reach IV. (Sta. 30697 – Sta. 37432)

Q Total	Min Ch El	W.S. Elev	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	W.P. Total	Hydr Depth	Hydr Radius	Froude # Chl
(m^3/s)	(m)	(m)	(m)	(m/m)	(m/s)	(m^2)	(m)	(m)	(m)	(m)	
431.55	1408.64	1411.01	1411.21	0.00403	1.96	238.10	258.25	259.40	1.03	1.02	0.61
203.03	1408.14	1409.99	1410.12	0.00414	1.60	134.70	182.18	182.95	0.84	0.83	0.58
70.23	1408.64	1409.95	1410.04	0.00459	1.27	59.87	112.91	113.38	0.58	0.57	0.56

Q Total	Min Ch El	W.S. Elev	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	W.P. Total	Hydr Depth	Hydr Radius	Froude # Chl
(m^3/s)	(m)	(m)	(m)	(m/m)	(m/s)	(m^2)	(m)	(m)	(m)	(m)	
35.11	1408.64	1409.69	1409.75	0.00520	1.11	35.30	82.87	83.19	0.46	0.46	0.55
18.94	1408.64	1409.49	1409.55	0.00611	0.98	22.21	64.71	64.95	0.37	0.37	0.56
8.86	1408.64	1409.30	1409.35	0.00692	0.86	12.48	44.83	44.99	0.30	0.30	0.56
4.7	1408.64	1409.18	1409.21	0.00741	0.74	7.96	34.22	34.34	0.25	0.25	0.54
3.26	1408.64	1409.12	1409.15	0.00774	0.68	6.16	29.56	29.66	0.23	0.22	0.54
2.52	1408.64	1409.08	1409.11	0.00802	0.64	5.17	26.80	26.90	0.21	0.21	0.53
2.1	1408.64	1409.06	1409.08	0.00784	0.61	4.57	25.01	25.10	0.20	0.19	0.52

Using the average hydraulics values and average sediment gradation curves previously presented, estimates of the sediment transport capacity were made. The following tables present the results for transport capacities using both the MPM and Yang equations:

Table 12. Sediment Transport Capacity using the MPM equation for Reaches I – IV.

Q	Q	Reaches I	I	II	II	III	III	IV	IV	Avg.
m^3/s	ft^3/s	(tons/day)	(ppm)	(tons/day)	(ppm)	(tons/day)	(ppm)	(tons/day)	(ppm)	(ppm)
431.55	15240	38434	934	30756	747	72992	1774	76018	1847	1326
203.03	7170	15286	790	12354	638	20992	1084	32395	1673	1046
70.23	2480	5392	805	4084	610	4794	716	11689	1746	969
35.11	1240	2958	883	2139	639	2312	690	6561	1960	1043
18.94	669	1627	901	1138	630	1347	746	4181	2315	1148
8.86	313	808	956	495	586	748	885	2214	2619	1262
4.70	166	448	1000	269	600	437	974	1192	2659	1308
3.26	115	329	1059	178	574	304	978	878	2827	1360
2.52	89	249	1038	152	633	238	991	698	2905	1392
2.10	74	206	1030	120	600	202	1012	569	2846	1372

Table 13. Sediment Transport Capacity using modified Yang equation, Sub-Reaches I – IV.

Q	Q	Reaches I	II	III	IV
m^3/s	ft^3/s	(tons/day)	tons/day)	tons/day)	tons/day)
431.55	15240	494.28	565.83	381.77	1048.73
203.03	7170	176.72	216.00	124.27	403.34
70.23	2480	48.91	58.72	26.29	116.41
35.11	1240	20.55	26.29	8.66	54.13
18.94	669	8.13	11.17	2.65	28.27
8.86	313	2.58	3.18	0.17	11.69
4.70	166	0.68	0.98	0.0	4.79
3.26	115	0.22	0.35	0.0	2.87
2.52	89	0.0	0.13	0.0	1.90
2.10	74	0.0	0.0	0.0	1.29

EFFECTIVE DISCHARGE CALCULATION

Andrews (1980) defines effective discharge as the mean of the discharge increment that transports the largest fraction of the annual sediment load over a period of years. The effective discharge incorporates the principle prescribed by Wolman and Miller (1960) that the channel-forming discharge is a function of both the magnitude of the event and its frequency of occurrence. It is calculated by convoluting the flow-duration curve and a bed-material sediment load-rating curve.

The effective discharge was computed using the technique outlined by Reclamation in the publication Reservoir Sedimentation Technical Guideline for Bureau of Reclamation (Strand, 1982). As discussed previously, this method is based on the convolution of the flow duration and sediment rating curves. Table 14 through Table 21 present the effective discharge computations.

Table 14. Effective Discharge Table Reach I (Modified Yang).

Column 1 Limits	*Column 2* Interval	*Column 3* Middle Ordinate	*Column 4* $^{*}Q$	*Column 5* Q_s	*Column 2 x 4* Q	*Column 2 x 5* Q_s
%	%	%	m^3/s	tons/day	m^3/s	tons/day
0.00 - 0.02	0.02	0.01	431.55	494.28	0.09	9.89
0.02 - 0.1	0.08	0.06	203.03	176.72	0.16	14.14
0.1 - 0.5	0.4	0.3	70.23	48.91	0.28	19.56
0.5 - 1.5	1	1	35.11	20.55	0.35	20.55
1.5 - 5.0	**3.5**	**3.25**	**18.94**	**8.13**	**0.66**	**28.46**
5.0 - 15	10	10	8.86	2.58	0.89	25.75
15 - 25	10	20	4.70	0.68	0.47	6.83
25 - 35	10	30	3.26	0.22	0.33	2.16
35 - 45	10	40	2.52	0.0	0.25	0.00
45 - 55	10	50	2.10	0.0	0.21	0.00
55 - 65	10	60	1.87	0.0	0.19	0.00
65 - 75	10	70	1.70	0.0	0.17	0.00
75 - 85	10	80	1.50	0.0	0.15	0.00
85 - 95	10	90	1.13	0.0	0.11	0.00
95 - 96.5	3.5	96.75	0.79	0.0	0.03	0.00
98.5 - 99.5	1	99	0.65	0.0	0.01	0.00
99.5 - 99.9	0.4	99.7	0.57	0.0	0.00	0.00
99.9 -99.98	0.08	99.94	0.51	0.0	0.00	0.00
99.98 - 100	0.02	99.99	0.45	0.0	0.00	0.00

Table 15. Effective Discharge Table Reach II (Modified Yang).

Column 1 Limits	*Column 2* Interval	*Column 3* Middle Ordinate	*Column 4* $^{*}Q$	*Column 5* Q_s	*Column 2 x 4* Q	*Column 2 x 5* Q_s
%	%	%	m^3/s	tons/day	m^3/s	tons/day
0.00 - 0.02	0.02	0.01	431.55	565.83	0.09	11.32
0.02 - 0.1	0.08	0.06	203.03	216.00	0.16	17.28
0.1 - 0.5	0.4	0.3	70.23	58.72	0.28	23.49
0.5 - 1.5	1	1	35.11	26.29	0.35	26.29
1.5 - 5.0	**3.5**	**3.25**	**18.94**	**11.17**	**0.66**	**39.11**
5.0 - 15	10	10	8.86	3.18	0.89	31.76
15 - 25	10	20	4.70	0.98	0.47	9.83
25 - 35	10	30	3.26	0.35	0.33	3.47
35 - 45	10	40	2.52	0.13	0.25	1.34
45 - 55	10	50	2.10	0.0	0.21	0.00
55 - 65	10	60	1.87	0.0	0.19	0.00
65 - 75	10	70	1.70	0.0	0.17	0.00
75 - 85	10	80	1.50	0.0	0.15	0.00
85 - 95	10	90	1.13	0.0	0.11	0.00
95 - 96.5	3.5	96.75	0.79	0.0	0.03	0.00
98.5 - 99.5	1	99	0.65	0.0	0.01	0.00
99.5 - 99.9	0.4	99.7	0.57	0.0	0.00	0.00
99.9 -99.98	0.08	99.94	0.51	0.0	0.00	0.00
99.98 - 100	0.02	99.99	0.45	0.0	0.00	0.00

Table 16. Effective Discharge Table Reach III (Modified Yang).

Column 1 Limits	*Column 2* Interval	*Column 3* Middle Ordinate	*Column 4* 'Q	*Column 5* Q_s	*Column 2 x 4* Q	*Column 2 x 5* Q_s
%	%	%	m^3/s	tons/day	m^3/s	tons/day
0.00 - 0.02	0.02	0.01	431.55	381.77	0.09	7.64
0.02 - 0.1	0.08	0.06	203.03	124.27	0.16	9.94
0.1 - 0.5	0.4	0.3	70.23	26.29	0.28	10.51
0.5 - 1.5	1	1	35.11	8.66	0.35	8.66
1.5 - 5.0	**3.5**	**3.25**	**18.94**	**2.65**	**0.66**	**9.26**
5.0 - 15	10	10	8.86	0.17	0.89	1.68
15 - 25	10	20	4.70	0.0	0.47	0.00
25 - 35	10	30	3.26	0.0	0.33	0.00
35 - 45	10	40	2.52	0.0	0.25	0.00
45 - 55	10	50	2.10	0.0	0.21	0.00
55 - 65	10	60	1.87	0.0	0.19	0.00
65 - 75	10	70	1.70	0.0	0.17	0.00
75 - 85	10	80	1.50	0.0	0.15	0.00
85 - 95	10	90	1.13	0.0	0.11	0.00
95 - 96.5	3.5	96.75	0.79	0.0	0.03	0.00
98.5 - 99.5	1	99	0.65	0.0	0.01	0.00
99.5 - 99.9	0.4	99.7	0.57	0.0	0.00	0.00
99.9 -99.98	0.08	99.94	0.51	0.0	0.00	0.00
99.98 - 100	0.02	99.99	0.45	0.0	0.00	0.00

Table 17. Effective Discharge Table Reach IV (Modified Yang).

Column 1 Limits	*Column 2* Interval	*Column 3* Middle Ordinate	*Column 4* 'Q	*Column 5* Q_s	*Column 2 x 4* Q	*Column 2 x 5* Q_s
%	%	%	m^3/s	tons/day	m^3/s	tons/day
0.00 - 0.02	0.02	0.01	431.55	1048.73	0.09	20.97
0.02 - 0.1	0.08	0.06	203.03	403.34	0.16	32.27
0.1 - 0.5	0.4	0.3	70.23	116.41	0.28	46.56
0.5 - 1.5	1	1	35.11	54.13	0.35	54.13
1.5 - 5.0	3.5	3.25	18.94	28.27	0.66	98.96
5.0 - 15	**10**	**10**	**8.86**	**11.69**	**0.89**	**116.92**
15 - 25	10	20	4.70	4.79	0.47	47.95
25 - 35	10	30	3.26	2.87	0.33	28.71
35 - 45	10	40	2.52	1.90	0.25	18.97
45 - 55	10	50	2.10	1.29	0.21	12.94
55 - 65	10	60	1.87	1.15	0.19	11.48
65 - 75	10	70	1.70	0.84	0.17	8.44
75 - 85	10	80	1.50	0.0	0.15	0.00
85 - 95	10	90	1.13	0.0	0.11	0.00
95 - 96.5	3.5	96.75	0.79	0.0	0.03	0.00
98.5 - 99.5	1	99	0.65	0.0	0.01	0.00
99.5 - 99.9	0.4	99.7	0.57	0.0	0.00	0.00
99.9 -99.98	0.08	99.94	0.51	0.0	0.00	0.00
99.98 - 100	0.02	99.99	0.45	0.0	0.00	0.00

Table 18. Effective Discharge Table Reach I (MPM).

Column 1	*Column 2*	*Column 3*	*Column 4*	*Column 5*	*Column 2 x 4*	*Column 2 x 5*

Limits	Interval	Middle Ordinate	'Q	Q_s	Q	Q_s
%	%	%	m^3/s	tons/day	m^3/s	tons/day
0.00 - 0.02	0.02	0.01	431.55	38434	0.09	768.68
0.02 - 0.1	0.08	0.06	203.03	15286	0.16	1222.85
0.1 - 0.5	0.4	0.3	70.23	5392	0.28	2156.69
0.5 - 1.5	1	1	35.11	2958	0.35	2957.73
1.5 - 5.0	3.5	3.25	18.94	1627	0.66	5695.83
5.0 - 15	**10**	**10**	**8.86**	**808**	**0.89**	**8081.00**
15 - 25	10	20	4.70	448	0.47	4483.80
25 - 35	10	30	3.26	329	0.33	3288.10
35 - 45	10	40	2.52	249	0.25	2494.20
45 - 55	10	50	2.10	206	0.21	2058.20
55 - 65	10	60	1.87	0.0	0.19	0.00
65 - 75	10	70	1.70	0.0	0.17	0.00
75 - 85	10	80	1.50	0.0	0.15	0.00
85 - 95	10	90	1.13	0.0	0.11	0.00
95 - 96.5	3.5	96.75	0.79	0.0	0.03	0.00
98.5 - 99.5	1	99	0.65	0.0	0.01	0.00
99.5 - 99.9	0.4	99.7	0.57	0.0	0.00	0.00
99.9 -99.98	0.08	99.94	0.51	0.0	0.00	0.00
99.98 - 100	0.02	99.99	0.45	0.0	0.00	0.00

Table 19. Effective Discharge Table Reach II (MPM).

Column 1 Limits	*Column 2* Interval	*Column 3* Middle Ordinate	*Column 4* 'Q	*Column 5* Q_s	*Column 2 x 4* Q	*Column 2 x 5* Q_s
%	%	%	m^3/s	tons/day	m^3/s	tons/day
0.00 - 0.02	0.02	0.01	431.55	30756	0.09	615.12
0.02 - 0.1	0.08	0.06	203.03	12354	0.16	988.36
0.1 - 0.5	0.4	0.3	70.23	4084	0.28	1633.58
0.5 - 1.5	1	1	35.11	2139	0.35	2138.67
1.5 - 5.0	3.5	3.25	18.94	1138	0.66	3981.81
5.0 - 15	**10**	**10**	**8.86**	**495**	**0.89**	**4948.40**
15 - 25	10	20	4.70	269	0.47	2687.80
25 - 35	10	30	3.26	178	0.33	1783.20
35 - 45	10	40	2.52	152	0.25	1521.10
45 - 55	10	50	2.10	120	0.21	1198.70
55 - 65	10	60	1.87	0.0	0.19	0.00
65 - 75	10	70	1.70	0.0	0.17	0.00
75 - 85	10	80	1.50	0.0	0.15	0.00
85 - 95	10	90	1.13	0.0	0.11	0.00
95 - 96.5	3.5	96.75	0.79	0.0	0.03	0.00
98.5 - 99.5	1	99	0.65	0.0	0.01	0.00
99.5 - 99.9	0.4	99.7	0.57	0.0	0.00	0.00
99.9 -99.98	0.08	99.94	0.51	0.0	0.00	0.00
99.98 - 100	0.02	99.99	0.45	0.0	0.00	0.00

Table 20. Effective Discharge Table Reach III (MPM).

Column 1 Limits	*Column 2* Interval	*Column 3* Middle Ordinate	*Column 4* 'Q	*Column 5* Q_s	*Column 2 x 4* Q	*Column 2 x 5* Q_s

%	%	%	m³/s	tons/day	m³/s	tons/day
0.00 - 0.02	0.02	0.01	431.55	72991.65	0.09	1459.83
0.02 - 0.1	0.08	0.06	203.03	20992.17	0.16	1679.37
0.1 - 0.5	0.4	0.3	70.23	4793.82	0.28	1917.53
0.5 - 1.5	1	1	35.11	2311.57	0.35	2311.57
1.5 - 5.0	3.5	3.25	18.94	1347.29	0.66	4715.52
5.0 - 15	**10**	**10**	**8.86**	**748.18**	**0.89**	**7481.80**
15 - 25	10	20	4.70	436.63	0.47	4366.30
25 - 35	10	30	3.26	303.67	0.33	3036.70
35 - 45	10	40	2.52	238.15	0.25	2381.50
45 - 55	10	50	2.10	202.25	0.21	2022.50
55 - 65	10	60	1.87	0.0	0.19	0.00
65 - 75	10	70	1.70	0.0	0.17	0.00
75 - 85	10	80	1.50	0.0	0.15	0.00
85 - 95	10	90	1.13	0.0	0.11	0.00
95 - 96.5	3.5	96.75	0.79	0.0	0.03	0.00
98.5 - 99.5	1	99	0.65	0.0	0.01	0.00
99.5 - 99.9	0.4	99.7	0.57	0.0	0.00	0.00
99.9 -99.98	0.08	99.94	0.51	0.0	0.00	0.00
99.98 - 100	0.02	99.99	0.45	0.0	0.00	0.00

Table 21. Effective Discharge Table Reach IV (MPM).

Column 1 Limits	*Column 2* Interval	*Column 3* Middle Ordinate	*Column 4* 'Q	*Column 5* Q_s	*Column 2 x 4* Q	*Column 2 x 5* Q_s
%	%	%	m³/s	tons/day	m³/s	tons/day
0.00 - 0.02	0.02	0.01	431.55	76018.35	0.09	1520.37
0.02 - 0.1	0.08	0.06	203.03	32394.69	0.16	2591.58
0.1 - 0.5	0.4	0.3	70.23	11689.47	0.28	4675.79
0.5 - 1.5	1	1	35.11	6560.86	0.35	6560.86
1.5 - 5.0	3.5	3.25	18.94	4180.84	0.66	14632.94
5.0 - 15	**10**	**10**	**8.86**	**2213.56**	**0.89**	**22135.60**
15 - 25	10	20	4.70	1191.95	0.47	11919.50
25 - 35	10	30	3.26	877.80	0.33	8778.00
35 - 45	10	40	2.52	698.17	0.25	6981.70
45 - 55	10	50	2.10	568.59	0.21	5685.90
55 - 65	10	60	1.87	0.0	0.19	0.00
65 - 75	10	70	1.70	0.0	0.17	0.00
75 - 85	10	80	1.50	0.0	0.15	0.00
85 - 95	10	90	1.13	0.0	0.11	0.00
95 - 96.5	3.5	96.75	0.79	0.0	0.03	0.00
98.5 - 99.5	1	99	0.65	0.0	0.01	0.00
99.5 - 99.9	0.4	99.7	0.57	0.0	0.00	0.00
99.9 -99.98	0.08	99.94	0.51	0.0	0.00	0.00
99.98 - 100	0.02	99.99	0.45	0.0	0.00	0.00

RESULTS

The analysis consists of a RISAD generated chart plotting the slope of the energy grade line versus top width of the channel for the given channel material size properties and calculated effective discharge. Comparison points derive from the HEC-RAS modeling. HEC-RAS calculates energy grade line slopes

and hydraulic geometry for the modeled flows, based upon the geometry input from the topography and other geometric data collected as part of other study tasks.

The measure for stability is the relative proximity of the actual 2001 modeled channel values to the RISAD generated plot, named the Stable Channel Curve. The zone above the stable channel curve is characterized by a tendency for the channel bed to degrade at a rate roughly inversely proportionate to the proximity to the curve. The zone below the stable channel curve is characterized by a tendency for the channel bed to aggrade at a rate roughly inversely proportionate to the proximity to the curve. Points on or in close proximity to the stable channel curve, above and below, are in a zone of stability. It is best to take a collective look at the points from a reach. Outliers usually indicate either sections with geologic (bed-rock) control or sections near diversion dams. The extremal hypothesis of stable channel analysis states that the channel will tend towards the minimum slope of the stable channel curve. Judgment regarding the trend of the river channel, both width and slope, comes from assessment of the relative position of the current channel conditions to the minimum slope on the stable channel curve.

Two sediment transport equations were used to develop the effective discharge as shown in Table 14 through Table 21. The effective discharge for Sub-Reaches I – IV using the MPM equation is estimated to be 8.86 m^3/s (313 ft^3/s). However, the effective discharge for the majority of Sub-Reaches using the Yang equation is estimated to be 18.94 m^3/s (669 ft^3/s). The utilization of mean daily discharges as a basis for computing the effective discharge could result in a lower value. As previously stated, this could be the channel forming discharge for the *Active Channel Width* channel. Based on engineering judgment, it would be more reasonable to assume the higher of the two values. Therefore, 18.94 m^3/s (669 ft^3/s) was selected as the effective discharge, and probably describes the flow forming the *Active Channel Width.*

The hydraulic analysis indicates the following average hydraulics values for the effective discharge. The average top width for Sub-Reach I is 77.0 meters (253 feet) and the average energy slope is 0.00424 meter/meter. For Sub-Reach II, the average top width is 70.9 meters (232 feet) and the average energy slope is 0.00362 meter/meter. For Sub-Reach III, the average top width is 72.6 meters (238 feet) and the average energy slope is 0.00449 meter/meter. For Sub-Reach IV, the average top width is 64.7 meters (212 feet) and the average energy slope is 0.00611 meter/meter. Figure 19 shows the longitudinal thalweg profile, along with the water surface and energy grade line profile corresponding to 431.5 m^3/s (15,238 ft^3/s).

Reclamation (Klawon, 2002) reports that the *Active Channel Width* varies roughly between 61 and 137 meters (200 ft – 450 ft), while the *Flood Channel Width* varies between 183 and 282 meters (600 ft - 925 ft). All of the top widths estimated in this analysis fall within the *Active Channel Width* range reported by Klawon. Figure 20 shows how the width, on average, along with the channel stream power, varies longitudinally, following the HEC-RAS results.

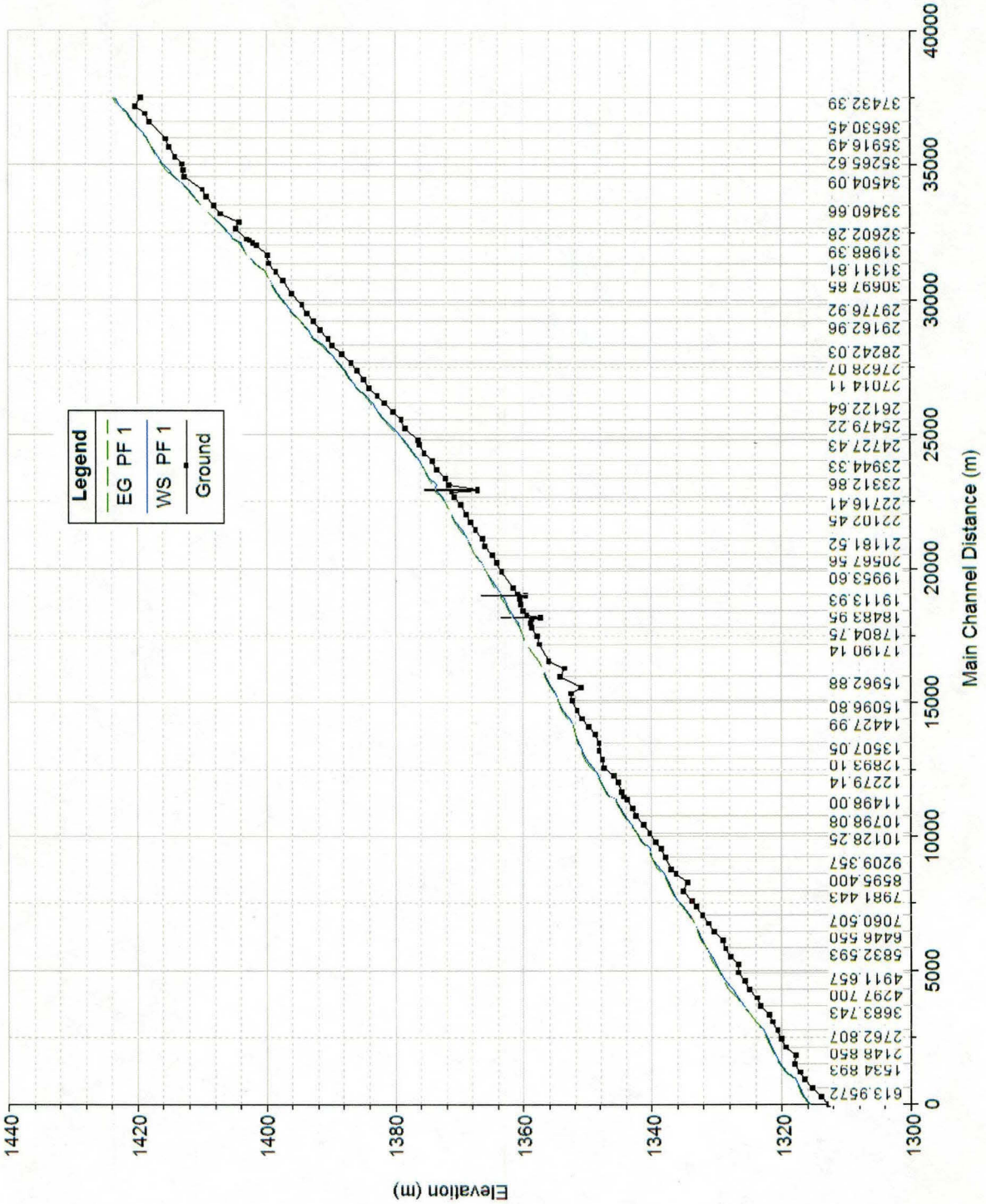

Figure 19. Thalweg, water surface, and energy grade line at 431.5 m^3/s (15,238 ft^3/s).

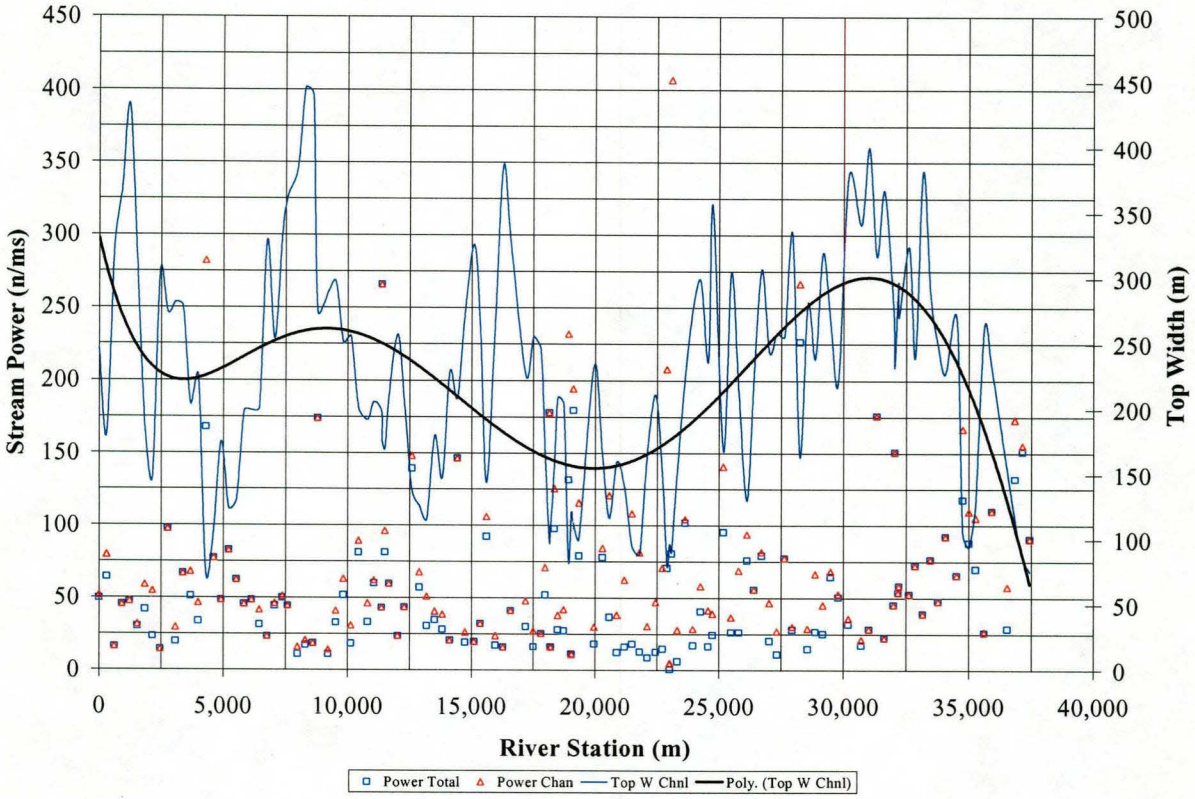

Figure 20. Longitudinal distribution of stream power along with channel top width.

Figure 21 through Figure 25 present the results of the stable channel analysis. The analysis shows relative stability throughout the entire study area.

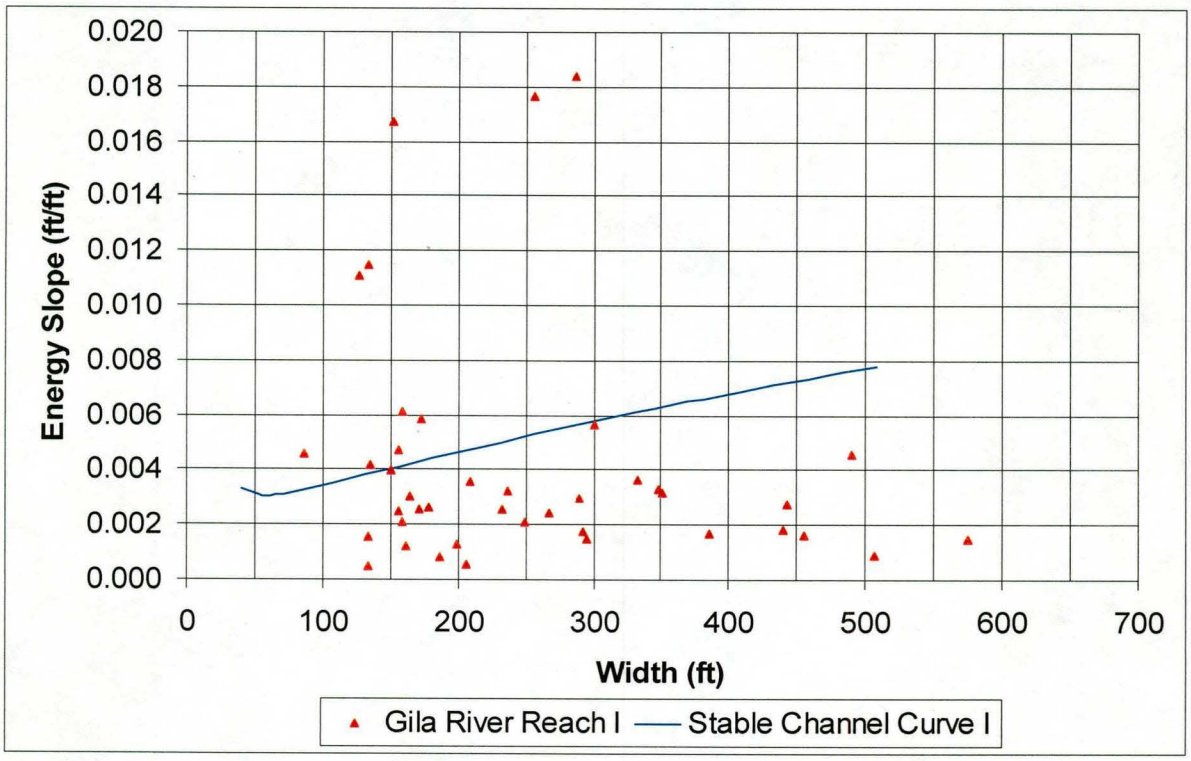

Figure 21. Stable channel analysis of sub-Reach I.

The computed stable values for Sub-Reach I indicate a stable channel top width between 12 and 155 meters and a stable energy slope between 0.00327 and 0.00781. For Sub-Reach II, the computed stable values for the top width are between 12 and 142 meters and a stable energy slope between 0.00230 and 0.00436 meter/meter. For Sub-Reach III, the computed stable values for the top width are between 12 and 146 meters and a stable energy slope between 0.00369 and 0.01185 meter/meter. For Sub-Reach IV, the computed stable values for the top width are between 11 and 130 meters and a stable energy slope between 0.00553 and 0.00758 meter/meter. The computed average values for top width and energy slope from the HEC-RAS model for all the Sub-Reaches lay within the generated stable regions.

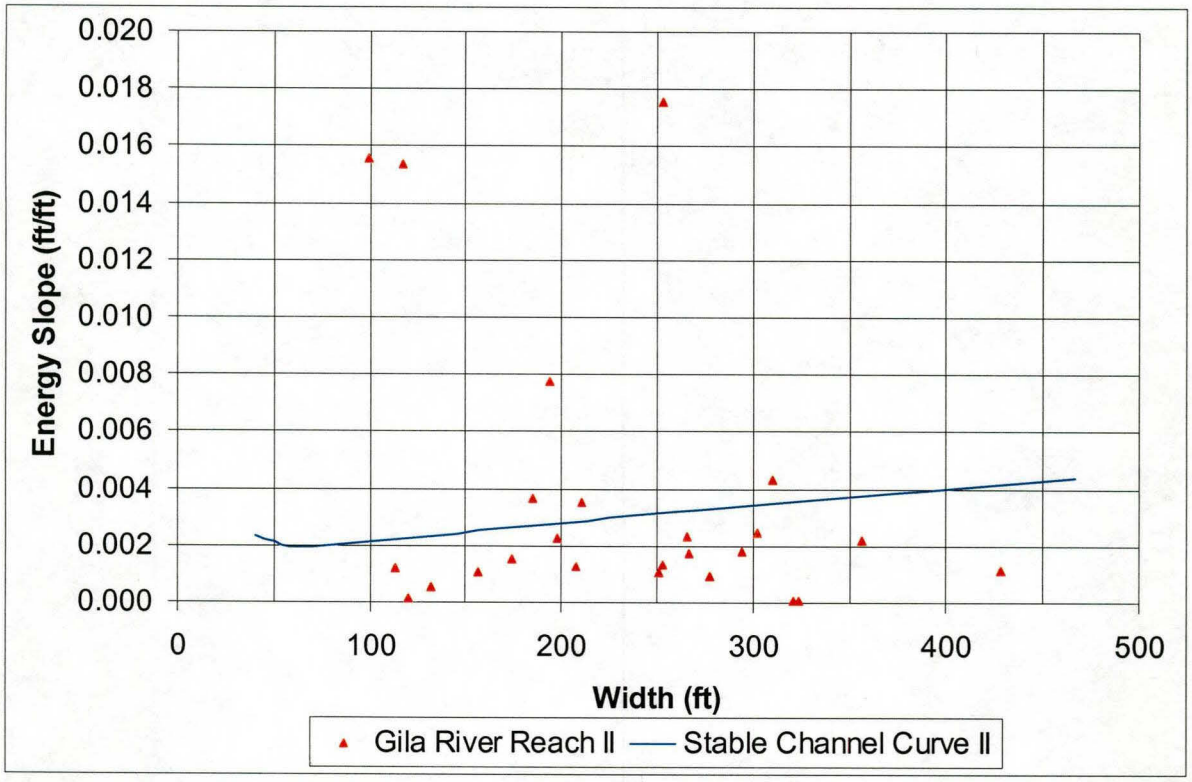

Figure 22. Stable channel analysis of Sub-Reach II.

Figure 25 shows the analysis for the entire Analysis Reach. The analysis used the average bed material gradation, that is the average of the 16 gradations in the analysis reach, as well as mean hydraulics of the reach.

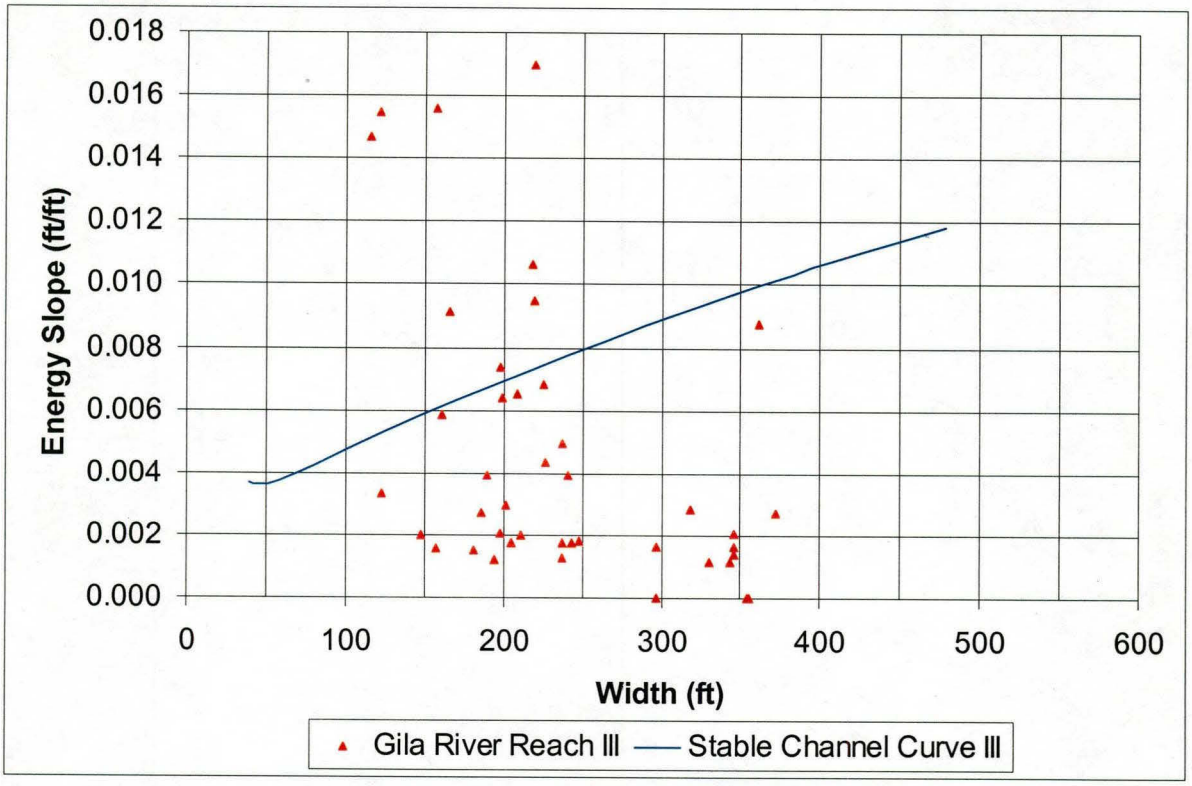

Figure 23. Stable channel analysis of Sub-Reach III.

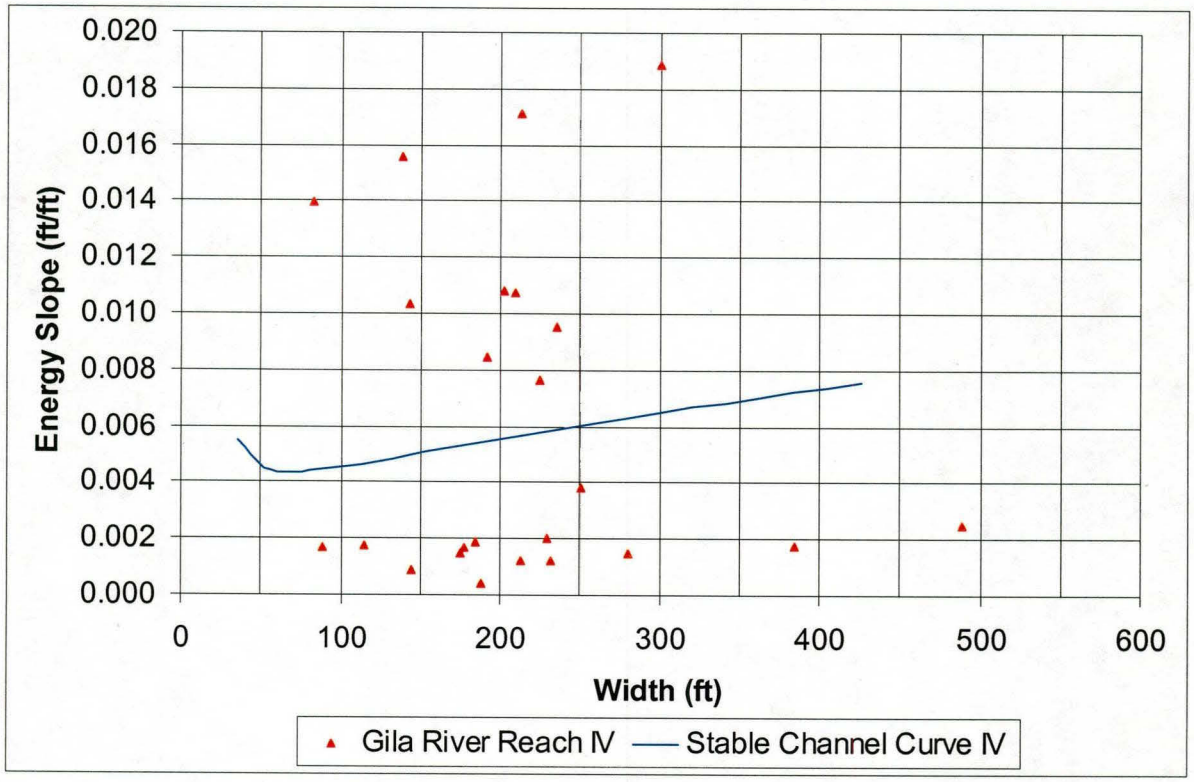

Figure 24. Stable channel analysis of Sub-Reach IV.

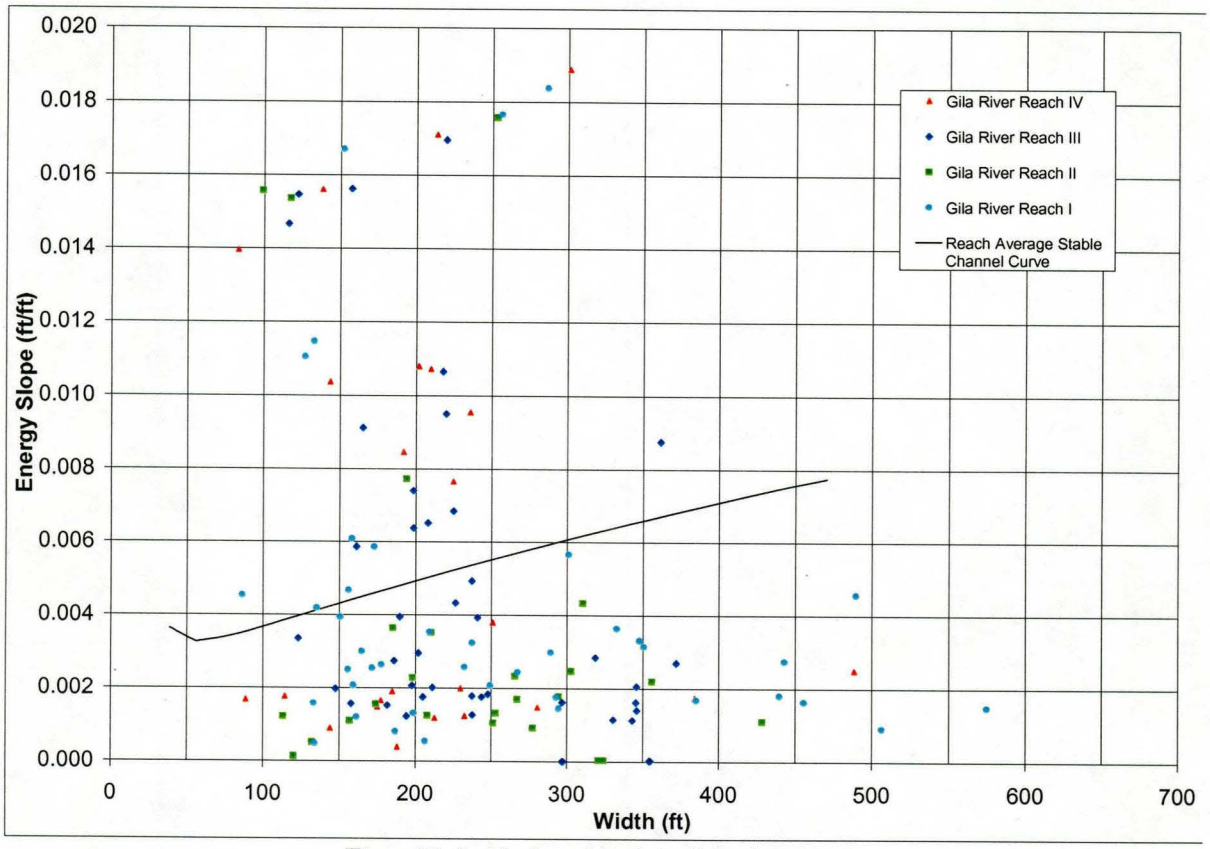

Figure 25. Stable channel analysis of Analysis Reach.

LIMITATIONS OF ANALYSIS

Reclamation hypothesizes that this Stable Channel Analysis identifies the effective discharge of the *Active Channel Width* channel. This section presents the limitations of the analysis and poses possible reasons for the inability to analyze the *Flood Channel Width* channel.

SEDIMENT TRANSPORT CAPACITY IN CONTRAST TO SEDIMENT TRANSPORT

Sediment transport capacity is the maximum amount of sediment that could be transported in any given reach under the given hydrologic and hydraulic conditions. It is not necessarily the actual sediment transported by known hydrological events. The difference is available supply of sediment. If transport capacity estimates match measured values, then the capacity is the actual transport of the river. In a situation with an abundance of sediment, above the transport capacity, the channel geometry rapidly changes as the channel adjusts its slope, depth, and width to increase transport capacity. In a situation where sediment supply is below the transport capacity, the channel may fossilize or even aggrade following vegetation encroachment.

SAM and RISAD model the sediment transport capacity. Further sediment transport (not capacity) modeling is only necessary if general aggradation or degradation is evident in the system.

VEGETATION

Vegetation in the river was modeled as channel roughness. However, model limitations do not allow for channel vegetation to be modeled as a structural component of bank stability and width adjustment. Neither RISAD nor HEC-RAS are capable of modeling structural components. RISAD does not model fixed boundaries. It is a transport capacity model. HEC-RAS does model fixed hydraulic boundaries.

INSTANTANEOUS PEAKS VS. MEAN DAILY FLOWS

The initial estimates of the effective discharge were lower than anticipated, especially when compared to the historical flood peaks. Reclamation suspects that use of mean daily flows in the duration analysis had biased the effective discharge estimate towards the *Active Channel Width* channel forming value.

The flow duration analysis should be repeated with roughly 10 years of 15-minute flow data supplied by the USGS from the Gila River near Gila, NM, gage. In lieu of analyzing the 15-minute data, Reclamation performed a rudimentary comparison of mean daily flows and instantaneous peaks. Figure 26 shows Instantaneous Peak flows plotted against the corresponding Mean Daily flows. On average, the instantaneous peak is 66% greater than the corresponding mean daily flow. At flows below 28.3 m^3/s (1,000 ft^3/s) the difference is greater. This supports the theory that the current analysis returns estimates of effective discharge for the *Active Channel Width* channel that are less than the channel forming flow of the *Flood Channel Width* channel.

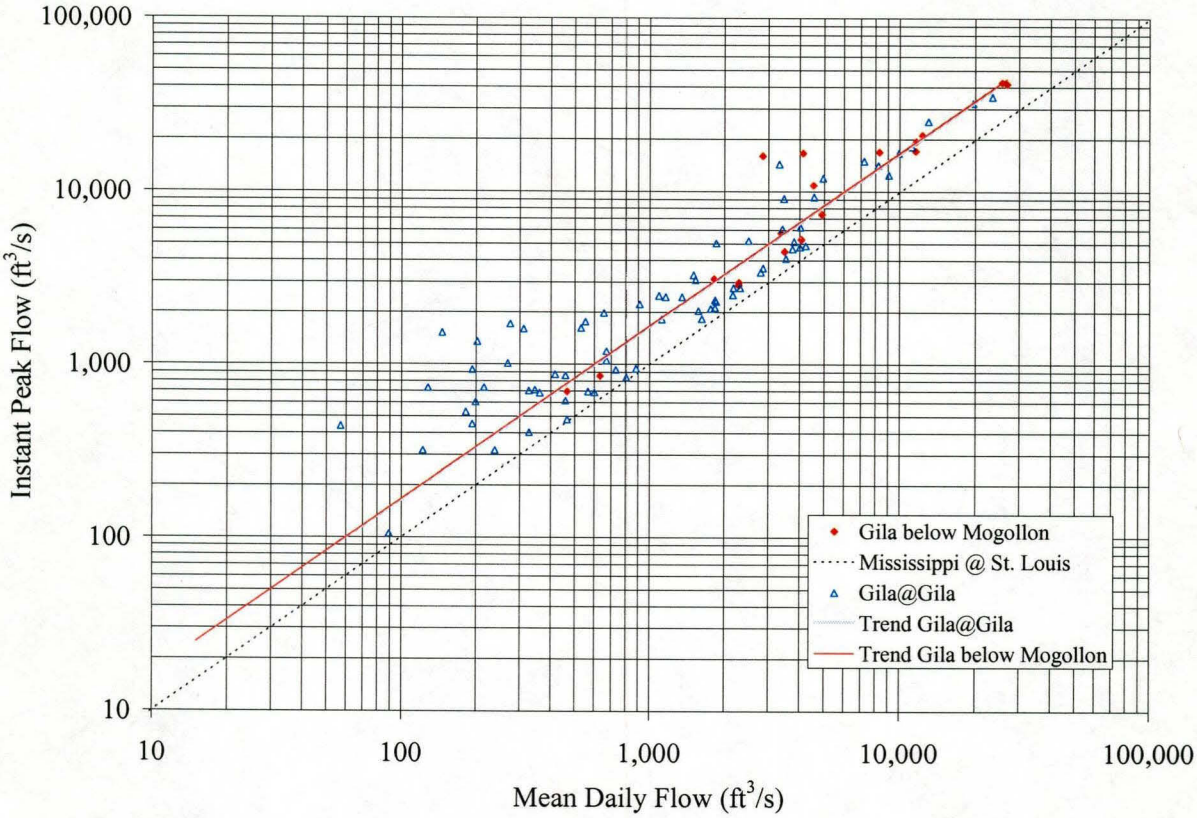

Figure 26. Relationship between instantaneous peak flows and mean daily flows, reported by USGS.

To further investigate channel stability, assuming the *Flood Channel Width* channel forming flow is greater than the estimated effective discharge, Reclamation completed additional stability analysis. Figure 27, Figure 28, and Figure 29 show the results of the additional investigation.

As the discharge increases, the stable channel curve falls, along with the points representing each HEC-RAS cross-section. In Figure 29 the points fall evenly about the stability curve, indicating that at this flow the channel is still relatively stable.

The results shown in these figures support the theory that the *Flood Channel Width* channel forming flow is greater than the estimate of effective discharge in the *Active Channel Width* channel. The analysis shows that the river is stable at flows of 203.00 m^3/s (7,170 ft^3/s).

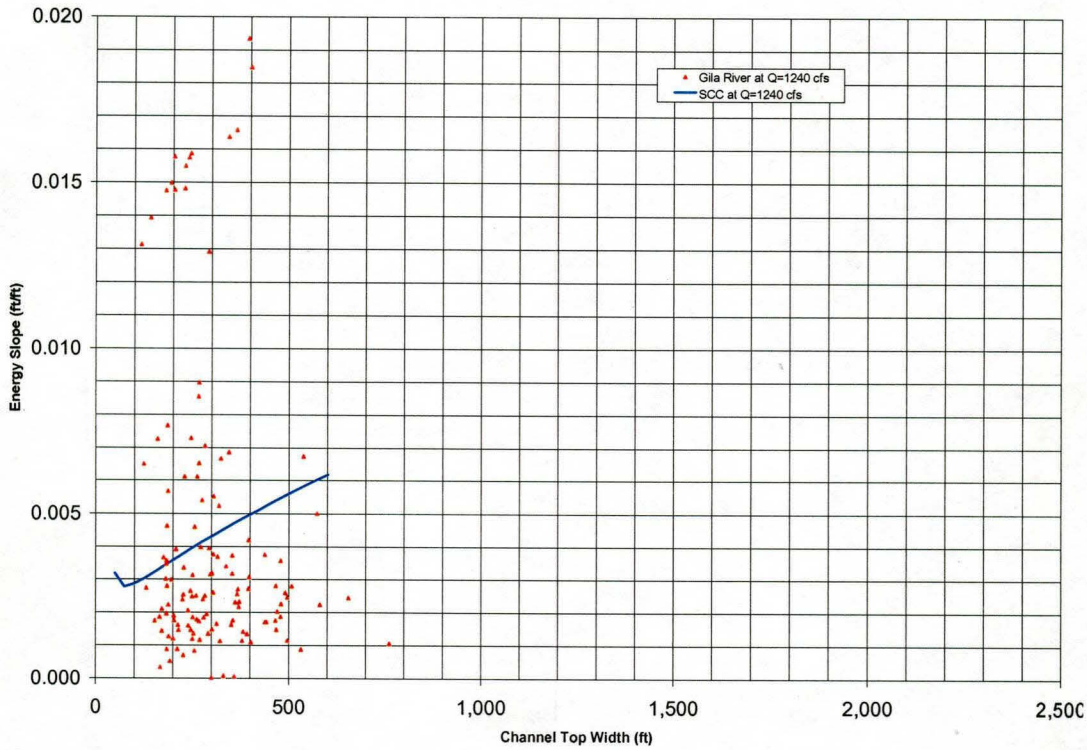

Figure 27. Stability analysis at 35.11 m^3/s (1,240 ft^3/s).

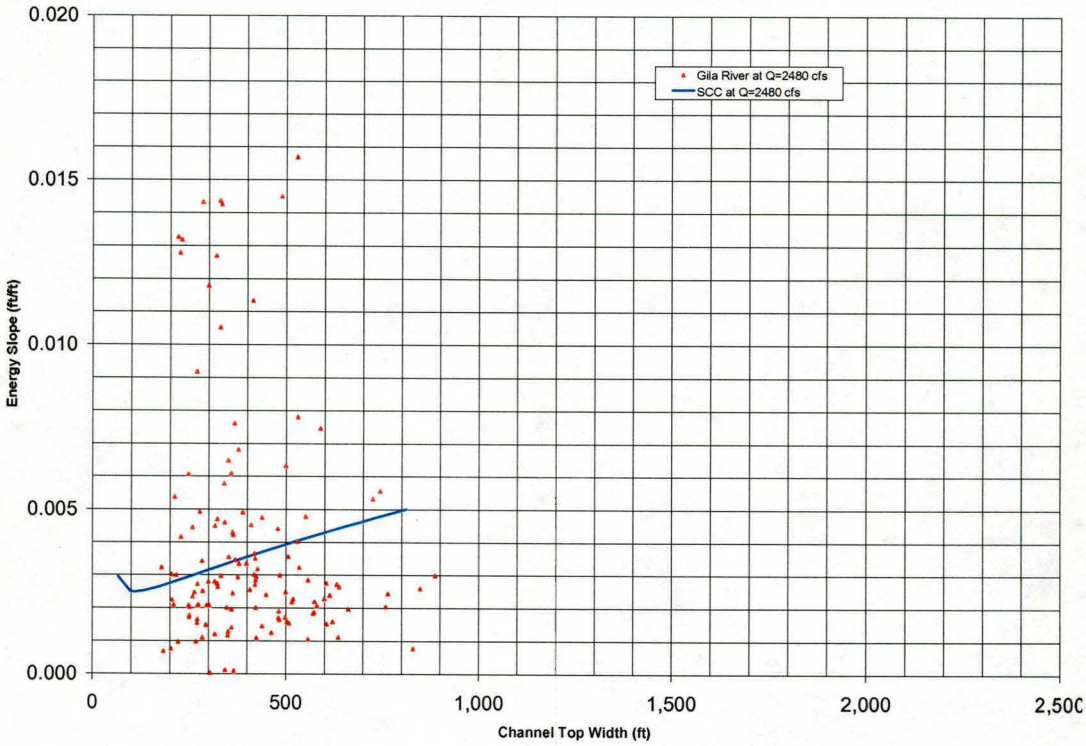

Figure 28. Stability analysis at 70.22 m^3/s (2,480 ft^3/s).

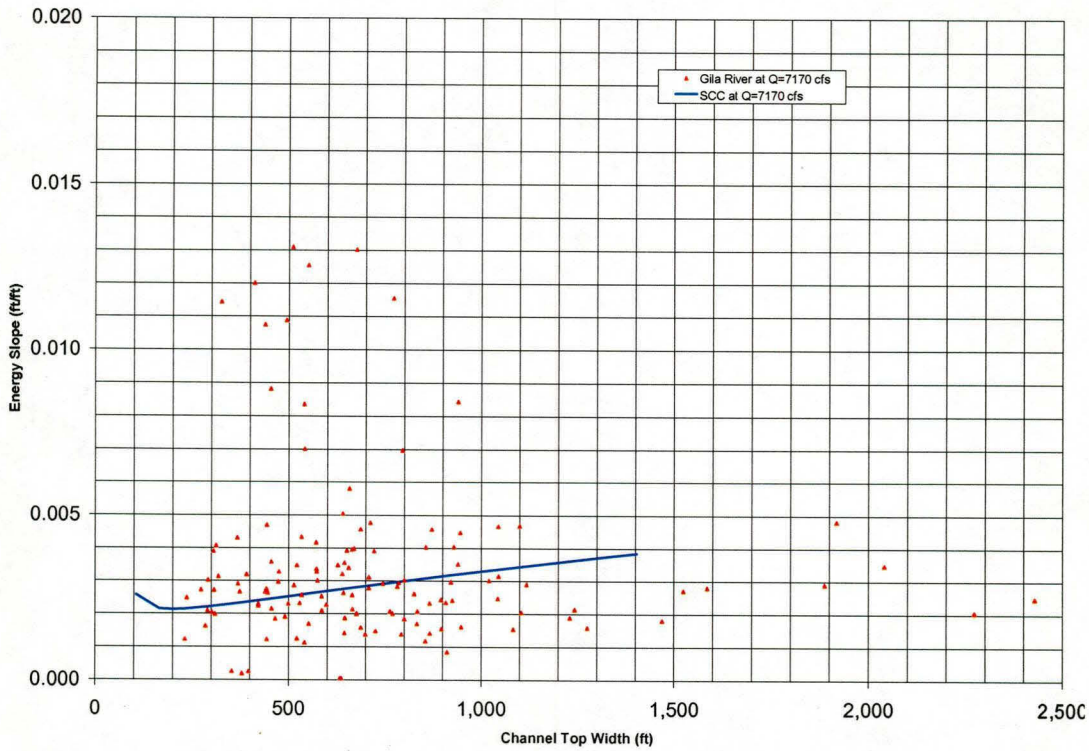

Figure 29. Stability analysis at 203.00 m^3/s (7,170 ft^3/s).

CONCLUSIONS

The Upper Gila River Analysis Reach tends toward stability. Figure 21 through Figure 25 show the *Active Channel Width* channel widths to be within stability guidelines for the analysis. These widths range between 64.7 meters (212 feet) to 77.0 meters (253 feet). The average energy slope within the analysis reaches ranges from 0.0036 meter/meter to 0.0061 meter/meter. These values are all within stability criteria generated within the RISAD module.

Field investigations did not reveal general aggradation or degradation occurring within the Analysis Reach. Hydraulically, the river accesses its floodplain. This indicates that local channel widening occurs only in areas of the river where distinct hydraulic features have tried to confine the natural flow path of the *Flood Channel Width* channel, or the channel has adjusted to decadal changes in the hydrologic regime. Reclamation's observations indicate that the current levee system is not functional, with few intact levees within the Analysis Reach. The primary effect of the current levee system in the Cliff-Gila Valley is to separate flow, shunting the river onto the flood plain (farm land) in several locations.

Reclamation does not recommend further sediment transport modeling in the Study Reach. NMED might consider such an effort if there was observational evidence of channel incision or other sediment budget related problems. The geomorphic analyses and *Stream Corridor Assessment Report* will make recommendations relevant to channel stability in the context of levees, bridges, and other anthropogenic disturbances in the channel.

Reclamation recommends repeating the *Flow Duration* analysis using available 15-minute flow data from the Gila River near Gila, NM, gage. It is likely that such an analysis will return a higher estimate of the effective discharge than the current analysis using mean daily flows.

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APPENDIX A

HEC-RAS SECTION LOCATIONS

Plate 1. Reach I, including Bird Area at Station 920 (Ira Canyon – Station 0).

Plate 2. Reach I.

Plate 3. Sub-reach II begins at Station 12,000, continuing upstream, North.

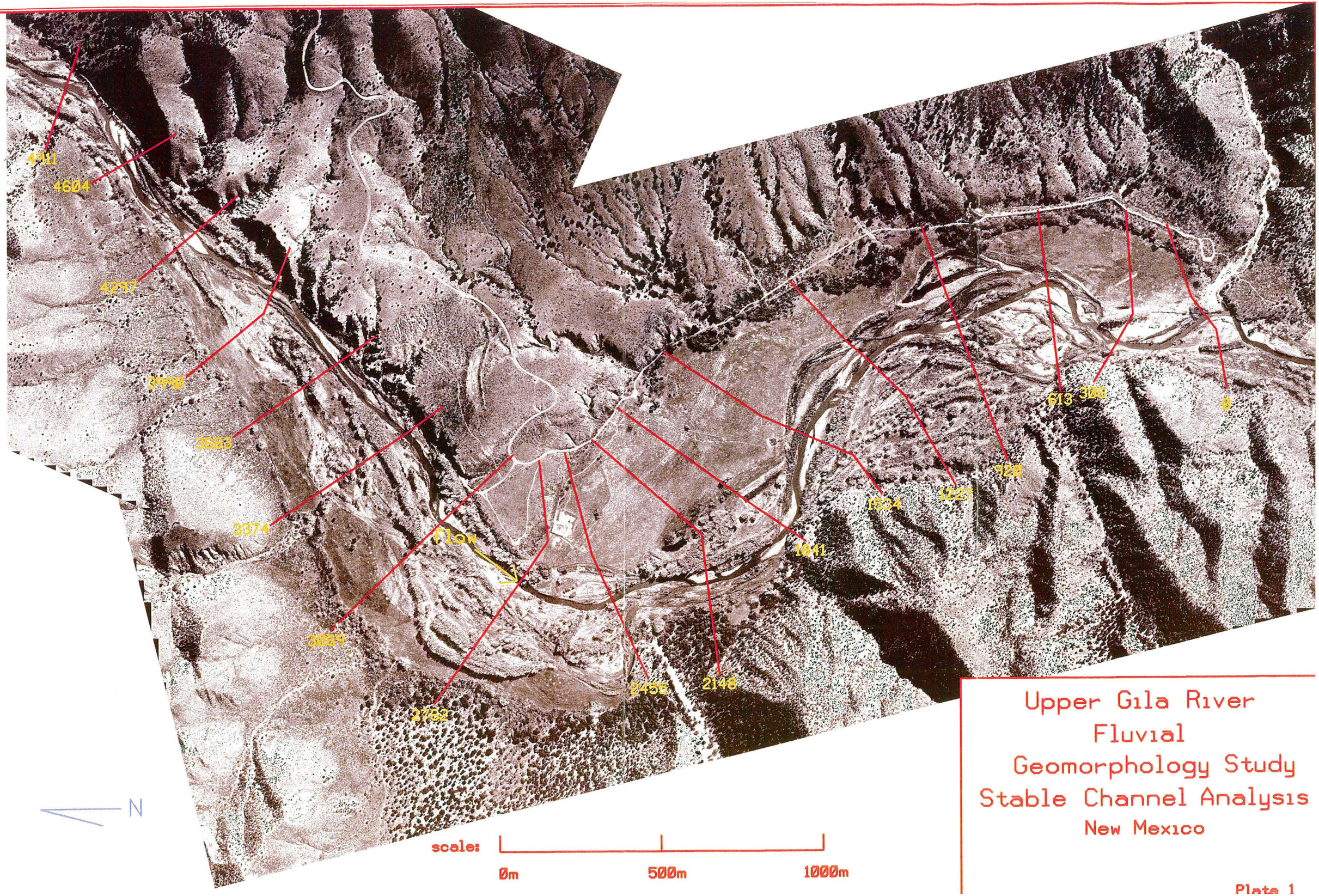
Plate 4. Sub-reach II ends at Station 18,500. Sub-reach III begins at Station 18,500, continuing upstream, North.

Plate 5. Reach III.

Plate 6. Reach III.

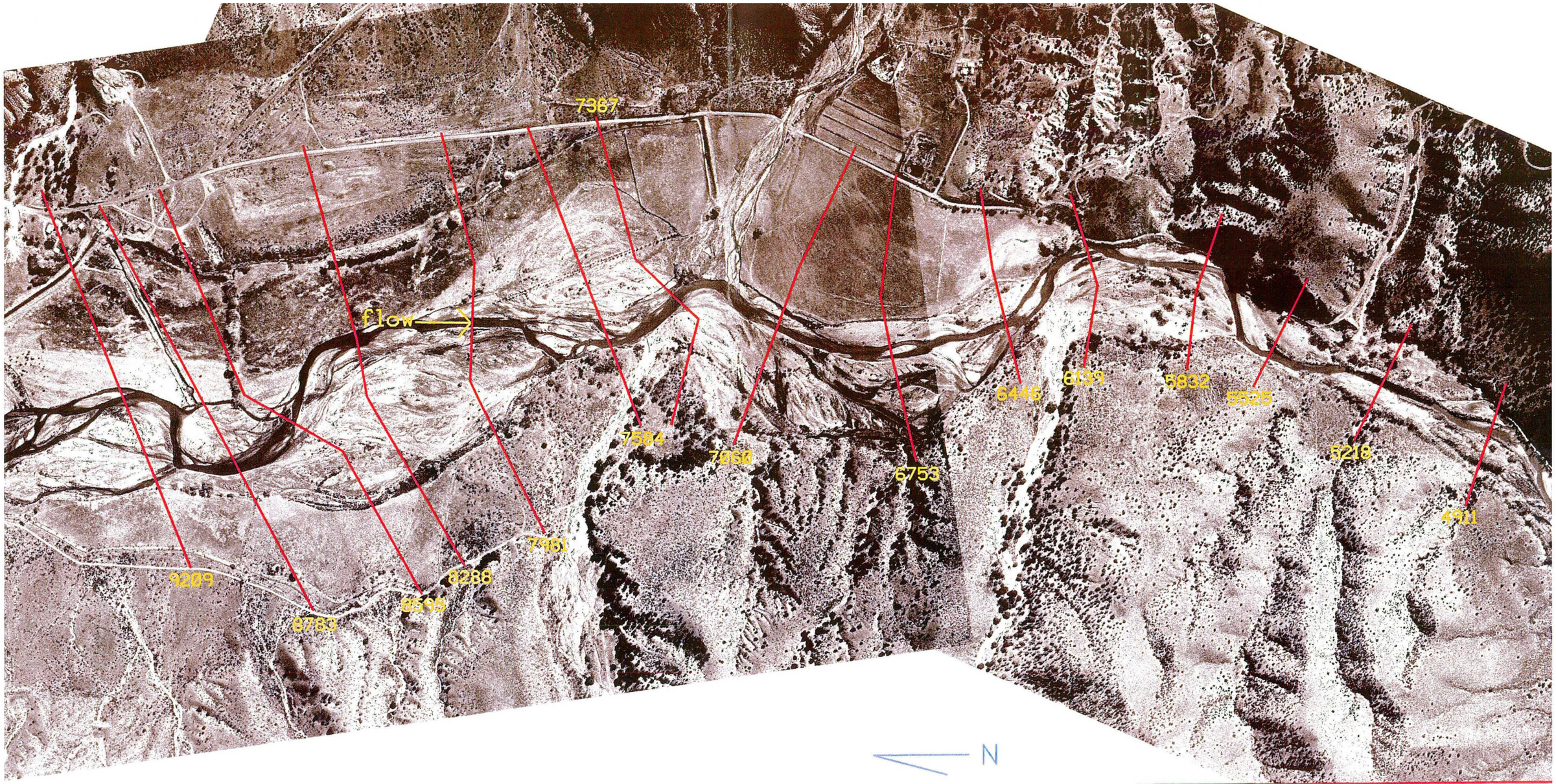
Plate 7. Sub-reach III ends at Station 30,000. Sub-reach IV begins at Station 30,000, continuing upstream, North.

Plate 8. Sub-reach IV ends at Station 37,432, USGS Gage 0943050.



Upper Gila River
Fluvial
Geomorphology Study
Stable Channel Analysis
New Mexico

Plate 1



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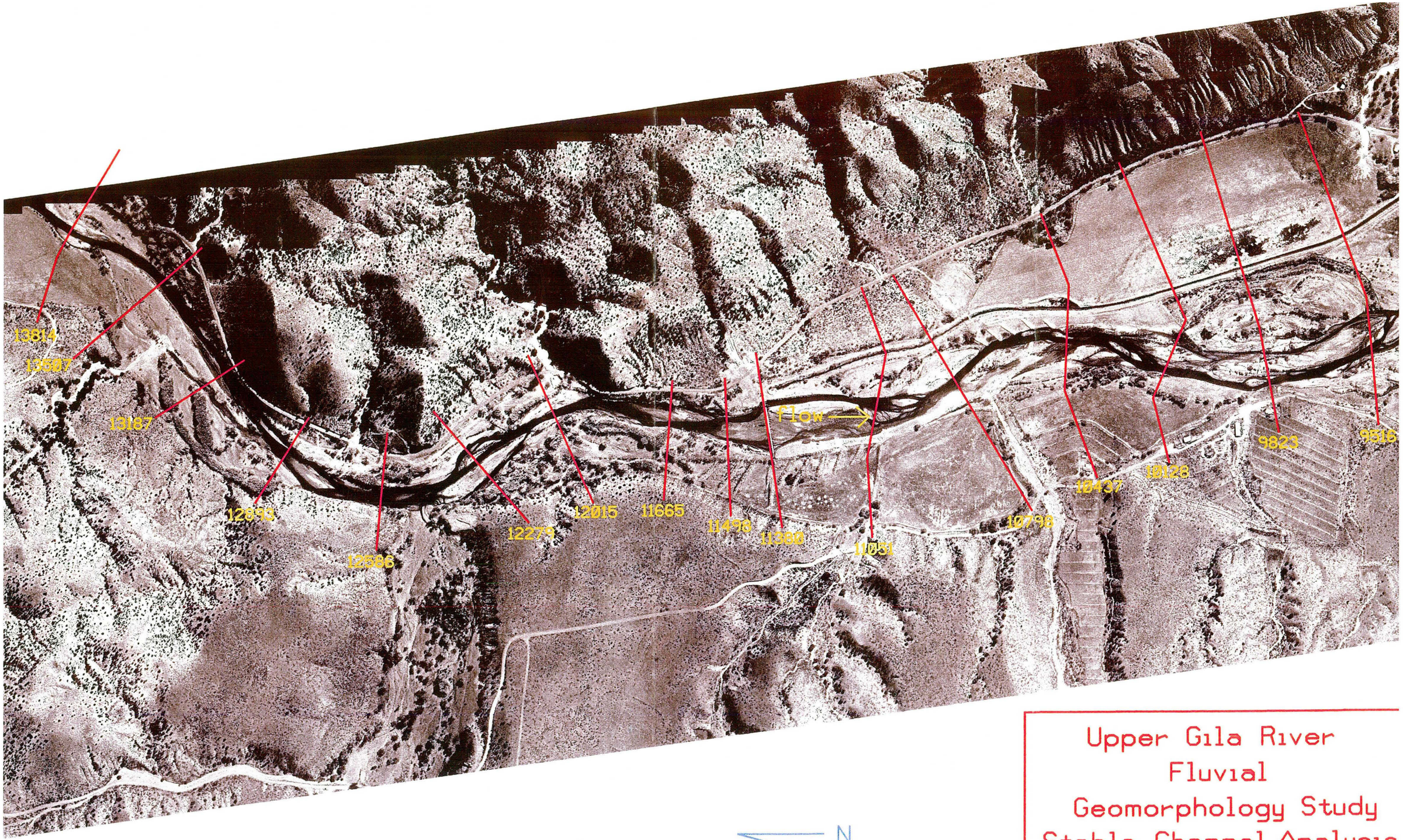
Upper Gila River Fluvial Geomorphology Study Stable Channel Analysis

New Mexico

Plate 2



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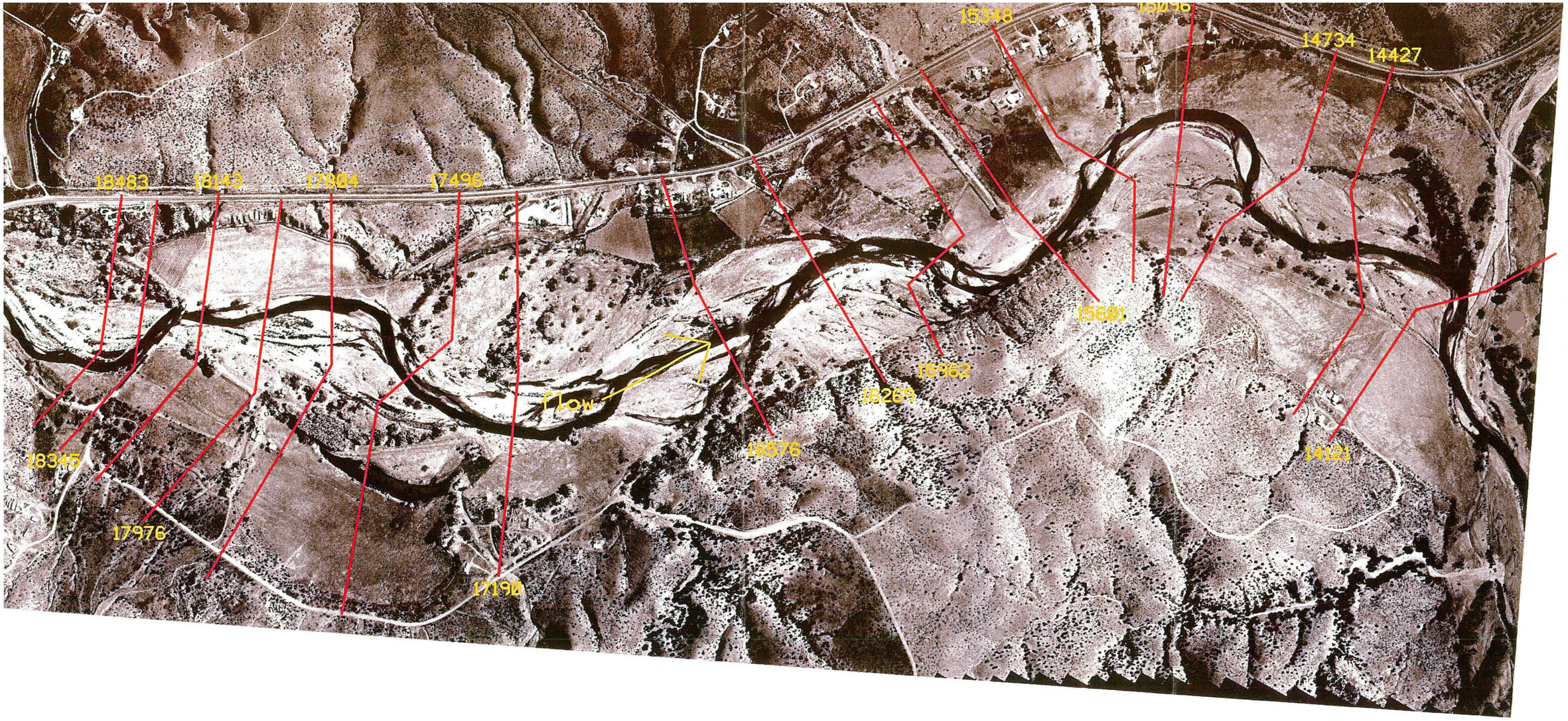
Upper Gila River Fluvial Geomorphology Study Stable Channel Analysis

New Mexico

Plate 3



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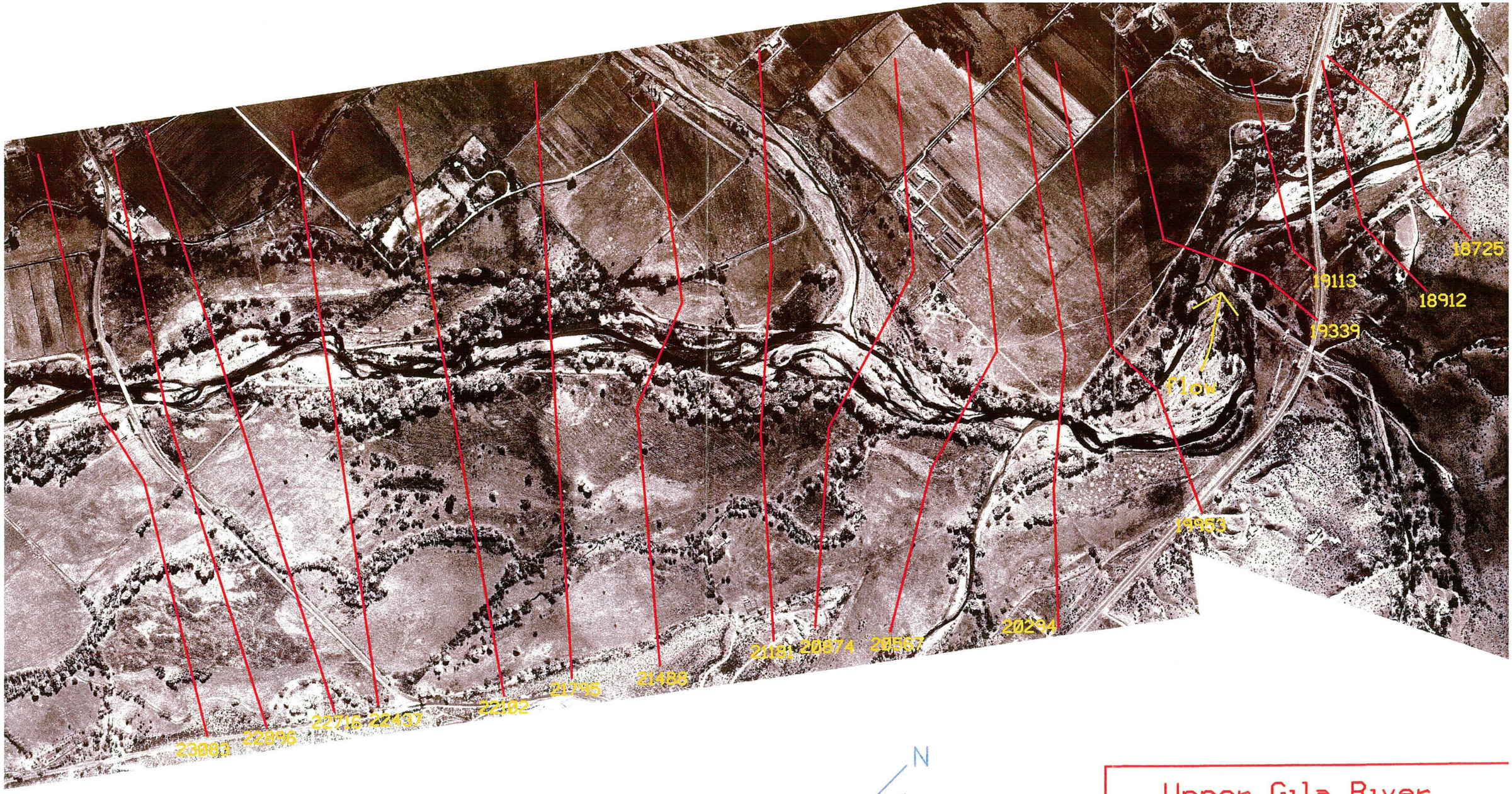
Upper Gila River Fluvial Geomorphology Study Stable Channel Analysis

New Mexico

Plate 4



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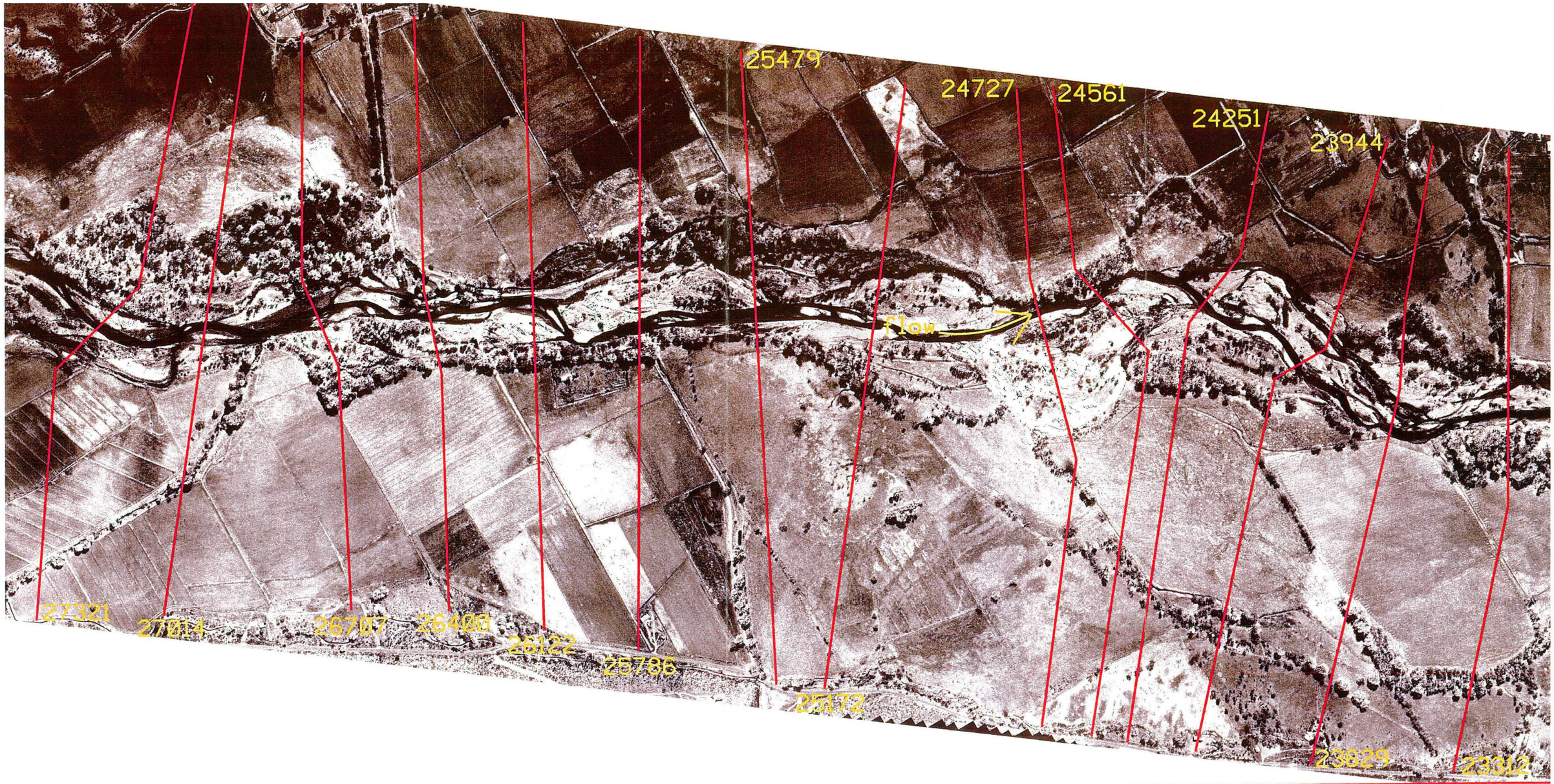
Upper Gila River Fluvial Geomorphology Study Stable Channel Analysis

New Mexico

Plate 5



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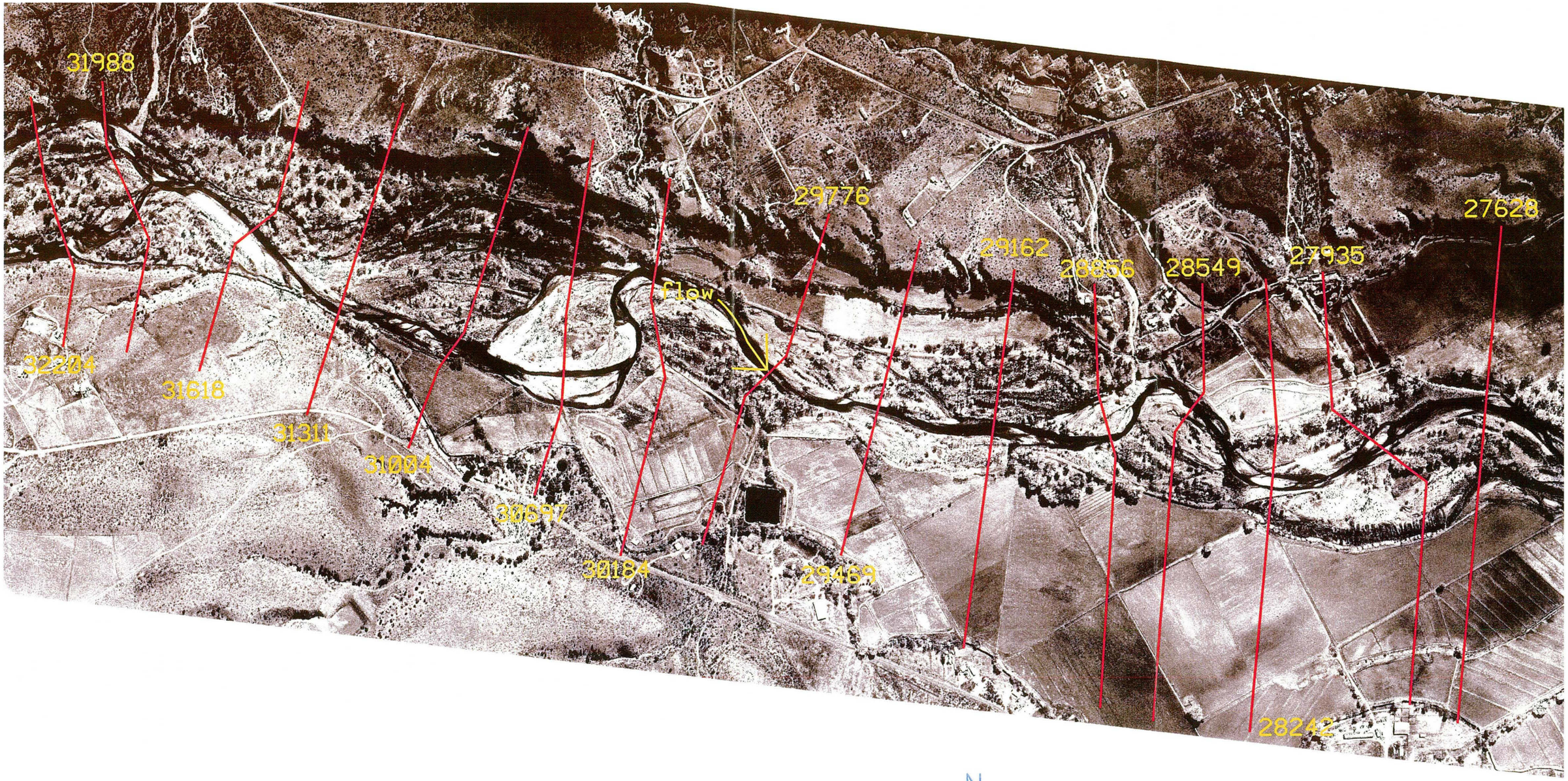
Upper Gila River
Fluvial
Geomorphology Study
Stable Channel Analysis
New Mexico

Plate 6



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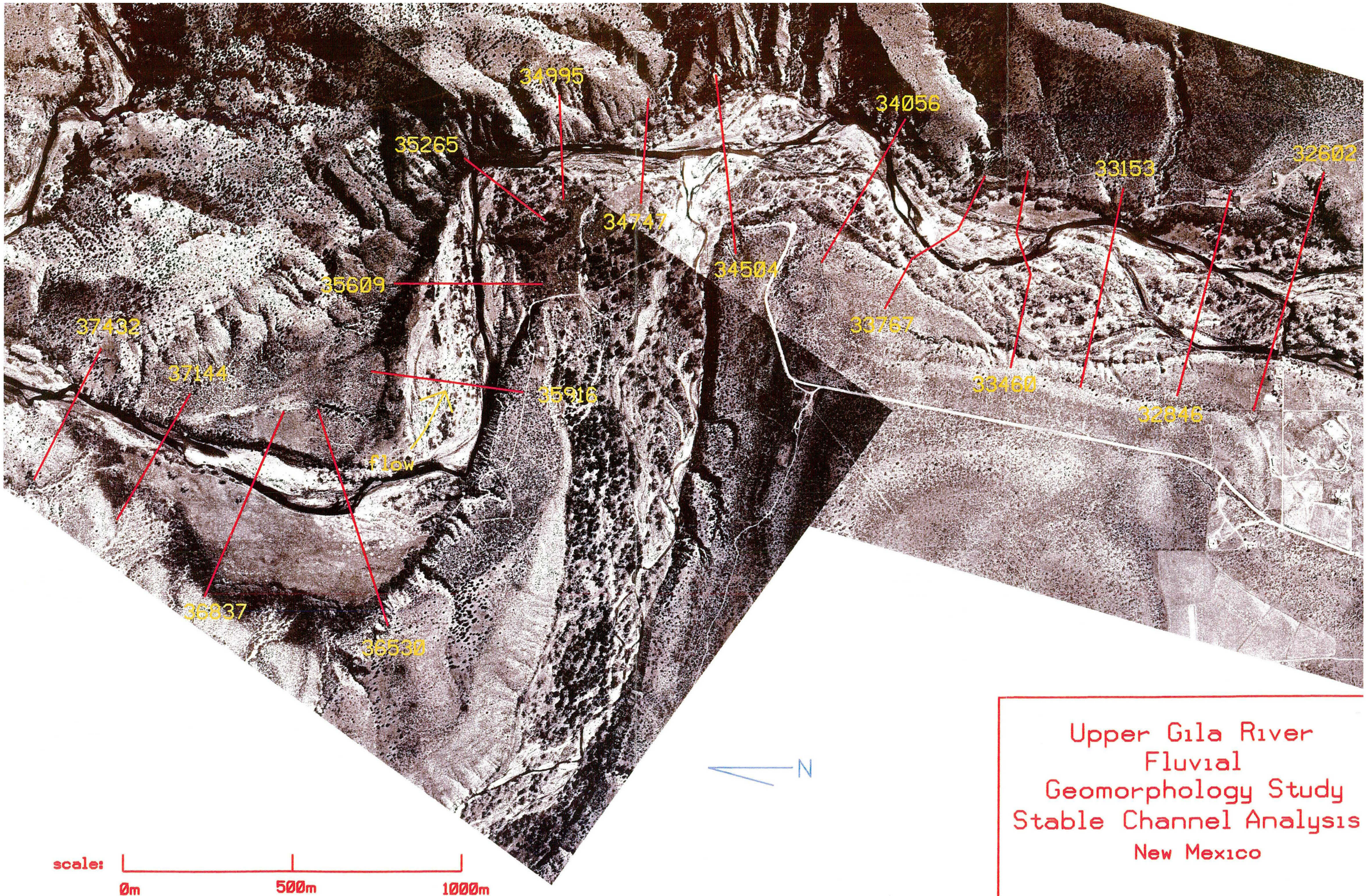
Upper Gila River Fluvial Geomorphology Study Stable Channel Analysis

New Mexico

Plate 7



Upper Gila River
Fluvial
Geomorphology Study
Stable Channel Analysis
New Mexico

Plate 8

APPENDIX B

SUMMARY OF BED MATERIAL SAMPLING LOCATIONS

Sample	Date	UTC	Description	Latitude	Longitude	Northing (m)	Easting (m)	State	Type	Depth	Location
1	12/13/00	2131	DS Valley Canal Diversion	N32°41.339'	W109°01.333'	3,618,347	685,421	NM	Grab	S-6 in	REW
1A	12/13/00	2134	DS Valley Canal Diversion	do	do	do	do	NM	Grab	S-3 in	Bar
2	12/13/00	2217	US Valley Canal Diversion	N32°41.389'	W109°00.216'	3,618,472	687,165	NM	Grab	S-4 in	Bar
3	12/13/00	2321	DS Sunset Ditch Diversion	N32°38.554'	W108°55.348'	3,613,379	694,875	NM	Grab	S-4 in	Bar
3A	12/13/00	2328	DS Sunset Ditch Diversion	do	do	do	do	NM	Grab	S-4 in	REW
4	12/13/00	2350	US Sunset Ditch Diversion	N32°38.430'	W108°55.234'	3,613,154	695,058	NM	Grab	S-5 in	
5	12/13/00	0026	DS Sunset Ditch Diversion	N32°39.171'	W108°55.826'	3,614,505	694,106	NM	Grab	S-6 in	Bar
5A	12/13/00	0030	Right Bank Tributary Delta opposite Sample 5	do	do	do	do	NM	Photo		REW
6	12/14/00	1545	US Virden Bridge	N32°39.292'	W108°57.173'	3,614,688	691,996	NM	Grab	S-6 in	Midbar
6A	12/14/00	1545	Left Bank Tributary Delta US of Virden Bridge	N32°39.273'	W108°57.294'	3,614,649	691,807	NM	Photo	S-6i n	
6B	12/14/00	1545	do	do	do	do	do	NM	Photo	S-6 in	
7	12/14/00	1558	DS Virden Bridge	N32°39.364'	W108°57.427'	3,614,813	691,596	NM	Grab	S-6 in	Midbar
7A	12/14/00	1558	DS Virden Bridge	do	do	do	do	NM	Photo		Midbar
8	12/14/00	1630	US Model Canal Diversion	N32°39.777'	W108°58.437'	3,615,546	690,002	NM	Grab	S-6 in	Midbar
8A	12/14/00	1625	Right Bank Trib. Delta US Model Canal Diversion	N32°39.803'	W108°58.459'	3,615,593	689,967	NM	Photo		REW
9	12/14/00	1700	DS Mode l Canal Diversion	N32°40.088'	W108°58.945'	3,616,106	689,197	NM	Grab	S-6 in	REW Midbar
9A	12/14/00	1700	do	do	do	do	do	NM	Photo		do
9B	12/14/00	1706	do	N32°40.095'	W108°58.960'	3,616,118	689,174	NM	Photo		do
9C	12/14/00	1706	do	do	do	do	do	NM	Photo		do
10	12/14/00	1755	State Line	N32°41.203'	W109°02.898'	3,618,051	682,980	AZ	Grab	S-6 in	LEW
10A	12/14/00	1751	do	N32°41.214'	W109°02.909'	3,618,071	682,963	AZ	Photo		REW
51	12/18/00	1645	DS Hooker Dam Site @ USGS Gage	N33°03.671'	W108°32.276'	3,660,574	729,871	NM	Grab	S-4 in	REW
51A	12/18/00	1645	do	do	do	do	do	NM	Photo		REW
51B	12/18/00	1645	do	do	do	do	do	NM	Photo		REW
51C	12/18/00	1645	do	do	do	do	do	NM	Photo		Bed
52	12/18/00	1709	¼ mi. DS Hooker Dam Site & USGS Gage	N33°03.379'	W108°32.447'	3,660,028	729,618	NM	Grab	S-4 in	Midbar
53	12/18/00	1817	DS Shelley Ditch Diversion	N33°01.411'	W108°32.267'	3,656,397	729,983	NM	Grab	S-2 in	REW
53A	12/18/00	1817	do	do	do	do	do	NM	Photo		
53B	12/18/00	1817	do	do	do	do	do	NM	Photo		
54	12/18/00	1833	US Shelley Ditch Diversion	N33°01.674'	W108°32.196'	3,656,886	730,082	NM	Grab	S-5 in	Midbar
55	12/18/00	1948	DS Seeds of Change	N33°00.835'	W108°33.008'	3,655,305	728,854	NM	Grab	S-4 in	
55A	12/18/00	1948	do	do	do	do	do	NM	Photo		
55B	12/18/00	1948	do	do	do	do	do	NM	Photo		
55C	12/18/00	1948	do	do	do	do	do	NM	Photo		
56	12/18/00	2015	US 211 Bridge	N32°58.175'	W108°35.219'	3,650,309	725,524	NM	Grab	S-5 in	REW
57	12/18/00	2023	DS 211 Bridge	N32°58.140'	W108°35.269'	3,650,243	725,447	NM	Grab	S-5 in	Midbar

Sample	Date	UTC	Description	Latitude	Longitude	Northing (m)	Easting (m)	State	Type	Depth	Location
58	12/18/00	2056	Riverside	N32°55.674'	W108°35.776'	3,645,667	724,761	NM	Grab	S-6 in	LEW
58A	12/18/00	2056	do	do	do	do	do	NM	Photo		LEW
58B	12/18/00	2056	do	do	do	do	do	NM	Photo		LEW
58C	12/18/00	2056	do	do	do	do	do	NM	Photo		LEW
59	12/18/00	2110	Bill Evans DS Greenwood	N32°54.596'	W108°35.679'	3,643,678	724,958	NM	Grab	S-3 in	LEW
60	12/18/00	2122	US Bill Evans	N32°53.795'	W108°35.842'	3,642,192	724,738	NM	Grab	S-6 in	
61	12/18/00	2200	River Vista	N32°49.949'	W108°36.697'	3,635,053	723,565	NM	Grab	S-5 in	Midbar
62	12/18/00	2227	Mouth of Ira Canyon	N32°48.806'	W108°36.169'	3,632,959	724,437	NM	Grab	S-6 in	
62A	12/18/00	2227	do	do	do	do	do	NM	Photo		
62B	12/18/00	2227	do	do	do	do	do	NM	Photo		
63	12/18/00	2300	Cherokee Canyon	N32°51.304'	W108°35.394'	3,637,604	725,541	NM	Grab	S-6 in	Midbar
64	12/18/00	2325	DS Iron Bridge	N32°56.240'	W108°36.254'	3,646,696	723,992	NM	Grab	S-6 in	Point Bar
65	12/18/00	2348	US Iron Bridge/DS 180 Bridge	N32°56.563'	W108°36.555'	3,647,282	723,510	NM	Grab	S-6 in	LEW
65A	12/18/00	2348	do	do	do	do	do	NM	Photo		
65B	12/18/00	2348	do	do	do	do	do	NM	Photo		
66	12/18/00	0005	US 180 Bridge	N32°56.824'	W108°36.420'	3,647,769	723,709	NM	Grab	S-6 in	LEW
66A	12/18/00	0005	do	do	do	do	do	NM	Photo		LEW
67	12/19/00	1542	Nichols Canyon	N32°39.073'	W108°50.588'	3,614,487	702,299	NM	Grab	S-3 in	LEW
67A	12/19/00	1542	do	do	do	do	do	NM	Photo		LEW
67B	12/19/00	1542	do	do	do	do	do	NM	Photo		LEW
67C	12/19/00	1542	do	do	do	do	do	NM	Photo		LEW
68	12/19/00	1643	US Redrock Bridge	N32°41.713'	W108°44.014'	3,619,580	712,474	NM	Grab	S-5 in	REW Point Bar
69	12/19/00	1656	DS Redrock Bridge	N32°41.597'	W108°43.979'	3,619,367	712,533	NM	Grab	S-5 in	REW
69A	12/19/00	1656	do	do	do	do	do	NM	Photo		REW
69B	12/19/00	1656	do	do	do	do	do	NM	Photo		REW
70	12/19/00	1808	Conner Ranch	N32°43.636'	W108°41.670'	3,623,213	716,059	NM	Grab	S-4 in	LEW
70A	12/19/00	1808	Conner Ranch	N32°43.636'	W108°41.670'	3,623,213	716,059	NM	Photo		REW
70B	12/19/00	1808	Conner Ranch	N32°43.636'	W108°41.670'	3,623,213	716,059	NM	Photo		REW
71	12/19/00	1900	Gila @ Redrock USGS gage	N32°43.592'	W108°40.706'	3,623,165	717,567	NM	Grab	S-5 in	LEW

APPENDIX C

HEC-RAS HYDRAULIC MODEL OUTPUT

Table 22. HEC-RAS output for 431.55 m^3/s.

River Sta	Q Total (m^3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m^2)	Top Width (m)	Froude # Chl
0.00	431.55	1312.89	1315.58	1315.12	1315.73	0.00300	1.73	250.86	255.70	0.55
306.98	431.55	1314.00	1316.53	1316.12	1316.74	0.00343	2.03	220.44	224.64	0.6
613.96	431.55	1315.27	1317.28		1317.35	0.00125	1.19	363.22	324.13	0.36
920.94	431.55	1316.38	1317.87		1318.00	0.00395	1.60	270.45	367.72	0.59
1227.91	431.55	1317.31	1319.21	1318.96	1319.34	0.00488	1.59	271.04	435.97	0.64
1534.89	431.55	1318.08	1320.24		1320.35	0.00233	1.46	297.37	326.66	0.48
1841.87	431.55	1317.98	1320.95	1320.39	1321.13	0.00264	1.84	240.30	265.85	0.53
2148.85	431.55	1319.39	1321.65		1321.81	0.00200	1.84	294.57	364.47	0.48
2455.83	431.55	1319.99	1322.17		1322.24	0.00104	1.15	374.89	305.46	0.33
2762.81	431.55	1320.70	1322.71		1322.93	0.00630	2.07	208.66	273.78	0.76
3069.79	431.55	1321.47	1323.86		1323.96	0.00201	1.44	335.45	430.71	0.45
3374.64	431.55	1322.02	1324.69		1324.86	0.00441	1.84	233.99	278.64	0.64
3683.74	431.55	1323.24	1325.85		1326.04	0.00329	1.91	233.79	272.24	0.58
3990.72	431.55	1323.75	1326.77		1326.92	0.00250	1.68	268.63	312.08	0.51
4297.70	431.55	1325.01	1327.57		1328.09	0.00511	3.23	148.45	127.59	0.78
4604.68	431.55	1325.66	1328.82		1329.05	0.00198	2.12	203.82	106.92	0.49
4911.66	431.55	1326.72	1329.51		1329.67	0.00202	1.75	246.13	175.13	0.47
5218.64	431.55	1326.76	1330.13		1330.36	0.00244	2.13	202.49	124.02	0.53
5525.61	431.55	1327.88	1330.84		1331.03	0.00194	1.95	221.65	130.37	0.48
5832.59	431.55	1328.69	1331.51		1331.66	0.00214	1.70	254.06	198.82	0.48
6139.57	431.55	1329.22	1332.19		1332.34	0.00229	1.73	249.38	199.09	0.49
6446.55	431.55	1330.46	1332.86		1333.00	0.00197	1.65	267.76	265.23	0.46
6753.53	431.55	1331.19	1333.49		1333.58	0.00181	1.32	326.88	329.04	0.42
7060.51	431.55	1332.31	1334.14		1334.28	0.00276	1.66	259.72	262.30	0.52
7367.49	431.55	1333.22	1335.14		1335.29	0.00403	1.67	259.25	341.25	0.61
7584.73	431.55	1333.90	1336.02		1336.14	0.00381	1.59	271.78	362.75	0.59
7981.44	431.55	1335.10	1336.97		1337.04	0.00146	1.16	401.90	562.46	0.38
8288.42	431.55	1334.58	1337.50	1337.04	1337.58	0.00217	1.23	360.90	526.24	0.45
8595.40	431.55	1336.32	1338.14		1338.21	0.00192	1.20	360.51	440.13	0.42
8783.90	431.55	1337.11	1338.74	1338.74	1339.04	0.01128	2.46	175.41	274.24	0.98
9209.36	431.55	1337.90	1339.98		1340.05	0.00095	1.15	384.73	366.97	0.32
9516.34	431.55	1338.57	1340.42		1340.54	0.00296	1.58	300.22	381.47	0.53

River Sta	Q Total (m^3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m^2)	Top Width (m)	Froude # Chl
9823.32	431.55	1339.47	1341.44		1341.60	0.00396	1.82	264.91	323.46	0.62
10128.25	431.55	1340.33	1342.29		1342.40	0.00189	1.47	323.30	436.40	0.44
10437.27	431.55	1341.30	1343.07		1343.28	0.00439	2.07	222.96	228.37	0.66
10798.08	431.55	1342.44	1344.23		1344.37	0.00216	1.71	274.46	274.17	0.48
11051.22	431.55	1343.04	1344.85		1345.02	0.00314	1.85	244.73	220.29	0.57
11370.27	431.55	1343.83	1345.67		1345.82	0.00202	1.67	258.17	198.02	0.47
11380.38	431.55	1344.03	1345.54	1345.54	1345.98	0.01110	2.92	147.74	176.34	1.02
11498.00	431.55	1344.43	1346.48	1346.15	1346.72	0.00388	2.16	203.59	201.34	0.64
11665.18	431.55	1344.78	1347.12		1347.29	0.00298	1.83	235.78	211.05	0.55
12015.90	431.55	1345.26	1347.90		1347.99	0.00143	1.36	317.61	257.16	0.39
12279.14	431.55	1345.93	1348.32		1348.46	0.00212	1.67	258.65	206.47	0.48
12586.12	431.55	1347.38	1349.14		1349.46	0.00483	2.51	173.49	146.18	0.72
12893.10	431.55	1347.76	1350.20	1349.56	1350.40	0.00205	2.00	230.05	151.70	0.49
13187.44	431.55	1348.13	1350.74		1350.90	0.00145	1.85	271.22	200.53	0.42
13507.05	431.55	1348.16	1351.29		1351.42	0.00179	1.65	285.94	218.64	0.45
13814.03	431.55	1348.86	1351.78		1351.92	0.00136	1.66	275.53	204.08	0.4
14121.01	431.55	1349.84	1352.20		1352.29	0.00111	1.32	326.84	228.52	0.35
14427.99	431.55	1350.87	1352.76		1353.05	0.00724	2.40	179.60	208.82	0.83
14734.97	431.55	1351.55	1353.92		1354.02	0.00170	1.39	321.80	374.00	0.42
15096.80	431.55	1352.40	1354.52		1354.60	0.00152	1.26	343.41	325.72	0.39
15348.92	431.55	1352.66	1354.93		1355.04	0.00199	1.49	289.95	261.82	0.45
15601.86	431.55	1350.90	1355.49	1354.91	1355.75	0.00362	2.26	192.32	165.18	0.63
15962.88	431.55	1354.16	1356.49		1356.58	0.00153	1.35	339.10	375.64	0.4
16269.86	431.55	1353.55	1356.98	1356.42	1357.05	0.00145	1.16	372.60	386.36	0.38
16576.84	431.55	1356.03	1357.58		1357.70	0.00317	1.57	275.48	327.69	0.55
17190.14	431.55	1357.54	1359.36		1359.49	0.00277	1.69	315.96	390.94	0.53
17496.63	431.55	1357.83	1360.02	1359.45	1360.12	0.00165	1.41	342.16	430.53	0.42
17804.75	431.55	1358.55	1360.51	1359.90	1360.60	0.00146	1.39	309.45	244.48	0.4
17976.90	431.55	1358.69	1360.77	1360.31	1360.97	0.00278	1.98	228.42	226.98	0.55
18143.34	431.55	1358.60	1361.21	1360.84	1361.59	0.00418	2.74	157.37	98.50	0.69
18191.00	431.55	1357.38	1361.55	1360.08	1361.67	0.00044	1.53	282.54	135.95	0.31
18200.00	Bridge									
18202.00	431.55	1357.38	1361.56	1360.07	1361.68	0.00044	1.52	284.28	266.73	0.3
18345.68	431.55	1359.46	1361.53		1361.81	0.00473	2.35	196.97	204.33	0.7

River Sta	Q Total (m^3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m^2)	Top Width (m)	Froude # Chl
18483.95	431.55	1360.06	1362.09	1361.58	1362.22	0.00192	1.60	298.24	291.29	0.45
18725.87	431.55	1360.38	1362.56	1362.02	1362.70	0.00204	1.65	284.64	317.46	0.47
18912.23	431.55	1360.48	1362.90	1362.69	1363.35	0.00487	3.00	170.40	175.05	0.75
19027.50	431.55	1359.59	1363.38	1361.71	1363.47	0.00033	1.36	317.37	121.54	0.27
19038.00	Bridge									
19039.00	431.55	1359.59	1363.41	1361.72	1363.50	0.00031	1.34	321.10	121.81	0.26
19113.93	431.55	1360.94	1363.26	1363.01	1363.66	0.00519	2.78	156.16	124.80	0.76
19339.65	431.55	1361.55	1364.22	1363.64	1364.51	0.00283	2.40	195.21	150.12	0.58
19953.60	431.55	1363.38	1365.73		1365.84	0.00168	1.47	327.45	389.48	0.42
20294.09	431.55	1364.12	1366.43		1366.65	0.00329	2.08	207.81	178.18	0.59
20567.56	431.55	1364.79	1367.33		1367.60	0.00349	2.39	231.47	401.25	0.63
20874.54	431.55	1365.85	1368.16	1367.49	1368.29	0.00153	1.63	353.07	528.44	0.42
21181.52	431.55	1366.24	1368.71	1368.35	1368.86	0.00255	1.89	397.33	666.97	0.53
21488.50	431.55	1367.42	1369.55	1369.41	1369.76	0.00320	2.31	400.64	746.65	0.6
21795.48	431.55	1368.17	1370.42		1370.58	0.00252	2.11	487.39	838.59	0.54
22102.45	431.55	1368.78	1371.12		1371.19	0.00202	1.45	628.48	989.68	0.45
22437.91	431.55	1369.68	1371.89		1372.01	0.00283	1.67	447.25	960.84	0.53
22716.41	431.55	1370.64	1372.64		1372.78	0.00339	1.93	462.76	971.71	0.59
22896.25	431.55	1371.22	1373.19	1372.99	1373.54	0.00489	2.87	229.53	1119.47	0.75
23002.00	431.55	1367.03	1373.55	1370.24	1373.61	0.00011	1.05	579.05	728.58	0.16
23015.00	Bridge									
23018.00	431.55	1367.03	1373.56	1370.25	1373.61	0.00011	1.06	511.91	731.43	0.17
23083.34	431.55	1371.66	1373.49	1373.49	1374.10	0.00908	3.53	166.77	476.11	0.99
23312.86	431.55	1372.10	1374.61	1373.69	1374.72	0.00106	1.49	413.39	732.38	0.36
23629.52	431.55	1373.36	1375.17		1375.41	0.00555	2.15	200.60	229.71	0.73
23944.33	431.55	1374.08	1376.26		1376.36	0.00190	1.42	335.55	463.43	0.44
24251.53	431.55	1375.36	1377.04		1377.20	0.00410	1.75	258.91	427.75	0.62
24561.73	431.55	1376.16	1378.02		1378.14	0.00249	1.61	356.69	637.51	0.5
24727.43	431.55	1376.31	1378.51	1378.24	1378.62	0.00333	1.53	310.10	576.39	0.55
25172.24	431.55	1378.36	1380.28	1380.10	1380.58	0.00569	2.42	189.11	251.00	0.76
25479.22	431.55	1378.94	1381.63	1381.09	1381.75	0.00265	1.52	302.09	426.97	0.5
25786.20	431.55	1380.22	1382.55		1382.72	0.00371	1.90	300.49	599.53	0.61
26122.64	431.55	1381.50	1383.59	1383.12	1383.84	0.00292	2.20	205.06	162.15	0.57
26400.15	431.55	1382.76	1384.50	1384.13	1384.66	0.00297	1.78	242.17	225.54	0.55

River Sta	Q Total (m^3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m^2)	Top Width (m)	Froude # Chl
26707.13	431.55	1384.03	1385.73		1385.92	0.00593	1.94	223.48	316.74	0.73
27014.11	431.55	1384.75	1387.01	1386.68	1387.14	0.00287	1.66	333.73	602.36	0.53
27321.09	431.55	1385.76	1387.78		1387.86	0.00226	1.37	537.22	867.01	0.46
27628.07	431.55	1386.84	1388.75	1388.49	1388.94	0.00470	1.94	222.11	255.94	0.67
27935.05	431.55	1388.30	1389.85	1389.43	1389.95	0.00237	1.42	306.45	358.02	0.48
28242.03	431.55	1389.65	1391.11	1391.11	1391.55	0.01053	2.94	153.70	195.06	1
28549.00	431.55	1390.40	1392.63	1392.15	1392.73	0.00192	1.43	328.72	548.10	0.44
28856.20	431.55	1391.67	1393.42		1393.57	0.00452	1.84	366.07	721.16	0.65
29162.96	431.55	1392.57	1394.69	1394.37	1394.82	0.00351	1.61	313.62	587.61	0.57
29469.94	431.55	1393.68	1395.85	1395.57	1396.02	0.00430	1.86	232.90	281.11	0.64
29776.92	431.55	1394.43	1396.91		1397.07	0.00276	1.76	248.34	230.38	0.53
30184.03	431.55	1396.02	1398.17		1398.29	0.00318	1.48	295.45	425.38	0.54
30697.85	431.55	1397.29	1399.42	1399.00	1399.50	0.00192	1.26	407.12	466.96	0.43
31004.83	431.55	1398.43	1400.08		1400.18	0.00267	1.37	314.24	400.32	0.49
31311.81	431.55	1399.58	1401.50	1401.50	1401.80	0.01319	2.43	177.35	316.98	1.04
31618.79	431.55	1399.78	1402.99	1402.26	1403.07	0.00195	1.29	334.32	366.95	0.43
31988.39	431.55	1401.48	1403.83		1403.96	0.00295	1.64	262.97	275.11	0.54
32033.38	431.55	1402.13	1403.93		1404.22	0.00834	2.40	180.09	232.35	0.87
32178.59	431.55	1402.50	1404.87	1404.54	1405.02	0.00379	1.72	251.61	296.62	0.59
32204.47	431.55	1402.97	1404.96		1405.12	0.00374	1.77	243.38	270.79	0.6
32602.28	431.55	1404.66	1406.52	1406.22	1406.67	0.00403	1.69	255.62	324.20	0.61
32846.70	431.55	1404.25	1407.48	1407.00	1407.67	0.00412	1.92	225.13	239.72	0.63
33153.68	431.55	1407.19	1408.72		1408.84	0.00352	1.52	284.08	381.83	0.56
33460.66	431.55	1408.05	1409.97	1409.73	1410.16	0.00519	1.91	225.66	287.13	0.69
33767.64	431.55	1409.22	1411.16		1411.31	0.00280	1.68	256.23	248.22	0.53
34056.21	431.55	1409.83	1412.17	1411.88	1412.38	0.00499	2.07	208.14	227.46	0.69
34504.09	431.55	1412.57	1414.26	1414.00	1414.43	0.00417	1.84	234.74	269.65	0.63
34747.74	431.55	1412.84	1415.15	1414.83	1415.51	0.00423	2.67	178.04	151.92	0.69
34995.55	431.55	1413.02	1416.01	1415.33	1416.30	0.00247	2.38	185.74	117.63	0.55
35265.62	431.55	1414.10	1416.80		1417.06	0.00323	2.28	204.08	194.26	0.6
35609.51	431.55	1415.17	1417.74		1417.84	0.00163	1.40	308.57	266.67	0.41
35916.49	431.55	1415.66	1418.51	1418.25	1418.75	0.00603	2.18	197.91	231.35	0.75
36530.45	431.55	1418.12	1420.65		1420.82	0.00213	1.87	266.42	315.01	0.49
36837.43	431.55	1418.91	1421.47		1421.83	0.00478	2.68	163.04	152.40	0.72

River Sta	Q Total (m^3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m^2)	Top Width (m)	Froude # Chl
37144.40	431.55	1420.28	1422.67		1423.03	0.00321	2.67	161.87	88.66	0.62
37432.39	431.55	1419.44	1423.41	1422.31	1423.68	0.00166	2.30	188.04	75.75	0.46

Table 23. HEC-RAS output for 203.03 m^3/s.

River Sta	Q Total (m^3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m^2)	Top Width (m)	Froude # Chl
0.00	203.03	1312.89	1315.06	1314.45	1315.17	0.00300	1.46	138.66	175.22	0.53
306.98	203.03	1314.00	1316.00		1316.14	0.00327	1.62	125.42	144.82	0.56
613.96	203.03	1315.27	1316.77		1316.82	0.00160	0.99	204.74	289.02	0.38
920.94	203.03	1316.38	1317.53	1317.36	1317.62	0.00466	1.31	154.47	318.25	0.60
1227.91	203.03	1317.31	1318.86	1318.55	1318.95	0.00402	1.36	149.19	260.96	0.57
1534.89	203.03	1318.08	1319.83		1319.90	0.00243	1.15	176.60	273.06	0.46
1841.87	203.03	1317.98	1320.47		1320.56	0.00190	1.36	149.68	149.51	0.43
2148.85	203.03	1319.39	1321.08		1321.18	0.00209	1.43	144.50	178.76	0.46
2455.83	203.03	1319.99	1321.61		1321.66	0.00117	0.94	215.82	260.64	0.33
2762.81	203.03	1320.70	1322.23		1322.42	0.00700	1.93	105.04	165.06	0.77
3069.79	203.03	1321.47	1323.40		1323.47	0.00200	1.18	173.39	234.72	0.43
3374.64	203.03	1322.02	1324.20		1324.34	0.00416	1.62	125.57	174.13	0.61
3683.74	203.03	1323.24	1325.29		1325.42	0.00297	1.57	128.96	144.19	0.53
3990.72	203.03	1323.75	1326.26		1326.37	0.00320	1.43	142.25	194.91	0.53
4297.70	203.03	1325.01	1327.03		1327.26	0.00248	2.12	99.64	72.32	0.53
4604.68	203.03	1325.66	1327.89		1328.06	0.00271	1.81	111.90	93.75	0.53
4911.66	203.03	1326.72	1328.77		1328.89	0.00266	1.57	129.58	133.90	0.51
5218.64	203.03	1326.76	1329.40		1329.53	0.00162	1.61	126.18	86.78	0.43
5525.61	203.03	1327.88	1330.03		1330.17	0.00266	1.67	121.45	114.00	0.52
5832.59	203.03	1328.69	1330.80		1330.91	0.00215	1.45	139.89	139.00	0.46
6139.57	203.03	1329.22	1331.47		1331.59	0.00223	1.51	134.17	128.42	0.47
6446.55	203.03	1330.46	1332.22		1332.32	0.00256	1.44	141.40	162.78	0.49
6753.53	203.03	1331.19	1333.02		1333.09	0.00234	1.13	179.69	276.82	0.45
7060.51	203.03	1332.31	1333.77		1333.85	0.00260	1.21	167.43	251.72	0.47
7367.49	203.03	1333.22	1334.72		1334.83	0.00390	1.45	140.37	220.03	0.58
7584.73	203.03	1333.90	1335.57		1335.68	0.00395	1.50	135.47	202.52	0.58
7981.44	203.03	1335.10	1336.59		1336.63	0.00158	0.91	224.11	388.73	0.37
8288.42	203.03	1334.58	1337.13	1336.66	1337.18	0.00204	1.01	201.38	336.56	0.41

River Sta	Q Total (m^3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m^2)	Top Width (m)	Froude # Chl
8595.40	203.03	1336.32	1337.78		1337.82	0.00214	0.97	209.03	378.69	0.42
8783.90	203.03	1337.11	1338.46	1338.44	1338.65	0.01155	1.95	104.19	235.21	0.93
9209.36	203.03	1337.90	1339.52		1339.55	0.00084	0.83	244.43	277.86	0.28
9516.34	203.03	1338.57	1339.97		1340.08	0.00447	1.43	145.94	288.17	0.61
9823.32	203.03	1339.47	1341.08		1341.17	0.00294	1.36	164.15	239.52	0.51
10128.25	203.03	1340.33	1341.85		1341.92	0.00207	1.14	181.52	254.33	0.43
10437.27	203.03	1341.30	1342.68		1342.79	0.00391	1.55	138.77	198.36	0.59
10798.08	203.03	1342.44	1343.75		1343.83	0.00214	1.27	165.98	202.85	0.45
11051.22	203.03	1343.04	1344.39	1344.10	1344.49	0.00339	1.44	147.50	199.99	0.55
11370.27	203.03	1343.83	1345.16		1345.24	0.00169	1.25	162.24	168.22	0.41
11380.38	203.03	1344.03	1345.20	1345.20	1345.46	0.01254	2.29	88.80	167.84	1.00
11498.00	203.03	1344.43	1346.05	1345.70	1346.17	0.00346	1.59	127.70	158.85	0.56
11665.18	203.03	1344.78	1346.59		1346.71	0.00286	1.51	134.74	156.65	0.52
12015.90	203.03	1345.26	1347.33		1347.39	0.00141	1.11	182.42	196.54	0.37
12279.14	203.03	1345.93	1347.78		1347.87	0.00227	1.32	153.29	182.26	0.46
12586.12	203.03	1347.38	1348.69		1348.86	0.00468	1.86	109.44	135.24	0.66
12893.10	203.03	1347.76	1349.62		1349.72	0.00184	1.45	143.98	141.91	0.44
13187.44	203.03	1348.13	1350.07		1350.17	0.00122	1.33	157.24	135.26	0.36
13507.05	203.03	1348.16	1350.60	1350.21	1350.71	0.00253	1.48	146.26	178.47	0.49
13814.03	203.03	1348.86	1351.18		1351.25	0.00124	1.20	170.08	159.04	0.36
14121.01	203.03	1349.84	1351.59		1351.65	0.00137	1.07	189.90	212.98	0.36
14427.99	203.03	1350.87	1352.33		1352.54	0.00835	2.04	99.52	164.59	0.84
14734.97	203.03	1351.55	1353.49		1353.54	0.00169	1.06	191.18	253.91	0.39
15096.80	203.03	1352.40	1354.05		1354.10	0.00140	0.99	205.66	264.24	0.36
15348.92	203.03	1352.66	1354.46		1354.53	0.00207	1.17	173.72	232.51	0.43
15601.86	203.03	1350.90	1354.93	1354.02	1355.08	0.00203	1.68	120.82	92.04	0.47
15962.88	203.03	1354.16	1355.87		1355.96	0.00291	1.31	155.29	226.86	0.50
16269.86	203.03	1353.55	1356.55	1356.04	1356.59	0.00153	0.93	218.72	330.24	0.36
16576.84	203.03	1356.03	1357.21		1357.29	0.00350	1.26	161.17	286.41	0.54
17190.14	203.03	1357.54	1358.99		1359.07	0.00247	1.26	183.66	317.85	0.47
17496.63	203.03	1357.83	1359.59	1359.06	1359.65	0.00154	1.05	196.92	273.33	0.38
17804.75	203.03	1358.55	1360.05	1359.64	1360.11	0.00137	1.02	199.57	241.55	0.36
17976.90	203.03	1358.69	1360.32	1359.93	1360.42	0.00231	1.41	143.57	161.18	0.47
18143.34	203.03	1358.60	1360.71	1360.33	1360.89	0.00313	1.87	108.40	97.10	0.57

River Sta	Q Total (m^3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m^2)	Top Width (m)	Froude # Chl
18191.00	203.03	1357.38	1360.89	1359.55	1360.93	0.00025	0.97	209.98	107.62	0.22
18200.00	Bridge									
18202.00	203.03	1357.38	1360.89	1359.54	1360.94	0.00025	0.96	210.65	120.77	0.22
18345.68	203.03	1359.46	1360.83	1360.83	1361.17	0.01199	2.57	79.24	125.41	1.02
18483.95	203.03	1360.06	1361.65	1361.24	1361.72	0.00184	1.18	175.12	243.93	0.41
18725.87	203.03	1360.38	1362.10	1361.63	1362.17	0.00187	1.23	165.64	196.95	0.42
18912.23	203.03	1360.48	1362.45	1362.05	1362.66	0.00318	2.02	106.01	119.31	0.58
19027.50	203.03	1359.59	1362.69	1361.24	1362.73	0.00018	0.86	235.58	115.60	0.19
19038.00	Bridge									
19039.00	203.03	1359.59	1362.70	1361.25	1362.74	0.00018	0.86	236.96	115.68	0.19
19113.93	203.03	1360.94	1362.51	1362.50	1362.89	0.01143	2.74	74.06	99.31	1.01
19339.65	203.03	1361.55	1363.67	1363.07	1363.81	0.00198	1.65	123.22	94.48	0.46
19953.60	203.03	1363.38	1365.16		1365.25	0.00282	1.30	157.95	238.45	0.50
20294.09	203.03	1364.12	1366.02		1366.12	0.00230	1.43	142.09	152.19	0.47
20567.56	203.03	1364.79	1366.67		1366.86	0.00301	1.93	105.38	88.85	0.56
20874.54	203.03	1365.85	1367.52	1367.08	1367.62	0.00200	1.37	155.06	206.27	0.44
21181.52	203.03	1366.24	1368.22	1367.88	1368.33	0.00290	1.57	169.12	340.73	0.53
21488.50	203.03	1367.42	1369.10	1368.77	1369.25	0.00301	1.84	157.58	311.00	0.56
21795.48	203.03	1368.17	1369.98		1370.13	0.00279	1.80	183.54	483.28	0.54
22102.45	203.03	1368.78	1370.75		1370.81	0.00205	1.23	306.66	692.44	0.44
22437.91	203.03	1369.68	1371.51		1371.61	0.00270	1.42	172.77	464.47	0.50
22716.41	203.03	1370.64	1372.32		1372.44	0.00347	1.60	187.73	621.90	0.57
22896.25	203.03	1371.22	1372.85	1372.54	1373.00	0.00290	1.87	153.20	575.27	0.55
23002.00	203.03	1367.03	1373.00	1369.50	1373.02	0.00004	0.58	349.59	192.99	0.10
23015.00	Bridge									
23018.00	203.03	1367.03	1373.01	1369.48	1373.03	0.00004	0.58	350.06	194.21	0.10
23083.34	203.03	1371.66	1372.96	1372.96	1373.38	0.01074	2.84	71.54	133.59	1.00
23312.86	203.03	1372.10	1373.93	1373.25	1374.00	0.00112	1.17	178.15	164.98	0.34
23629.52	203.03	1373.36	1374.60	1374.56	1374.87	0.01088	2.29	88.85	150.53	0.95
23944.33	203.03	1374.08	1375.82		1375.88	0.00147	1.09	187.81	221.14	0.37
24251.53	203.03	1375.36	1376.61	1376.47	1376.75	0.00697	1.66	122.40	242.40	0.74
24561.73	203.03	1376.16	1377.70		1377.77	0.00189	1.14	194.06	374.87	0.41
24727.43	203.03	1376.31	1378.15	1377.97	1378.24	0.00467	1.30	156.51	335.26	0.60
25172.24	203.03	1378.36	1379.91		1380.07	0.00357	1.72	119.44	138.80	0.58

River Sta	Q Total (m^3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m^2)	Top Width (m)	Froude # Chl
25479.22	203.03	1378.94	1381.00	1380.65	1381.12	0.00327	1.50	135.12	174.60	0.55
25786.20	203.03	1380.22	1382.11		1382.23	0.00397	1.56	133.71	204.10	0.59
26122.64	203.03	1381.50	1383.12	1382.70	1383.24	0.00229	1.53	133.04	128.66	0.48
26400.15	203.03	1382.76	1384.01	1383.81	1384.13	0.00476	1.54	131.63	216.98	0.63
26707.13	203.03	1384.03	1385.46		1385.56	0.00456	1.40	144.54	265.67	0.61
27014.11	203.03	1384.75	1386.63	1386.36	1386.71	0.00314	1.31	170.68	318.52	0.52
27321.09	203.03	1385.76	1387.47		1387.52	0.00247	1.13	280.79	740.05	0.46
27628.07	203.03	1386.84	1388.39	1388.06	1388.50	0.00355	1.47	138.27	196.61	0.56
27935.05	203.03	1388.30	1389.41	1389.15	1389.49	0.00297	1.21	167.76	280.95	0.50
28242.03	203.03	1389.65	1390.73	1390.66	1390.99	0.00881	2.27	90.72	138.31	0.87
28549.00	203.03	1390.40	1392.19	1391.79	1392.25	0.00232	1.15	176.84	263.95	0.45
28856.20	203.03	1391.67	1393.13	1392.97	1393.24	0.00481	1.52	167.82	584.46	0.63
29162.96	203.03	1392.57	1394.32		1394.40	0.00302	1.31	155.02	244.07	0.51
29469.94	203.03	1393.68	1395.43	1395.18	1395.55	0.00456	1.54	131.45	209.36	0.62
29776.92	203.03	1394.43	1396.48		1396.57	0.00256	1.32	153.85	202.68	0.48
30184.03	203.03	1396.02	1397.77		1397.86	0.00403	1.32	153.80	283.14	0.57
30697.85	203.03	1397.29	1399.10	1398.72	1399.14	0.00180	0.92	260.53	447.70	0.39
31004.83	203.03	1398.43	1399.71		1399.77	0.00241	1.13	179.18	281.94	0.45
31311.81	203.03	1399.58	1401.20	1401.20	1401.44	0.01301	2.13	95.32	205.94	1.00
31618.79	203.03	1399.78	1402.45	1401.65	1402.52	0.00158	1.12	181.22	209.49	0.38
31988.39	203.03	1401.48	1403.24		1403.35	0.00336	1.51	134.11	174.50	0.55
32033.38	203.03	1402.13	1403.44	1403.44	1403.73	0.01308	2.38	85.22	155.51	1.03
32178.59	203.03	1402.50	1404.47	1404.12	1404.57	0.00311	1.36	149.62	215.85	0.52
32204.47	203.03	1402.97	1404.55		1404.65	0.00263	1.34	151.16	195.74	0.49
32602.28	203.03	1404.66	1406.01	1405.81	1406.15	0.00579	1.69	120.34	200.41	0.69
32846.70	203.03	1404.25	1406.94	1406.39	1407.07	0.00263	1.55	130.61	136.16	0.51
33153.68	203.03	1407.19	1408.27	1408.17	1408.40	0.00843	1.64	123.88	286.46	0.80
33460.66	203.03	1408.05	1409.69	1409.33	1409.78	0.00277	1.31	154.58	215.85	0.50
33767.64	203.03	1409.22	1410.63		1410.74	0.00347	1.47	137.70	191.41	0.55
34056.21	203.03	1409.83	1411.71	1411.45	1411.86	0.00432	1.68	120.82	162.56	0.62
34504.09	203.03	1412.57	1413.81	1413.59	1413.94	0.00504	1.64	124.02	195.26	0.66
34747.74	203.03	1412.84	1414.70	1414.29	1414.86	0.00290	1.82	113.93	112.53	0.55
34995.55	203.03	1413.02	1415.33		1415.48	0.00208	1.72	118.09	88.54	0.48
35265.62	203.03	1414.10	1416.05		1416.26	0.00406	2.04	99.53	95.24	0.64

River Sta	Q Total (m^3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m^2)	Top Width (m)	Froude # Chl
35609.51	203.03	1415.17	1417.15		1417.22	0.00199	1.21	167.40	206.01	0.43
35916.49	203.03	1415.66	1417.89		1418.10	0.00389	2.03	99.82	93.11	0.63
36530.45	203.03	1418.12	1419.97	1419.54	1420.10	0.00275	1.58	128.24	134.89	0.52
36837.43	203.03	1418.91	1420.97		1421.16	0.00430	1.95	104.33	112.00	0.64
37144.40	203.03	1420.28	1422.02		1422.20	0.00272	1.91	106.51	83.49	0.54
37432.39	203.03	1419.44	1422.58	1421.59	1422.71	0.00122	1.59	127.51	70.65	0.38

Table 24. HEC-RAS output for 70.23 m^3/s.

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
0.00	70.23	1312.89	1314.17	1313.86	1314.28	0.00300	1.45	48.54	62.35	0.52
306.98	70.23	1314.00	1315.28		1315.40	0.00443	1.48	47.44	78.75	0.61
613.96	70.23	1315.27	1316.26	1316.00	1316.30	0.00204	0.85	82.71	176.93	0.40
920.94	70.23	1316.38	1317.22	1317.11	1317.27	0.00554	1.04	67.68	226.62	0.61
1227.91	70.23	1317.31	1318.40		1318.46	0.00282	1.06	66.07	128.41	0.47
1534.89	70.23	1318.08	1319.28		1319.34	0.00291	1.12	62.52	114.58	0.49
1841.87	70.23	1317.98	1319.78		1319.82	0.00096	0.92	76.41	81.61	0.30
2148.85	70.23	1319.39	1320.34		1320.44	0.00608	1.43	49.11	109.09	0.68
2455.83	70.23	1319.99	1321.07		1321.09	0.00104	0.70	99.68	169.91	0.29
2762.81	70.23	1320.70	1321.71		1321.89	0.01178	1.87	37.50	91.28	0.93
3069.79	70.23	1321.47	1322.84		1322.87	0.00143	0.85	82.29	133.63	0.35
3374.64	70.23	1322.02	1323.63	1323.51	1323.75	0.00760	1.51	46.40	111.69	0.75
3683.74	70.23	1323.24	1324.78		1324.83	0.00199	1.03	67.91	105.84	0.41
3990.72	70.23	1323.75	1325.38		1325.47	0.00207	1.28	54.93	64.01	0.44
4297.70	70.23	1325.01	1326.14		1326.26	0.00321	1.55	45.23	54.54	0.54
4604.68	70.23	1325.66	1327.12	1326.79	1327.22	0.00298	1.40	50.01	66.12	0.52
4911.66	70.23	1326.72	1328.11		1328.20	0.00341	1.32	53.36	86.28	0.53
5218.64	70.23	1326.76	1328.66		1328.71	0.00095	0.99	70.95	67.72	0.31
5525.61	70.23	1327.88	1329.17		1329.31	0.00536	1.69	41.48	64.69	0.67
5832.59	70.23	1328.69	1330.10		1330.16	0.00164	1.08	65.16	82.81	0.39
6139.57	70.23	1329.22	1330.73		1330.80	0.00278	1.21	58.03	91.38	0.48
6446.55	70.23	1330.46	1331.53		1331.60	0.00246	1.23	57.09	80.38	0.47
6753.53	70.23	1331.19	1332.43		1332.50	0.00348	1.13	61.99	128.18	0.52
7060.51	70.23	1332.31	1333.40		1333.44	0.00270	0.89	78.65	192.60	0.45

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
7367.49	70.23	1333.22	1334.21		1334.28	0.00273	1.17	59.89	98.28	0.48
7584.73	70.23	1333.90	1334.94		1335.04	0.00447	1.37	51.28	96.39	0.60
7981.44	70.23	1335.10	1336.09		1336.12	0.00182	0.83	84.98	173.80	0.38
8288.42	70.23	1334.58	1336.63	1335.80	1336.67	0.00170	0.86	82.12	151.74	0.37
8595.40	70.23	1336.32	1337.29		1337.33	0.00274	0.91	76.96	184.41	0.45
8783.90	70.23	1337.11	1338.14	1338.09	1338.27	0.01132	1.62	43.22	126.19	0.89
9209.36	70.23	1337.90	1339.09		1339.10	0.00076	0.55	128.36	252.91	0.25
9516.34	70.23	1338.57	1339.55		1339.63	0.00631	1.27	55.49	152.16	0.67
9823.32	70.23	1339.47	1340.68	1340.45	1340.72	0.00227	0.93	80.49	182.75	0.42
10128.25	70.23	1340.33	1341.42		1341.46	0.00262	0.89	80.24	194.49	0.44
10437.27	70.23	1341.30	1342.31		1342.36	0.00321	1.03	72.26	162.86	0.49
10798.08	70.23	1342.44	1343.33		1343.36	0.00237	0.87	83.67	187.11	0.42
11051.22	70.23	1343.04	1343.95	1343.68	1344.01	0.00293	1.07	69.72	129.15	0.48
11370.27	70.23	1343.83	1344.66		1344.69	0.00162	0.85	82.28	147.17	0.36
11380.38	70.23	1344.03	1344.92	1344.92	1345.05	0.01449	1.64	42.83	148.69	0.98
11498.00	70.23	1344.43	1345.58	1345.20	1345.64	0.00243	1.08	65.08	110.55	0.45
11665.18	70.23	1344.78	1345.99		1346.06	0.00262	1.15	60.83	98.84	0.47
12015.90	70.23	1345.26	1346.60		1346.64	0.00114	0.87	80.37	106.60	0.32
12279.14	70.23	1345.93	1347.12		1347.21	0.00489	1.30	54.17	118.35	0.61
12586.12	70.23	1347.38	1348.35	1348.12	1348.41	0.00316	1.10	64.09	130.08	0.50
12893.10	70.23	1347.76	1348.99		1349.04	0.00147	1.01	69.53	89.44	0.37
13187.44	70.23	1348.13	1349.40		1349.45	0.00126	0.90	78.20	106.96	0.34
13507.05	70.23	1348.16	1349.95	1349.47	1350.03	0.00271	1.27	55.50	82.74	0.49
13814.03	70.23	1348.86	1350.48		1350.53	0.00109	0.93	75.17	86.64	0.32
14121.01	70.23	1349.84	1350.99		1351.03	0.00282	0.95	73.80	169.80	0.46
14427.99	70.23	1350.87	1352.04		1352.12	0.00451	1.24	56.72	124.93	0.59
14734.97	70.23	1351.55	1352.80		1352.84	0.00139	0.92	76.65	109.75	0.35
15096.80	70.23	1352.40	1353.46		1353.51	0.00247	0.95	73.62	152.19	0.44
15348.92	70.23	1352.66	1354.01	1353.72	1354.05	0.00185	0.83	84.78	174.73	0.38
15601.86	70.23	1350.90	1354.27	1352.83	1354.31	0.00066	0.96	73.39	56.03	0.27
15962.88	70.23	1354.16	1355.12	1355.12	1355.30	0.01435	1.91	36.72	100.40	1.01
16269.86	70.23	1353.55	1356.13	1355.10	1356.15	0.00110	0.68	103.21	193.72	0.30
16576.84	70.23	1356.03	1356.79		1356.87	0.00745	1.25	56.37	179.42	0.71
17190.14	70.23	1357.54	1358.60		1358.63	0.00149	0.82	88.67	184.57	0.35

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
17496.63	70.23	1357.83	1359.06	1358.62	1359.09	0.00152	0.82	85.70	154.91	0.35
17804.75	70.23	1358.55	1359.60	1359.33	1359.63	0.00202	0.76	92.28	231.21	0.38
17976.90	70.23	1358.69	1359.91	1359.48	1359.95	0.00168	0.86	81.25	146.63	0.37
18143.34	70.23	1358.60	1360.20	1359.69	1360.27	0.00208	1.15	60.99	83.51	0.43
18191.00	70.23	1357.38	1360.27	1358.64	1360.29	0.00010	0.49	144.70	104.67	0.13
18200.00	Bridge									
18202.00	70.23	1357.38	1360.28	1358.64	1360.29	0.00010	0.48	144.86	104.68	0.13
18345.68	70.23	1359.46	1360.34	1360.34	1360.59	0.01326	2.19	32.03	67.19	1.01
18483.95	70.23	1360.06	1361.19	1360.85	1361.23	0.00218	0.87	80.70	174.89	0.41
18725.87	70.23	1360.38	1361.63	1361.30	1361.67	0.00155	0.83	84.84	153.38	0.36
18912.23	70.23	1360.48	1361.94	1361.56	1362.01	0.00201	1.18	59.51	76.71	0.43
19027.50	70.23	1359.59	1362.03	1360.78	1362.04	0.00007	0.44	160.49	111.25	0.12
19038.00	Bridge									
19039.00	70.23	1359.59	1362.03	1360.78	1362.04	0.00007	0.44	160.83	111.27	0.12
19113.93	70.23	1360.94	1362.08	1362.08	1362.29	0.01431	2.03	34.67	86.73	1.02
19339.65	70.23	1361.55	1363.03	1362.60	1363.08	0.00152	1.05	66.67	82.45	0.37
19953.60	70.23	1363.38	1364.51	1364.33	1364.60	0.00458	1.34	52.46	104.06	0.60
20294.09	70.23	1364.12	1365.54		1365.59	0.00199	0.96	73.33	128.60	0.40
20567.56	70.23	1364.79	1366.08		1366.16	0.00206	1.19	58.82	75.94	0.43
20874.54	70.23	1365.85	1366.89	1366.64	1366.96	0.00344	1.19	58.96	112.28	0.52
21181.52	70.23	1366.24	1367.78	1367.48	1367.84	0.00238	1.05	72.19	136.79	0.44
21488.50	70.23	1367.42	1368.57	1368.33	1368.65	0.00295	1.27	58.44	101.26	0.50
21795.48	70.23	1368.17	1369.45		1369.53	0.00278	1.26	57.86	96.29	0.49
22102.45	70.23	1368.78	1370.25		1370.32	0.00242	1.14	76.75	233.13	0.46
22437.91	70.23	1369.68	1370.98		1371.03	0.00193	1.01	69.41	109.62	0.41
22716.41	70.23	1370.64	1371.75		1371.85	0.00468	1.41	50.20	98.23	0.61
22896.25	70.23	1371.22	1372.34	1372.02	1372.41	0.00226	1.23	65.45	158.12	0.45
23002.00	70.23	1367.03	1372.42	1368.90	1372.42	0.00001	0.24	294.51	92.77	0.04
23015.00	Bridge									
23018.00	70.23	1367.03	1372.42	1368.90	1372.42	0.00001	0.24	294.59	92.77	0.04
23083.34	70.23	1371.66	1372.50	1372.50	1372.73	0.01317	2.15	32.68	70.19	1.01
23312.86	70.23	1372.10	1373.31	1372.89	1373.34	0.00108	0.80	88.15	129.25	0.31
23629.52	70.23	1373.36	1374.19	1374.19	1374.37	0.01425	1.90	37.01	101.55	1.00
23944.33	70.23	1374.08	1375.28		1375.31	0.00123	0.80	87.93	140.97	0.32

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
24251.53	70.23	1375.36	1376.07	1376.05	1376.24	0.01268	1.87	37.64	97.30	0.96
24561.73	70.23	1376.16	1377.29	1376.94	1377.32	0.00157	0.77	91.57	189.30	0.35
24727.43	70.23	1376.31	1377.74	1377.64	1377.83	0.00780	1.32	53.38	161.60	0.73
25172.24	70.23	1378.36	1379.37	1379.01	1379.43	0.00206	1.15	60.96	82.89	0.43
25479.22	70.23	1378.94	1380.37	1380.24	1380.48	0.00647	1.47	47.87	106.93	0.70
25786.20	70.23	1380.22	1381.58		1381.65	0.00250	1.20	58.65	86.80	0.46
26122.64	70.23	1381.50	1382.55	1382.33	1382.62	0.00333	1.14	61.42	121.28	0.51
26400.15	70.23	1382.76	1383.65	1383.52	1383.71	0.00476	1.12	62.80	167.90	0.58
26707.13	70.23	1384.03	1385.05		1385.12	0.00439	1.15	60.87	145.93	0.57
27014.11	70.23	1384.75	1386.16	1385.85	1386.22	0.00299	1.10	64.00	127.28	0.49
27321.09	70.23	1385.76	1387.09		1387.14	0.00297	0.98	81.64	270.33	0.47
27628.07	70.23	1386.84	1387.93	1387.68	1387.99	0.00253	1.04	67.29	124.12	0.45
27935.05	70.23	1388.30	1389.02	1388.90	1389.07	0.00531	1.04	67.85	221.01	0.60
28242.03	70.23	1389.65	1390.44	1390.27	1390.52	0.00419	1.27	55.17	110.86	0.57
28549.00	70.23	1390.40	1391.65	1391.41	1391.71	0.00354	1.06	66.43	154.33	0.51
28856.20	70.23	1391.67	1392.81		1392.87	0.00400	1.08	65.13	161.26	0.54
29162.96	70.23	1392.57	1393.87		1393.92	0.00297	1.02	68.74	147.66	0.48
29469.94	70.23	1393.68	1394.94	1394.68	1395.03	0.00427	1.28	54.86	110.29	0.58
29776.92	70.23	1394.43	1395.84		1395.91	0.00206	1.10	63.59	92.19	0.42
30184.03	70.23	1396.02	1396.96	1396.72	1397.07	0.00413	1.52	46.09	69.67	0.60
30697.85	70.23	1397.29	1398.66	1398.42	1398.69	0.00258	0.85	97.51	258.49	0.43
31004.83	70.23	1398.43	1399.33		1399.36	0.00195	0.79	88.36	201.71	0.38
31311.81	70.23	1399.58	1400.63	1400.63	1400.87	0.01277	2.15	32.70	68.80	0.99
31618.79	70.23	1399.78	1401.69	1401.17	1401.74	0.00119	0.92	76.65	96.53	0.33
31988.39	70.23	1401.48	1402.60	1402.54	1402.76	0.01050	1.74	40.37	100.51	0.88
32033.38	70.23	1402.13	1403.04		1403.20	0.00917	1.81	38.87	82.15	0.84
32178.59	70.23	1402.50	1403.95	1403.69	1404.01	0.00364	1.15	61.18	127.65	0.53
32204.47	70.23	1402.97	1404.04		1404.10	0.00269	1.05	66.98	128.03	0.46
32602.28	70.23	1404.66	1405.52	1405.39	1405.62	0.00577	1.43	48.97	103.69	0.67
32846.70	70.23	1404.25	1406.28	1405.72	1406.35	0.00176	1.13	61.89	76.46	0.40
33153.68	70.23	1407.19	1407.91	1407.91	1408.04	0.01568	1.63	43.20	161.06	1.00
33460.66	70.23	1408.05	1409.28	1408.91	1409.33	0.00188	0.89	78.78	146.79	0.39
33767.64	70.23	1409.22	1410.13	1409.98	1410.21	0.00473	1.22	57.44	133.49	0.59
34056.21	70.23	1409.83	1411.28	1410.94	1411.34	0.00332	1.17	60.26	115.43	0.51

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
34504.09	70.23	1412.57	1413.30	1413.21	1413.41	0.00680	1.45	48.47	114.82	0.71
34747.74	70.23	1412.84	1414.19	1413.80	1414.25	0.00206	1.12	62.88	89.86	0.43
34995.55	70.23	1413.02	1414.65		1414.71	0.00170	1.12	62.49	76.15	0.40
35265.62	70.23	1414.10	1415.38		1415.52	0.00605	1.65	42.52	75.56	0.70
35609.51	70.23	1415.17	1416.65		1416.69	0.00216	0.91	77.55	157.24	0.41
35916.49	70.23	1415.66	1417.30		1417.39	0.00223	1.32	53.25	62.69	0.46
36530.45	70.23	1418.12	1419.24	1419.08	1419.35	0.00490	1.48	47.30	84.45	0.63
36837.43	70.23	1418.91	1420.55	1420.07	1420.62	0.00353	1.22	57.53	107.40	0.53
37144.40	70.23	1420.28	1421.41		1421.49	0.00233	1.22	57.62	78.98	0.46
37432.39	70.23	1419.44	1421.79	1421.00	1421.84	0.00074	0.95	74.13	61.98	0.28

Table 25. HEC-RAS output for 35.11 m^3/s.

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
0.00	35.11	1312.89	1313.87	1313.63	1313.94	0.00300	1.15	30.53	55.40	0.49
306.98	35.11	1314.00	1314.98		1315.07	0.00461	1.30	27.06	56.42	0.60
613.96	35.11	1315.27	1316.06	1315.89	1316.08	0.00245	0.72	48.53	151.38	0.41
920.94	35.11	1316.38	1317.09	1317.00	1317.12	0.00499	0.85	41.52	174.80	0.55
1227.91	35.11	1317.31	1318.16		1318.20	0.00259	0.89	39.25	92.72	0.44
1534.89	35.11	1318.08	1319.03		1319.08	0.00314	0.96	36.67	90.56	0.48
1841.87	35.11	1317.98	1319.45		1319.47	0.00069	0.68	52.00	69.27	0.25
2148.85	35.11	1319.39	1320.04	1320.04	1320.18	0.01548	1.71	20.55	70.43	1.01
2455.83	35.11	1319.99	1320.88		1320.89	0.00086	0.51	68.24	162.06	0.25
2762.81	35.11	1320.70	1321.47	1321.47	1321.64	0.01497	1.81	19.37	59.31	1.01
3069.79	35.11	1321.47	1322.61	1322.26	1322.63	0.00133	0.66	53.12	119.59	0.32
3374.64	35.11	1322.02	1323.29		1323.43	0.00650	1.68	20.85	37.99	0.73
3683.74	35.11	1323.24	1324.44		1324.49	0.00205	0.92	38.26	73.01	0.40
3990.72	35.11	1323.75	1325.05		1325.10	0.00195	1.01	34.91	55.88	0.41
4297.70	35.11	1325.01	1325.83	1325.65	1325.91	0.00365	1.23	28.43	53.52	0.54
4604.68	35.11	1325.66	1326.82	1326.55	1326.89	0.00279	1.11	31.57	56.40	0.47
4911.66	35.11	1326.72	1327.77		1327.84	0.00345	1.19	29.46	55.84	0.52
5218.64	35.11	1326.76	1328.29		1328.32	0.00088	0.75	47.01	64.48	0.28
5525.61	35.11	1327.88	1328.82		1328.95	0.00725	1.57	22.31	48.81	0.74
5832.59	35.11	1328.69	1329.77		1329.81	0.00145	0.86	40.64	65.51	0.35

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
6139.57	35.11	1329.22	1330.37		1330.43	0.00298	1.11	31.64	59.71	0.49
6446.55	35.11	1330.46	1331.25	1331.04	1331.30	0.00264	0.98	35.83	74.86	0.45
6753.53	35.11	1331.19	1332.20	1331.98	1332.25	0.00367	0.98	35.90	96.35	0.51
7060.51	35.11	1332.31	1333.20	1333.02	1333.23	0.00279	0.77	45.50	142.26	0.44
7367.49	35.11	1333.22	1333.98		1334.02	0.00239	0.91	38.74	84.64	0.43
7584.73	35.11	1333.90	1334.71		1334.78	0.00539	1.16	30.26	83.92	0.62
7981.44	35.11	1335.10	1335.87		1335.89	0.00169	0.68	51.58	133.67	0.35
8288.42	35.11	1334.58	1336.23	1335.46	1336.26	0.00087	0.79	44.61	56.24	0.28
8595.40	35.11	1336.32	1336.91	1336.91	1337.02	0.01636	1.48	23.68	104.72	1.00
8783.90	35.11	1337.11	1338.13	1337.77	1338.16	0.00306	0.85	41.53	121.15	0.46
9209.36	35.11	1337.90	1338.86		1338.87	0.00105	0.47	74.23	232.05	0.27
9516.34	35.11	1338.57	1339.42		1339.46	0.00418	0.93	37.78	120.82	0.53
9823.32	35.11	1339.47	1340.47		1340.50	0.00278	0.78	45.53	154.83	0.44
10128.25	35.11	1340.33	1341.24		1341.27	0.00224	0.72	49.40	146.42	0.39
10437.27	35.11	1341.30	1342.11		1342.15	0.00373	0.87	42.36	133.55	0.50
10798.08	35.11	1342.44	1343.17		1343.19	0.00222	0.65	55.40	177.11	0.38
11051.22	35.11	1343.04	1343.75	1343.54	1343.78	0.00270	0.82	45.16	112.29	0.44
11370.27	35.11	1343.83	1344.45	1344.25	1344.47	0.00174	0.67	52.35	141.97	0.35
11380.38	35.11	1344.03	1344.77	1344.77	1344.89	0.01933	1.48	23.80	120.17	1.06
11498.00	35.11	1344.43	1345.34		1345.37	0.00171	0.83	42.24	81.76	0.37
11665.18	35.11	1344.78	1345.65		1345.70	0.00222	1.03	33.93	57.44	0.43
12015.90	35.11	1345.26	1346.27		1346.29	0.00134	0.75	47.02	88.84	0.33
12279.14	35.11	1345.93	1346.91		1346.98	0.00667	1.16	30.28	98.71	0.67
12586.12	35.11	1347.38	1348.18	1347.86	1348.21	0.00271	0.82	42.98	120.66	0.44
12893.10	35.11	1347.76	1348.71		1348.74	0.00118	0.76	46.00	76.45	0.31
13187.44	35.11	1348.13	1349.09		1349.12	0.00147	0.76	46.35	91.92	0.34
13507.05	35.11	1348.16	1349.60		1349.65	0.00174	1.04	33.63	46.72	0.39
13814.03	35.11	1348.86	1350.05		1350.09	0.00119	0.84	42.02	61.20	0.32
14121.01	35.11	1349.84	1350.61		1350.67	0.00334	1.08	32.40	69.54	0.51
14427.99	35.11	1350.87	1351.70		1351.77	0.00390	1.18	29.82	63.52	0.55
14734.97	35.11	1351.55	1352.49		1352.52	0.00164	0.77	45.53	95.49	0.36
15096.80	35.11	1352.40	1353.22		1353.25	0.00254	0.83	42.54	111.77	0.43
15348.92	35.11	1352.66	1353.80	1353.55	1353.82	0.00202	0.70	50.34	143.46	0.38
15601.86	35.11	1350.90	1353.97	1352.30	1353.99	0.00033	0.61	57.72	50.95	0.18

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
15962.88	35.11	1354.16	1354.90	1354.90	1355.07	0.01576	1.81	19.39	61.75	1.03
16269.86	35.11	1353.55	1355.73	1354.68	1355.75	0.00082	0.68	51.81	78.06	0.27
16576.84	35.11	1356.03	1356.58	1356.58	1356.68	0.01657	1.45	24.14	110.98	1.00
17190.14	35.11	1357.54	1358.43	1358.10	1358.44	0.00114	0.59	60.06	151.38	0.29
17496.63	35.11	1357.83	1358.81	1358.43	1358.83	0.00140	0.68	51.62	116.36	0.33
17804.75	35.11	1358.55	1359.39	1359.17	1359.41	0.00258	0.74	47.55	149.66	0.42
17976.90	35.11	1358.69	1359.67	1359.30	1359.69	0.00112	0.68	51.61	98.25	0.30
18143.34	35.11	1358.60	1359.86	1359.44	1359.91	0.00143	0.94	37.35	52.35	0.36
18191.00	35.11	1357.38	1359.91	1358.27	1359.92	0.00006	0.33	107.53	100.91	0.10
18200.00	Bridge									
18202.00	35.11	1357.38	1359.91	1358.27	1359.92	0.00006	0.33	107.60	100.92	0.10
18345.68	35.11	1359.46	1360.08	1360.08	1360.29	0.01392	2.01	17.44	43.20	1.01
18483.95	35.11	1360.06	1360.91	1360.69	1360.95	0.00229	0.80	43.62	110.19	0.41
18725.87	35.11	1360.38	1361.40	1361.13	1361.42	0.00169	0.68	51.81	134.85	0.35
18912.23	35.11	1360.48	1361.69	1361.27	1361.73	0.00159	0.85	41.28	73.02	0.36
19027.50	35.11	1359.59	1361.74	1360.51	1361.75	0.00004	0.27	129.13	109.39	0.08
19038.00	Bridge									
19039.00	35.11	1359.59	1361.74	1360.51	1361.75	0.00004	0.27	129.26	109.39	0.08
19113.93	35.11	1360.94	1361.91	1361.91	1362.05	0.01480	1.69	20.78	70.01	0.99
19339.65	35.11	1361.55	1362.75	1362.42	1362.78	0.00135	0.79	44.44	77.34	0.33
19953.60	35.11	1363.38	1364.25	1364.14	1364.33	0.00611	1.23	28.60	80.10	0.66
20294.09	35.11	1364.12	1365.32	1365.03	1365.35	0.00175	0.75	46.97	108.32	0.36
20567.56	35.11	1364.79	1365.79		1365.83	0.00175	0.93	37.56	61.94	0.38
20874.54	35.11	1365.85	1366.59	1366.44	1366.66	0.00458	1.14	30.87	78.15	0.58
21181.52	35.11	1366.24	1367.56	1367.13	1367.59	0.00215	0.84	43.64	113.03	0.40
21488.50	35.11	1367.42	1368.34	1368.14	1368.39	0.00318	1.00	35.76	91.96	0.49
21795.48	35.11	1368.17	1369.20		1369.25	0.00247	0.98	36.04	76.17	0.44
22102.45	35.11	1368.78	1369.96		1370.01	0.00253	1.00	35.15	69.36	0.45
22437.91	35.11	1369.68	1370.67		1370.71	0.00177	0.85	41.44	79.91	0.38
22716.41	35.11	1370.64	1371.50	1371.39	1371.58	0.00652	1.24	28.24	81.47	0.67
22896.25	35.11	1371.22	1372.11	1371.84	1372.15	0.00183	0.90	40.63	85.27	0.39
23002.00	35.11	1367.03	1372.15	1368.53	1372.15	0.00000	0.13	269.79	91.46	0.02
23015.00	Bridge									
23018.00	35.11	1367.03	1372.15	1368.57	1372.15	0.00000	0.13	269.89	91.47	0.02

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
23083.34	35.11	1371.66	1372.27	1372.27	1372.45	0.01474	1.85	18.94	55.30	1.01
23312.86	35.11	1372.10	1373.06	1372.70	1373.08	0.00109	0.62	56.90	122.60	0.29
23629.52	35.11	1373.36	1374.00	1374.00	1374.14	0.01586	1.68	20.93	74.92	1.01
23944.33	35.11	1374.08	1375.02		1375.04	0.00113	0.64	54.97	115.59	0.30
24251.53	35.11	1375.36	1375.86	1375.86	1376.01	0.01572	1.69	20.80	73.41	1.01
24561.73	35.11	1376.16	1377.08	1376.76	1377.10	0.00147	0.64	55.13	142.64	0.33
24727.43	35.11	1376.31	1377.51	1377.43	1377.61	0.00853	1.35	26.02	81.08	0.76
25172.24	35.11	1378.36	1379.11	1378.84	1379.14	0.00184	0.87	40.27	76.53	0.38
25479.22	35.11	1378.94	1380.14	1380.07	1380.23	0.00896	1.37	25.70	81.59	0.78
25786.20	35.11	1380.22	1381.28		1381.33	0.00189	0.96	36.64	61.66	0.40
26122.64	35.11	1381.50	1382.27	1382.16	1382.34	0.00550	1.12	31.33	93.00	0.62
26400.15	35.11	1382.76	1383.52	1383.36	1383.56	0.00356	0.82	42.77	146.03	0.48
26707.13	35.11	1384.03	1384.81		1384.87	0.00522	1.08	32.41	97.35	0.60
27014.11	35.11	1384.75	1385.91	1385.62	1385.95	0.00249	0.94	37.30	79.43	0.44
27321.09	35.11	1385.76	1386.83		1386.88	0.00371	0.95	37.02	107.82	0.51
27628.07	35.11	1386.84	1387.74	1387.55	1387.77	0.00231	0.80	44.02	113.46	0.41
27935.05	35.11	1388.30	1388.86	1388.78	1388.90	0.00674	0.95	36.97	163.95	0.64
28242.03	35.11	1389.65	1390.28	1390.12	1390.32	0.00338	0.93	37.80	102.98	0.49
28549.00	35.11	1390.40	1391.39	1391.17	1391.44	0.00393	1.03	34.18	89.65	0.53
28856.20	35.11	1391.67	1392.58		1392.63	0.00375	1.00	35.14	92.80	0.52
29162.96	35.11	1392.57	1393.64		1393.69	0.00316	0.89	39.24	107.79	0.47
29469.94	35.11	1393.68	1394.65	1394.36	1394.72	0.00355	1.20	29.21	56.21	0.53
29776.92	35.11	1394.43	1395.44		1395.49	0.00185	1.03	34.06	50.48	0.40
30184.03	35.11	1396.02	1396.63	1396.50	1396.72	0.00566	1.37	25.54	57.07	0.66
30697.85	35.11	1397.29	1398.49	1398.28	1398.51	0.00243	0.70	58.25	199.68	0.40
31004.83	35.11	1398.43	1399.12		1399.14	0.00186	0.68	51.91	146.01	0.36
31311.81	35.11	1399.58	1400.30	1400.30	1400.53	0.01312	2.13	16.48	35.79	1.00
31618.79	35.11	1399.78	1401.37	1400.83	1401.40	0.00116	0.73	47.78	82.27	0.31
31988.39	35.11	1401.48	1402.35	1402.35	1402.51	0.01476	1.77	19.80	61.87	1.00
32033.38	35.11	1402.13	1402.88	1402.81	1402.97	0.00728	1.32	26.52	75.23	0.71
32178.59	35.11	1402.50	1403.68	1403.52	1403.74	0.00396	1.06	33.13	82.95	0.54
32204.47	35.11	1402.97	1403.78		1403.82	0.00249	0.91	38.58	86.25	0.43
32602.28	35.11	1404.66	1405.30	1405.21	1405.38	0.00705	1.24	28.24	86.21	0.69
32846.70	35.11	1404.25	1405.96	1405.42	1406.00	0.00125	0.87	40.34	57.64	0.33

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
33153.68	35.11	1407.19	1407.77	1407.77	1407.88	0.01847	1.44	24.31	122.37	1.03
33460.66	35.11	1408.05	1409.04	1408.73	1409.07	0.00161	0.73	47.99	107.19	0.35
33767.64	35.11	1409.22	1409.91	1409.82	1409.98	0.00685	1.14	30.81	105.00	0.67
34056.21	35.11	1409.83	1411.02	1410.73	1411.07	0.00238	0.98	35.68	68.65	0.44
34504.09	35.11	1412.57	1413.06	1413.04	1413.17	0.01290	1.47	23.83	89.05	0.91
34747.74	35.11	1412.84	1413.94	1413.62	1413.98	0.00145	0.82	42.92	75.27	0.35
34995.55	35.11	1413.02	1414.32		1414.36	0.00161	0.89	39.38	65.12	0.37
35265.62	35.11	1414.10	1415.09	1414.99	1415.21	0.00766	1.51	23.30	56.77	0.75
35609.51	35.11	1415.17	1416.36		1416.40	0.00194	0.84	41.84	87.73	0.39
35916.49	35.11	1415.66	1416.96		1417.01	0.00210	1.05	33.28	52.37	0.42
36530.45	35.11	1418.12	1418.98	1418.89	1419.07	0.00611	1.30	27.10	69.99	0.66
36837.43	35.11	1418.91	1420.19		1420.27	0.00273	1.27	27.67	40.08	0.49
37144.40	35.11	1420.28	1421.12	1420.92	1421.17	0.00312	1.02	34.39	76.59	0.49
37432.39	35.11	1419.44	1421.45	1420.67	1421.47	0.00051	0.66	53.56	58.68	0.22

Table 26. HEC-RAS output for 18.94 m^3/s.

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
0.00	18.94	1312.89	1313.67	1313.49	1313.72	0.00300	0.93	20.27	50.20	0.47
306.98	18.94	1314.00	1314.80		1314.86	0.00467	1.09	17.36	47.53	0.58
613.96	18.94	1315.27	1315.93	1315.80	1315.95	0.00275	0.61	30.92	134.97	0.41
920.94	18.94	1316.38	1317.00	1316.88	1317.03	0.00457	0.69	27.63	149.17	0.51
1227.91	18.94	1317.31	1318.01		1318.04	0.00244	0.72	26.21	81.51	0.41
1534.89	18.94	1318.08	1318.86		1318.90	0.00324	0.83	22.93	72.30	0.47
1841.87	18.94	1317.98	1319.22		1319.24	0.00054	0.51	37.23	62.94	0.21
2148.85	18.94	1319.39	1319.88	1319.88	1320.01	0.01669	1.61	11.73	46.37	1.02
2455.83	18.94	1319.99	1320.74		1320.75	0.00090	0.42	45.54	154.30	0.24
2762.81	18.94	1320.70	1321.33		1321.45	0.01146	1.52	12.44	40.54	0.88
3069.79	18.94	1321.47	1322.41	1322.13	1322.42	0.00144	0.59	31.88	89.74	0.32
3374.64	18.94	1322.02	1323.07		1323.17	0.00453	1.37	13.85	26.29	0.60
3683.74	18.94	1323.24	1324.18		1324.22	0.00263	0.87	21.76	54.15	0.44
3990.72	18.94	1323.75	1324.80		1324.83	0.00157	0.84	22.64	40.57	0.36
4297.70	18.94	1325.01	1325.61	1325.52	1325.68	0.00586	1.12	16.92	52.69	0.63
4604.68	18.94	1325.66	1326.65	1326.32	1326.68	0.00207	0.84	22.45	48.53	0.40

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
4911.66	18.94	1326.72	1327.51	1327.34	1327.57	0.00419	1.11	16.99	41.20	0.55
5218.64	18.94	1326.76	1328.05		1328.06	0.00080	0.60	31.72	56.96	0.26
5525.61	18.94	1327.88	1328.59	1328.54	1328.71	0.01105	1.53	12.37	38.73	0.87
5832.59	18.94	1328.69	1329.52		1329.55	0.00120	0.71	26.50	49.21	0.31
6139.57	18.94	1329.22	1330.11		1330.17	0.00393	1.05	18.08	45.88	0.53
6446.55	18.94	1330.46	1331.10	1330.94	1331.13	0.00257	0.78	24.39	70.82	0.42
6753.53	18.94	1331.19	1332.01	1331.85	1332.05	0.00353	0.89	21.27	63.79	0.49
7060.51	18.94	1332.31	1333.05	1332.86	1333.07	0.00314	0.70	27.05	106.86	0.44
7367.49	18.94	1333.22	1333.83		1333.85	0.00207	0.71	26.72	75.95	0.38
7584.73	18.94	1333.90	1334.52		1334.59	0.00608	1.17	16.13	48.17	0.65
7981.44	18.94	1335.10	1335.73		1335.74	0.00168	0.56	33.88	117.36	0.33
8288.42	18.94	1334.58	1335.97	1335.24	1335.99	0.00048	0.58	32.40	40.77	0.21
8595.40	18.94	1336.32	1336.81	1336.81	1336.90	0.01764	1.33	14.21	78.07	1.00
8783.90	18.94	1337.11	1337.85	1337.59	1337.89	0.00249	0.90	20.96	47.42	0.43
9209.36	18.94	1337.90	1338.69		1338.70	0.00148	0.46	41.31	175.16	0.30
9516.34	18.94	1338.57	1339.30		1339.33	0.00298	0.74	25.44	88.11	0.44
9823.32	18.94	1339.47	1340.31		1340.34	0.00364	0.75	25.36	101.37	0.48
10128.25	18.94	1340.33	1341.07		1341.09	0.00175	0.64	30.05	89.24	0.35
10437.27	18.94	1341.30	1341.94	1341.81	1341.98	0.00567	0.89	22.47	91.70	0.59
10798.08	18.94	1342.44	1343.05		1343.07	0.00180	0.54	36.79	133.95	0.34
11051.22	18.94	1343.04	1343.60	1343.41	1343.62	0.00331	0.68	28.99	105.93	0.45
11370.27	18.94	1343.83	1344.33	1344.17	1344.35	0.00163	0.52	36.57	138.88	0.32
11380.38	18.94	1344.03	1344.69	1344.69	1344.77	0.01837	1.29	14.68	87.25	1.00
11498.00	18.94	1344.43	1345.14		1345.16	0.00131	0.68	28.06	60.56	0.32
11665.18	18.94	1344.78	1345.42		1345.46	0.00254	0.87	21.67	52.25	0.43
12015.90	18.94	1345.26	1346.07	1345.80	1346.09	0.00131	0.61	30.83	77.05	0.31
12279.14	18.94	1345.93	1346.73		1346.80	0.00773	1.16	16.30	59.12	0.71
12586.12	18.94	1347.38	1347.94	1347.74	1347.98	0.00228	0.80	23.71	60.41	0.41
12893.10	18.94	1347.76	1348.47		1348.49	0.00125	0.65	28.96	63.36	0.31
13187.44	18.94	1348.13	1348.90		1348.92	0.00170	0.65	29.20	81.39	0.35
13507.05	18.94	1348.16	1349.34		1349.38	0.00121	0.83	22.91	34.47	0.32
13814.03	18.94	1348.86	1349.77		1349.80	0.00155	0.75	25.28	53.05	0.35
14121.01	18.94	1349.84	1350.45	1350.31	1350.49	0.00352	0.89	21.32	64.11	0.49
14427.99	18.94	1350.87	1351.54		1351.59	0.00364	0.94	20.05	56.45	0.51

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
14734.97	18.94	1351.55	1352.32		1352.34	0.00178	0.63	29.94	89.74	0.35
15096.80	18.94	1352.40	1353.05		1353.08	0.00233	0.71	26.50	80.97	0.40
15348.92	18.94	1352.66	1353.64	1353.36	1353.66	0.00219	0.62	30.33	108.49	0.38
15601.86	18.94	1350.90	1353.73	1351.95	1353.74	0.00013	0.41	46.37	36.58	0.12
15962.88	18.94	1354.16	1354.70	1354.70	1354.88	0.01556	1.88	10.10	30.20	1.04
16269.86	18.94	1353.55	1355.33	1354.40	1355.34	0.00050	0.60	31.79	40.24	0.21
16576.84	18.94	1356.03	1356.47	1356.47	1356.56	0.01757	1.34	14.16	77.11	1.00
17190.14	18.94	1357.54	1358.28	1357.97	1358.30	0.00110	0.47	40.16	130.53	0.27
17496.63	18.94	1357.83	1358.61	1358.30	1358.63	0.00104	0.57	32.97	76.58	0.28
17804.75	18.94	1358.55	1359.18	1359.07	1359.21	0.00433	0.81	23.40	94.57	0.52
17976.90	18.94	1358.69	1359.49	1359.19	1359.51	0.00091	0.53	35.69	84.53	0.26
18143.34	18.94	1358.60	1359.65	1359.27	1359.68	0.00109	0.70	26.96	47.79	0.30
18191.00	18.94	1357.38	1359.68	1358.03	1359.69	0.00004	0.22	84.67	97.76	0.08
18200.00	Bridge									
18202.00	18.94	1357.38	1359.71	1358.03	1359.71	0.00004	0.22	87.35	98.81	0.07
18345.68	18.94	1359.46	1359.91	1359.91	1360.07	0.01535	1.75	10.84	35.76	1.01
18483.95	18.94	1360.06	1360.75	1360.58	1360.78	0.00247	0.69	27.42	92.23	0.40
18725.87	18.94	1360.38	1361.25	1360.98	1361.26	0.00162	0.58	32.85	105.27	0.33
18912.23	18.94	1360.48	1361.50	1361.07	1361.53	0.00122	0.67	28.35	59.21	0.31
19027.50	18.94	1359.59	1361.53	1360.24	1361.53	0.00002	0.18	106.29	108.01	0.06
19038.00	Bridge									
19039.00	18.94	1359.59	1361.56	1360.24	1361.56	0.00002	0.17	109.24	108.19	0.06
19113.93	18.94	1360.94	1361.76	1361.76	1361.88	0.01561	1.56	12.14	47.99	0.99
19339.65	18.94	1361.55	1362.56	1362.26	1362.58	0.00126	0.62	30.46	72.40	0.31
19953.60	18.94	1363.38	1364.08	1364.02	1364.15	0.00739	1.14	16.66	60.47	0.69
20294.09	18.94	1364.12	1365.16		1365.18	0.00161	0.61	30.92	90.49	0.33
20567.56	18.94	1364.79	1365.58		1365.61	0.00152	0.73	25.88	55.36	0.34
20874.54	18.94	1365.85	1366.40	1366.31	1366.46	0.00637	1.09	17.43	60.54	0.65
21181.52	18.94	1366.24	1367.36	1366.94	1367.39	0.00175	0.73	26.03	62.48	0.36
21488.50	18.94	1367.42	1368.15	1368.01	1368.20	0.00433	0.92	20.62	69.02	0.54
21795.48	18.94	1368.17	1369.04		1369.07	0.00201	0.75	25.24	64.38	0.38
22102.45	18.94	1368.78	1369.74		1369.78	0.00274	0.87	21.87	56.67	0.44
22437.91	18.94	1369.68	1370.50		1370.52	0.00183	0.68	27.68	75.58	0.36
22716.41	18.94	1370.64	1371.35	1371.24	1371.41	0.00651	1.07	17.65	63.46	0.65

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
22896.25	18.94	1371.22	1371.94	1371.71	1371.96	0.00175	0.70	27.29	74.31	0.36
23002.00	18.94	1367.03	1371.96	1368.19	1371.96	0.00000	0.07	252.78	90.46	0.01
23015.00	Bridge									
23018.00	18.94	1367.03	1371.99	1368.19	1371.99	0.00000	0.07	255.01	90.64	0.01
23083.34	18.94	1371.66	1372.08	1372.08	1372.23	0.01466	1.73	10.95	35.38	0.99
23312.86	18.94	1372.10	1372.88	1372.57	1372.89	0.00114	0.53	35.83	100.69	0.28
23629.52	18.94	1373.36	1373.82	1373.82	1373.97	0.01546	1.72	11.02	37.26	1.01
23944.33	18.94	1374.08	1374.85	1374.59	1374.86	0.00113	0.52	36.52	104.59	0.28
24251.53	18.94	1375.36	1375.76	1375.76	1375.86	0.01695	1.40	13.53	66.98	0.99
24561.73	18.94	1376.16	1376.90	1376.64	1376.92	0.00140	0.55	34.32	105.47	0.31
24727.43	18.94	1376.31	1377.34	1377.27	1377.42	0.00911	1.30	14.56	50.36	0.77
25172.24	18.94	1378.36	1378.93	1378.73	1378.96	0.00178	0.69	27.45	72.35	0.36
25479.22	18.94	1378.94	1380.00	1379.95	1380.07	0.01065	1.22	15.52	66.38	0.81
25786.20	18.94	1380.22	1381.05		1381.08	0.00156	0.78	24.27	48.07	0.35
26122.64	18.94	1381.50	1382.09	1382.03	1382.16	0.00950	1.18	16.11	67.03	0.77
26400.15	18.94	1382.76	1383.42	1383.25	1383.44	0.00270	0.65	29.00	113.37	0.41
26707.13	18.94	1384.03	1384.64	1384.55	1384.70	0.00684	1.06	17.93	68.56	0.66
27014.11	18.94	1384.75	1385.72	1385.49	1385.75	0.00206	0.78	24.42	60.26	0.39
27321.09	18.94	1385.76	1386.65		1386.70	0.00493	0.94	20.21	72.29	0.57
27628.07	18.94	1386.84	1387.62	1387.43	1387.63	0.00205	0.62	30.59	105.38	0.37
27935.05	18.94	1388.30	1388.74	1388.68	1388.78	0.00875	0.94	20.14	110.15	0.70
28242.03	18.94	1389.65	1390.17	1390.03	1390.20	0.00285	0.71	26.85	97.12	0.43
28549.00	18.94	1390.40	1391.19	1391.03	1391.23	0.00394	0.96	19.78	57.80	0.52
28856.20	18.94	1391.67	1392.41	1392.26	1392.45	0.00393	0.87	21.78	73.46	0.51
29162.96	18.94	1392.57	1393.44		1393.48	0.00295	0.86	22.11	61.56	0.46
29469.94	18.94	1393.68	1394.39	1394.19	1394.45	0.00335	1.08	17.46	37.49	0.51
29776.92	18.94	1394.43	1395.19		1395.22	0.00197	0.86	22.02	44.97	0.39
30184.03	18.94	1396.02	1396.46	1396.35	1396.53	0.00586	1.15	16.44	49.12	0.64
30697.85	18.94	1397.29	1398.35	1398.10	1398.37	0.00249	0.63	34.60	148.88	0.40
31004.83	18.94	1398.43	1398.98	1398.80	1398.99	0.00174	0.57	33.51	117.09	0.34
31311.81	18.94	1399.58	1400.08	1400.08	1400.27	0.01395	1.95	9.73	25.33	1.00
31618.79	18.94	1399.78	1401.13	1400.46	1401.16	0.00118	0.63	29.84	64.86	0.30
31988.39	18.94	1401.48	1402.19	1402.19	1402.33	0.01560	1.64	11.53	42.16	1.00
32033.38	18.94	1402.13	1402.76	1402.68	1402.82	0.00766	1.09	17.36	68.52	0.69

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
32178.59	18.94	1402.50	1403.54	1403.39	1403.58	0.00379	0.84	22.42	76.51	0.50
32204.47	18.94	1402.97	1403.62		1403.65	0.00199	0.72	26.23	70.05	0.38
32602.28	18.94	1404.66	1405.13	1405.09	1405.21	0.01072	1.24	15.26	63.94	0.81
32846.70	18.94	1404.25	1405.72	1405.13	1405.74	0.00089	0.68	27.67	43.89	0.28
33153.68	18.94	1407.19	1407.69	1407.69	1407.77	0.01887	1.27	14.86	91.74	1.01
33460.66	18.94	1408.05	1408.86	1408.58	1408.88	0.00147	0.61	31.08	85.52	0.32
33767.64	18.94	1409.22	1409.75	1409.70	1409.82	0.00954	1.14	16.55	71.88	0.76
34056.21	18.94	1409.83	1410.84	1410.58	1410.87	0.00189	0.78	24.39	56.35	0.38
34504.09	18.94	1412.57	1412.93	1412.93	1413.03	0.01709	1.42	13.34	65.07	1.00
34747.74	18.94	1412.84	1413.77	1413.51	1413.79	0.00123	0.62	30.42	70.85	0.30
34995.55	18.94	1413.02	1414.10		1414.13	0.00148	0.74	25.75	53.36	0.34
35265.62	18.94	1414.10	1414.88	1414.84	1414.99	0.01036	1.43	13.23	43.75	0.83
35609.51	18.94	1415.17	1416.12		1416.15	0.00165	0.76	25.01	54.03	0.36
35916.49	18.94	1415.66	1416.63		1416.68	0.00176	0.92	20.57	34.85	0.38
36530.45	18.94	1418.12	1418.80	1418.76	1418.88	0.01079	1.26	14.98	61.54	0.82
36837.43	18.94	1418.91	1419.89		1419.94	0.00167	1.00	18.92	27.05	0.38
37144.40	18.94	1420.28	1420.85	1420.80	1420.92	0.00846	1.20	15.81	58.52	0.74
37432.39	18.94	1419.44	1421.21	1420.34	1421.22	0.00038	0.47	39.89	57.35	0.18

Table 27. HEC-RAS output for 8.86 m^3/s.

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
0.00	8.86	1312.89	1313.51	1313.37	1313.53	0.00300	0.72	12.23	44.43	0.44
306.98	8.86	1314.00	1314.59		1314.63	0.00430	0.96	9.27	29.05	0.54
613.96	8.86	1315.27	1315.81	1315.65	1315.83	0.00356	0.55	16.05	99.35	0.44
920.94	8.86	1316.38	1316.89		1316.91	0.00347	0.61	14.51	75.72	0.45
1227.91	8.86	1317.31	1317.84		1317.86	0.00280	0.62	14.37	62.94	0.41
1534.89	8.86	1318.08	1318.72		1318.74	0.00294	0.64	13.85	59.68	0.42
1841.87	8.86	1317.98	1319.01		1319.02	0.00041	0.36	24.58	56.96	0.18
2148.85	8.86	1319.39	1319.76	1319.76	1319.85	0.01748	1.33	6.66	36.45	0.99
2455.83	8.86	1319.99	1320.59	1320.36	1320.60	0.00090	0.36	24.79	105.53	0.24
2762.81	8.86	1320.70	1321.19	1321.14	1321.26	0.00932	1.18	7.50	30.59	0.76
3069.79	8.86	1321.47	1322.21	1322.00	1322.22	0.00154	0.51	17.22	63.05	0.31
3374.64	8.86	1322.02	1322.82		1322.87	0.00301	1.04	8.53	17.98	0.48

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
3683.74	8.86	1323.24	1323.87	1323.69	1323.91	0.00377	0.97	9.17	25.53	0.51
3990.72	8.86	1323.75	1324.55		1324.57	0.00137	0.64	13.78	33.22	0.32
4297.70	8.86	1325.01	1325.43	1325.37	1325.49	0.01062	1.10	8.08	40.57	0.78
4604.68	8.86	1325.66	1326.47	1326.13	1326.49	0.00153	0.62	14.25	38.83	0.33
4911.66	8.86	1326.72	1327.27	1327.17	1327.32	0.00604	1.07	8.28	28.14	0.63
5218.64	8.86	1326.76	1327.71		1327.72	0.00055	0.50	17.86	31.82	0.21
5525.61	8.86	1327.88	1328.35	1328.35	1328.48	0.01577	1.60	5.55	21.38	1.00
5832.59	8.86	1328.69	1329.30		1329.32	0.00107	0.54	16.54	43.43	0.28
6139.57	8.86	1329.22	1329.86		1329.91	0.00425	0.95	9.37	29.48	0.54
6446.55	8.86	1330.46	1330.95	1330.83	1330.97	0.00283	0.61	14.53	65.16	0.41
6753.53	8.86	1331.19	1331.87	1331.73	1331.89	0.00320	0.69	12.93	53.36	0.44
7060.51	8.86	1332.31	1332.86	1332.73	1332.89	0.00329	0.74	11.97	45.16	0.46
7367.49	8.86	1333.22	1333.63	1333.47	1333.65	0.00190	0.59	15.07	53.11	0.35
7584.73	8.86	1333.90	1334.34		1334.40	0.00764	1.00	8.82	39.53	0.68
7981.44	8.86	1335.10	1335.59		1335.60	0.00161	0.45	19.70	91.67	0.31
8288.42	8.86	1334.58	1335.74		1335.75	0.00023	0.37	23.90	34.20	0.14
8595.40	8.86	1336.32	1336.70	1336.70	1336.77	0.01905	1.18	7.52	52.72	0.99
8783.90	8.86	1337.11	1337.65		1337.67	0.00208	0.71	12.52	35.67	0.38
9209.36	8.86	1337.90	1338.53		1338.54	0.00201	0.45	19.50	105.20	0.34
9516.34	8.86	1338.57	1339.15		1339.17	0.00207	0.59	14.97	55.55	0.36
9823.32	8.86	1339.47	1340.04		1340.08	0.00454	0.89	9.98	36.42	0.54
10128.25	8.86	1340.33	1340.90		1340.91	0.00177	0.53	16.94	67.71	0.33
10437.27	8.86	1341.30	1341.79	1341.68	1341.82	0.00580	0.82	11.56	52.89	0.58
10798.08	8.86	1342.44	1342.89		1342.90	0.00176	0.47	20.11	87.02	0.32
11051.22	8.86	1343.04	1343.45	1343.22	1343.47	0.00409	0.58	15.32	73.14	0.47
11370.27	8.86	1343.83	1344.23	1344.08	1344.23	0.00151	0.40	22.24	118.09	0.29
11380.38	8.86	1344.03	1344.45	1344.45	1344.60	0.01538	1.68	5.28	18.54	1.00
11498.00	8.86	1344.43	1344.95	1344.76	1344.96	0.00127	0.51	17.22	54.62	0.29
11665.18	8.86	1344.78	1345.25		1345.28	0.00289	0.69	12.92	49.49	0.43
12015.90	8.86	1345.26	1345.92	1345.65	1345.93	0.00130	0.46	19.41	75.16	0.29
12279.14	8.86	1345.93	1346.55		1346.61	0.00688	1.03	8.64	34.65	0.66
12586.12	8.86	1347.38	1347.77	1347.64	1347.79	0.00245	0.64	13.90	52.43	0.40
12893.10	8.86	1347.76	1348.29		1348.30	0.00121	0.49	18.19	60.42	0.28
13187.44	8.86	1348.13	1348.71		1348.73	0.00175	0.55	16.15	59.33	0.34

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
13507.05	8.86	1348.16	1349.09		1349.11	0.00086	0.59	14.97	28.79	0.26
13814.03	8.86	1348.86	1349.48		1349.50	0.00206	0.71	12.43	34.76	0.38
14121.01	8.86	1349.84	1350.31	1350.21	1350.33	0.00380	0.69	12.83	59.61	0.48
14427.99	8.86	1350.87	1351.39		1351.42	0.00328	0.72	12.23	47.47	0.46
14734.97	8.86	1351.55	1352.18		1352.20	0.00202	0.50	17.81	84.30	0.35
15096.80	8.86	1352.40	1352.88		1352.90	0.00187	0.59	15.13	52.75	0.35
15348.92	8.86	1352.66	1353.41	1353.18	1353.44	0.00251	0.68	13.11	46.00	0.40
15601.86	8.86	1350.90	1353.47		1353.48	0.00005	0.24	37.54	31.35	0.07
15962.88	8.86	1354.16	1354.53	1354.53	1354.66	0.01589	1.56	5.69	22.84	1.00
16269.86	8.86	1353.55	1354.94	1354.14	1354.95	0.00029	0.45	19.73	25.42	0.16
16576.84	8.86	1356.03	1356.37	1356.37	1356.44	0.01959	1.18	7.53	53.94	1.01
17190.14	8.86	1357.54	1358.10		1358.10	0.00102	0.42	21.25	78.28	0.26
17496.63	8.86	1357.83	1358.42	1358.13	1358.43	0.00112	0.46	19.43	67.11	0.27
17804.75	8.86	1358.55	1359.04	1358.94	1359.07	0.00503	0.72	12.29	66.15	0.53
17976.90	8.86	1358.69	1359.33	1359.10	1359.34	0.00072	0.39	22.73	71.42	0.22
18143.34	8.86	1358.60	1359.45	1359.06	1359.46	0.00084	0.50	17.78	43.36	0.25
18191.00	8.86	1357.38	1359.47	1357.83	1359.47	0.00002	0.14	64.93	84.84	0.05
18200.00	Bridge									
18202.00	8.86	1357.38	1359.48	1357.83	1359.48	0.00002	0.13	66.11	85.56	0.05
18345.68	8.86	1359.46	1359.78	1359.78	1359.88	0.01763	1.41	6.28	31.72	1.01
18483.95	8.86	1360.06	1360.61	1360.48	1360.63	0.00250	0.56	15.69	72.20	0.39
18725.87	8.86	1360.38	1361.09	1360.86	1361.10	0.00157	0.48	18.31	74.59	0.31
18912.23	8.86	1360.48	1361.29	1360.91	1361.30	0.00078	0.50	17.74	41.01	0.24
19027.50	8.86	1359.59	1361.31	1360.02	1361.31	0.00001	0.11	81.87	106.51	0.04
19038.00	Bridge									
19039.00	8.86	1359.59	1361.32	1360.02	1361.32	0.00001	0.11	83.49	106.61	0.04
19113.93	8.86	1360.94	1361.52	1361.52	1361.69	0.01572	1.79	4.94	15.88	1.03
19339.65	8.86	1361.55	1362.38	1362.10	1362.39	0.00126	0.49	18.05	60.93	0.29
19953.60	8.86	1363.38	1363.94	1363.88	1363.99	0.00804	0.98	9.02	43.42	0.69
20294.09	8.86	1364.12	1364.96		1364.97	0.00148	0.54	16.38	54.00	0.31
20567.56	8.86	1364.79	1365.39		1365.41	0.00165	0.57	15.68	52.70	0.33
20874.54	8.86	1365.85	1366.27	1366.20	1366.31	0.00628	0.86	10.24	49.57	0.61
21181.52	8.86	1366.24	1367.06	1366.76	1367.08	0.00134	0.66	13.33	30.05	0.32
21488.50	8.86	1367.42	1367.92	1367.89	1367.98	0.01049	1.09	8.16	41.20	0.78

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
21795.48	8.86	1368.17	1368.90	1368.69	1368.92	0.00140	0.53	16.84	55.85	0.31
22102.45	8.86	1368.78	1369.49		1369.53	0.00295	0.85	10.41	29.28	0.46
22437.91	8.86	1369.68	1370.34	1370.18	1370.36	0.00209	0.54	16.31	69.50	0.36
22716.41	8.86	1370.64	1371.19	1371.08	1371.24	0.00507	0.91	9.72	36.98	0.57
22896.25	8.86	1371.22	1371.76	1371.59	1371.78	0.00193	0.57	15.42	56.72	0.35
23002.00	8.86	1367.03	1371.78	1367.87	1371.78	0.00000	0.04	236.22	89.13	0.01
23015.00	Bridge									
23018.00	8.86	1367.03	1371.80	1367.87	1371.80	0.00000	0.04	237.70	89.25	0.01
23083.34	8.86	1371.66	1371.94	1371.94	1372.04	0.01584	1.37	6.47	31.49	0.96
23312.86	8.86	1372.10	1372.68	1372.45	1372.69	0.00111	0.46	19.45	67.14	0.27
23629.52	8.86	1373.36	1373.66	1373.66	1373.77	0.01761	1.47	6.04	28.53	1.02
23944.33	8.86	1374.08	1374.69	1374.44	1374.70	0.00116	0.42	21.28	86.46	0.27
24251.53	8.86	1375.36	1375.67	1375.67	1375.74	0.01936	1.15	7.69	56.36	1.00
24561.73	8.86	1376.16	1376.73	1376.53	1376.74	0.00126	0.47	18.97	69.19	0.28
24727.43	8.86	1376.31	1377.14	1377.08	1377.22	0.01075	1.28	6.91	27.58	0.82
25172.24	8.86	1378.36	1378.79	1378.64	1378.80	0.00173	0.52	17.14	68.16	0.33
25479.22	8.86	1378.94	1379.87	1379.83	1379.93	0.01220	1.08	8.19	46.46	0.82
25786.20	8.86	1380.22	1380.81	1380.58	1380.83	0.00128	0.60	14.65	36.81	0.31
26122.64	8.86	1381.50	1381.93	1381.93	1382.01	0.01889	1.26	7.04	44.23	1.01
26400.15	8.86	1382.76	1383.30	1383.13	1383.32	0.00208	0.50	17.77	85.82	0.35
26707.13	8.86	1384.03	1384.47	1384.43	1384.53	0.00966	1.02	8.66	45.06	0.74
27014.11	8.86	1384.75	1385.56	1385.29	1385.58	0.00173	0.58	15.41	52.27	0.34
27321.09	8.86	1385.76	1386.39	1386.28	1386.45	0.00528	1.05	8.40	26.49	0.60
27628.07	8.86	1386.84	1387.48	1387.32	1387.49	0.00234	0.51	17.20	86.28	0.37
27935.05	8.86	1388.30	1388.66	1388.61	1388.69	0.00776	0.72	12.33	92.44	0.63
28242.03	8.86	1389.65	1390.05	1389.94	1390.07	0.00292	0.56	15.89	83.34	0.41
28549.00	8.86	1390.40	1391.02	1390.87	1391.05	0.00350	0.77	11.54	42.95	0.47
28856.20	8.86	1391.67	1392.24	1392.14	1392.27	0.00450	0.77	11.45	50.87	0.52
29162.96	8.86	1392.57	1393.24		1393.27	0.00243	0.71	12.40	39.19	0.41
29469.94	8.86	1393.68	1394.17	1394.06	1394.21	0.00389	0.89	9.94	32.08	0.51
29776.92	8.86	1394.43	1394.99		1395.01	0.00183	0.65	13.57	39.70	0.36
30184.03	8.86	1396.02	1396.28	1396.23	1396.33	0.00722	0.99	8.99	39.67	0.66
30697.85	8.86	1397.29	1398.17	1397.91	1398.19	0.00217	0.63	14.86	65.54	0.38
31004.83	8.86	1398.43	1398.83	1398.72	1398.85	0.00211	0.48	18.42	94.90	0.35

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
31311.81	8.86	1399.58	1399.95	1399.90	1400.04	0.00878	1.30	6.80	22.86	0.76
31618.79	8.86	1399.78	1400.69	1400.23	1400.71	0.00095	0.73	12.13	18.01	0.28
31988.39	8.86	1401.48	1402.01	1402.01	1402.12	0.01642	1.48	5.97	26.39	1.00
32033.38	8.86	1402.13	1402.62	1402.56	1402.66	0.00878	0.96	9.24	48.94	0.70
32178.59	8.86	1402.50	1403.41	1403.30	1403.43	0.00349	0.68	13.03	57.91	0.46
32204.47	8.86	1402.97	1403.47		1403.49	0.00149	0.52	16.92	59.00	0.31
32602.28	8.86	1404.66	1404.96	1404.96	1405.05	0.01849	1.32	6.71	38.66	1.01
32846.70	8.86	1404.25	1405.49	1404.89	1405.50	0.00064	0.48	18.32	37.96	0.22
33153.68	8.86	1407.19	1407.59	1407.59	1407.66	0.02060	1.16	7.63	57.80	1.02
33460.66	8.86	1408.05	1408.69	1408.45	1408.70	0.00135	0.49	18.01	63.98	0.30
33767.64	8.86	1409.22	1409.61	1409.59	1409.67	0.01323	1.09	8.11	48.22	0.85
34056.21	8.86	1409.83	1410.65	1410.38	1410.67	0.00156	0.59	15.02	45.38	0.33
34504.09	8.86	1412.57	1412.83	1412.83	1412.90	0.01517	1.14	7.74	47.75	0.91
34747.74	8.86	1412.84	1413.61	1413.40	1413.62	0.00121	0.46	19.17	68.76	0.28
34995.55	8.86	1413.02	1413.89		1413.91	0.00116	0.56	15.77	40.91	0.29
35265.62	8.86	1414.10	1414.61	1414.61	1414.76	0.01540	1.68	5.28	18.54	1.00
35609.51	8.86	1415.17	1415.89		1415.91	0.00141	0.61	14.48	38.31	0.32
35916.49	8.86	1415.66	1416.37		1416.40	0.00175	0.73	12.08	28.69	0.36
36530.45	8.86	1418.12	1418.66	1418.64	1418.73	0.01354	1.18	7.52	40.71	0.87
36837.43	8.86	1418.91	1419.63		1419.65	0.00128	0.72	12.34	23.77	0.32
37144.40	8.86	1420.28	1420.67	1420.67	1420.75	0.01494	1.28	6.94	35.77	0.93
37432.39	8.86	1419.44	1420.97	1420.06	1420.97	0.00024	0.33	26.99	47.18	0.14

Table 28. HEC-RAS output for 4.70 m3/s.

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
0.00	4.70	1312.89	1313.41	1313.28	1313.43	0.00300	0.58	8.11	41.16	0.42
306.98	4.70	1314.00	1314.46	1314.35	1314.50	0.00404	0.78	6.01	24.34	0.50
613.96	4.70	1315.27	1315.68	1315.55	1315.70	0.00377	0.61	7.68	42.47	0.46
920.94	4.70	1316.38	1316.79		1316.81	0.00346	0.57	8.27	48.10	0.44
1227.91	4.70	1317.31	1317.75		1317.76	0.00280	0.53	8.95	49.87	0.40
1534.89	4.70	1318.08	1318.64	1318.53	1318.65	0.00301	0.51	9.14	55.58	0.40
1841.87	4.70	1317.98	1318.87		1318.88	0.00032	0.28	16.98	48.05	0.15
2148.85	4.70	1319.39	1319.68	1319.68	1319.75	0.02057	1.17	4.01	30.00	1.02

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
2455.83	4.70	1319.99	1320.49		1320.49	0.00088	0.31	15.07	77.24	0.23
2762.81	4.70	1320.70	1321.09	1321.04	1321.14	0.00888	0.99	4.75	24.33	0.72
3069.79	4.70	1321.47	1322.10	1321.90	1322.11	0.00160	0.43	10.99	54.53	0.30
3374.64	4.70	1322.02	1322.66		1322.69	0.00228	0.79	5.92	15.16	0.41
3683.74	4.70	1323.24	1323.67	1323.57	1323.72	0.00522	0.95	4.97	18.23	0.58
3990.72	4.70	1323.75	1324.41		1324.42	0.00125	0.51	9.25	29.52	0.29
4297.70	4.70	1325.01	1325.28	1325.26	1325.35	0.01439	1.22	3.85	20.66	0.90
4604.68	4.70	1325.66	1326.27	1326.03	1326.28	0.00127	0.57	8.29	22.57	0.30
4911.66	4.70	1326.72	1327.10	1327.07	1327.16	0.01093	1.10	4.27	21.81	0.79
5218.64	4.70	1326.76	1327.52	1327.16	1327.53	0.00041	0.38	12.45	27.03	0.18
5525.61	4.70	1327.88	1328.24	1328.24	1328.34	0.01742	1.37	3.44	17.98	1.00
5832.59	4.70	1328.69	1329.17		1329.18	0.00106	0.43	10.97	40.00	0.26
6139.57	4.70	1329.22	1329.74		1329.77	0.00431	0.79	5.96	24.89	0.51
6446.55	4.70	1330.46	1330.87	1330.78	1330.88	0.00307	0.50	9.42	60.64	0.40
6753.53	4.70	1331.19	1331.78		1331.79	0.00286	0.56	8.38	42.95	0.41
7060.51	4.70	1332.31	1332.75	1332.63	1332.77	0.00345	0.63	7.41	36.50	0.45
7367.49	4.70	1333.22	1333.53	1333.40	1333.54	0.00188	0.48	9.82	46.73	0.33
7584.73	4.70	1333.90	1334.24		1334.28	0.00755	0.90	5.24	27.52	0.66
7981.44	4.70	1335.10	1335.49		1335.50	0.00165	0.39	11.91	68.68	0.30
8288.42	4.70	1334.58	1335.60		1335.60	0.00012	0.25	19.17	31.09	0.10
8595.40	4.70	1336.32	1336.64	1336.64	1336.69	0.01808	0.99	4.73	41.23	0.93
8783.90	4.70	1337.11	1337.52		1337.53	0.00194	0.57	8.24	30.81	0.35
9209.36	4.70	1337.90	1338.42		1338.43	0.00234	0.46	10.23	60.91	0.36
9516.34	4.70	1338.57	1339.06		1339.07	0.00181	0.47	10.02	47.81	0.33
9823.32	4.70	1339.47	1339.91	1339.81	1339.94	0.00501	0.80	5.85	26.69	0.55
10128.25	4.70	1340.33	1340.75		1340.76	0.00164	0.49	9.59	39.97	0.32
10437.27	4.70	1341.30	1341.68	1341.61	1341.71	0.00772	0.77	6.61	39.97	0.64
10798.08	4.70	1342.44	1342.81		1342.82	0.00153	0.37	13.43	71.32	0.29
11051.22	4.70	1343.04	1343.32		1343.34	0.00541	0.57	7.87	36.71	0.52
11370.27	4.70	1343.83	1344.15	1344.04	1344.16	0.00144	0.33	14.34	98.43	0.27
11380.38	4.70	1344.03	1344.33	1344.33	1344.44	0.01674	1.44	3.27	15.43	1.00
11498.00	4.70	1344.43	1344.84	1344.68	1344.85	0.00138	0.42	11.27	52.42	0.29
11665.18	4.70	1344.78	1345.16		1345.17	0.00298	0.56	8.45	45.27	0.41
12015.90	4.70	1345.26	1345.78		1345.79	0.00115	0.43	11.03	43.07	0.27

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
12279.14	4.70	1345.93	1346.42		1346.47	0.00978	1.02	4.63	24.51	0.75
12586.12	4.70	1347.38	1347.69	1347.59	1347.70	0.00215	0.48	9.72	50.31	0.35
12893.10	4.70	1347.76	1348.18		1348.19	0.00122	0.40	11.66	52.01	0.27
13187.44	4.70	1348.13	1348.56		1348.58	0.00141	0.50	9.41	33.71	0.30
13507.05	4.70	1348.16	1348.89		1348.90	0.00075	0.48	9.73	22.90	0.24
13814.03	4.70	1348.86	1349.28		1349.31	0.00281	0.69	6.76	24.84	0.42
14121.01	4.70	1349.84	1350.24	1350.14	1350.25	0.00331	0.54	8.69	52.59	0.42
14427.99	4.70	1350.87	1351.29		1351.31	0.00356	0.61	7.73	41.44	0.45
14734.97	4.70	1351.55	1352.09		1352.10	0.00198	0.44	10.65	59.47	0.33
15096.80	4.70	1352.40	1352.72	1352.56	1352.74	0.00158	0.53	8.81	31.15	0.32
15348.92	4.70	1352.66	1353.23	1353.08	1353.25	0.00271	0.67	6.98	26.10	0.42
15601.86	4.70	1350.90	1353.27		1353.28	0.00002	0.15	31.65	27.32	0.04
15962.88	4.70	1354.16	1354.44	1354.44	1354.53	0.01861	1.31	3.60	21.21	1.01
16269.86	4.70	1353.55	1354.71	1353.98	1354.72	0.00018	0.32	14.55	21.62	0.13
16576.84	4.70	1356.03	1356.30	1356.30	1356.36	0.02086	1.06	4.45	39.34	1.00
17190.14	4.70	1357.54	1357.98		1357.98	0.00098	0.36	13.24	60.58	0.24
17496.63	4.70	1357.83	1358.29	1358.04	1358.30	0.00107	0.40	11.70	47.41	0.26
17804.75	4.70	1358.55	1358.93	1358.85	1358.96	0.00581	0.72	6.57	39.84	0.56
17976.90	4.70	1358.69	1359.22	1359.00	1359.22	0.00068	0.31	15.16	64.75	0.20
18143.34	4.70	1358.60	1359.32	1358.95	1359.33	0.00066	0.38	12.49	38.66	0.21
18191.00	4.70	1357.38	1359.33	1357.71	1359.33	0.00001	0.09	54.20	72.02	0.03
18200.00	Bridge									
18202.00	4.70	1357.38	1359.36	1357.71	1359.36	0.00001	0.08	56.15	77.33	0.03
18345.68	4.70	1359.46	1359.70	1359.70	1359.77	0.01901	1.20	3.93	26.81	1.00
18483.95	4.70	1360.06	1360.52	1360.40	1360.53	0.00259	0.48	9.79	58.89	0.38
18725.87	4.70	1360.38	1360.96	1360.78	1360.97	0.00129	0.42	11.21	48.85	0.28
18912.23	4.70	1360.48	1361.12	1360.83	1361.13	0.00062	0.40	11.74	31.76	0.21
19027.50	4.70	1359.59	1361.13	1359.91	1361.13	0.00001	0.07	63.87	102.68	0.03
19038.00	Bridge									
19039.00	4.70	1359.59	1361.14	1359.91	1361.14	0.00001	0.07	64.88	103.09	0.03
19113.93	4.70	1360.94	1361.40	1361.40	1361.51	0.01577	1.49	3.15	13.35	0.98
19339.65	4.70	1361.55	1362.23	1361.97	1362.24	0.00132	0.45	10.42	41.50	0.29
19953.60	4.70	1363.38	1363.85	1363.78	1363.88	0.00795	0.84	5.58	33.57	0.66
20294.09	4.70	1364.12	1364.77		1364.78	0.00129	0.52	9.03	28.53	0.30

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
20567.56	4.70	1364.79	1365.19		1365.21	0.00192	0.61	7.70	25.79	0.36
20874.54	4.70	1365.85	1366.19	1366.13	1366.21	0.00679	0.73	6.44	42.65	0.60
21181.52	4.70	1366.24	1366.90	1366.64	1366.92	0.00113	0.52	9.06	26.14	0.28
21488.50	4.70	1367.42	1367.81	1367.81	1367.88	0.02531	1.21	3.88	32.16	1.11
21795.48	4.70	1368.17	1368.80	1368.56	1368.81	0.00110	0.40	11.73	48.57	0.26
22102.45	4.70	1368.78	1369.33		1369.36	0.00318	0.75	6.29	22.77	0.45
22437.91	4.70	1369.68	1370.24		1370.25	0.00226	0.47	10.01	56.23	0.36
22716.41	4.70	1370.64	1371.09	1370.98	1371.11	0.00434	0.76	6.22	27.96	0.51
22896.25	4.70	1371.22	1371.65	1371.53	1371.67	0.00220	0.49	9.65	50.30	0.35
23002.00	4.70	1367.03	1371.67	1367.68	1371.67	0.00000	0.02	226.18	88.32	0.00
23015.00	Bridge									
23018.00	4.70	1367.03	1371.68	1367.68	1371.68	0.00000	0.02	227.20	88.40	0.00
23083.34	4.70	1371.66	1371.87	1371.87	1371.93	0.01818	1.13	4.14	29.59	0.97
23312.86	4.70	1372.10	1372.56	1372.37	1372.57	0.00106	0.38	12.43	54.60	0.25
23629.52	4.70	1373.36	1373.58	1373.58	1373.66	0.02148	1.26	3.74	25.87	1.06
23944.33	4.70	1374.08	1374.58	1374.35	1374.59	0.00110	0.36	12.93	61.83	0.25
24251.53	4.70	1375.36	1375.60	1375.60	1375.66	0.02441	1.09	4.30	40.58	1.07
24561.73	4.70	1376.16	1376.63	1376.45	1376.63	0.00116	0.38	12.51	59.39	0.26
24727.43	4.70	1376.31	1377.01	1376.95	1377.08	0.00973	1.15	4.07	17.66	0.77
25172.24	4.70	1378.36	1378.70	1378.58	1378.71	0.00189	0.42	11.16	64.66	0.32
25479.22	4.70	1378.94	1379.78	1379.63	1379.83	0.00934	0.97	4.84	26.42	0.72
25786.20	4.70	1380.22	1380.68	1380.50	1380.69	0.00135	0.48	9.75	35.70	0.29
26122.64	4.70	1381.50	1381.85	1381.85	1381.91	0.01792	1.13	4.15	29.29	0.96
26400.15	4.70	1382.76	1383.20	1383.06	1383.21	0.00209	0.46	10.23	55.91	0.34
26707.13	4.70	1384.03	1384.39	1384.35	1384.43	0.01022	0.89	5.30	35.57	0.73
27014.11	4.70	1384.75	1385.44	1385.18	1385.45	0.00161	0.49	9.68	40.17	0.32
27321.09	4.70	1385.76	1386.25	1386.16	1386.30	0.00568	0.93	5.08	20.60	0.60
27628.07	4.70	1386.84	1387.37	1387.21	1387.38	0.00240	0.48	9.71	54.44	0.37
27935.05	4.70	1388.30	1388.61	1388.57	1388.63	0.00826	0.60	7.79	79.42	0.62
28242.03	4.70	1389.65	1389.98	1389.88	1389.99	0.00274	0.45	10.43	71.99	0.38
28549.00	4.70	1390.40	1390.90	1390.76	1390.92	0.00335	0.67	7.03	31.19	0.45
28856.20	4.70	1391.67	1392.13	1392.05	1392.16	0.00486	0.70	6.67	36.19	0.52
29162.96	4.70	1392.57	1393.08		1393.10	0.00211	0.63	7.45	25.56	0.37
29469.94	4.70	1393.68	1394.04	1393.96	1394.07	0.00522	0.78	6.04	29.87	0.55

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
29776.92	4.70	1394.43	1394.88		1394.89	0.00160	0.50	9.37	36.81	0.32
30184.03	4.70	1396.02	1396.19	1396.16	1396.23	0.01021	0.87	5.41	37.52	0.73
30697.85	4.70	1397.29	1398.02	1397.75	1398.03	0.00175	0.56	8.36	29.56	0.34
31004.83	4.70	1398.43	1398.74	1398.66	1398.75	0.00318	0.46	10.23	76.87	0.40
31311.81	4.70	1399.58	1399.90		1399.94	0.00466	0.85	5.54	22.09	0.54
31618.79	4.70	1399.78	1400.44	1400.10	1400.46	0.00086	0.58	8.09	15.82	0.26
31988.39	4.70	1401.48	1401.92	1401.92	1402.00	0.01539	1.21	3.89	22.33	0.92
32033.38	4.70	1402.13	1402.52	1402.49	1402.56	0.01031	0.89	5.30	35.66	0.73
32178.59	4.70	1402.50	1403.33	1403.23	1403.34	0.00324	0.54	8.64	50.73	0.42
32204.47	4.70	1402.97	1403.38		1403.39	0.00117	0.39	11.91	53.02	0.27
32602.28	4.70	1404.66	1404.88	1404.88	1404.95	0.01881	1.19	3.94	26.74	0.99
32846.70	4.70	1404.25	1405.28	1404.74	1405.28	0.00044	0.40	11.78	24.85	0.18
33153.68	4.70	1407.19	1407.52	1407.52	1407.58	0.02092	1.09	4.31	36.22	1.01
33460.66	4.70	1408.05	1408.56		1408.57	0.00124	0.43	10.94	44.76	0.28
33767.64	4.70	1409.22	1409.51	1409.51	1409.58	0.01992	1.10	4.26	33.89	0.99
34056.21	4.70	1409.83	1410.53	1410.25	1410.54	0.00132	0.47	9.93	36.76	0.29
34504.09	4.70	1412.57	1412.74	1412.74	1412.81	0.01996	1.11	4.24	33.77	1.00
34747.74	4.70	1412.84	1413.52	1413.29	1413.52	0.00111	0.36	13.02	63.46	0.25
34995.55	4.70	1413.02	1413.77		1413.78	0.00092	0.43	10.85	35.01	0.25
35265.62	4.70	1414.10	1414.48	1414.48	1414.60	0.01705	1.48	3.17	14.42	1.01
35609.51	4.70	1415.17	1415.71		1415.72	0.00132	0.54	8.65	26.11	0.30
35916.49	4.70	1415.66	1416.19		1416.21	0.00194	0.63	7.41	23.70	0.36
36530.45	4.70	1418.12	1418.58	1418.55	1418.63	0.01179	0.99	4.74	29.92	0.80
36837.43	4.70	1418.91	1419.45		1419.47	0.00117	0.57	8.30	21.46	0.29
37144.40	4.70	1420.28	1420.57	1420.57	1420.64	0.01916	1.18	3.99	27.91	1.00
37432.39	4.70	1419.44	1420.78	1419.91	1420.79	0.00014	0.24	19.44	36.23	0.11

Table 29. HEC-RAS output for 3.26 m3/s.

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
0.00	3.26	1312.89	1313.36	1313.24	1313.37	0.00300	0.53	6.13	35.38	0.41
306.98	3.26	1314.00	1314.41	1314.31	1314.43	0.00398	0.70	4.66	22.09	0.49
613.96	3.26	1315.27	1315.61	1315.51	1315.63	0.00378	0.61	5.33	29.60	0.46
920.94	3.26	1316.38	1316.74		1316.76	0.00355	0.53	6.13	40.10	0.43

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
1227.91	3.26	1317.31	1317.70		1317.71	0.00274	0.49	6.70	41.21	0.38
1534.89	3.26	1318.08	1318.60		1318.61	0.00311	0.47	6.95	49.70	0.40
1841.87	3.26	1317.98	1318.78		1318.78	0.00022	0.25	13.13	33.00	0.13
2148.85	3.26	1319.39	1319.64	1319.64	1319.70	0.02144	1.06	3.07	27.32	1.01
2455.83	3.26	1319.99	1320.44		1320.44	0.00086	0.28	11.48	66.38	0.22
2762.81	3.26	1320.70	1321.04	1320.99	1321.08	0.00956	0.93	3.51	20.93	0.72
3069.79	3.26	1321.47	1322.03	1321.84	1322.04	0.00155	0.42	7.74	38.42	0.30
3374.64	3.26	1322.02	1322.57		1322.60	0.00215	0.70	4.63	13.55	0.38
3683.74	3.26	1323.24	1323.59	1323.52	1323.63	0.00596	0.91	3.59	15.38	0.60
3990.72	3.26	1323.75	1324.33		1324.34	0.00118	0.46	7.04	24.78	0.28
4297.70	3.26	1325.01	1325.22	1325.21	1325.29	0.01990	1.20	2.71	18.99	1.02
4604.68	3.26	1325.66	1326.20	1325.97	1326.21	0.00113	0.49	6.72	21.23	0.28
4911.66	3.26	1326.72	1327.04	1327.04	1327.10	0.01706	1.13	2.88	19.69	0.94
5218.64	3.26	1326.76	1327.44	1327.10	1327.44	0.00035	0.32	10.32	25.89	0.16
5525.61	3.26	1327.88	1328.19	1328.19	1328.27	0.01842	1.27	2.57	15.64	1.00
5832.59	3.26	1328.69	1329.10		1329.11	0.00103	0.39	8.33	34.06	0.25
6139.57	3.26	1329.22	1329.67		1329.70	0.00470	0.74	4.43	21.83	0.52
6446.55	3.26	1330.46	1330.84	1330.76	1330.85	0.00302	0.44	7.40	56.79	0.39
6753.53	3.26	1331.19	1331.71		1331.73	0.00278	0.55	5.90	30.26	0.40
7060.51	3.26	1332.31	1332.70	1332.59	1332.72	0.00377	0.57	5.70	34.99	0.45
7367.49	3.26	1333.22	1333.48	1333.39	1333.49	0.00180	0.42	7.79	43.99	0.32
7584.73	3.26	1333.90	1334.19		1334.22	0.00808	0.84	3.89	23.91	0.66
7981.44	3.26	1335.10	1335.45		1335.46	0.00164	0.35	9.24	62.62	0.29
8288.42	3.26	1334.58	1335.53		1335.53	0.00008	0.19	16.94	29.51	0.08
8595.40	3.26	1336.32	1336.61	1336.61	1336.65	0.02200	0.98	3.31	33.91	1.00
8783.90	3.26	1337.11	1337.46		1337.47	0.00180	0.50	6.57	28.69	0.33
9209.36	3.26	1337.90	1338.34		1338.35	0.00235	0.50	6.49	33.99	0.37
9516.34	3.26	1338.57	1339.00		1339.01	0.00198	0.43	7.54	43.42	0.33
9823.32	3.26	1339.47	1339.86	1339.77	1339.89	0.00439	0.70	4.67	23.78	0.50
10128.25	3.26	1340.33	1340.67	1340.52	1340.68	0.00168	0.47	6.93	31.10	0.32
10437.27	3.26	1341.30	1341.64	1341.57	1341.66	0.00822	0.70	5.03	35.68	0.64
10798.08	3.26	1342.44	1342.76		1342.77	0.00149	0.33	10.36	61.28	0.28
11051.22	3.26	1343.04	1343.23		1343.25	0.00503	0.60	5.63	20.96	0.51
11370.27	3.26	1343.83	1344.11	1344.02	1344.11	0.00164	0.31	10.44	85.02	0.28

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
11380.38	3.26	1344.03	1344.28	1344.28	1344.37	0.01807	1.32	2.47	14.04	1.00
11498.00	3.26	1344.43	1344.79	1344.65	1344.79	0.00145	0.37	8.70	49.18	0.28
11665.18	3.26	1344.78	1345.11		1345.12	0.00282	0.50	6.47	38.73	0.39
12015.90	3.26	1345.26	1345.71		1345.72	0.00113	0.39	8.32	36.41	0.26
12279.14	3.26	1345.93	1346.36		1346.41	0.01084	0.98	3.33	20.18	0.77
12586.12	3.26	1347.38	1347.65	1347.56	1347.66	0.00209	0.42	7.80	49.30	0.34
12893.10	3.26	1347.76	1348.12		1348.13	0.00117	0.36	8.94	44.91	0.26
13187.44	3.26	1348.13	1348.50		1348.51	0.00144	0.44	7.39	32.54	0.30
13507.05	3.26	1348.16	1348.80		1348.81	0.00065	0.42	7.82	20.70	0.22
13814.03	3.26	1348.86	1349.20	1349.10	1349.22	0.00367	0.69	4.74	21.67	0.47
14121.01	3.26	1349.84	1350.20		1350.21	0.00286	0.47	7.01	47.63	0.39
14427.99	3.26	1350.87	1351.24		1351.26	0.00413	0.57	5.76	38.50	0.47
14734.97	3.26	1351.55	1352.03		1352.04	0.00170	0.42	7.70	40.85	0.31
15096.80	3.26	1352.40	1352.65	1352.53	1352.67	0.00178	0.48	6.73	30.06	0.33
15348.92	3.26	1352.66	1353.17	1353.02	1353.19	0.00238	0.58	5.63	24.04	0.38
15601.86	3.26	1350.90	1353.20		1353.20	0.00001	0.11	29.79	25.91	0.03
15962.88	3.26	1354.16	1354.40	1354.40	1354.47	0.01975	1.16	2.80	20.56	1.01
16269.86	3.26	1353.55	1354.61	1353.91	1354.62	0.00014	0.26	12.41	20.04	0.11
16576.84	3.26	1356.03	1356.28	1356.28	1356.32	0.01589	0.89	3.67	34.35	0.87
17190.14	3.26	1357.54	1357.92	1357.77	1357.93	0.00103	0.33	9.96	53.22	0.24
17496.63	3.26	1357.83	1358.21	1358.00	1358.22	0.00094	0.38	8.56	34.03	0.24
17804.75	3.26	1358.55	1358.85	1358.81	1358.89	0.00923	0.83	3.94	27.23	0.69
17976.90	3.26	1358.69	1359.17	1358.96	1359.17	0.00066	0.27	12.13	62.58	0.19
18143.34	3.26	1358.60	1359.25	1358.90	1359.26	0.00049	0.32	10.04	30.93	0.18
18191.00	3.26	1357.38	1359.26	1357.66	1359.26	0.00000	0.07	49.55	55.92	0.02
18200.00	Bridge									
18202.00	3.26	1357.38	1359.28	1357.66	1359.28	0.00000	0.06	50.64	60.03	0.02
18345.68	3.26	1359.46	1359.66	1359.66	1359.72	0.02029	1.10	2.97	24.24	1.00
18483.95	3.26	1360.06	1360.48	1360.37	1360.49	0.00254	0.43	7.63	53.81	0.36
18725.87	3.26	1360.38	1360.90	1360.75	1360.91	0.00128	0.38	8.61	43.54	0.27
18912.23	3.26	1360.48	1361.05	1360.79	1361.06	0.00050	0.34	9.54	28.03	0.19
19027.50	3.26	1359.59	1361.06	1359.86	1361.06	0.00000	0.06	56.15	97.14	0.02
19038.00	Bridge									
19039.00	3.26	1359.59	1361.08	1359.86	1361.08	0.00000	0.06	58.48	99.16	0.02

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
19113.93	3.26	1360.94	1361.34	1361.34	1361.44	0.01756	1.40	2.33	11.78	1.01
19339.65	3.26	1361.55	1362.16	1361.91	1362.17	0.00129	0.42	7.70	33.09	0.28
19953.60	3.26	1363.38	1363.79	1363.74	1363.83	0.00882	0.82	3.96	26.54	0.68
20294.09	3.26	1364.12	1364.71	1364.53	1364.72	0.00121	0.44	7.34	28.06	0.28
20567.56	3.26	1364.79	1365.12		1365.13	0.00197	0.54	6.00	24.35	0.35
20874.54	3.26	1365.85	1366.15	1366.09	1366.17	0.00707	0.67	4.84	37.21	0.60
21181.52	3.26	1366.24	1366.83	1366.59	1366.84	0.00105	0.45	7.22	24.27	0.26
21488.50	3.26	1367.42	1367.79	1367.79	1367.84	0.02077	1.01	3.24	30.59	0.99
21795.48	3.26	1368.17	1368.75		1368.75	0.00112	0.36	9.01	44.22	0.26
22102.45	3.26	1368.78	1369.27		1369.29	0.00302	0.67	4.88	20.04	0.43
22437.91	3.26	1369.68	1370.19		1370.20	0.00248	0.44	7.34	48.15	0.36
22716.41	3.26	1370.64	1371.04	1370.94	1371.06	0.00391	0.66	4.92	24.86	0.48
22896.25	3.26	1371.22	1371.60	1371.49	1371.61	0.00246	0.46	7.15	44.66	0.36
23002.00	3.26	1367.03	1371.61	1367.60	1371.61	0.00000	0.01	221.45	87.93	0.00
23015.00	Bridge									
23018.00	3.26	1367.03	1371.62	1367.60	1371.62	0.00000	0.01	222.36	88.01	0.00
23083.34	3.26	1371.66	1371.84	1371.84	1371.89	0.01902	1.00	3.25	28.83	0.96
23312.86	3.26	1372.10	1372.51	1372.33	1372.51	0.00103	0.34	9.61	48.66	0.24
23629.52	3.26	1373.36	1373.54	1373.54	1373.61	0.02502	1.16	2.81	24.73	1.10
23944.33	3.26	1374.08	1374.51	1374.31	1374.52	0.00103	0.36	9.08	42.32	0.25
24251.53	3.26	1375.36	1375.57	1375.57	1375.62	0.02306	0.98	3.34	35.87	1.02
24561.73	3.26	1376.16	1376.58	1376.41	1376.58	0.00115	0.34	9.66	53.68	0.25
24727.43	3.26	1376.31	1376.95	1376.84	1377.01	0.00808	1.05	3.11	13.57	0.70
25172.24	3.26	1378.36	1378.65	1378.55	1378.66	0.00214	0.39	8.29	58.42	0.33
25479.22	3.26	1378.94	1379.71	1379.54	1379.76	0.00701	0.94	3.47	15.98	0.64
25786.20	3.26	1380.22	1380.61	1380.46	1380.62	0.00151	0.44	7.49	34.83	0.30
26122.64	3.26	1381.50	1381.81	1381.80	1381.86	0.01846	1.07	3.06	24.24	0.96
26400.15	3.26	1382.76	1383.14	1383.02	1383.15	0.00206	0.43	7.53	44.54	0.34
26707.13	3.26	1384.03	1384.35	1384.31	1384.38	0.01062	0.84	3.89	29.33	0.73
27014.11	3.26	1384.75	1385.37	1385.12	1385.38	0.00156	0.46	7.09	31.04	0.31
27321.09	3.26	1385.76	1386.18	1386.11	1386.22	0.00613	0.87	3.75	17.71	0.60
27628.07	3.26	1386.84	1387.31	1387.17	1387.33	0.00235	0.46	7.03	41.45	0.36
27935.05	3.26	1388.30	1388.58	1388.55	1388.60	0.00891	0.56	5.81	69.93	0.62
28242.03	3.26	1389.65	1389.94	1389.87	1389.95	0.00263	0.41	8.02	62.54	0.36

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
28549.00	3.26	1390.40	1390.84	1390.70	1390.86	0.00332	0.62	5.24	25.70	0.44
28856.20	3.26	1391.67	1392.08	1392.01	1392.10	0.00505	0.66	4.97	30.97	0.52
29162.96	3.26	1392.57	1393.02		1393.04	0.00200	0.55	5.97	24.42	0.35
29469.94	3.26	1393.68	1393.99	1393.94	1394.02	0.00587	0.71	4.58	28.28	0.56
29776.92	3.26	1394.43	1394.83		1394.84	0.00152	0.43	7.52	35.46	0.30
30184.03	3.26	1396.02	1396.16	1396.14	1396.19	0.01210	0.80	4.09	36.70	0.76
30697.85	3.26	1397.29	1397.95	1397.69	1397.96	0.00160	0.51	6.37	24.26	0.32
31004.83	3.26	1398.43	1398.70	1398.65	1398.71	0.00416	0.46	7.15	66.43	0.44
31311.81	3.26	1399.58	1399.86		1399.89	0.00354	0.68	4.79	21.62	0.46
31618.79	3.26	1399.78	1400.34		1400.35	0.00082	0.50	6.46	15.05	0.25
31988.39	3.26	1401.48	1401.85	1401.85	1401.94	0.01700	1.32	2.47	13.42	0.98
32033.38	3.26	1402.13	1402.48	1402.45	1402.52	0.00993	0.81	4.02	30.12	0.71
32178.59	3.26	1402.50	1403.29	1403.21	1403.30	0.00333	0.49	6.69	47.36	0.41
32204.47	3.26	1402.97	1403.33		1403.34	0.00110	0.35	9.39	48.20	0.25
32602.28	3.26	1404.66	1404.83	1404.83	1404.90	0.02225	1.15	2.84	23.12	1.05
32846.70	3.26	1404.25	1405.16	1404.67	1405.17	0.00034	0.35	9.32	19.45	0.16
33153.68	3.26	1407.19	1407.48	1407.48	1407.53	0.02076	1.03	3.18	29.16	0.99
33460.66	3.26	1408.05	1408.50		1408.51	0.00121	0.39	8.45	40.01	0.27
33767.64	3.26	1409.22	1409.48	1409.48	1409.53	0.02085	1.04	3.14	28.45	1.00
34056.21	3.26	1409.83	1410.44	1410.19	1410.45	0.00123	0.46	7.15	26.55	0.28
34504.09	3.26	1412.57	1412.71	1412.71	1412.76	0.02183	1.03	3.15	29.74	1.01
34747.74	3.26	1412.84	1413.47	1413.25	1413.47	0.00108	0.32	10.15	57.78	0.24
34995.55	3.26	1413.02	1413.70		1413.70	0.00078	0.38	8.60	29.86	0.23
35265.62	3.26	1414.10	1414.42	1414.42	1414.52	0.01819	1.38	2.37	12.64	1.02
35609.51	3.26	1415.17	1415.63		1415.64	0.00128	0.49	6.72	23.48	0.29
35916.49	3.26	1415.66	1416.11		1416.13	0.00202	0.58	5.66	21.53	0.36
36530.45	3.26	1418.12	1418.54	1418.50	1418.58	0.01127	0.89	3.65	26.09	0.76
36837.43	3.26	1418.91	1419.37		1419.38	0.00111	0.49	6.64	20.43	0.27
37144.40	3.26	1420.28	1420.53	1420.53	1420.59	0.02001	1.12	2.92	22.96	1.00
37432.39	3.26	1419.44	1420.70	1419.84	1420.70	0.00010	0.20	16.48	31.69	0.09

Table 30. HEC-RAS output for 2.52 m3/s.

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
0.00	2.52	1312.89	1313.32	1313.20	1313.34	0.00300	0.51	4.98	30.95	0.40
306.98	2.52	1314.00	1314.37	1314.29	1314.39	0.00404	0.65	3.88	20.66	0.48
613.96	2.52	1315.27	1315.57	1315.49	1315.59	0.00380	0.59	4.26	24.92	0.46
920.94	2.52	1316.38	1316.71		1316.72	0.00357	0.51	4.97	34.98	0.43
1227.91	2.52	1317.31	1317.67		1317.68	0.00272	0.46	5.43	35.69	0.38
1534.89	2.52	1318.08	1318.57		1318.58	0.00313	0.46	5.52	41.41	0.40
1841.87	2.52	1317.98	1318.71		1318.71	0.00016	0.23	11.18	26.22	0.11
2148.85	2.52	1319.39	1319.63	1319.63	1319.67	0.02191	0.99	2.55	25.75	1.00
2455.83	2.52	1319.99	1320.40		1320.40	0.00084	0.28	9.04	52.97	0.22
2762.81	2.52	1320.70	1321.00	1320.97	1321.04	0.01075	0.91	2.77	18.59	0.75
3069.79	2.52	1321.47	1322.00	1321.80	1322.01	0.00148	0.39	6.49	35.24	0.29
3374.64	2.52	1322.02	1322.52		1322.54	0.00203	0.64	3.91	12.57	0.37
3683.74	2.52	1323.24	1323.55	1323.50	1323.58	0.00667	0.86	2.94	15.02	0.62
3990.72	2.52	1323.75	1324.27		1324.28	0.00112	0.44	5.78	21.48	0.27
4297.70	2.52	1325.01	1325.19	1325.19	1325.26	0.02087	1.12	2.26	18.38	1.02
4604.68	2.52	1325.66	1326.15	1325.94	1326.16	0.00109	0.44	5.71	20.33	0.27
4911.66	2.52	1326.72	1327.01	1327.01	1327.07	0.01977	1.08	2.33	19.00	0.99
5218.64	2.52	1326.76	1327.39	1327.08	1327.39	0.00032	0.28	8.96	25.14	0.15
5525.61	2.52	1327.88	1328.16	1328.16	1328.23	0.01888	1.20	2.10	14.23	1.00
5832.59	2.52	1328.69	1329.05		1329.06	0.00101	0.37	6.81	30.01	0.25
6139.57	2.52	1329.22	1329.63		1329.66	0.00491	0.70	3.58	19.54	0.53
6446.55	2.52	1330.46	1330.81	1330.74	1330.82	0.00300	0.41	6.19	53.20	0.38
6753.53	2.52	1331.19	1331.64		1331.66	0.00249	0.59	4.29	18.49	0.39
7060.51	2.52	1332.31	1332.65	1332.56	1332.67	0.00439	0.63	4.02	24.11	0.49
7367.49	2.52	1333.22	1333.46	1333.35	1333.47	0.00173	0.38	6.65	42.33	0.31
7584.73	2.52	1333.90	1334.16		1334.19	0.00858	0.78	3.22	22.96	0.67
7981.44	2.52	1335.10	1335.42		1335.42	0.00159	0.35	7.24	49.08	0.29
8288.42	2.52	1334.58	1335.48		1335.48	0.00006	0.16	15.54	28.47	0.07
8595.40	2.52	1336.32	1336.58	1336.58	1336.63	0.02166	0.98	2.57	26.02	1.00
8783.90	2.52	1337.11	1337.43		1337.44	0.00175	0.45	5.57	27.33	0.32
9209.36	2.52	1337.90	1338.29		1338.30	0.00236	0.51	4.99	25.96	0.37
9516.34	2.52	1338.57	1338.97		1338.98	0.00208	0.41	6.21	40.87	0.33
9823.32	2.52	1339.47	1339.83	1339.73	1339.85	0.00404	0.64	3.96	21.85	0.48
10128.25	2.52	1340.33	1340.63	1340.50	1340.64	0.00176	0.45	5.66	28.53	0.32

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
10437.27	2.52	1341.30	1341.61	1341.54	1341.63	0.00799	0.63	4.26	33.39	0.61
10798.08	2.52	1342.44	1342.73	1342.60	1342.74	0.00148	0.31	8.62	55.45	0.27
11051.22	2.52	1343.04	1343.18		1343.20	0.00520	0.52	4.65	18.96	0.50
11370.27	2.52	1343.83	1344.09	1344.00	1344.09	0.00168	0.30	8.51	76.30	0.28
11380.38	2.52	1344.03	1344.26	1344.26	1344.33	0.01522	1.15	2.20	13.52	0.91
11498.00	2.52	1344.43	1344.75	1344.63	1344.76	0.00157	0.35	7.16	47.13	0.29
11665.18	2.52	1344.78	1345.07		1345.08	0.00241	0.49	5.19	29.12	0.37
12015.90	2.52	1345.26	1345.66		1345.67	0.00123	0.38	6.59	31.88	0.27
12279.14	2.52	1345.93	1346.34		1346.38	0.00939	0.88	2.87	18.40	0.71
12586.12	2.52	1347.38	1347.62	1347.55	1347.63	0.00227	0.39	6.49	48.61	0.34
12893.10	2.52	1347.76	1348.09		1348.10	0.00112	0.33	7.69	43.99	0.25
13187.44	2.52	1348.13	1348.47		1348.48	0.00146	0.40	6.26	31.86	0.29
13507.05	2.52	1348.16	1348.75		1348.76	0.00059	0.37	6.77	19.65	0.20
13814.03	2.52	1348.86	1349.14	1349.08	1349.17	0.00502	0.70	3.61	20.34	0.53
14121.01	2.52	1349.84	1350.19		1350.19	0.00238	0.41	6.20	45.06	0.35
14427.99	2.52	1350.87	1351.21		1351.22	0.00501	0.55	4.56	36.61	0.50
14734.97	2.52	1351.55	1352.00		1352.01	0.00155	0.38	6.70	39.58	0.29
15096.80	2.52	1352.40	1352.62	1352.52	1352.63	0.00183	0.44	5.67	29.51	0.32
15348.92	2.52	1352.66	1353.14	1352.97	1353.15	0.00233	0.53	4.71	22.29	0.37
15601.86	2.52	1350.90	1353.16		1353.16	0.00001	0.09	28.62	24.99	0.03
15962.88	2.52	1354.16	1354.38	1354.38	1354.44	0.02127	1.08	2.33	20.16	1.02
16269.86	2.52	1353.55	1354.55	1353.87	1354.55	0.00011	0.23	11.19	19.08	0.09
16576.84	2.52	1356.03	1356.24	1356.24	1356.29	0.02705	1.03	2.45	27.31	1.10
17190.14	2.52	1357.54	1357.89	1357.75	1357.90	0.00091	0.29	8.62	49.92	0.22
17496.63	2.52	1357.83	1358.17	1357.98	1358.17	0.00087	0.35	7.13	29.83	0.23
17804.75	2.52	1358.55	1358.81	1358.78	1358.85	0.01192	0.88	2.85	21.59	0.78
17976.90	2.52	1358.69	1359.14	1358.94	1359.14	0.00064	0.24	10.40	61.30	0.19
18143.34	2.52	1358.60	1359.22	1358.87	1359.22	0.00035	0.28	8.93	26.73	0.16
18191.00	2.52	1357.38	1359.22	1357.62	1359.22	0.00000	0.05	47.38	53.28	0.02
18200.00	Bridge									
18202.00	2.52	1357.38	1359.23	1357.62	1359.23	0.00000	0.05	48.12	54.19	0.02
18345.68	2.52	1359.46	1359.64	1359.64	1359.69	0.02097	1.03	2.46	22.73	1.00
18483.95	2.52	1360.06	1360.46	1360.34	1360.46	0.00252	0.40	6.37	50.28	0.35
18725.87	2.52	1360.38	1360.87	1360.72	1360.88	0.00124	0.35	7.21	40.13	0.26

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
18912.23	2.52	1360.48	1361.01	1360.76	1361.01	0.00046	0.30	8.33	27.22	0.17
19027.50	2.52	1359.59	1361.01	1359.83	1361.01	0.00000	0.05	51.82	93.25	0.02
19038.00	Bridge									
19039.00	2.52	1359.59	1361.03	1359.83	1361.03	0.00000	0.05	53.58	94.86	0.02
19113.93	2.52	1360.94	1361.30	1361.30	1361.39	0.01713	1.30	1.94	10.75	0.98
19339.65	2.52	1361.55	1362.11	1361.88	1362.12	0.00129	0.41	6.21	28.45	0.28
19953.60	2.52	1363.38	1363.76	1363.71	1363.79	0.00896	0.80	3.14	22.19	0.68
20294.09	2.52	1364.12	1364.67	1364.51	1364.68	0.00119	0.40	6.29	27.76	0.27
20567.56	2.52	1364.79	1365.08		1365.09	0.00198	0.50	5.05	23.51	0.34
20874.54	2.52	1365.85	1366.12	1366.09	1366.14	0.00709	0.63	3.98	33.72	0.59
21181.52	2.52	1366.24	1366.78	1366.55	1366.79	0.00100	0.41	6.08	22.43	0.25
21488.50	2.52	1367.42	1367.76	1367.76	1367.81	0.02293	1.06	2.38	22.51	1.04
21795.48	2.52	1368.17	1368.71		1368.72	0.00109	0.33	7.61	41.79	0.25
22102.45	2.52	1368.78	1369.22		1369.24	0.00296	0.62	4.05	18.26	0.42
22437.91	2.52	1369.68	1370.15		1370.16	0.00254	0.45	5.60	36.65	0.37
22716.41	2.52	1370.64	1371.00	1370.92	1371.02	0.00386	0.62	4.08	22.63	0.47
22896.25	2.52	1371.22	1371.57	1371.47	1371.58	0.00248	0.43	5.85	40.22	0.36
23002.00	2.52	1367.03	1371.58	1367.54	1371.58	0.00000	0.01	218.67	87.70	0.00
23015.00	Bridge									
23018.00	2.52	1367.03	1371.59	1367.54	1371.59	0.00000	0.01	219.45	87.77	0.00
23083.34	2.52	1371.66	1371.82	1371.82	1371.86	0.02158	0.95	2.66	28.32	0.99
23312.86	2.52	1372.10	1372.48	1372.30	1372.48	0.00099	0.31	8.07	45.08	0.24
23629.52	2.52	1373.36	1373.52	1373.52	1373.58	0.02662	1.07	2.36	24.54	1.10
23944.33	2.52	1374.08	1374.46	1374.29	1374.47	0.00100	0.34	7.39	36.24	0.24
24251.53	2.52	1375.36	1375.56	1375.56	1375.60	0.02271	0.89	2.84	34.67	0.99
24561.73	2.52	1376.16	1376.54	1376.38	1376.55	0.00114	0.32	7.99	48.79	0.25
24727.43	2.52	1376.31	1376.89	1376.79	1376.95	0.00706	1.03	2.44	9.84	0.66
25172.24	2.52	1378.36	1378.62	1378.53	1378.63	0.00232	0.38	6.70	53.61	0.34
25479.22	2.52	1378.94	1379.62	1379.48	1379.67	0.00522	1.03	2.46	7.88	0.59
25786.20	2.52	1380.22	1380.56	1380.44	1380.57	0.00184	0.43	5.85	32.05	0.32
26122.64	2.52	1381.50	1381.80	1381.77	1381.84	0.01146	0.84	3.01	24.00	0.75
26400.15	2.52	1382.76	1383.10	1383.00	1383.11	0.00244	0.44	5.75	37.96	0.36
26707.13	2.52	1384.03	1384.34	1384.29	1384.36	0.00805	0.71	3.53	27.50	0.64
27014.11	2.52	1384.75	1385.28	1385.08	1385.29	0.00156	0.51	4.98	18.97	0.32

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
27321.09	2.52	1385.76	1386.14	1386.07	1386.17	0.00678	0.85	2.98	15.77	0.62
27628.07	2.52	1386.84	1387.28	1387.14	1387.29	0.00227	0.43	5.86	37.64	0.35
27935.05	2.52	1388.30	1388.56	1388.53	1388.58	0.01002	0.55	4.57	61.81	0.65
28242.03	2.52	1389.65	1389.92	1389.85	1389.93	0.00247	0.37	6.77	57.53	0.35
28549.00	2.52	1390.40	1390.79	1390.67	1390.81	0.00340	0.60	4.17	21.78	0.44
28856.20	2.52	1391.67	1392.05	1391.98	1392.07	0.00503	0.61	4.11	28.22	0.51
29162.96	2.52	1392.57	1392.98		1392.99	0.00198	0.51	4.97	22.57	0.34
29469.94	2.52	1393.68	1393.97	1393.92	1393.99	0.00617	0.66	3.80	27.03	0.56
29776.92	2.52	1394.43	1394.80		1394.80	0.00147	0.39	6.44	34.37	0.29
30184.03	2.52	1396.02	1396.14	1396.12	1396.16	0.01401	0.75	3.34	36.22	0.79
30697.85	2.52	1397.29	1397.89	1397.65	1397.91	0.00149	0.48	5.23	20.61	0.31
31004.83	2.52	1398.43	1398.67	1398.62	1398.68	0.00519	0.47	5.42	57.64	0.48
31311.81	2.52	1399.58	1399.84		1399.86	0.00294	0.58	4.32	21.31	0.41
31618.79	2.52	1399.78	1400.27		1400.29	0.00080	0.46	5.51	14.58	0.24
31988.39	2.52	1401.48	1401.81	1401.81	1401.89	0.01827	1.27	1.98	12.03	1.00
32033.38	2.52	1402.13	1402.46		1402.49	0.00987	0.77	3.27	26.31	0.70
32178.59	2.52	1402.50	1403.26	1403.19	1403.27	0.00336	0.45	5.62	45.40	0.41
32204.47	2.52	1402.97	1403.31		1403.31	0.00101	0.31	8.05	45.34	0.24
32602.28	2.52	1404.66	1404.82	1404.82	1404.87	0.02090	1.04	2.43	21.98	1.00
32846.70	2.52	1404.25	1405.10	1404.63	1405.10	0.00029	0.31	8.11	18.06	0.15
33153.68	2.52	1407.19	1407.46	1407.46	1407.51	0.02159	1.01	2.50	24.22	1.00
33460.66	2.52	1408.05	1408.46		1408.47	0.00118	0.36	7.09	37.16	0.26
33767.64	2.52	1409.22	1409.45	1409.45	1409.51	0.02193	1.00	2.51	24.85	1.01
34056.21	2.52	1409.83	1410.39	1410.16	1410.40	0.00115	0.43	5.86	22.64	0.27
34504.09	2.52	1412.57	1412.69	1412.69	1412.74	0.02305	0.96	2.61	28.46	1.02
34747.74	2.52	1412.84	1413.43	1413.21	1413.44	0.00106	0.31	8.25	50.02	0.24
34995.55	2.52	1413.02	1413.65		1413.65	0.00073	0.35	7.24	27.15	0.22
35265.62	2.52	1414.10	1414.39	1414.39	1414.47	0.01807	1.28	1.97	11.65	1.00
35609.51	2.52	1415.17	1415.58		1415.59	0.00130	0.45	5.56	21.75	0.29
35916.49	2.52	1415.66	1416.07		1416.08	0.00200	0.53	4.72	19.99	0.35
36530.45	2.52	1418.12	1418.51	1418.48	1418.55	0.01168	0.85	2.96	23.33	0.76
36837.43	2.52	1418.91	1419.32		1419.33	0.00108	0.44	5.67	19.81	0.26
37144.40	2.52	1420.28	1420.50	1420.50	1420.56	0.02340	1.11	2.26	20.07	1.06
37432.39	2.52	1419.44	1420.64	1419.80	1420.64	0.00007	0.17	14.86	28.90	0.08

Table 31. HEC-RAS output for 2.10 m3/s.

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
0.00	2.10	1312.89	1313.30	1313.18	1313.31	0.00300	0.49	4.28	27.93	0.40
306.98	2.10	1314.00	1314.35	1314.26	1314.37	0.00396	0.61	3.43	19.77	0.47
613.96	2.10	1315.27	1315.55	1315.46	1315.57	0.00385	0.57	3.66	22.71	0.46
920.94	2.10	1316.38	1316.69		1316.70	0.00355	0.49	4.30	31.98	0.42
1227.91	2.10	1317.31	1317.64		1317.65	0.00269	0.45	4.67	31.94	0.38
1534.89	2.10	1318.08	1318.54		1318.55	0.00324	0.46	4.57	34.78	0.40
1841.87	2.10	1317.98	1318.66		1318.66	0.00012	0.21	9.99	21.08	0.10
2148.85	2.10	1319.39	1319.61	1319.61	1319.66	0.02720	1.00	2.09	24.26	1.09
2455.83	2.10	1319.99	1320.38		1320.38	0.00082	0.26	7.93	49.03	0.21
2762.81	2.10	1320.70	1320.97	1320.94	1321.02	0.01177	0.90	2.33	17.06	0.78
3069.79	2.10	1321.47	1321.98	1321.77	1321.98	0.00142	0.37	5.75	33.23	0.28
3374.64	2.10	1322.02	1322.48		1322.50	0.00195	0.60	3.47	11.93	0.36
3683.74	2.10	1323.24	1323.52	1323.49	1323.56	0.00716	0.82	2.57	14.81	0.63
3990.72	2.10	1323.75	1324.24		1324.25	0.00108	0.41	5.12	20.29	0.26
4297.70	2.10	1325.01	1325.19	1325.19	1325.24	0.01677	0.97	2.16	18.24	0.90
4604.68	2.10	1325.66	1326.11	1325.92	1326.12	0.00113	0.42	5.00	19.66	0.27
4911.66	2.10	1326.72	1326.99	1326.98	1327.05	0.02069	1.03	2.04	18.63	0.99
5218.64	2.10	1326.76	1327.35	1327.05	1327.35	0.00031	0.26	8.02	24.61	0.15
5525.61	2.10	1327.88	1328.14	1328.14	1328.21	0.01939	1.15	1.82	13.30	1.00
5832.59	2.10	1328.69	1329.02		1329.03	0.00100	0.36	5.89	27.11	0.24
6139.57	2.10	1329.22	1329.61		1329.63	0.00515	0.69	3.06	17.99	0.53
6446.55	2.10	1330.46	1330.80	1330.73	1330.81	0.00296	0.38	5.48	50.97	0.37
6753.53	2.10	1331.19	1331.61		1331.62	0.00239	0.57	3.66	15.85	0.38
7060.51	2.10	1332.31	1332.62	1332.55	1332.64	0.00485	0.62	3.38	22.09	0.51
7367.49	2.10	1333.22	1333.44	1333.35	1333.45	0.00166	0.35	5.98	41.33	0.29
7584.73	2.10	1333.90	1334.14		1334.17	0.00927	0.75	2.79	22.34	0.68
7981.44	2.10	1335.10	1335.39	1335.28	1335.40	0.00151	0.35	5.98	38.56	0.28
8288.42	2.10	1334.58	1335.44		1335.44	0.00005	0.14	14.54	27.72	0.06
8595.40	2.10	1336.32	1336.56	1336.56	1336.61	0.02150	1.03	2.04	19.04	1.01
8783.90	2.10	1337.11	1337.40		1337.41	0.00172	0.42	4.95	26.47	0.31
9209.36	2.10	1337.90	1338.26		1338.27	0.00239	0.49	4.31	23.94	0.37
9516.34	2.10	1338.57	1338.96		1338.96	0.00206	0.38	5.51	39.45	0.33
9823.32	2.10	1339.47	1339.81	1339.72	1339.83	0.00403	0.61	3.46	20.36	0.47

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
10128.25	2.10	1340.33	1340.60	1340.47	1340.61	0.00175	0.42	4.97	27.04	0.31
10437.27	2.10	1341.30	1341.60	1341.52	1341.61	0.00821	0.61	3.67	30.11	0.62
10798.08	2.10	1342.44	1342.72	1342.57	1342.72	0.00145	0.29	7.67	52.95	0.27
11051.22	2.10	1343.04	1343.15		1343.16	0.00548	0.44	3.99	17.50	0.49
11370.27	2.10	1343.83	1344.07	1344.00	1344.08	0.00164	0.28	7.44	70.59	0.28
11380.38	2.10	1344.03	1344.24	1344.24	1344.30	0.01685	1.12	1.87	12.90	0.94
11498.00	2.10	1344.43	1344.74	1344.61	1344.74	0.00159	0.33	6.33	45.99	0.29
11665.18	2.10	1344.78	1345.05		1345.06	0.00222	0.45	4.66	27.46	0.35
12015.90	2.10	1345.26	1345.63		1345.63	0.00121	0.38	5.57	27.26	0.27
12279.14	2.10	1345.93	1346.31		1346.35	0.01016	0.87	2.40	16.37	0.73
12586.12	2.10	1347.38	1347.61	1347.55	1347.61	0.00222	0.36	5.84	48.26	0.33
12893.10	2.10	1347.76	1348.07		1348.08	0.00110	0.31	6.85	42.56	0.24
13187.44	2.10	1348.13	1348.44		1348.45	0.00150	0.38	5.53	31.41	0.29
13507.05	2.10	1348.16	1348.72		1348.72	0.00055	0.34	6.11	18.98	0.19
13814.03	2.10	1348.86	1349.11	1349.07	1349.13	0.00664	0.71	2.94	19.76	0.59
14121.01	2.10	1349.84	1350.17		1350.18	0.00206	0.37	5.73	43.47	0.32
14427.99	2.10	1350.87	1351.19	1351.10	1351.20	0.00634	0.56	3.76	35.27	0.55
14734.97	2.10	1351.55	1351.99	1351.87	1351.99	0.00139	0.34	6.16	38.88	0.27
15096.80	2.10	1352.40	1352.59	1352.52	1352.60	0.00203	0.43	4.90	29.11	0.33
15348.92	2.10	1352.66	1353.11	1352.94	1353.13	0.00212	0.49	4.26	21.19	0.35
15601.86	2.10	1350.90	1353.14		1353.14	0.00001	0.07	28.08	24.54	0.02
15962.88	2.10	1354.16	1354.37	1354.37	1354.42	0.01843	0.97	2.18	20.03	0.94
16269.86	2.10	1353.55	1354.51	1353.84	1354.51	0.00009	0.20	10.45	18.48	0.09
16576.84	2.10	1356.03	1356.24	1356.24	1356.28	0.01785	0.84	2.50	27.63	0.89
17190.14	2.10	1357.54	1357.87		1357.87	0.00099	0.29	7.32	46.46	0.23
17496.63	2.10	1357.83	1358.14	1357.96	1358.14	0.00078	0.33	6.37	27.42	0.22
17804.75	2.10	1358.55	1358.77	1358.77	1358.82	0.01843	0.99	2.13	18.96	0.94
17976.90	2.10	1358.69	1359.12	1358.92	1359.13	0.00062	0.22	9.35	60.52	0.18
18143.34	2.10	1358.60	1359.19	1358.85	1359.19	0.00028	0.25	8.28	24.52	0.14
18191.00	2.10	1357.38	1359.19	1357.60	1359.19	0.00000	0.05	45.99	51.53	0.02
18200.00	Bridge									
18202.00	2.10	1357.38	1359.21	1357.60	1359.21	0.00000	0.05	46.57	52.26	0.02
18345.68	2.10	1359.46	1359.63	1359.63	1359.67	0.01651	0.89	2.35	22.42	0.88
18483.95	2.10	1360.06	1360.42	1360.33	1360.43	0.00270	0.42	4.94	36.96	0.37

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
18725.87	2.10	1360.38	1360.85	1360.71	1360.85	0.00122	0.33	6.35	37.91	0.26
18912.23	2.10	1360.48	1360.98	1360.74	1360.98	0.00043	0.28	7.56	26.70	0.17
19027.50	2.10	1359.59	1360.98	1359.81	1360.98	0.00000	0.04	49.08	90.71	0.02
19038.00	Bridge									
19039.00	2.10	1359.59	1361.00	1359.81	1361.00	0.00000	0.04	50.47	92.01	0.02
19113.93	2.10	1360.94	1361.27	1361.27	1361.36	0.01973	1.31	1.60	9.77	1.03
19339.65	2.10	1361.55	1362.08	1361.85	1362.08	0.00125	0.40	5.32	24.88	0.27
19953.60	2.10	1363.38	1363.73	1363.69	1363.77	0.00980	0.83	2.54	18.35	0.71
20294.09	2.10	1364.12	1364.65	1364.49	1364.65	0.00117	0.37	5.65	27.58	0.26
20567.56	2.10	1364.79	1365.06	1364.94	1365.07	0.00198	0.47	4.49	23.00	0.34
20874.54	2.10	1365.85	1366.11	1366.06	1366.12	0.00723	0.61	3.44	31.32	0.59
21181.52	2.10	1366.24	1366.75	1366.53	1366.76	0.00097	0.39	5.38	21.09	0.25
21488.50	2.10	1367.42	1367.71	1367.71	1367.79	0.02018	1.23	1.71	11.73	1.03
21795.48	2.10	1368.17	1368.68		1368.69	0.00111	0.33	6.39	35.96	0.25
22102.45	2.10	1368.78	1369.20		1369.21	0.00290	0.59	3.56	17.12	0.41
22437.91	2.10	1369.68	1370.11		1370.12	0.00252	0.49	4.29	24.65	0.37
22716.41	2.10	1370.64	1370.97	1370.88	1370.99	0.00402	0.60	3.50	20.98	0.47
22896.25	2.10	1371.22	1371.55	1371.45	1371.56	0.00252	0.41	5.07	37.28	0.36
23002.00	2.10	1367.03	1371.56	1367.50	1371.56	0.00000	0.01	216.83	87.55	0.00
23015.00	Bridge									
23018.00	2.10	1367.03	1371.59	1367.50	1371.59	0.00000	0.01	219.30	87.76	0.00
23083.34	2.10	1371.66	1371.81	1371.81	1371.85	0.02162	0.88	2.37	28.07	0.97
23312.86	2.10	1372.10	1372.45	1372.29	1372.46	0.00096	0.30	7.10	41.89	0.23
23629.52	2.10	1373.36	1373.51	1373.51	1373.56	0.02787	1.01	2.08	24.44	1.10
23944.33	2.10	1374.08	1374.44	1374.28	1374.44	0.00098	0.32	6.47	33.77	0.24
24251.53	2.10	1375.36	1375.55	1375.55	1375.59	0.02605	0.87	2.41	33.62	1.04
24561.73	2.10	1376.16	1376.52	1376.36	1376.53	0.00110	0.30	7.06	45.85	0.24
24727.43	2.10	1376.31	1376.85	1376.75	1376.90	0.00623	1.00	2.11	8.11	0.62
25172.24	2.10	1378.36	1378.60	1378.52	1378.61	0.00257	0.37	5.63	49.12	0.35
25479.22	2.10	1378.94	1379.59	1379.44	1379.64	0.00442	0.93	2.27	7.47	0.54
25786.20	2.10	1380.22	1380.54	1380.44	1380.54	0.00209	0.42	4.94	30.43	0.34
26122.64	2.10	1381.50	1381.80	1381.77	1381.82	0.00887	0.73	2.88	23.31	0.66
26400.15	2.10	1382.76	1383.07	1382.98	1383.08	0.00272	0.44	4.81	34.66	0.37
26707.13	2.10	1384.03	1384.32	1384.27	1384.35	0.00694	0.65	3.23	25.88	0.59

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
27014.11	2.10	1384.75	1385.24	1385.06	1385.25	0.00161	0.49	4.30	17.62	0.32
27321.09	2.10	1385.76	1386.11	1386.05	1386.15	0.00667	0.80	2.61	14.78	0.61
27628.07	2.10	1386.84	1387.26	1387.13	1387.27	0.00228	0.43	4.86	31.14	0.35
27935.05	2.10	1388.30	1388.55	1388.51	1388.56	0.01054	0.55	3.83	54.12	0.66
28242.03	2.10	1389.65	1389.91	1389.84	1389.92	0.00241	0.35	5.99	54.70	0.34
28549.00	2.10	1390.40	1390.76	1390.66	1390.78	0.00338	0.59	3.56	19.18	0.44
28856.20	2.10	1391.67	1392.03		1392.05	0.00515	0.59	3.54	25.95	0.51
29162.96	2.10	1392.57	1392.95		1392.97	0.00194	0.48	4.39	21.37	0.34
29469.94	2.10	1393.68	1393.95	1393.90	1393.97	0.00641	0.63	3.33	26.25	0.57
29776.92	2.10	1394.43	1394.77		1394.78	0.00143	0.37	5.71	32.79	0.28
30184.03	2.10	1396.02	1396.13	1396.13	1396.15	0.01048	0.64	3.26	36.17	0.68
30697.85	2.10	1397.29	1397.84	1397.62	1397.85	0.00159	0.50	4.23	16.74	0.32
31004.83	2.10	1398.43	1398.66	1398.62	1398.67	0.00526	0.45	4.70	53.57	0.48
31311.81	2.10	1399.58	1399.82		1399.84	0.00285	0.54	3.88	21.03	0.40
31618.79	2.10	1399.78	1400.24		1400.25	0.00076	0.42	4.97	14.31	0.23
31988.39	2.10	1401.48	1401.78	1401.78	1401.86	0.01946	1.24	1.69	11.10	1.02
32033.38	2.10	1402.13	1402.44		1402.47	0.00962	0.74	2.84	23.87	0.68
32178.59	2.10	1402.50	1403.25	1403.14	1403.26	0.00342	0.42	4.96	44.13	0.40
32204.47	2.10	1402.97	1403.29		1403.29	0.00094	0.29	7.21	43.07	0.23
32602.28	2.10	1404.66	1404.81	1404.81	1404.85	0.01731	0.92	2.28	21.57	0.90
32846.70	2.10	1404.25	1405.05	1404.59	1405.06	0.00027	0.29	7.27	17.11	0.14
33153.68	2.10	1407.19	1407.44	1407.44	1407.49	0.02137	0.99	2.12	21.08	0.99
33460.66	2.10	1408.05	1408.44		1408.44	0.00118	0.34	6.22	35.22	0.26
33767.64	2.10	1409.22	1409.44	1409.44	1409.49	0.02172	0.96	2.18	22.73	0.99
34056.21	2.10	1409.83	1410.35	1410.13	1410.36	0.00113	0.42	5.00	19.74	0.27
34504.09	2.10	1412.57	1412.67	1412.67	1412.72	0.02830	0.97	2.17	27.37	1.10
34747.74	2.10	1412.84	1413.41	1413.21	1413.41	0.00099	0.29	7.16	43.92	0.23
34995.55	2.10	1413.02	1413.61		1413.62	0.00069	0.33	6.34	24.65	0.21
35265.62	2.10	1414.10	1414.37	1414.37	1414.45	0.01872	1.23	1.70	10.95	1.00
35609.51	2.10	1415.17	1415.55		1415.56	0.00128	0.42	4.95	21.15	0.28
35916.49	2.10	1415.66	1416.04		1416.05	0.00205	0.51	4.10	18.83	0.35
36530.45	2.10	1418.12	1418.50		1418.53	0.01134	0.81	2.60	21.78	0.74
36837.43	2.10	1418.91	1419.29		1419.30	0.00106	0.41	5.06	19.41	0.26
37144.40	2.10	1420.28	1420.50	1420.50	1420.54	0.01673	0.94	2.24	19.97	0.89

River Sta	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
37432.39	2.10	1419.44	1420.61	1419.78	1420.61	0.00006	0.15	13.86	27.03	0.07