FIGURA 7
ESTACIONES DE MUESTREO ACUÁTICO

PROYECTO GRAVERO
SAN LORENZO, PR

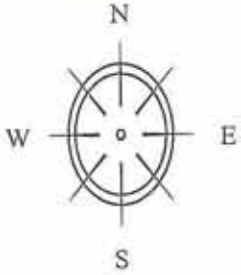

Tabla 1: Tabla de Especies Caribeñas en Peligro de Extinción (USF&WS)

SAN LORENZO

SCIENTIFIC NAME	COMMON NAME	COMMON NAME SPANISH	GROUP	STATUS	DISTRIBUTION
Accipiter striatus venator	Puerto Rican Sharp-Shinned Hawk	Falcon de Sierra	Bird	E	Carite State Forest
Buteo platypterus brunnescens	Puerto Rican Broad-winged Hawk	Guaraguao de Bosque	Bird	E	Carite State Forest
Patagioenas (Columba) inornata wetmore	Puerto Rican Plain Pigeon	Paloma Sabanera	Bird	E	Lower Montane Forest and Riparian Habitats
Eleutherodactylus cooki	Puerto Rican Rock Frog	Guajon	Amphibian	T, CH	Caves, Grottoes, Rocky Formations, Rocky Streams
Epicrates inornatus	Puerto Rican Boa	Boa Puertorriqueña	Reptile	E	Forested Volcanic and Limestone (Karst) Hills

Status
E=Endangered
T=Threatened
CH=Critical Habitat

BACK

Apéndice C: Documentación Fotográfica

Foto 1. Vista general del camino de acceso hacia el área de operaciones.

Foto 2. Vista general del lugar en donde se propone el área de operaciones. Al fondo se observa la flora (Bambúas) asociada al Río Cayaguas.

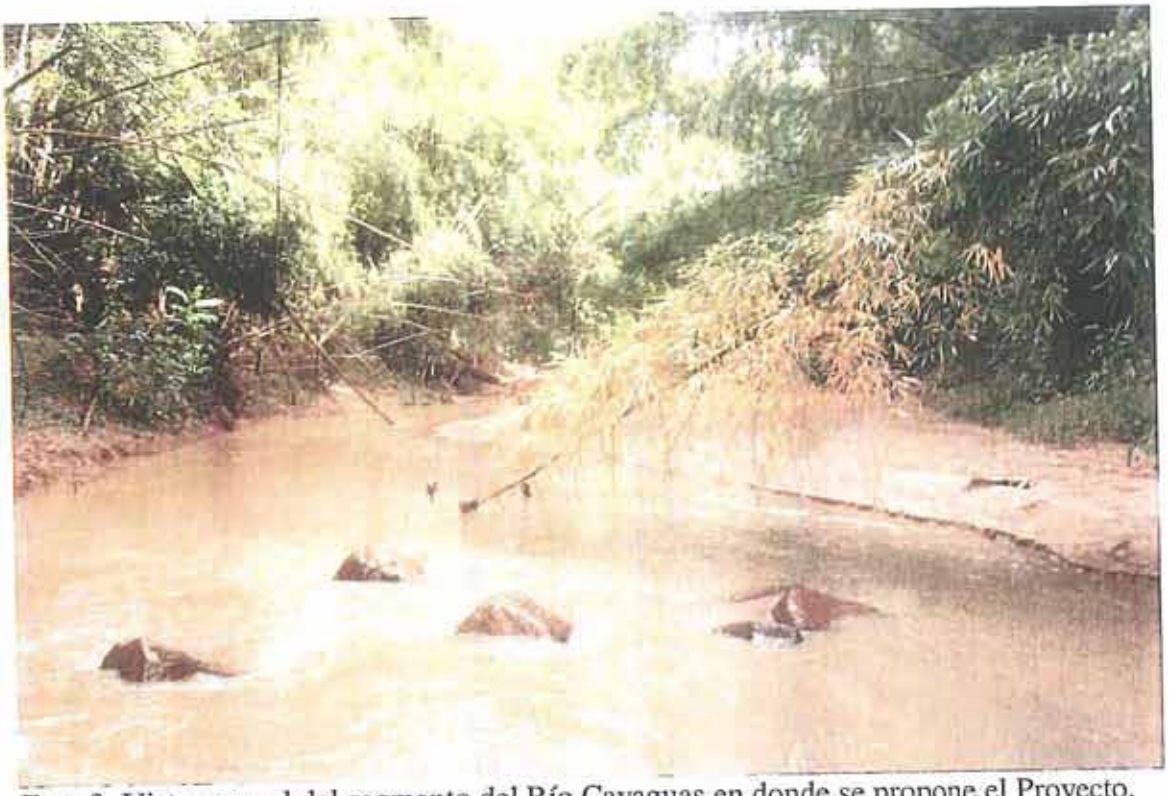

Foto 3. Vista general del segmento del Río Cayaguas en donde se propone el Proyecto.

Foto 4. Confluencia aguas abajo del islote que separa las aguas del Río Cayaguas en el extremo sur del segmento en donde se propone el Proyecto.

Foto 5. Vista del extremo norte del segmento del Río Cayaguas en donde se propone el Proyecto.

Foto 6. Parte del equipo utilizado para el muestreo acuático.

Foto 7. Grupo de trabajo colocando las nasas en la sección sur del extremo sur del Río Cayaguas.

Foto 8. Una de las especies (Chopa pechicolorada) capturadas con las nasas.

Foto 9. Parte del grupo de trabajo verificando las nasas en el extremo norte del segmento del río.

Foto 10. Otra de las especies (Buruquena) capturadas con las nasas.

Foto 11. Colocación de las redes en sección norte del extremo sur del río.

Foto 12. Especie (Mino rosado) de pez capturado en las redes.

Apéndice: 4, Results of Grain-size Analysis Tests for Dredging of Río Cayaguas

LUIS O. GARCIA & ASSOCIATES
GEOTECHNICAL ENGINEERING CONSULTANTS

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Luis Oscar García, MSCE, CE
Carlos García Echevarría, MSCE
James A. Baigés, MSCE

Associate
Alejandro E. Soto, MS, PG

MEMORANDUM

To: Eng. José Vargas

E-mail: vargas-josei@yahoo.com

Date: July 22, 2009

From: James A. Baiges, P.E.

RE: ***Results of Grain-size Analysis Tests for Dredging of Río Cayaguax, San Lorenzo, PR***

GCI Job No. : 4001-09

This memorandum presents the results laboratory tests performed for the proposed dredging of a segment of Río Cayaguax in San Lorenzo, PR. as per your request. As indicated by you, it is proposed to dredge the deposited materials along a 1 km segment of the river basin commencing approximately 1 km of the intersection with Río Grande de Loíza as shown in Figure 1 – Site Location Plan.

A total of 5 grab samples, GS-1 to GS-5, were collected approximately every 250 m as approximately shown in Figure 2 – Sample Location Plan. The samples were taken at a shallow depth (~1ft) and transported to our laboratory in Guaynabo, PR to conduct laboratory soil classification tests to characterize the deposited materials. The tests consisted of performing grain-size distribution analysis following guidelines include in ASTM D-1140. Figure

Results of the tests and the grain size distribution curves per sample are summarized in Figure 3. The material mostly coarse to medium grained, poorly graded sands. The samples contained a fine content (materials passing sieve 200) ranging from 0.1 to 1.4 percent and a gravel portion (materials greater than sieve 4) of 0.3 to 8.9 percent. These materials are product of eroded sand and transported by runoff from the Granodiorite Formation (TKgd) which

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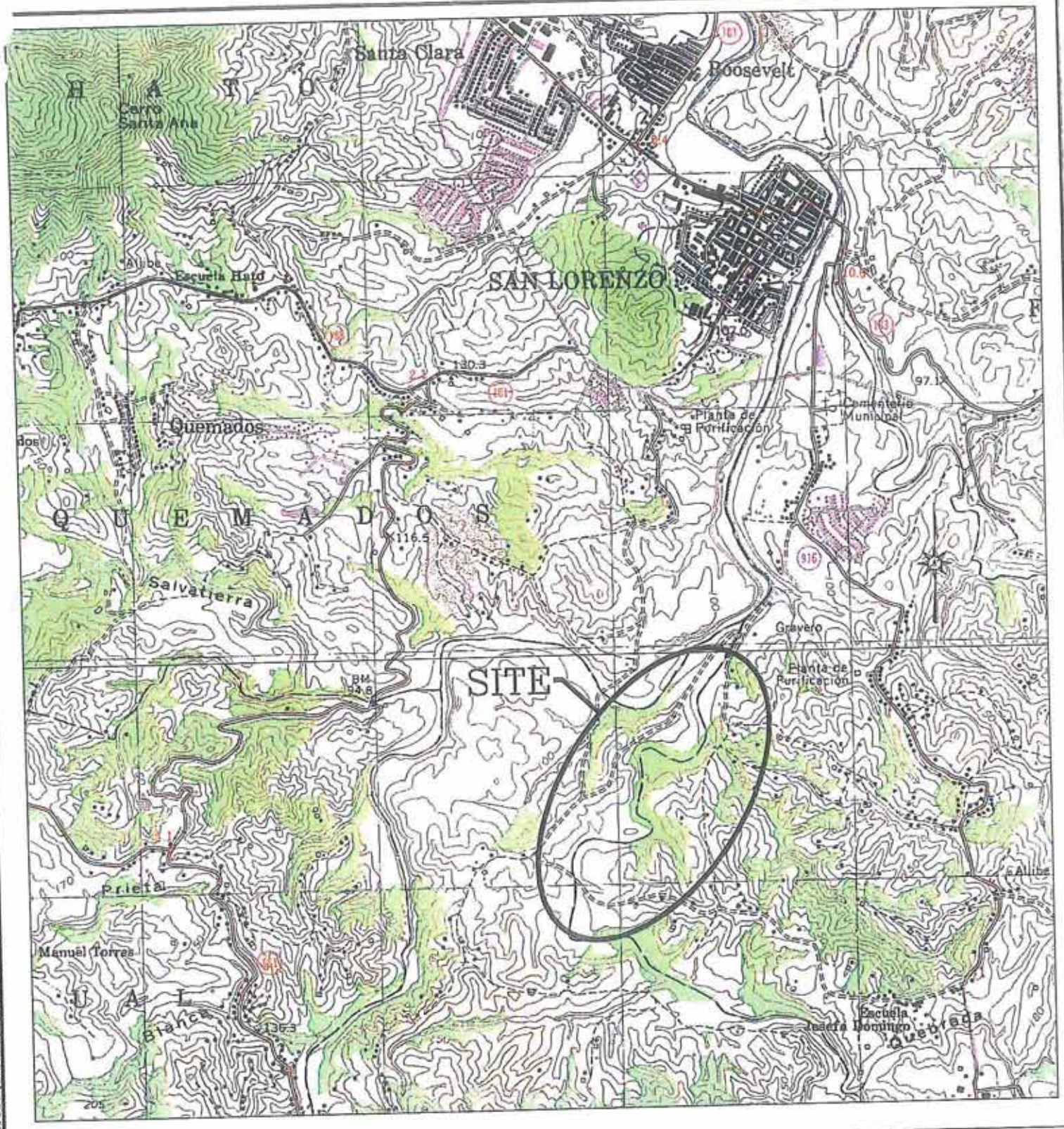
consists of a medium grained rock of plagioclase, quartz and orthoclase which can locally grade into quartz diorite as describe in the geologic map[1] published by the US Geological Survey; portion of the map is presented in Figure 4.

Please feel free to contact us if you have any comments or observations regarding the information herein provide.

Enclosures:
Figure 1 - Site Location Plan
Figure 2 - Test Location Plan
Figure 3 - Grain-size Distribution Curves for Samples GS- 1 to GS-5
Figure 4 – Geologic Map

N:\0000-PROJECT FILE\4001-09 Lab Testing Río Cayaguax\Memo 7-22-09.JVargas.doc

[1] "Preliminary Geologic Map showing Iron and Copper Products and Copper Prospects in the Juncos Quadrangle, Puerto Rico", Misc. Geol. Invest. Series Map I-326, 1961 prepared Carl H. Broedle published by the US Geological Survey



Autocad\Drawings\4001-09\FIG 1

GeoCim
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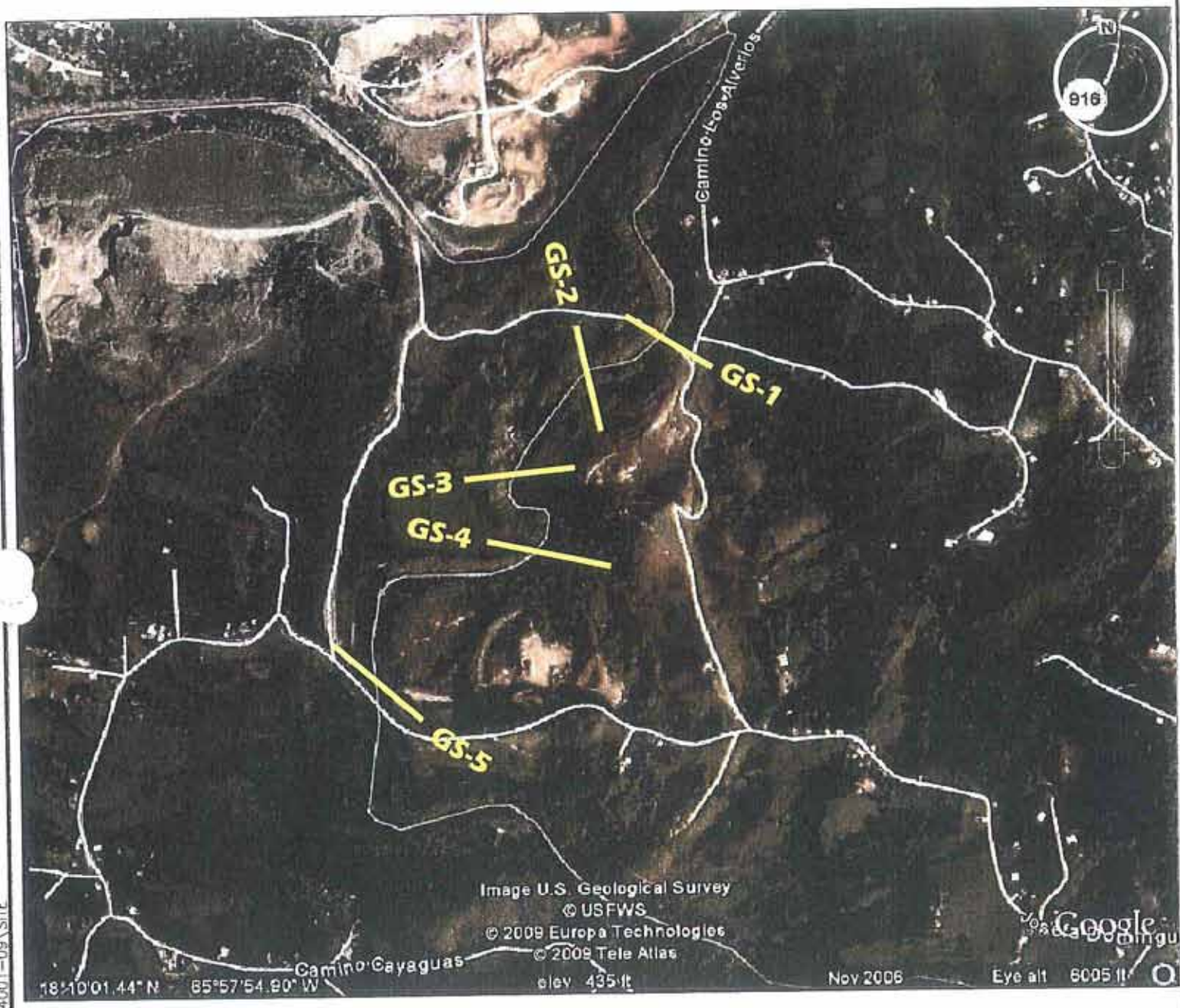
SITE LOCATION PLAN

DREDGING ALONG SEGMENT OF RIO CAYAGUAX, SAN LORENZO, P.R.

DRW. BY:	CKD. BY:	SCALE:	DATE:	JOB. NO:	FIGURE NO:
G.Ortega	J.B.	N.T.S.	07/22/09	4001-09	1



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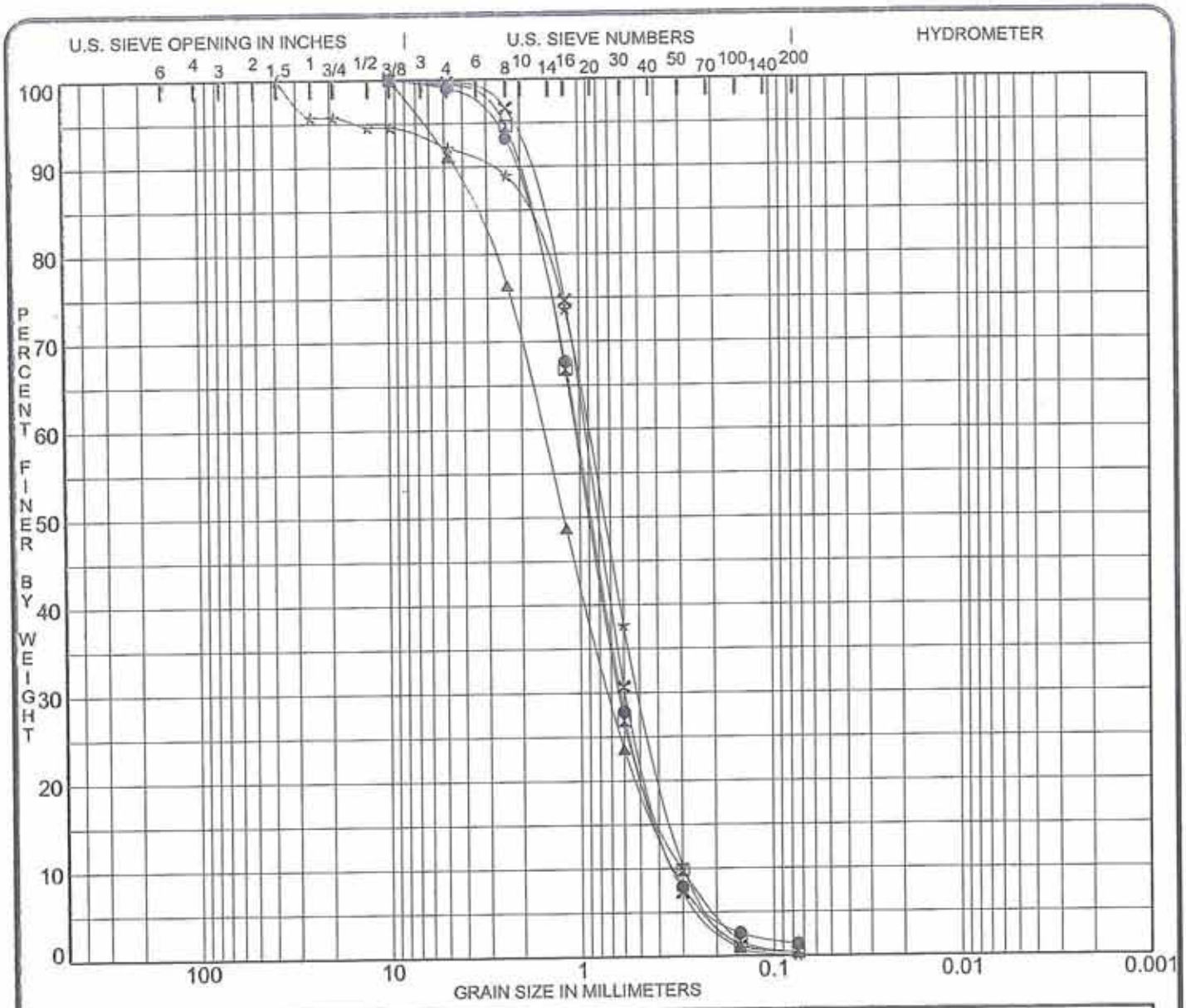
GeoCim
LUIS O. GARCIA & ASSOCIATES

TEST LOCATION PLAN

DREDGING ALONG SEGMENT OF RIO CAYAGUAX, SAN LORENZO, P.R.

DRW. BY:	CKD. BY:	SCALE:	DATE:	JOB. NO:	FIGURE NO:
G.Ortega	J.B.	N.T.S.	07/22/09	4001-09	2



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	GS-1	1.0	POORLY GRADED SAND SP		NP	NP	NP	1.16	3.2
⊠	GS-2	1.0	POORLY GRADED SAND SP		NP	NP	NP	1.26	3.5
▲	GS-3	1.0	POORLY GRADED SAND SP		NP	NP	NP	0.99	4.8
★	GS-4	1.0	POORLY GRADED SAND SP		NP	NP	NP	0.91	3.1
✕	GS-5	1.0	POORLY GRADED SAND SP		NP	NP	NP	1.13	2.9

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	GS-1	1.0	9.50	1.04	0.622	0.3225	1.0	97.6	1.4	
⊠	GS-2	1.0	9.50	1.05	0.633	0.3021	0.6	98.9	0.5	
▲	GS-3	1.0	9.50	1.56	0.713	0.3274	8.9	90.8	0.4	
★	GS-4	1.0	37.50	0.91	0.494	0.2927	7.8	92.1	0.1	
✕	GS-5	1.0	9.50	0.94	0.588	0.3250	0.3	99.3	0.4	

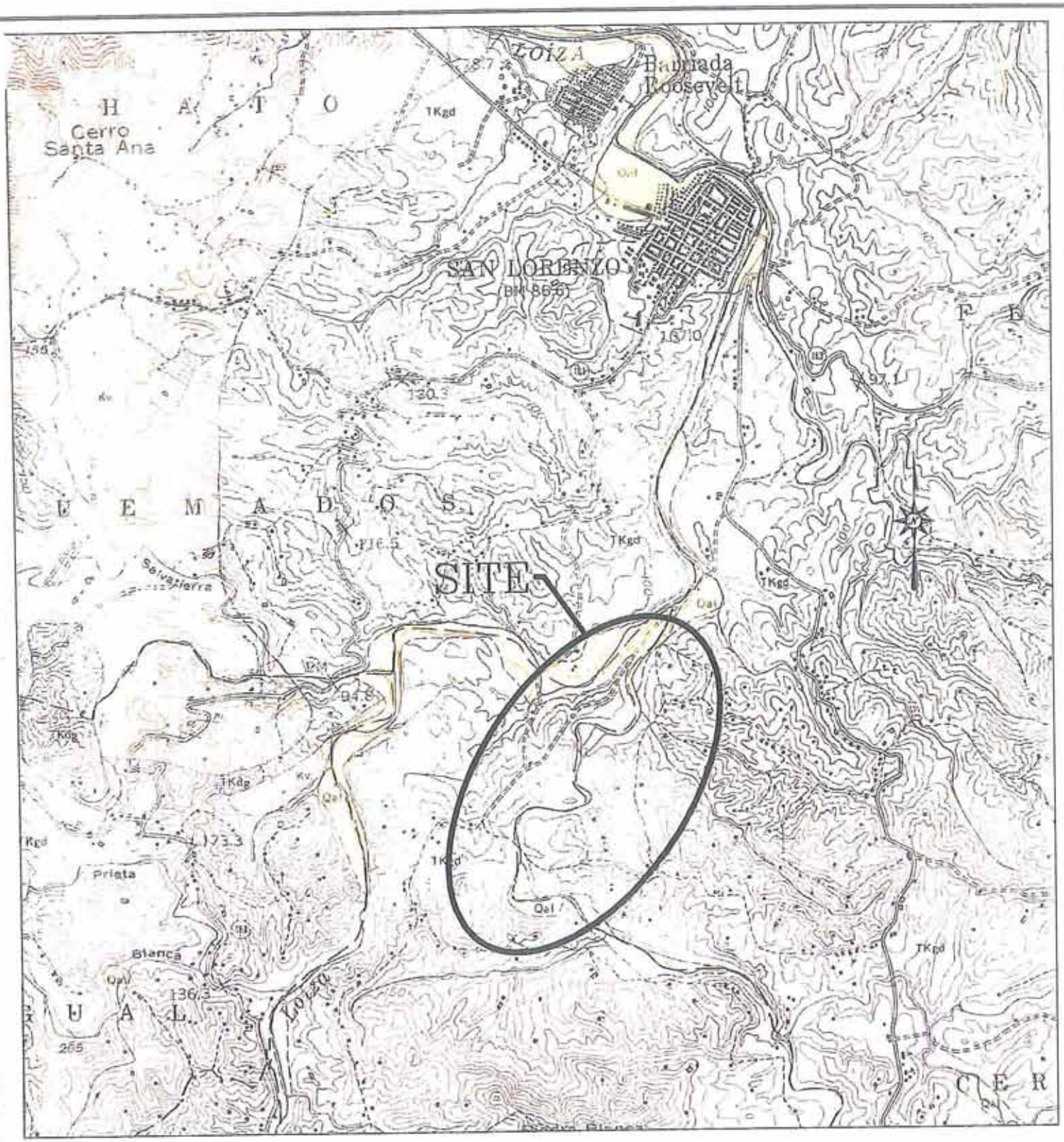
PROJECT Lab. Testing of Rio Cayaguax - San Lorenzo, PR

JOB NO. 4001-09
DATE

GRADATION CURVES

geocim

FIGURE 3



N:\Autocad\Drawings\4001-09\FIG 3

GeoCim
LUIS O. GARCIA & ASSOCIATES

GEOLOGIC MAP

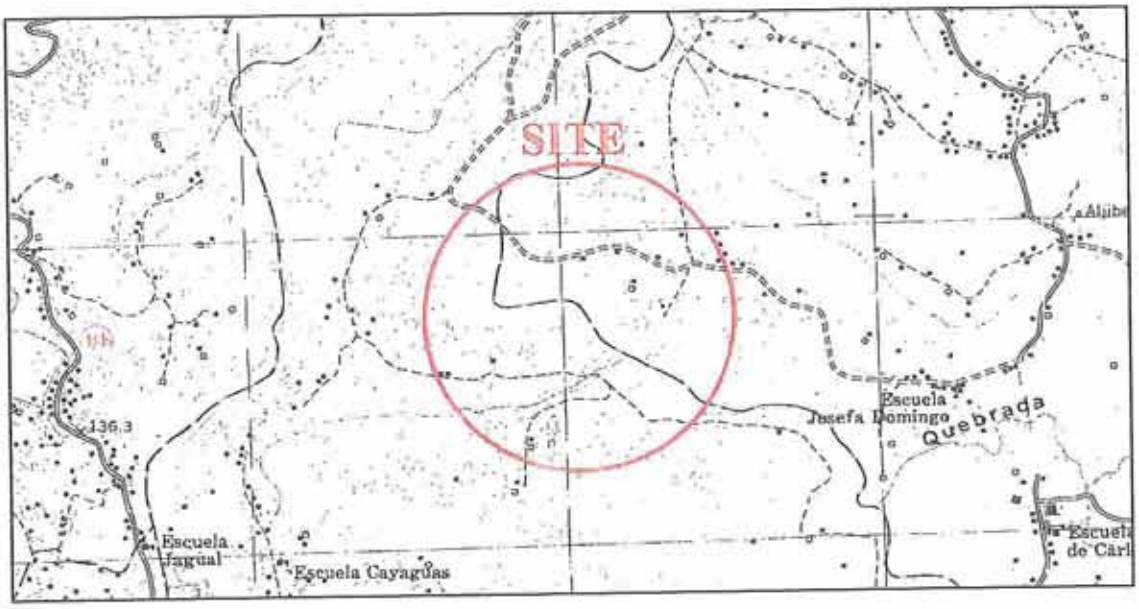
DREDGING ALONG SEGMENT OF RIO CAYAGUAX, SAN LORENZO, P.R.

DRW. BY:	CKD. BY:	SCALE:	DATE:	JOB. NO:	FIGURE NO:
G.Ortega	J.B.	N.T.S.	07/22/09	4001-09	4

Apéndice: 5, Sediment Transport Study for rio Cayaguas San Lorenzo, Puerto Rico

Eriberto Díaz Santiago
San Lorenzo, Puerto Rico

Sediment Transport Study
For Río Cayaguas
San Lorenzo, Puerto Rico



August, 2009

CA Engineering PSC

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FIGURE 7. Thalweg Wye Profile Considering Extraction (11602 days Time Period)

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SEDIMENT TRANSPORT STUDY
FOR GRANULAR MATERIAL EXTRACTION AT
RIO CAYAGUAS
SAN LORENZO, PUERTO RICO

Casiano Ancalle, P.E.

August, 2009

I. INTRODUCTION

Mr. Eriberto Díaz Santiago plans to conduct a granular material extraction deposited on the Río Cayaguas riverbed. The granular material deposits are located in serial point bars, within Quemados ward, in the Municipality of San Lorenzo.

This study assesses the impact of this extraction activity in the geomorphology of the river bed and provides recommendations as to best perform this activity taking into consideration material reposition and the river bank stability. A river segment of about 1 km is assessed.

Purpose of Study

The purpose of the study is to estimate the impact to the solids balance and to the overall stability of the river bed from the extraction activity. The analysis will concentrate in establishing a reference extraction depth and length at the existing point bars.

Authorization

Mr. Jose J. Vargas, on behalf of the owner, Mr. Eriberto Díaz Santiago, authorized this study under a contract signed with CA Engineering, PSC, represented by its president, Casiano Ancalle.

Approach

The following steps have been undertaken throughout the study:

Histogram: A histogram was developed from historic data, to simulate the dynamic action of the flowing water on the movable bed throughout a set up period of time. Data from the USGS Water Resources Stations were used for developing the histogram. The statistical Package MINITAB 14 was used for ranging and analyzes the time series data.

Solids: Incoming solids concentration patterns as well as granular size distribution of these solids were estimated by a regression analysis of the historic data. A soil engineer surveyed the grain size distribution of the river bed.

Sediment Yield: The sediment yield was developed from historic data, as indicator of the eroded soil amounts that leaves the basin. A statistical analysis and the guidelines of USACE EM 1110-2-4000 was used for approximate a theoretical sediment yield.

Sediment Transport Model: The sediment transport model was set up. Two analyses were made, one with and the other without considering extraction. Comparison of the movable bed behavior of both was performed. HEC-RAS model was used for the analysis.

Conclusions and recommendations were elaborated.

II. PROJECT BACKGROUND

Location

The project site is located about 1.8 km upstream of the confluence of Río Grande de Loíza and Río Cayaguas, at Río Cayaguas, Quemados Ward, in the Municipality of San Lorenzo. Figure 1 shows the location of the site in the USGS quadrangle.

Site Characteristics

The river segment identified for the extraction activity has mostly an intermediate pattern with propensity to be braided originated by the overloading of sediment and by the wide shallow channel with steep slopes upstream. Channel divisions around alluvial islands; small pools, point, detached and alternate bars characterize the channel configuration.

To confirm the characteristics of the river in quantitative mode, Lane's relation was used:

$$SQ^{1/4} = K$$

Where: S = Mean slope (*dimensionless*)
Q = Mean flow (*cfs*)
K = Constant value.

When $K \geq 0.01$, the river has a braided pattern, and when $K \leq 0.0017$ the river has a meandering pattern; in between these ranges is intermediate pattern.

For the case of study, a segment of Rio Cayaguas, using mean values for slope and discharge, K is equal to 0.0062, which means that the river is intermediate with a slight tendency toward point bar braided channel pattern. The channel classification is confirmed by the multiple divisions around alluvial island that exist in Cayaguas River.

In geomorphologic terms, the river is classified as mature because the valleys have widened sides and flat slope. However, there are some characteristics that can indicate a recently transition from youthful to mature (Ex. the bed material is not well graded and do not have a meandering pattern.)

The sites identified for extraction are places in which deposit of sediments are evident. Figure 2 shows the location of the extraction sites in a satellite photograph from Google Earth web site. The course of the river at the segment of extraction has an intermediate configuration.

The bed configuration is characterized by dunes formations at downstream of the project.

Flooding

From the regulatory point of view, the project site is classified as floodable for the 100-year rainfall event. Figure 3 shows a portion of the FEMA flood insurance rate map Panel 1240H, revised on April 19, 2005.

Field Information

Field data used in this study was taken from the topographic information provided by surveyor José J. Villanova Portalatín. Results obtained in this study are based on this information. The topography of the site is tied to a local level reference. Appendix I includes this information.

Granular Classification Study

GEO CIM, Inc. performed the grain size classification of the soils samples taken from five representative points of the riverbed, in which the extraction sites will be located. GEO CIM's work is included in a report dated July 22, 2009. The present study is based on this report. See Appendix C. The sample site locations are shown on figure 4.

Former Studies

To our knowledge, no previous studies of this specific kind were found during the information research in the project site. The only related study is a hydrologic-hydraulic study entitled "Hydrologic-Hydraulic Study for Granular Material Extraction at Rio Grande de Loíza" performs by CA Engineering, in March 2003. This study only was a reference but no data from it was used.

Study Level

This study is intended as an aid to establishing a material extraction plan that must be performed by a soil engineer. The assumptions of depth and extension of extraction, as well as grain size, must be carefully verified by the engineer. Figures, schematics and drawings must not be used as extraction plan drawings. The design engineer must elaborate an extraction plan in agreement with the recommendations of this study.

III. HYDRAULIC ANALYSIS

To understand the river hydraulics behaviors under a continuous unsteady flow is necessary predicts different flow parameters like water surface elevation as reference water level for the sediment transport model.

The hydraulic analysis was made using the mathematical model HEC-RAS 4.0 developed by the US Corps of Engineers. For this model, the hydraulic regime is steady, uniform and one-dimensional. The model accepts changes in the geometry of the watercourse, bank-bed-overbank friction coefficient and shapes of hydraulic structures

The friction coefficient used in the modeling was obtained from visual inspection of the watercourses bed and banks; and cross-checked with the typical values provided by Barnes (1967) and Chow (1959).

Cross sections of the watercourses were taken from the fieldwork provided by surveyor José J. Villanova Portalatín. Certified copy of this work is included in Appendix I. Cross sections for analysis are shown in Figure 4.

Roughness

Manning coefficients for the river segment studied was estimated in 0.045 for the overbanks and 0.040 for the main channel. These values reflect the changes in direction and the irregular shape of the channel bed, and the vegetation present in the courses.

Elaborating of River Rating Curve

The sediment transport model is not provided by a subroutine for estimating a reference stating water levels for hydraulic calculations. Therefore, a hydraulic analysis was performed for various increasing flows that would cover all the spectrum of the recorded discharges.

The computer output and the resulting rating curve are included in Appendix D.

IV. SEDIMENT YIELD

The sediment yield for the Cayaguas River basin at the extraction site is a measurement of the eroded soil amounts that leaves the basin. This parameter helps in the estimation of the granular material quantity that can be extracting from the site.

A statistical analysis of the In-stream sampling interpolating from the USGS stations 50051310 was made in order to approximate the sediment yield by using the USACE guidance EM 1110-2-4000 for sediment transport.

The water discharge used in the analysis was obtained from the streamflow record of 1977 to 2009 and the sediment discharge by a regression of the suspended sediment sampling record from October 1983 to September 1984 and from October 1985 to September 1986. A visual site inspection of the watercourses was made in order to aggregate erosion from the individual mechanism (tributary inflows).

Calculations

Along the flow duration curve, 17 computations points was establishing by intervals based on the "percent of time flow equaled or exceeded". The duration mid ordinate and the incremental time of each was compute. The value of water discharge for the midpoint of each segment was obtained from the records (1977 to 2009). The sediment discharge in tons/day for that Q is compute using the USGS formula:

$$Qs = 0.0027*Q*C$$

Where:

Qs = sediment discharge, tons/day

0.0027 = convert cfs to tons/day

Q = mean daily water discharge, cfs

C = mean daily sediment concentration, mg/L

(Reading from the sediment versus discharge curve)

From the sum of the daily average water discharge and the daily suspended sediment discharge was obtained the respective annual yields. By take an unmeasured sediment discharge of 10% and the contributing drainage area of the watershed a value of 1,210.75tons/mi^2 for the unit sediment yield were obtained.

Sediment Yield Results

Based on the calculations the annual yield and the unit sediment yield results based on average data are shown in Tables 1-a and 1-b.

The proposed extraction is focused in the sediment available with a material grain size greater than 0.062mm. With the intention to establish a threshold is necessary estimate the maximum amount of sand available for extraction at the project site.

As a result, the total annual material that can be extracting from the Rio Cayaguas at San Lorenzo is approximate between 768,051.91 cubic meters to 10,252.04 cubic meters, depend if high or low season is. See Appendix E for calculations details.

Table 1-a. Sediment Yield Results

Annual Water Yield *Acr*ft*yr*	**Annual Suspended Sediment Yield** *Tons/year*	**Total Sediment Yield** *Tons/year*	**Unit Sediment Yield** *Tons/square mile*
44,813.43	15,350.17	16,885.18	1,210.75

Table 1-b. Sediment Yield Results

Condition	Total Sediment *Tons/day*	Total Material Yield *Tons/day*	Material Unit Weight *Tons/cubic meter*	Total Material *Cubic meter*
High	19574.33	3,104.03	1.47	768,051.91
Low	328.38	52.07	1.47	10,252.04

V. SEDIMENT TRANSPORT ANALYSIS

Granular material extraction is sought in two locations where there is visible evidence of granular material deposits (river bed bars). The plan of extraction includes the determination of the depth and extends of extraction, so that the riverbed is not adversely and permanently affected.

The approach for the analysis is to first estimate the behavior of the movable riverbed profile over time without any extraction activity (sediment transport rates); followed by the estimation of the riverbed profile when impacted by the extraction activity. Finally, comparison of the profiles is made.

Mathematical Model

The sediment transport analysis was made using the mathematical model HEC-RAS 4.0 developed by the US Corps of Engineers. This model allows perform a one dimensional sediment transport analysis taking into consideration movable boundaries. The model set up to simulate and predict changes in the river profiles resulting from scour and deposition of granular material over a determined period of time. For the analysis, it was used the Meyer-Peter Muller sediment transport function, the Exner sediment continuity equation and the HEC 6 default method for fall velocity.

Discharge Histogram

To simulate a quasi-unsteady solids transport analysis over a set up period of time, the sediment transport model requires on the introduction of a histogram. A histogram is a representation of a frequency distribution by means of rectangles whose widths represent class intervals and whose areas are proportional to the corresponding frequencies. A continuous daily flow record is partitioned into a series of steady flows of variable discharges and durations. The result is a quasi-unsteady flow simulation.

Discharge records for Río Cayaguas were gathered from the Water Resources Data for Puerto Rico and US Virgin Islands from the US Geological Survey. Records from September 16, 1977 to June 17, 2009 were available. The extension of these records was deemed to be sufficient for the purposes of this analysis. Records from Station 50051310 at Rio Cayaguas were used. The USGS Station is located approximately 1 km upstream of the project and the gage drainage area is about 10.20mi^2. The project site drainage area is 13.95 mi^2. A strait line relation of drainage areas were assumed for estimating the flow time series data for the project site. This makes a relation of 1.37.

The resulting daily mean values from the water discharge records were ranked as to their frequency of occurrence. The statistical package MINITAB 14 was used. Appendix A includes the calculations and the results. The data fell in twenty (20) arithmetic *bins* or ranges, from them only thirteen (13) had data. The ranked values were then ordered in a symmetric histogram by splitting the bins to both sides around the central peak flow value. Figure 5 shows the resulting histogram.

Influent Solid Loads

Similar to that of the daily flow, Río Cayaguas is not provided with solids gage at the project site. Sediment load and concentration coming from the upstream was obtained also extrapolating from the USGS station 50051310 with the arithmetic factors of 1.37. The records sediment load and concentration data is from October 1, 1983 until September 30, 1984 and from October 1, 1985 to September 30, 1986. The extension of these records was deemed to be sufficient for the purposes of this analysis. Plots of solid concentration and load against to discharge were developed in order to determine the relation between solids and it with flow. Solids distribution was obtained from the USGS records for station 50051800. Values corresponding to clay were eliminated; therefore, grains were sized from very fine sand (VFS) to fine gravel (FG). Calculations and plots are included in Appendix B.

Granular Classification at the River Bed

GEO CIM, Inc. performed the bed material classification. A summary of the particles size distribution report is included in Appendix C.

Analysis without Considering Extraction Activity

The first step in the analysis was estimating the dynamics of the river bed morphology without any extraction activity intervention. This analysis was made for a period of 11,569 days (~32 years) resembling the stream flow records used.

The HEC-RAS 4.0 program was loaded with the information regarding the characteristics of the river at the segment of study: geometry data, the histogram based on historic records, the incoming sediments load including their classification and the particle size distribution in each section of the river bed.

On the other hand, the granular materials bellow the bed elevation was adopted to be 2 meters at most of the cross sections. To take into account the rocks at the river bed or to calibrate and stabilized the model, eight hard points were considered. The points are located at Sections 15,14,13,12,8,1,0.5 and 0, in which the granular material depth was adopted between 0.10 and 0.05 meters.

The bed extraction material classification was given at five points: Sample No. 1 at Section 0.5, Sample No.2 at Section 3, Sample No.3 at Section 8, Sample No.4 at Section 13 and Sample No. 5 at Section 20. The classification for the other cross section were interpolated or repeated according to their location. See Appendix C for grain classification.

Several runs were made until the model was finally stabilized and calibrated. The output of the computer run is included in Appendix D. Table 1 shows the results of the sediment transport analysis without considering any extraction activity.

Table 1: Results of the Sediment Transport Analysis without Considering Extraction Activity

(Status of the bed profile at time =11569 days (~32 years))

Original Condition							32 Years Condition							
RS	Ch Dist	Ch El	Wsel	Q	V	Mean Eff Ch IE	Ch El	Wsel	IE Change	V	τ0	Sediment Q	Mean Eff Ch IE	Mean Eff Ch IE Change
	(m)	*(m)*	*(m)*	*(m3/s)*	*(ft/s)*	*(m)*	(m)	(m)	(m)	(ft/s)	(lb/sq ft)	(tons/day)	(m)	(m)
20	56.58	76.58	76.89	1.31	0.45	78.07	77.20	78.08	0.62	1.06	5.52	93.14	80.14	2.07
19	74.52	76.42	76.76	1.31	0.31	77.52	76.99	78.20	0.57	0.45	26.37	39.12	78.12	0.60
18	30.24	76.18	76.63	1.31	0.32	78.51	77.88	78.17	1.70	0.41	4.81	36.68	79.35	0.84
17	31.67	76.14	76.48	1.31	0.74	78.44	76.12	76.60	-0.02	0.45	10.53	36.68	78.44	0.00
16	14.38	76.14	76.41	1.31	0.24	76.81	76.33	76.50	0.19	0.47	1.57	36.47	77.03	0.22
15	17.26	76.13	76.40	1.31	0.28	76.75	76.20	76.41	0.07	0.53	2.50	36.51	76.81	0.05
14	1.55	76.12	76.37	1.31	0.37	76.38	76.09	76.27	-0.03	0.53	2.45	36.49	76.43	0.05
13	17.03	76.12	76.36	1.31	0.34	76.32	76.03	76.28	-0.09	0.53	2.79	36.49	76.24	-0.08
12	90.67	76.11	76.31	1.31	0.46	76.80	76.04	76.17	-0.07	0.51	2.43	37.80	76.76	-0.03
11	80.54	75.86	76.06	1.31	0.40	76.51	75.67	76.12	-0.19	0.52	7.90	37.80	76.39	-0.12
10	46.36	75.59	75.87	1.31	0.46	76.66	75.67	76.00	0.08	0.58	5.85	47.95	76.80	0.14
9	17.58	75.48	75.74	1.31	0.46	76.12	75.55	75.98	0.07	0.55	13.27	44.48	76.15	0.03
8	75.61	75.38	75.72	1.31	0.25	76.05	75.79	75.93	0.41	0.54	3.12	41.18	76.38	0.33
7	66.61	75.30	75.66	1.31	0.40	76.57	75.38	75.80	0.08	0.57	10.49	56.19	76.59	0.02
6	32.05	75.25	75.58	1.31	0.33	76.05	75.25	75.65	0.00	0.61	2.52	35.82	76.22	0.18
5	34.80	75.22	75.48	1.31	0.77	76.90	75.11	75.58	-0.11	0.60	4.69	32.13	76.86	-0.04
4	43.34	75.04	75.27	1.31	0.49	75.62	75.04	75.47	0.00	0.55	1.74	18.37	75.84	0.22
3	107.15	74.88	75.17	1.31	0.35	75.38	74.88	75.38	0.00	0.50	2.22	17.61	75.52	0.14
2	48.26	74.71	75.02	1.31	0.34	75.10	74.84	75.04	0.13	0.48	1.75	16.95	75.22	0.12
1	39.31	74.60	74.96	1.31	0.34	75.17	74.56	74.92	-0.04	0.48	3.22	16.95	75.14	-0.03
0.5	67.32	74.54	74.86	1.31	0.53	74.89	74.50	74.81	-0.04	0.54	2.00	16.95	74.86	-0.03
0	0.00	74.10	74.36	1.31	0.74	74.88	74.06	74.36	-0.04	0.62	2.95	16.95	74.86	-0.02

The results show clearly that the river bed will suffer a mild degradation mostly in the center of the site at cross sections 17, 14 until 11, 5 and from 1 until 0 over the analysis period of 32 years; but the main trend of the river is to build up deposits (aggradate) or remain stable at most of the cross sections. The overall aggradation in Section 18 over a period of 32 years has been estimated in 1.69 meters.

A wye graph for the river thalweg elevation at each cross section is shown in Figure 6. This figure compares the present with the expected (at the end of ~32-year time span) thalweg

profiles. Additionally, the graph includes the results for half of the period in which the histogram used exhibits its maximum discharge. The tendency to aggradate in some cross sections does not vary significantly; the stability of the river bed is rather a constant parameter at river cross sections.

Analysis Considering Extraction Activity

The model for the present riverbed morphology was adapted for reflecting the extraction activity along the segment of river subject to study. Simultaneous extraction activity was set up for the sites A and B. The extraction areas comprehend the segments between cross sections 2 until 7 and 9 until 12.

Extraction was assumed to be on de sand bars at most of the cross sections. The depth of extraction was brought down to the thalweg invert elevation, except of cross sections between 11 until 9 and 2; 7 and 4; 6; 5 and 2 where the depth of extraction went bellow the thalweg invert 0.05, 0.10, 0.15, 0.20 meters, respectively.

The output of the computer run is included in Appendix G. Table 2 shows the results of the sediment transport analysis considering any extraction activity in the specified sites.

Table 2: Results of Sediment Transport Analysis Considering Extraction Activity at Sites A & B

(Status of the bed profile at time =11569 days (~32 years))

Original Condition							32 Years Condition							
RS	Ch Dist	Ch El	Wsel	Q	V	Mean Eff Ch IE	Ch El	Wsel	IE Change	V	τ0	Sediment Q	Mean Eff Ch IE	Mean Eff Ch IE Change
	(m)	*(m)*	*(m)*	*(m3/s)*	*(ft/s)*	*(m)*	(m)	(m)	(m)	(ft/s)	(lb/sq ft)	(tons/day)	(m)	(m)
20.00	56.58	76.58	76.89	1.31	0.45	78.07	77.20	78.07	0.62	1.10	5.84	124.45	80.14	2.08
19.00	74.52	76.42	76.76	1.31	0.31	77.52	76.99	78.19	0.57	0.46	27.58	44.07	78.15	0.63
18.00	30.24	76.18	76.63	1.31	0.32	78.51	77.87	78.16	1.69	0.42	4.81	40.67	79.34	0.84
17.00	31.67	76.14	76.49	1.31	0.72	78.44	76.10	76.57	-0.04	0.46	9.84	40.67	78.43	-0.01
16.00	14.38	76.14	76.41	1.31	0.25	76.81	76.28	76.45	0.14	0.40	1.47	42.76	77.00	0.19
15.00	17.26	76.13	76.39	1.31	0.29	76.75	76.04	76.46	-0.09	0.41	3.78	42.76	76.69	-0.07

14.00	1.55	76.12	76.35	1.31	0.41	76.38	76.26	76.42	0.14	0.46	2.78	34.61	76.52	0.14
13.00	17.03	76.12	76.34	1.31	0.39	76.32	76.03	76.43	-0.09	0.55	8.89	34.61	76.24	-0.08
12.00	90.67	76.11	76.29	1.31	0.41	76.76	76.11	76.35	0.00	0.66	2.29	34.59	76.96	0.20
11.00	80.54	75.81	75.95	1.31	0.48	76.41	75.63	75.97	-0.18	0.59	9.37	34.59	76.33	-0.08
10.00	46.36	75.54	75.69	1.31	0.34	76.00	75.54	75.80	0.00	0.46	1.00	21.42	76.21	0.21
9.00	17.58	75.43	75.62	1.31	0.27	75.78	75.49	75.78	0.06	0.43	3.91	21.53	75.83	0.05
8.00	75.61	75.38	75.57	1.31	0.51	76.05	75.58	75.74	0.20	0.46	1.83	21.22	76.21	0.16
7.00	66.61	75.20	75.40	1.31	0.31	76.06	75.20	75.43	0.00	0.44	2.78	20.34	76.12	0.05
6.00	32.05	75.10	75.28	1.31	0.40	75.74	75.10	75.29	0.00	0.35	0.89	2.32	75.74	0.00
5.00	34.80	75.02	75.20	1.31	0.39	76.30	75.01	75.25	-0.01	0.37	0.81	3.12	76.30	-0.01
4.00	43.34	74.94	75.13	1.31	0.33	75.37	75.04	75.16	0.10	0.39	1.01	3.15	75.46	0.09
3.00	107.15	74.88	75.06	1.31	0.30	75.20	74.88	75.07	0.00	0.34	1.60	3.41	75.20	0.00
2.00	48.26	74.66	74.99	1.31	0.24	74.99	74.66	74.97	0.00	0.31	0.58	1.40	75.03	0.05
1.00	39.31	74.60	74.96	1.31	0.34	75.17	74.56	74.92	-0.04	0.40	0.63	1.40	75.14	-0.03
0.50	67.32	74.54	74.86	1.31	0.53	74.89	74.49	74.81	-0.05	0.54	2.00	1.40	74.86	-0.03
0.00	0.00	74.10	74.36	1.31	0.74	74.88	74.06	74.36	-0.04	0.62	2.95	1.40	74.86	-0.02

The wye graph shown in Figure 7 indicates that with the extraction activity a serial aggradation-degradation will occurs along the bed profile within the 32-year in the period of analysis, having aggradation in 13 cross sections. Considering the peak of the histogram, that is a half of the period of analysis, the very same pattern is repeated, meaning that the peak discharges will not produce an additional effect in the regular pattern of the bed morphology.

Comparison

Several runs were tried to estimate the effect to the river profile configuration from the extraction activity in order to find the minimum time span in which the river bed is regenerated for subsequent activity. From these trials, it is concluded that the river can perfectly assimilate the proposed extraction activity at the sites A and B in a two and a half-year period. Solids reposition to the levels indicated by the model, in either case, can be expected in this period of time. In the cross sections that not aggrading occurs, the removal rate and quantity should not be more than the average annual yield of the size classes being removed[1].

[1] See Appendix E: Sediment Yield calculations.

Figure 8 shows the river segment profile without extraction compared to the profile with extraction for a two and a half-year period. Both profiles look very similar. This means that the effect in the river bed profile configuration from the extraction activity will be negligible after two years and a half.

Parameters for the Extraction Plan

The following Table 3 is the summary of the extraction parameters obtained from this study. These parameters will serve for the planer to set up an extraction plan.

Table 3: Projected River Bed Bottom Elevation after 2.5 years with Extraction activity

Section	Bottom Elevation	
	Feet	*Meters*
0	74.06	242.98
0.5	74.53	244.53
1	74.59	244.74
2	74.66	244.96
3	74.88	245.68
4	74.95	245.92
5	75.02	246.14
6	75.10	246.40
7	75.20	246.73
8	75.37	247.28
9	75.45	247.55
10	75.54	247.85
11	75.80	248.69
12	76.11	249.72
13	76.07	249.59
14	76.05	249.53
15	76.15	249.86
16	76.16	249.88
17	76.11	249.71

18	76.17	249.93
19	76.42	250.73
20	76.59	251.28

Though the overall length of analysis is approximately 0.60 Km., the length for dredging at the bottom elevations indicated in Table 3 is about 800 meters. Figure 9 shows the limits of the extraction site.

VI. CONCLUSIONS AND RECOMMENDATIONS

The following are the conclusions of this study:

1. The hydraulics regime at the river segment studied is subcritical for the daily mean discharges estimated from the stream flow records from 1977 to 2009. Also, the present reach is stable.

2. The histogram resulting from the flow data analysis indicates that 97.88 percent of the data belonging to the lowest flows is contained in the first rank while only 0.0086 percent is in the rank where the peak flow is.

3. Without any extraction activity, the movable river bed will aggradate or remain stable most of the segments, except some intermediate sections. Degradation will be rare in the horizon of about 32 years time frame.

4. The extraction activity, as described, will not jeopardize the stability of the river bed. Reposition of dredged material is expected would be complete in a period of about two and a half years.

The following are the recommendations of this study:

1. The actual depth and extent of dredging must be determined by the soil engineer after additional soil exploration and within constrain provided in this study.

2. The dredging must not weaken the banks stability. The resulting river banks slope after dredging must be the recommend by the soil engineer in order to avoid the bank caving and the associate introduction of sediment into the stream.

3. Environmental regulations must be carefully followed during the dredging activity.

Study Limits

All the recommendations specified in this study must be considered to assure the optimum performance of the proposed structures operation. The design engineer will be responsible for elaborating the drawings in conformance with the recommendations of this study.

The results of this study are based on free flow conditions. Proper maintenance must be developed to assure this condition. On the event of the occurrence of any severe obstruction to the flow, the results and recommendations may be impaired. Finally, the design engineer must use results and recommendations included in this report only and exclusively for the intended purposes as indicated in this study.

VII. BIBLIOGRAPHY

1. McCuen, Richard. "A Guide to Hydrologic Analysis Using SCS Methods", Prentice Hall Inc. Engle`wood Cliffs, New Jersey, 1982

2. U.S. Army Corps of Engineers. 1998. River Analysis System HEC-RAS 4.0, Hydrologic Engineering Center. Davis, California.

3. Barnes, Harry H. 1967. "Roughness Characteristics of Natural Channel". U.S. Geological Survey Water Supply Paper 1849. U.S. Govt. Printing Office, Washington, D.C.

4. Chow, Ven Te. "Open Channel Hydraulics". McGraw Hill Book Company. New York 1959.

5. U.S.Geological Survey. *"Water Resources Data for Puerto Rico and the Virgin Islands"* 1960-2007. Caribbean District, Water Resources Division. Guaynabo, Puerto Rico.

6. Simons, Daryl B. and Fuat Şentürk. "Sediment Transport Technology". Water Resources Publications 1977. Fort Collins, Colorado 80522, USA.

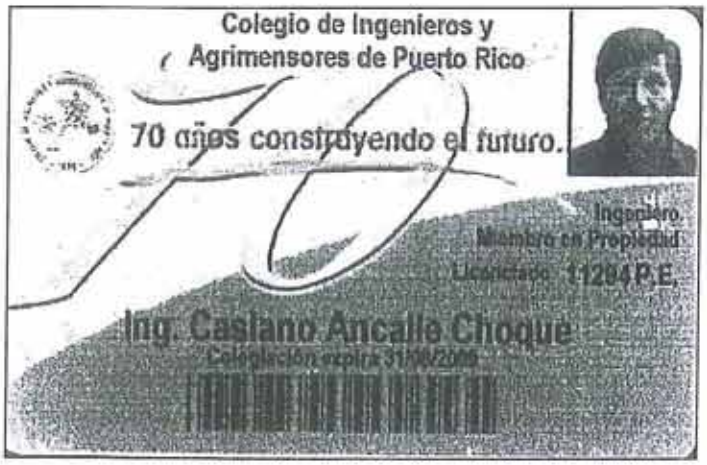
CERTIFICATION
HYDROLOGIC-HYDRAULIC STUDY

I hereby certify that the document "***Sediment Transport Study for Río Cayaguas, San Lorenzo, Puerto Rico***" has been prepared in accordance with the best hydrologic and hydraulic practices as described in this document and that, based on the studies and field measurements provided by other parties, results are true and correct.

Certified today, August 27, 2009

CASIANO ANCALLE
INGENIERO LICENCIADO
LIC.#11294
PUERTO RICO

Casiano Ancalle, P.E.
Lic. 11294



Estado Libre Asociado de Puerto Rico
Departamento de Estado
Secretaria Auxiliar de Juntas Examinadoras

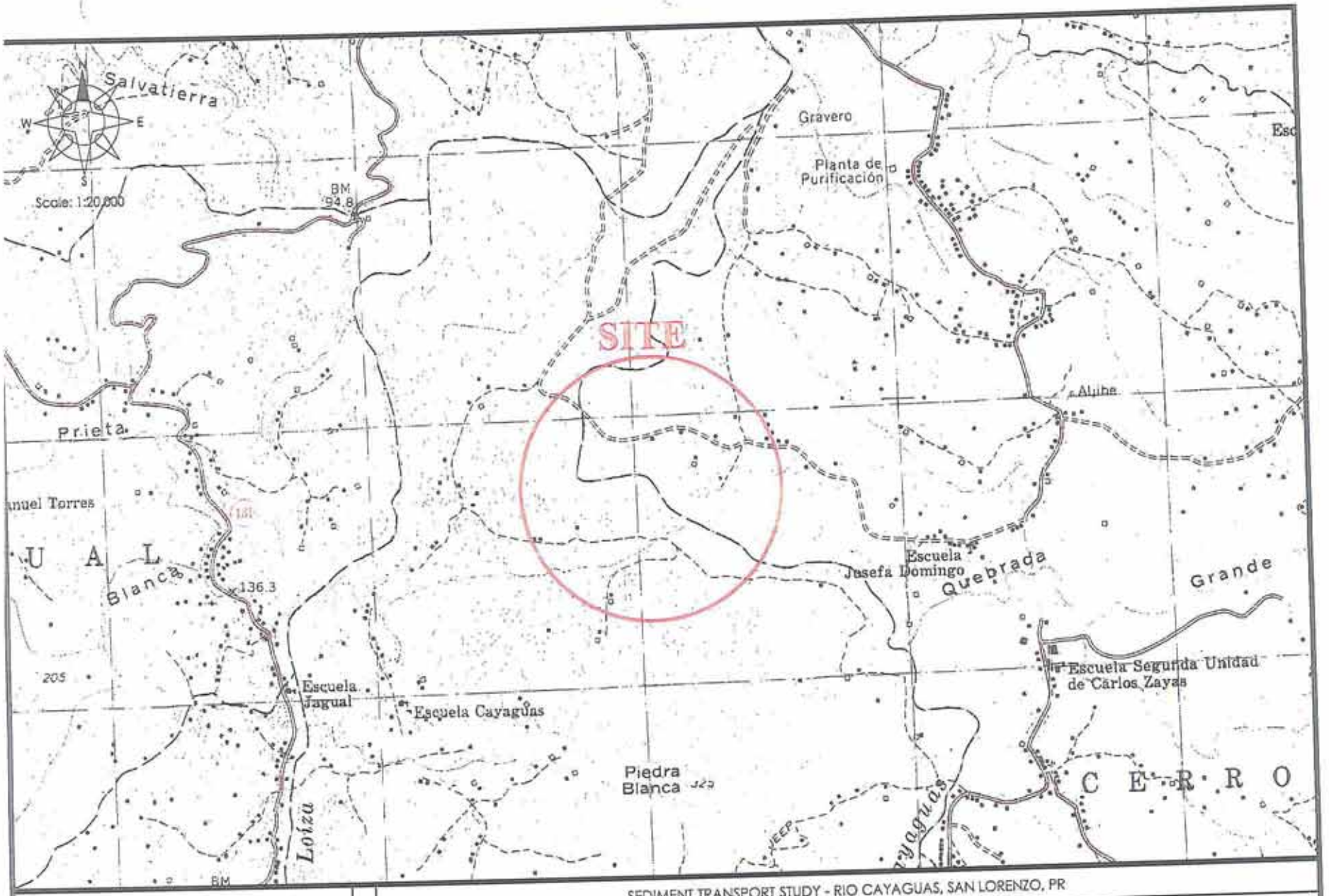
certificamos que:
Casiano Ancalle Choque
esta autorizado a ejercer como
Ingeniero Licenciado
en Puerto Rico

Licencia Núm: **11294**
Expedición: **23 de abril de 2005**
Expiracion: **22 de abril de 2010**

Secretario Auxiliar

Presidente de la Junta

FIGURES



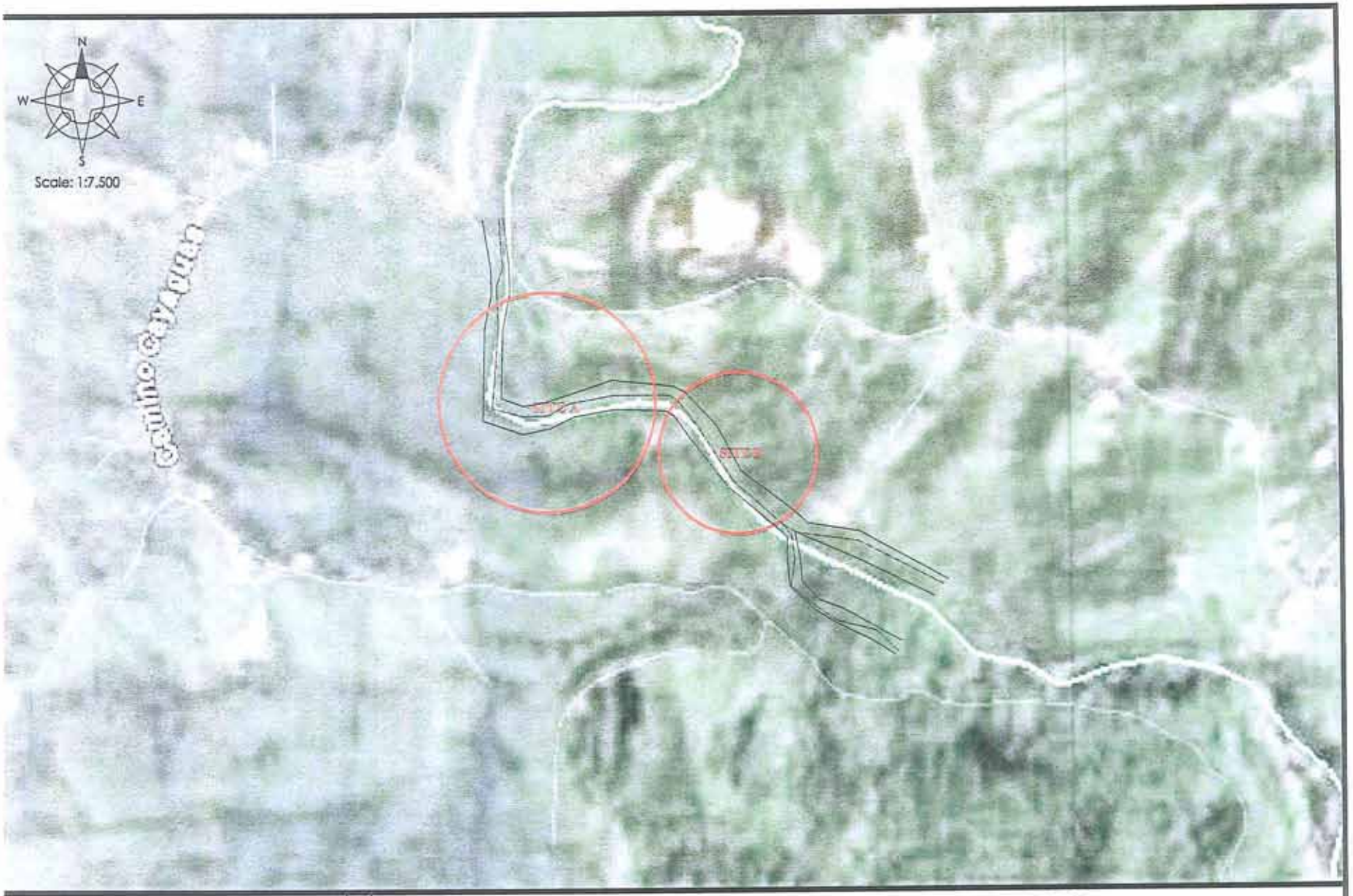
SEDIMENT TRANSPORT STUDY - RIO CAYAGUAS, SAN LORENZO, PR

CA Engineering PSC

Scale: 1:20,000

Figure 1

Location Map



SEDIMENT TRANSPORT STUDY - RIO CAYAGUAS , SAN LORENZO, PR

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Scale: 1:7,500

Figure 2

Location of Extraction Sites at Cayaguas River

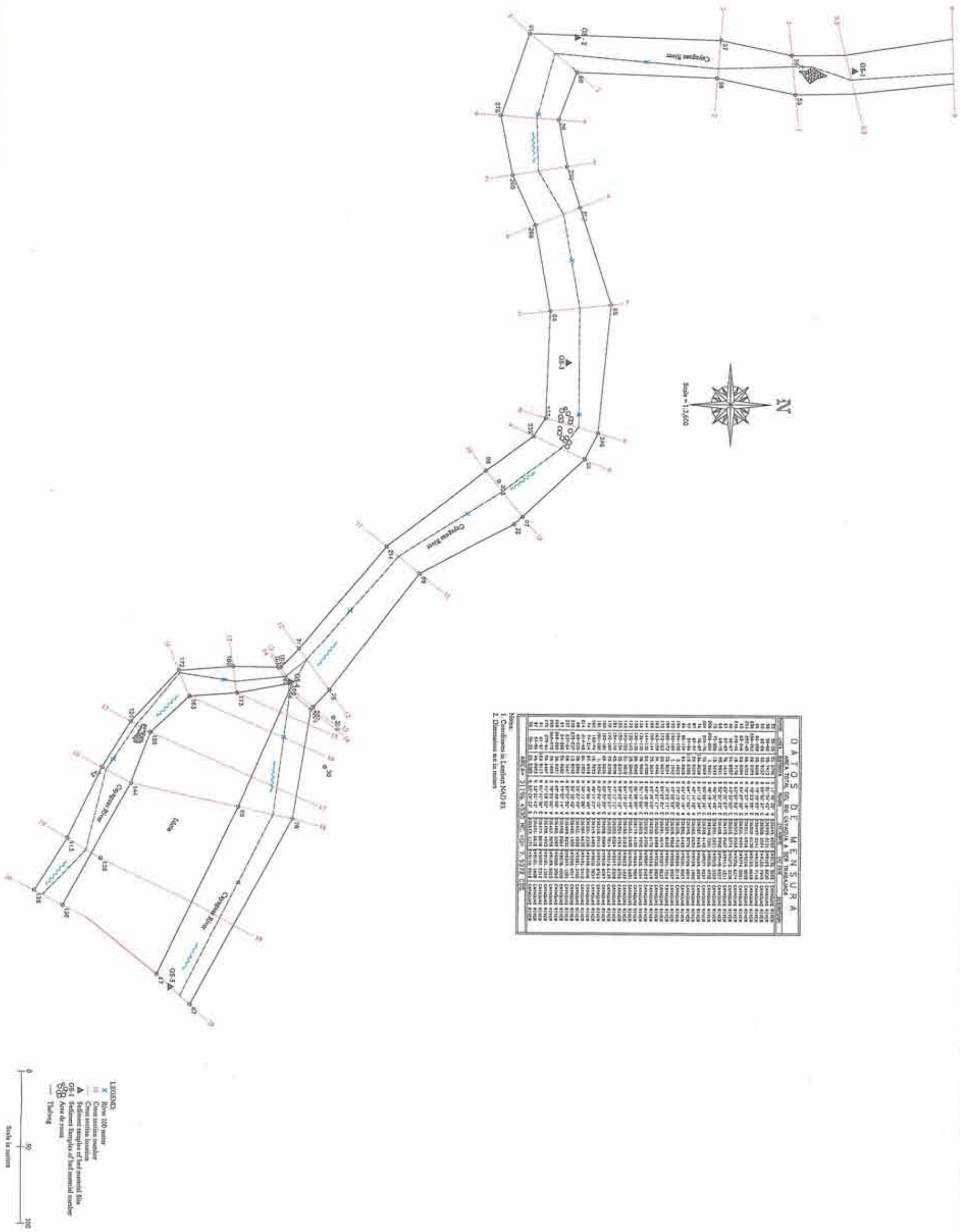
CA Engineering PSC

Scale: 1:20,000

SEDIMENT TRANSPORT STUDY - RIO CAYAGUAS , SAN LORENZO, PR

Figure 3

FEMA's Flood Insurance Rate Map (1240H)



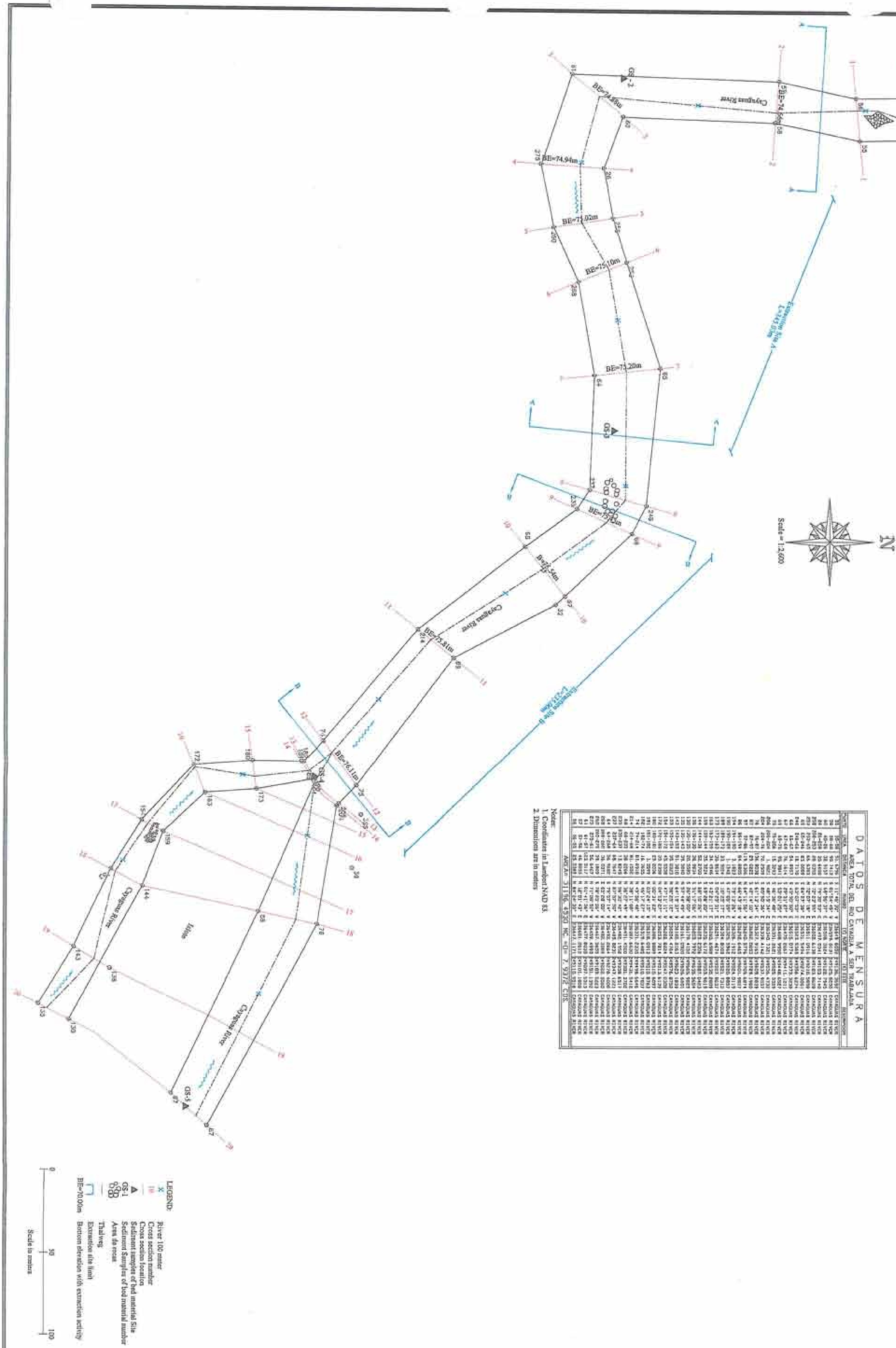
SEDIMENT TRANSPORT STUDY - RIO CAYAGUAS , SAN LORENZO, PR

Figure 4

Location of Cross Sections at Cayaguas River

Scale: 1:2,400

CA Engineering PSC



SEDIMENT TRANSPORT STUDY - RIO CAYAGUAS, SAN LORENZO, PR

Figure 9

Extraction Sites Location

CA Engineering PSC

Scale: 1:2,600

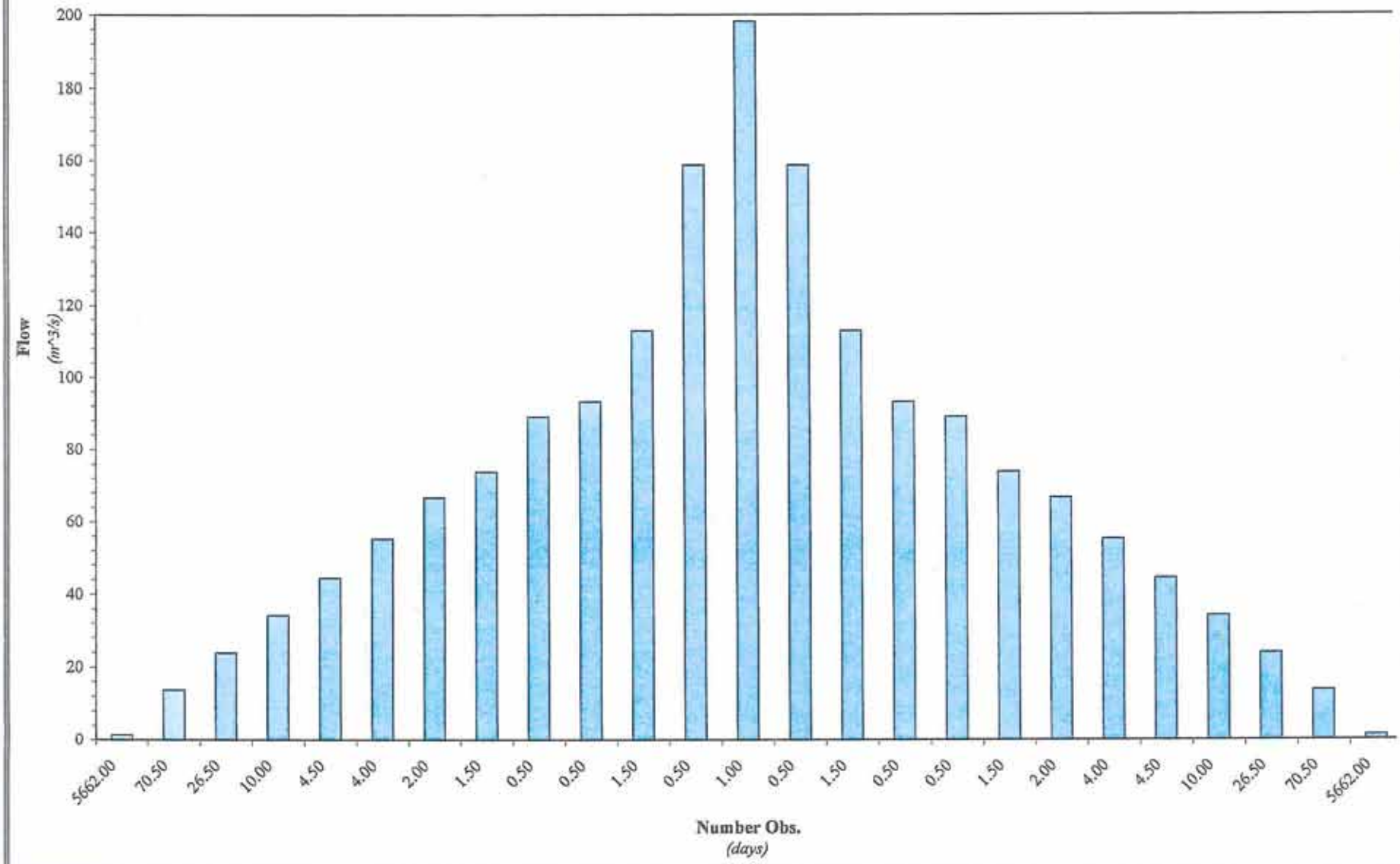


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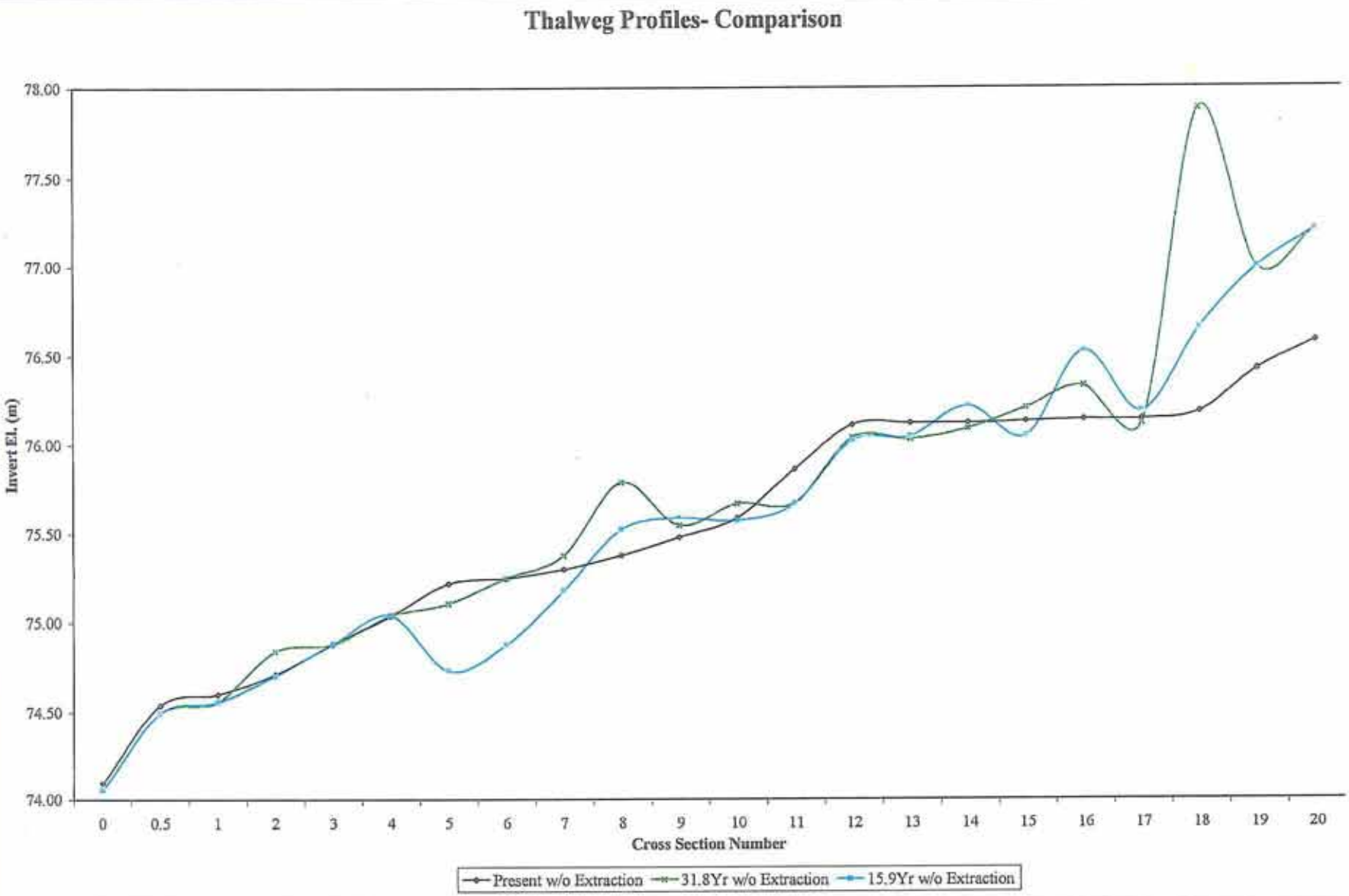
Figure 5

Histogram



SEDIMENT TRANSPORT STUDY - RIO CAYAGUAS, SAN LORENZO, PR

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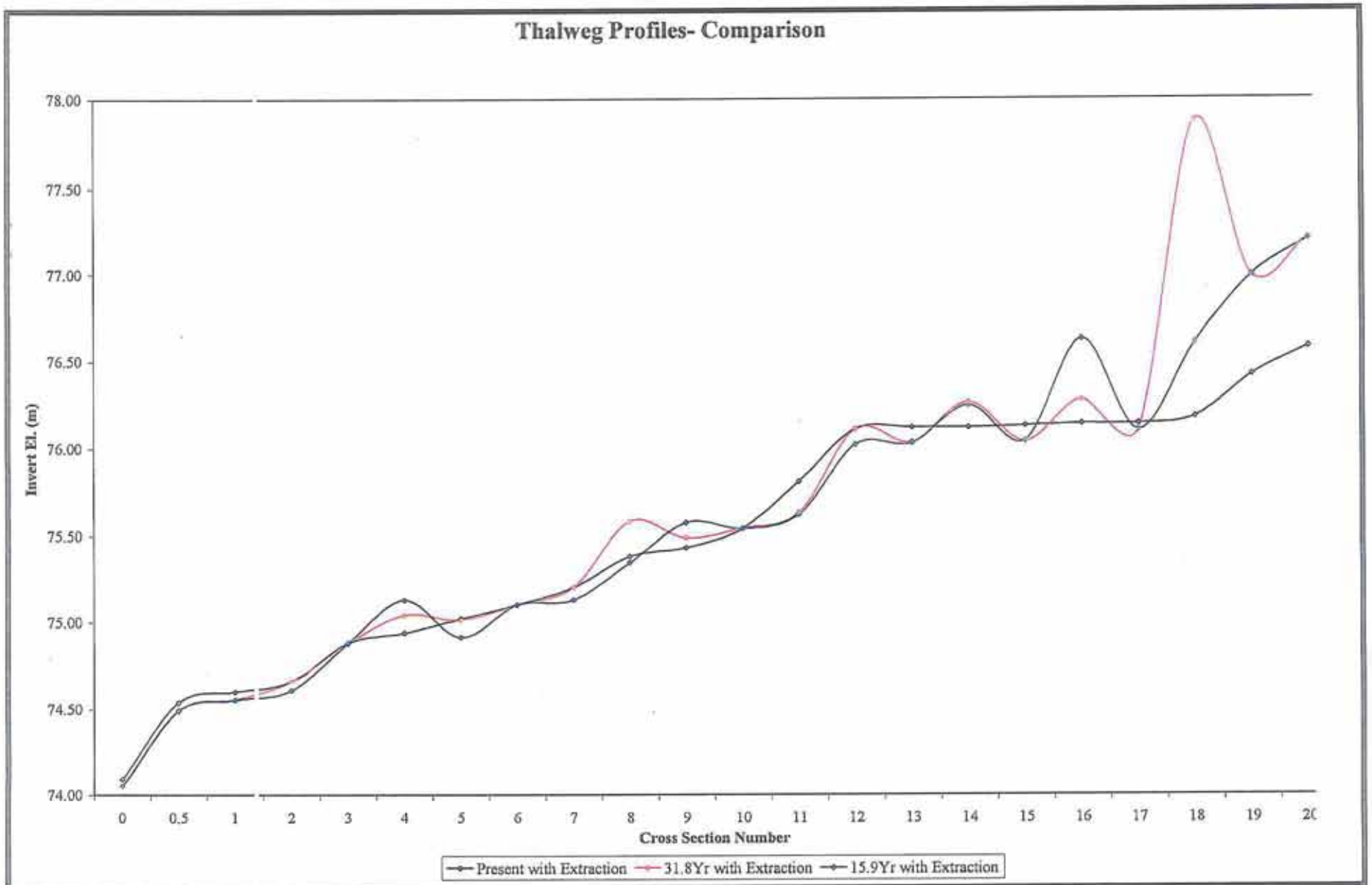
Figure 6

Thalweg Wye Profile w/o Considering Extraction



SEDIMENT TRANSPORT STUDY - RIO CAYAGUAS, SAN LORENZO, PR

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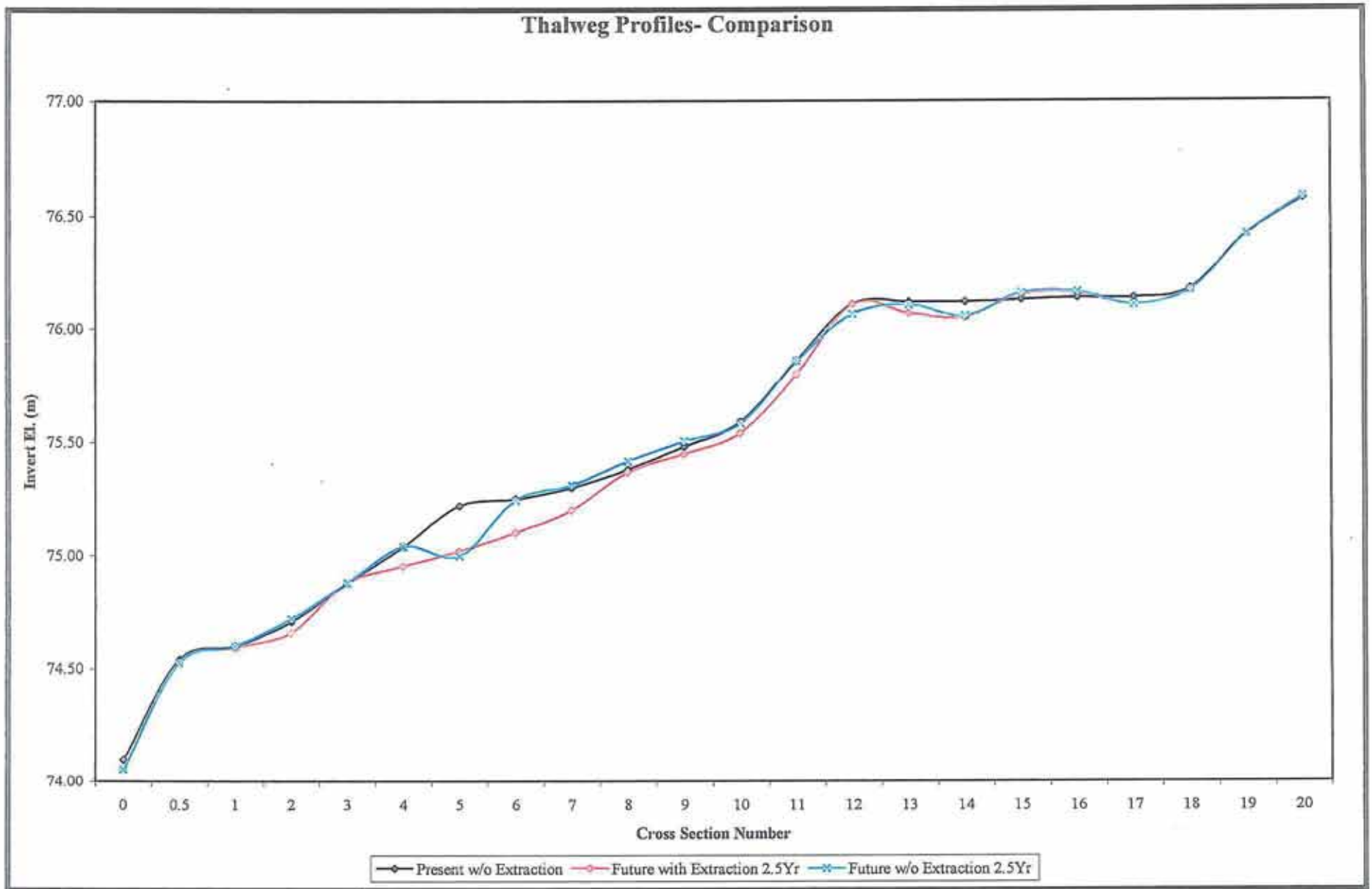
Figure 7

Thalweg Wye Profile Considering Extraction



SEDIMENT TRANSPORT STUDY - RIO CAYAGUAS, SAN LORENZO, PR

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Figure 8

Thalweg Wye Profile with & w/o Considering Extraction

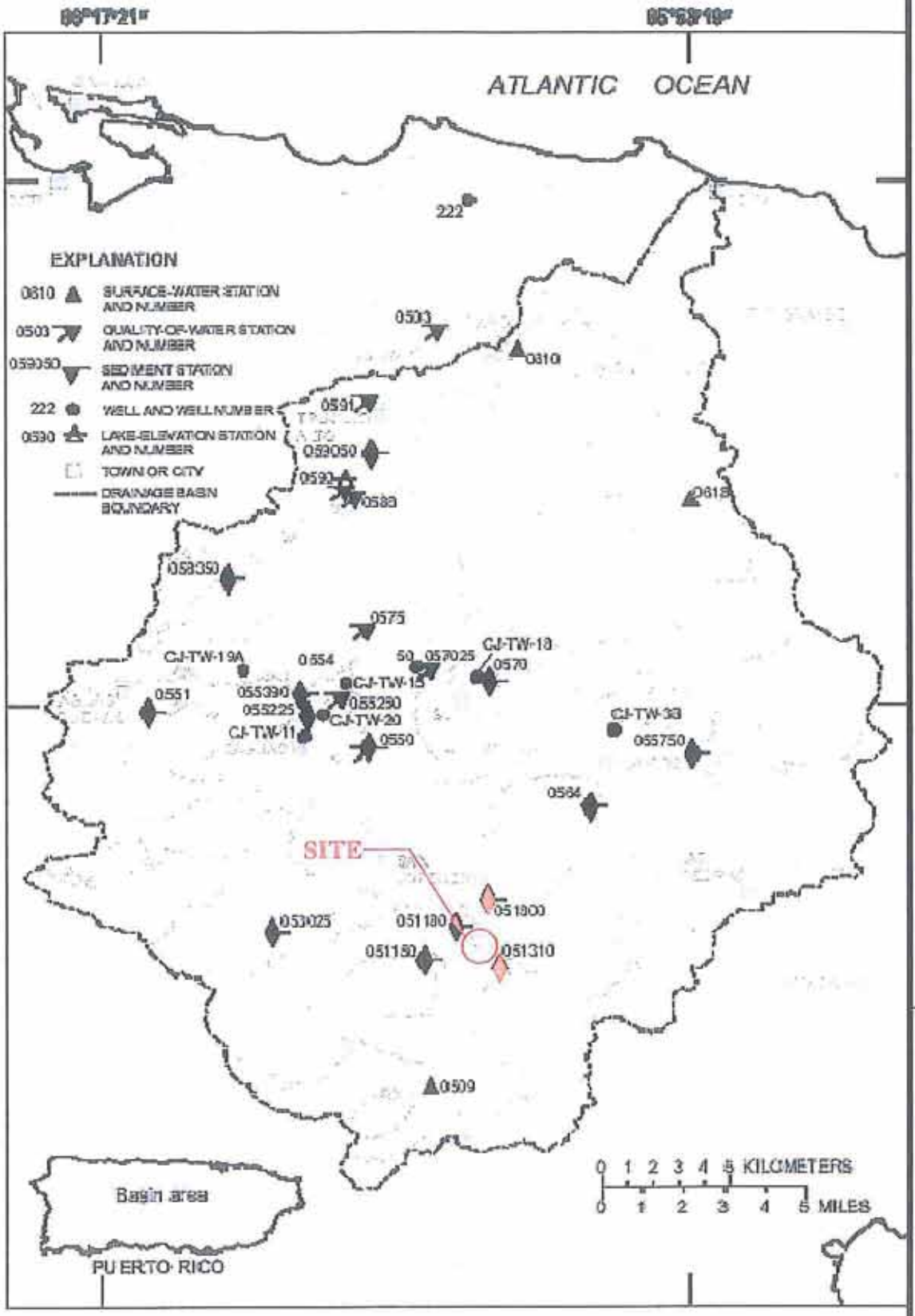

Figure 18. Río Grande de Loíza basin.

SEDIMENT TRANSPORT STUDY - RIO CAYAGUAS, SAN LORENZO, PR

Figure 10
Río Cayaguas and Grande de Loíza Basin showing the USGS Water Resources Stations 50051310 and 50051800

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APPENDIXES

APPENDIX A

HISTOGRAM PREPARATORY CALCULATIONS

MINITAB 14
Statistical Analisys of the Data
Gravero, Río Cayaguas
San Lorenzo, PR

The MEANS Procedure

Frank	Rango			Number Obs	Variable	Mean	Std Dev	Minimun	Maximun	Median
1.00	0	-	350	11324.00	Flow *(cfs)*	46.13	43.99	9.71	348.65	32.81
2.00	351	-	700	141.00	Flow *(cfs)*	485.27	97.13	351.39	691.84	468.97
3.00	701	-	1050	53.00	Flow *(cfs)*	843.42	84.13	706.88	1017.25	840.87
4.00	1051	-	1400	20.00	Flow *(cfs)*	1204.56	104.00	1062.36	1380.94	1169.01
5.00	1401	-	1750	9.00	Flow *(cfs)*	1567.80	107.88	1421.96	1736.43	1545.01
6.00	1751	-	2100	8.00	Flow *(cfs)*	1950.06	103.08	1791.12	2091.92	1975.70
7.00	2101	-	2450	4.00	Flow *(cfs)*	2355.11	51.61	2310.68	2406.39	2351.70
8.00	2451	-	2800	3.00	Flow *(cfs)*	2606.92	15.79	2597.80	2625.15	2597.80
9.00	2801	-	3150	1.00	Flow *(cfs)*	3144.71	*	3144.71	3144.71	3144.71
10.00	3151	-	3500	1.00	Flow *(cfs)*	3295.11	*	3295.11	3295.11	3295.11
11.00	3501	-	3850	*	*	*	*	*	*	*
12.00	3851	-	4200	3.00	Flow *(cfs)*	3987.86	39.47	3965.07	4033.43	3965.07
13.00	4201	-	4550	*	*	*	*	*	*	*
14.00	4551	-	4900	*	*	*	*	*	*	*
15.00	4901	-	5250	*	*	*	*	*	*	*
16.00	5251	-	5600	*	*	*	*	*	*	*
17.00	5601	-	5950	1.00	Flow *(cfs)*	5605.79	*	5605.79	5605.79	5605.79
18.00	5951	-	6300	*	*	*	*	*	*	*
19.00	6301	-	6650	*	*	*	*	*	*	*
20.00	6651	-	7000	1.00	Flow *(cfs)*	7000.00	*	7000.00	7000.00	7000.00

SUM Obs.	11569.00

Statistical Analisys of the Data
Gravero, Río Cayaguas
San Lorenzo, PR

The FREQ Procedure

Frank	Frequency	Percent	Cummulative Frecuency	Cummulative
1	11324	97.8823	11324.00	97.88
2	141	1.2188	11465.00	99.10
3	53	0.4581	11518.00	99.56
4	20	0.1729	11538.00	99 73
5	9	0.0778	11547.00	99.81
6	8	0.0692	11555.00	99.88
7	4	0.0346	11559.00	99.91
8	3	0.0259	11562.00	99.94
9	1	0.0086	11563.00	99.95
10	1	0.0086	11564.00	99.96
12	3	0.0259	11567.00	99.98
17	1	0.0086	11568.00	99.99
20	1	0.0086	11569.00	100.00

Statistical Analisys of the Data
Gravero, Río Cayaguas
San Lorenzo, PR

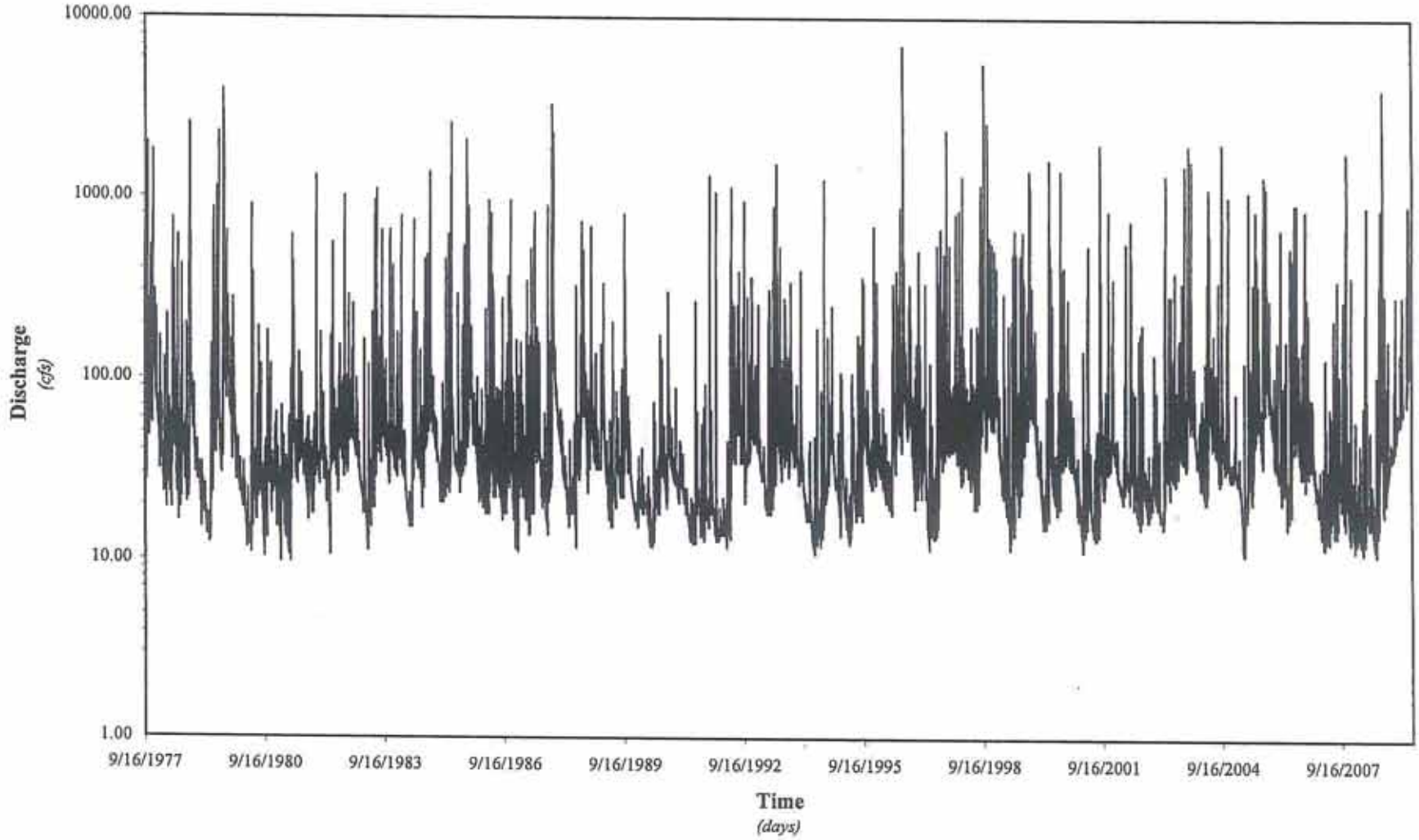
Histogram Data

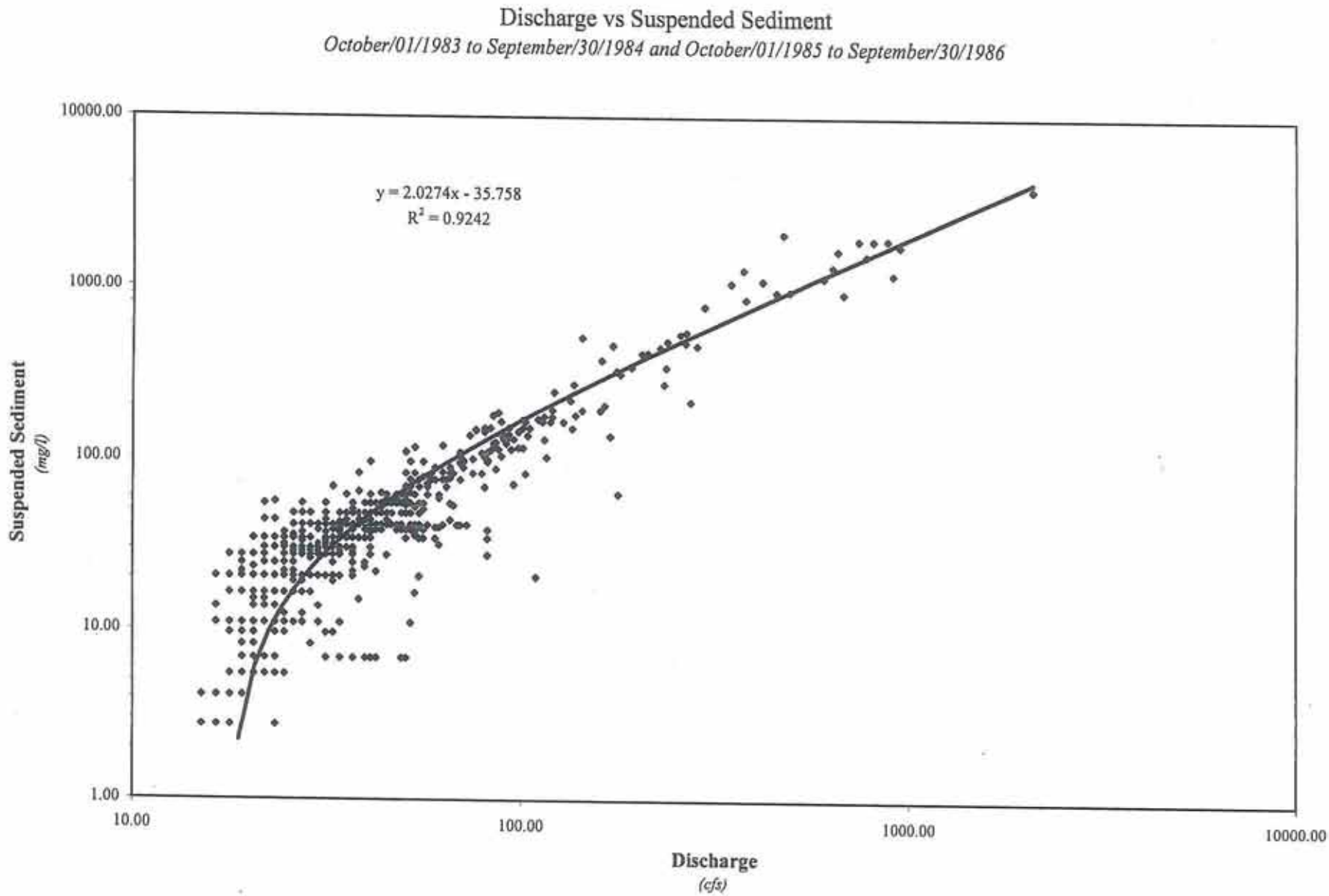
Frank	Frequency *Days*	Obs.	Discharge m^3/s
1	5662.00	46.13	1.31
2	70.50	485.27	13.74
3	26.50	843.42	23.88
4	10.00	1204.56	34.10
5	4.50	1567.80	44.39
6	4.00	1950.06	55.21
7	2.00	2355.11	66.68
8	1.50	2606.92	73.81
9	0.50	3144.71	89.04
10	0.50	3295.11	93.29
12	1.50	3987.86	112.91
17	0.50	5605.79	158.71
20	1.00	7000.40	198.20
17	0.50	5605.79	158.71
12	1.50	3987.86	112.91
10	0.50	3295.11	93.29
9	0.50	3144.71	89.04
8	1.50	2606.92	73.81
7	2.00	2355.11	66.68
6	4.00	1950.06	55.21
5	4.50	1567.80	44.39
4	10.00	1204.56	34.10
3	26.50	843.42	23.88
2	70.50	485.27	13.74
1	5662.00	46.13	1.31

APPENDIX B

INFLOW SOLIDS DATA DEVELOPMENT

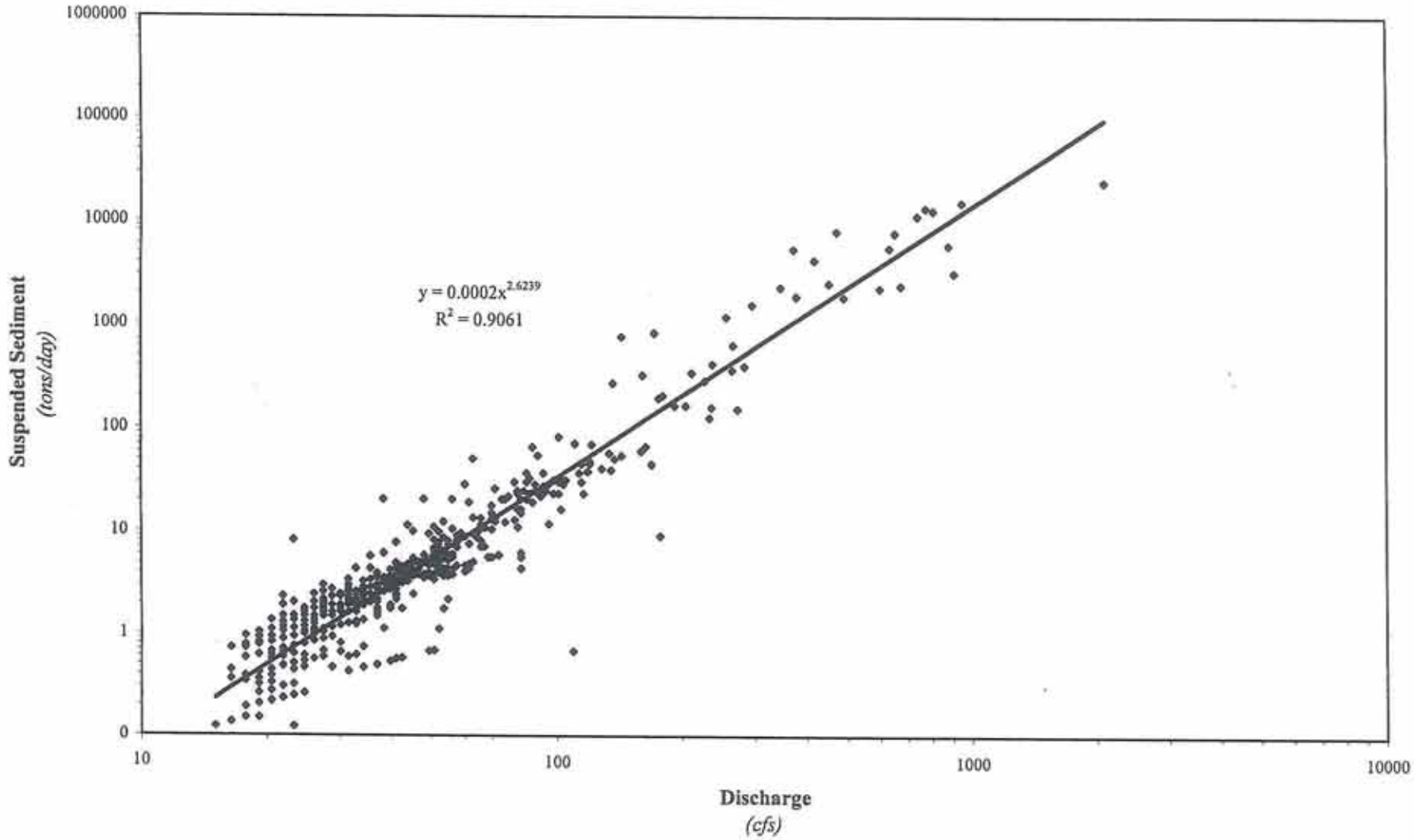
Average Daily Discharge
Based on USGS 50051310 (Río Cayaguas) at San Lorenzo, PR
September/16/1977 - June/17/2009



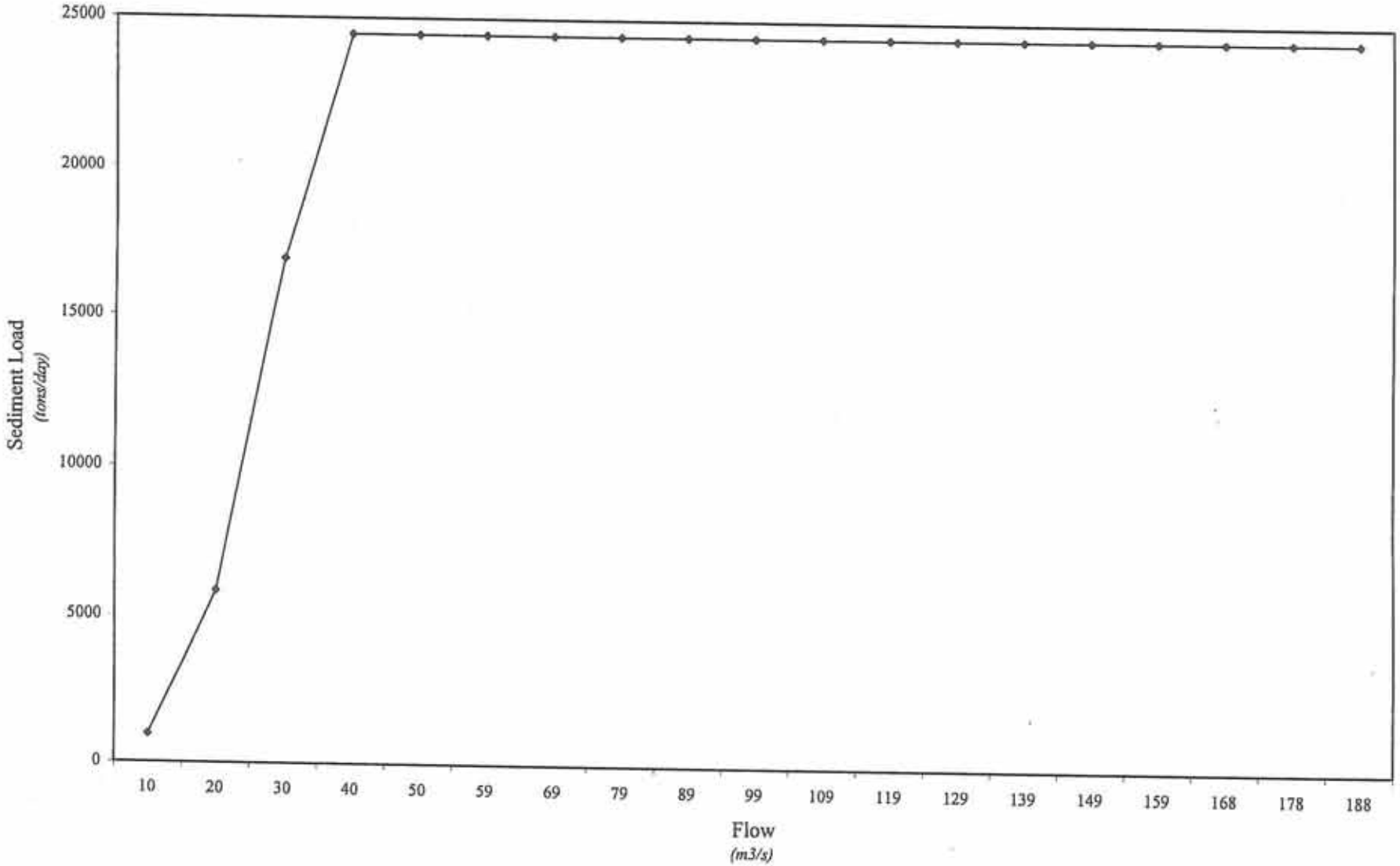

Discharge vs Suspended Sediment
October/01/1983 to September/30/1984 and October/01/1985 to September/30/1986
y = 2.0274x - 35.758
R² = 0.9242
10000.00
1000.00
100.00
10.00
1.00
Suspended Sediment
(mg/l)
10.00
100.00
1000.00
10000.00
Discharge
(cfs)

Discharge vs Suspended Sediment

October/01/1983 to September/30/1984 and October/01/1985 to September/30/1986



Sediment Load Series



APPENDIX C

PARTICLE SIZE DISTRIBUTION REPORT

(GEO CIM, INC.)

LUIS O. GARCIA & ASSOCIATES
GEOTECHNICAL ENGINEERING CONSULTANTS

Partners
Luis Oscar Garcia, MSCE, CE
Carlos Garcia Echevarría, MSCE
James A. Baigés, MSCE

Associate
Alejandro E. Soto, MS, PG

MEMORANDUM

To: Eng. José Vargas
Roble Consulting Group
PMB 132
Carolina, PR 00984-6030

E-mail: vargas_josej@yahoo.com

Date: July 22, 2009

From: James A. Baiges, P.E.

RE: ***Results of Grain-size Analysis Tests for Dredging of Río Cayaguax, San Lorenzo, PR***

GCI Job No. : 4001-09

This memorandum presents the results laboratory tests performed for the proposed dredging of a segment of Río Cayaguax in San Lorenzo, PR, as per your request. As indicated by you, it is proposed to dredge the deposited materials along a 1 km segment of the river basin commencing approximately 1 km of the intersection with Río Grande de Loíza as shown in Figure 1 – Site Location Plan.

A total of 5 grab samples, GS-1 to GS-5, were collected approximately every 250 m as approximately shown in Figure 2 – Sample Location Plan. The samples were taken at a shallow depth (~1ft) and transported to our laboratory in Guaynabo, PR to conduct laboratory soil classification tests to characterize the deposited materials. The tests consisted of performing grain-size distribution analysis following guidelines include in ASTM D-1140. Figure

AMELIA DISTRIBUTION CENTER, EMMA STREET NO. 26A, GUAYNABO, PR 00968-8007
TEL. (787) 792-2626 FAX (787) 782-5990
Email: jbaiges@geocim.com

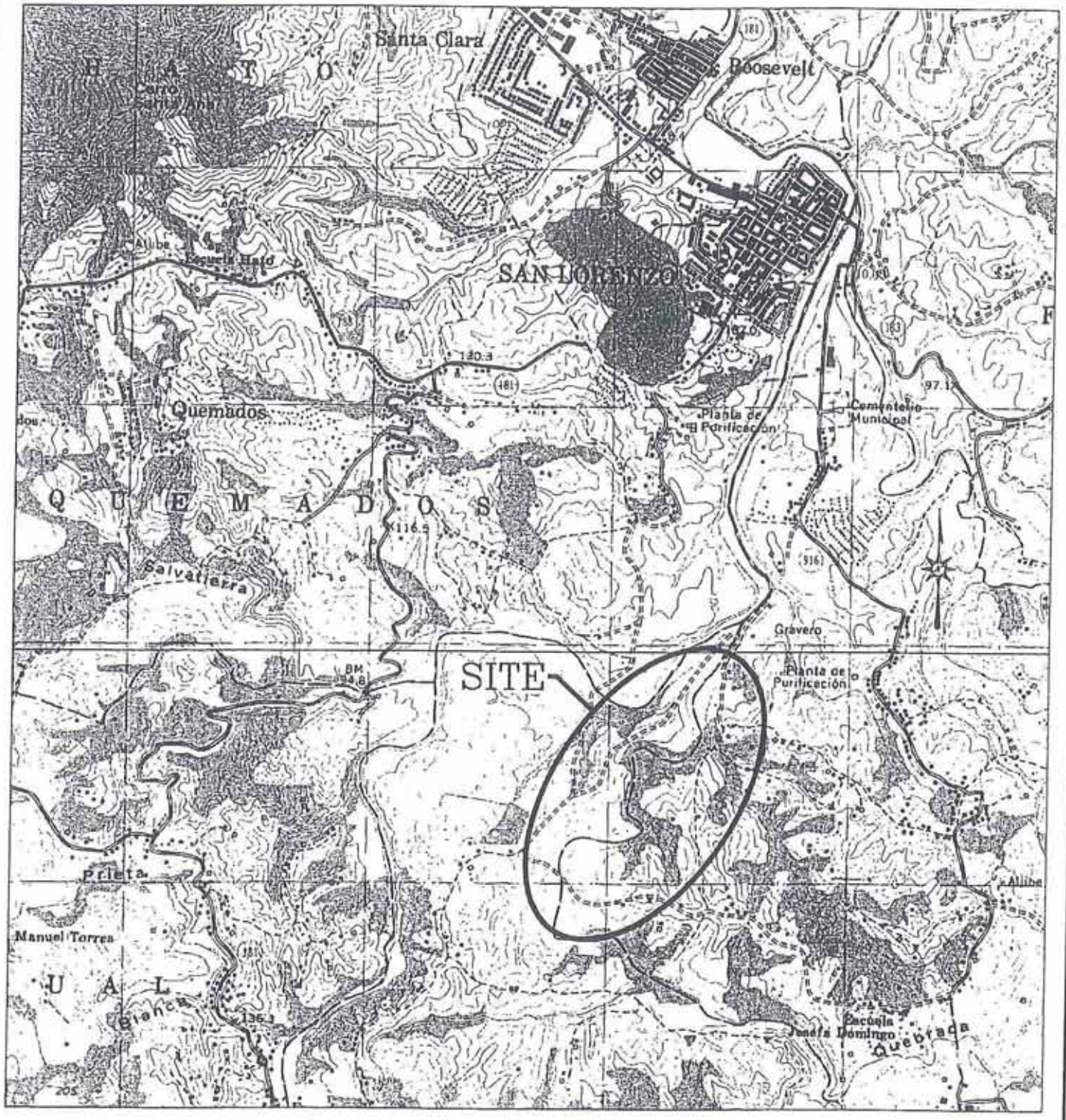
Results of the tests and the grain size distribution curves per sample are summarized in Figure 3. The material mostly coarse to medium grained, poorly graded sands. The samples contained a fine content (materials passing sieve 200) ranging from 0.1 to 1.4 percent and a gravel portion (materials greater than sieve 4) of 0.3 to 8.9 percent. These materials are product of eroded sand and transported by runoff from the Granodiorite Formation (TKgd) which consists of a medium grained rock of plagioclase, quartz and orthoclase which can locally grade into quartz diorite as describe in the geologic map[1] published by the US Geological Survey; portion of the map is presented in Figure 4.

Please feel free to contact us if you have any comments or observations regarding the information herein provide.

Enclosures:
Figure 1 - Site Location Plan
Figure 2 - Test Location Plan
Figure 3 - Grain-size Distribution Curves for Samples GS- 1 to GS-5
Figure 4 – Geologic Map

N: 0000-PROJECT FILE 4001-09 Lab Testing Rio Cayaguax Memo 7-22-09.Wargax.doc

[1] "Preliminary Geologic Map showing Iron and Copper Products and Copper Prospects in the Juncos Quadrangle. Puerto Rico". Misc. Geol. Invest. Series Map I-326, 1961 prepared Carl H. Broedle published by the US Geological Survey



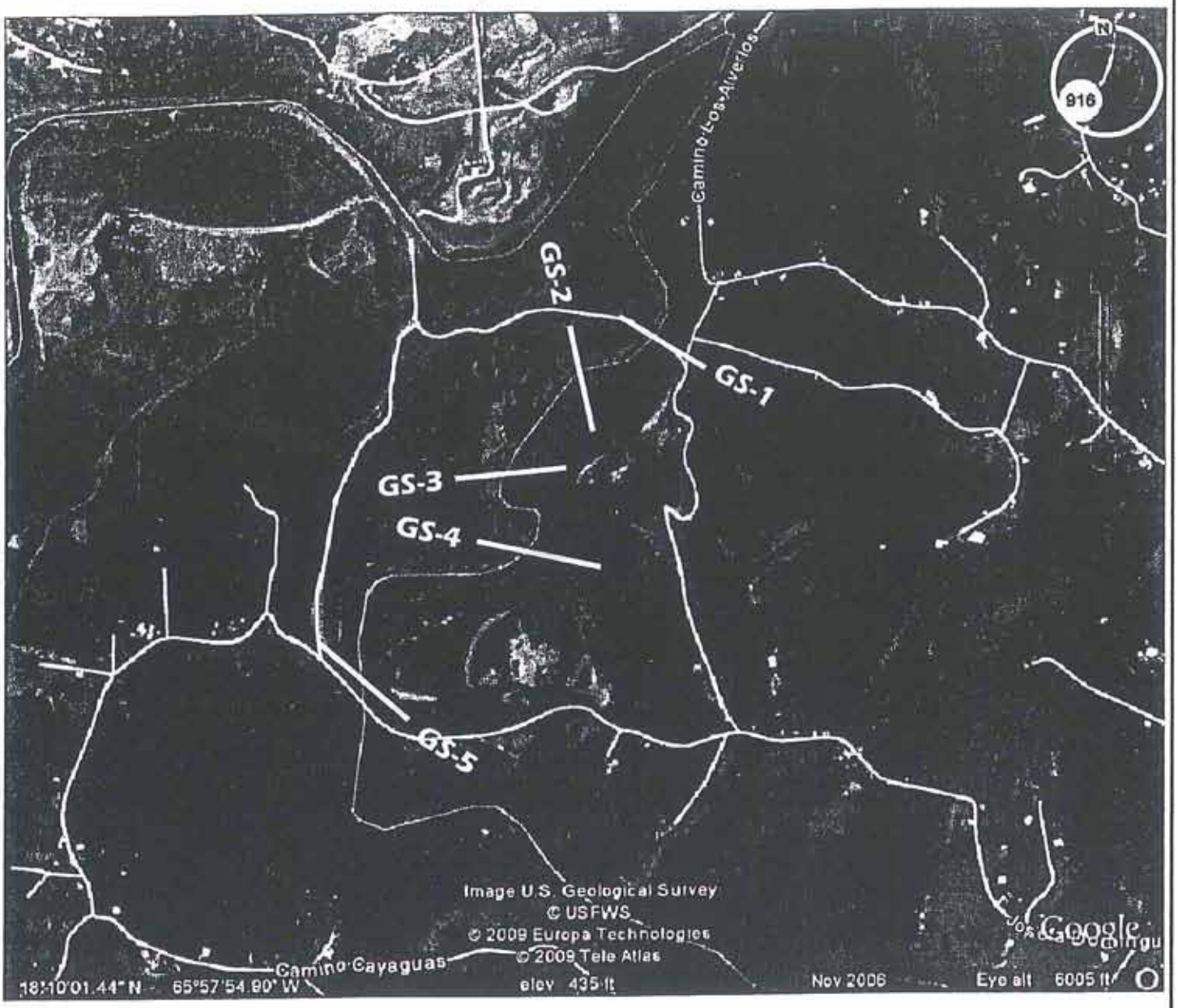
GeoCim
LUIS O. GARCIA & ASSOCIATES

SITE LOCATION PLAN

DREDGING ALONG SEGMENT OF RIO CAYAGUAX, SAN LORENZO, P.R.

DRW. BY:	CKD. BY:	SCALE:	DATE:	JOB. NO:	FIGURE NO:
G.Ortega	J.B.	N.T.S.	07/22/09	4001-09	1

Giovanni: N:\Autocad\Drawings\4001-09\FIG 1

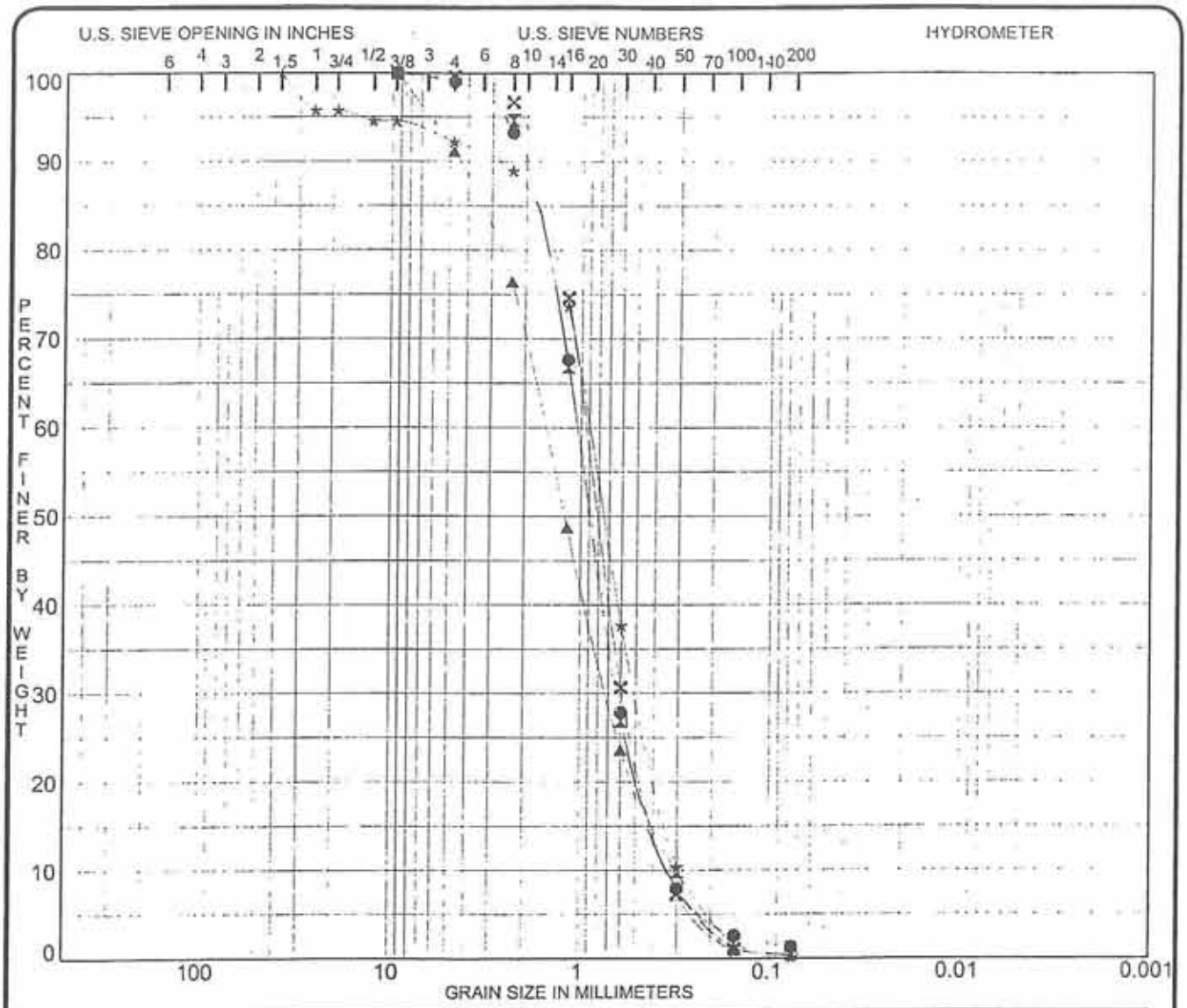


GeoCim
LUIS O. GARCIA & ASSOCIATES

TEST LOCATION PLAN

DREDGING ALONG SEGMENT OF RIO CAYAGUAX, SAN LORENZO, P.R.

DRW. BY:	CKD. BY:	SCALE:	DATE:	JOB NO:	FIGURE NO:
G.Ortega	J.B.	N.T.S.	07/22/09	4001-09	2



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	GS-1	1.0	POORLY GRADED SAND SP		NP	NP	NP	1.16	3.2
✕	GS-2	1.0	POORLY GRADED SAND SP		NP	NP	NP	1.26	3.5
▲	GS-3	1.0	POORLY GRADED SAND SP		NP	NP	NP	0.99	4.8
★	GS-4	1.0	POORLY GRADED SAND SP		NP	NP	NP	0.91	3.1
×	GS-5	1.0	POORLY GRADED SAND SP		NP	NP	NP	1.13	2.9

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	GS-1	1.0	9.50	1.04	0.622	0.3225	1.0	97.6	1.4	
✕	GS-2	1.0	9.50	1.05	0.633	0.3021	0.6	98.9	0.5	
▲	GS-3	1.0	9.50	1.56	0.713	0.3274	8.9	90.8	0.4	
★	GS-4	1.0	37.50	0.91	0.494	0.2927	7.8	92.1	0.1	
×	GS-5	1.0	9.50	0.94	0.588	0.3250	0.3	99.3	0.4	

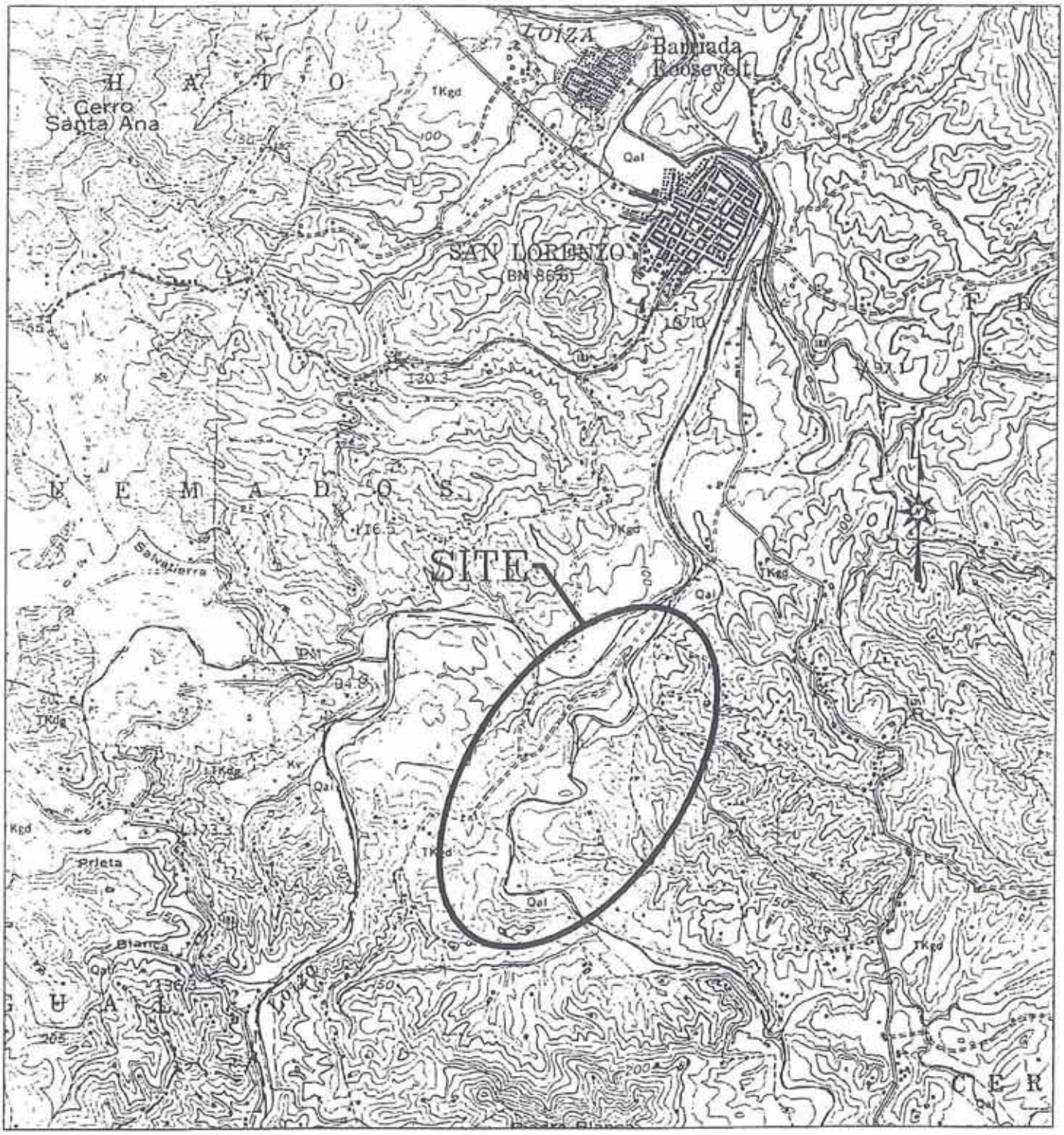
PROJECT Lab. Testing of Rio Cayaguax - San Lorenzo, PR

JOB NO. 4001-09
DATE

GRADATION CURVES

geocim

FIGURE 3



GeoCim
LUIS O. GARCIA & ASSOCIATES

GEOLOGIC MAP

DREDGING ALONG SEGMENT OF RIO CAYAGUAX, SAN LORENZO, P.R.

DRW. BY:	CKD. BY:	SCALE:	DATE:	JOB. NO:	FIGURE NO:
G.Ortega	J.B.	N.T.S.	07/22/09	4001-09	4

Giovanni: N:\Autocad\Drawings\4001-09\FIG 3

APPENDIX D

HEC-RAS MODEL

AND

RIVER RATING CURVE ELABORATION

```
HEC-RAS Version 4.0.0 March 2008
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

X     X  XXXXXX   XXXX        XXXX       XX      XXXX
X     X  X       X    X       X  X     X  X    X
X     X  X       X            X  X     X    X   X
XXXXXXX  XXXX    X       XXX  XXXX     XXXXXX   XXXX
X     X  X       X            X  X     X    X       X
X     X  X       X    X       X  X     X    X       X
X     X  XXXXXX   XXXX        X    X   X    X   XXXXX

*****************************************************************

PROJECT DATA
Project Title: CAYAGUAS_ST_3
Project File : CAYAGUAS_ST_5.prj
Run Date and Time: 8/26/2009 11:15:20 AM

Project in SI units

Project Description:
Sediment transport Study for Cayaguas River at San Lorenzo, PR.
Surveyor: José
Villanova
Soil Testing: Eng. Baiges (GEO Cim)

*****************************************************************

PLAN DATA

Plan Title: RATING CURVE
Plan File : P:\526-Material Extraction at Rio Cayaguas\HEC-RAS\CAYAGUAS_ST_5.p01

        Geometry Title: W/o EXTRACTION
        Geometry File : P:\526-Material Extraction at Rio Cayaguas\HEC-RAS\CAYAGUAS_ST_5.g01

        Flow Title    : CAYAGUAS FLOW RATING
        Flow File     : P:\526-Material Extraction at Rio Cayaguas\HEC-RAS\CAYAGUAS_ST_5.f01

Plan Summary Information:
Number of:  Cross Sections =  22    Multiple Openings  =  0
            Culverts       =  0     Inline Structures  =  0
            Bridges        =  0     Lateral Structures =  0

Computational Information
    Water surface calculation tolerance  =  0.003
    Critical depth calculation tolerance =  0.003
    Maximum number of iterations         =  20
    Maximum difference tolerance         =  0.1
    Flow tolerance factor                =  0.001

Computation Options
    Critical depth computed only where necessary
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method:         Average Conveyance
    Computational Flow Regime:     Mixed Flow

*****************************************************************

FLOW DATA

Flow Title: CAYAGUAS FLOW RATING
Flow File : P:\526-Material Extraction at Rio Cayaguas\HEC-RAS\CAYAGUAS_ST_5.f01

Flow Data (m3/s)
*****************************************************************************************************************
* River      Reach    RS    *  PF 1    PF 2    PF 3    PF 4    PF 5    PF 6    PF 7    PF 8 *
* CAYAGUAS   ONE      20    *  1.31    13.74   23.88   34.1    44.39   55.21   66.88   71.71 *
*****************************************************************************************************************
*****************************************************************************************************
* River      Reach    RS    *  PF 9    PF 10   PF 11   PF 12   PF 13 *
* CAYAGUAS   ONE      20    *  89.04   93.29   112.91  158.71  198.2 *
*****************************************************************************************************

Boundary Conditions
*****************************************************************************************************
* River      Reach    Profile    *  Upstream      Downstream    *
*****************************************************************************************************
* CAYAGUAS   ONE      PF 1       *  Critical      Normal S = 0.01 *
* CAYAGUAS   ONE      PF 2       *  Critical      Normal S = 0.01 *
* CAYAGUAS   ONE      PF 3       *  Critical      Normal S = 0.01 *
* CAYAGUAS   ONE      PF 4       *  Critical      Normal S = 0.01 *
* CAYAGUAS   ONE      PF 5       *  Critical      Normal S = 0.01 *
* CAYAGUAS   ONE      PF 6       *  Critical      Normal S = 0.01 *
* CAYAGUAS   ONE      PF 7       *  Critical      Normal S = 0.01 *
* CAYAGUAS   ONE      PF 8       *  Critical      Normal S = 0.01 *
* CAYAGUAS   ONE      PF 9       *  Critical      Normal S = 0.01 *
* CAYAGUAS   ONE      PF 10      *  Critical      Normal S = 0.01 *
* CAYAGUAS   ONE      PF 11      *  Critical      Normal S = 0.01 *
*****************************************************************

*****************************************************************

GEOMETRY DATA

Geometry Title: W/o EXTRACTION
Geometry File : P:\526-Material Extraction at Rio Cayaguas\HEC-RAS\CAYAGUAS_ST_5.g01

CROSS SECTION

RIVER: CAYAGUAS
REACH: ONE          RS: 20
```

INPUT
escription:

Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	80.51	6.06	76.6	10.66	76.91	18.06	77.07	19.41	77.84
20.61	79.97	37.39	79.91	86.08	81.02	97.38	79.69	107.8	76.73
109.12	76.73	111.47	76.58	115.93	76.63	116.51	76.62	120.44	77.25
121.93	77.2	123.21	78.04	125.23	78.6				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	0	.04	125.23	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	125.23	39.56	56.58	58.5	.1	.3

CROSS SECTION OUTPUT Profile RPF 1

			Left OB	Channel	Right OB
E.G. Elev (m)	78.90	Element		0.040	
Vel Head (m)	0.01	Wt. n-Val.	39.56	56.58	58.50
W.S. Elev (m)	78.89	Reach Len. (m)		2.89	
Crit W.S. (m)	76.77	Flow Area (m2)		2.89	
E.G. Slope (m/m)	+0.003802	Area (m2)		1.31	
Q Total (m3/s)	1.31	Flow (m3/s)		18.01	
Top Width (m)	18.01	Top Width (m)		0.45	
Vel Total (m/s)	0.45	Avg. Vel. (m/s)		0.16	
Max Chl Dpth (m)	0.31	Hydr. Depth (m)		21.2	
Conv. Total (m3/s)	21.2	Conv. (m3/s)		18.09	
Length Wtd. (m)	56.58	Wetted Per. (m)		5.95	
Min Ch El (m)	76.58	Shear (N/m2)		2.70	
Alpha	1.00	Stream Power (N/m s)		3.40	
Frctn Loss (m)	0.14	Cum Volume (1000 m3)		17.23	
C & E Loss (m)	0.00	Cum SA (1000 m2)			

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile RPF 2

			Left OB	Channel	Right OB
E.G. Elev (m)	77.41	Element		0.040	
Vel Head (m)	0.04	Wt. n-Val.	39.56	56.58	58.50
W.S. Elev (m)	77.37	Reach Len. (m)		15.03	
Crit W.S. (m)	77.11	Flow Area (m2)		15.03	
E.G. Slope (m/m)	+0.001438	Area (m2)		13.74	
Q Total (m3/s)	13.74	Flow (m3/s)		30.08	
Top Width (m)	30.08	Top Width (m)		0.91	
Vel Total (m/s)	0.49	Avg. Vel. (m/s)		0.50	
Max Chl Dpth (m)	0.79	Hydr. Depth (m)		234.3	
Conv. Total (m3/s)	234.3	Conv. (m3/s)		30.52	
Length Wtd. (m)	56.58	Wetted Per. (m)		16.60	
Min Ch El (m)	76.58	Shear (N/m2)		15.18	
Alpha	1.00	Stream Power (N/m s)		15.86	
Frctn Loss (m)	0.13	Cum Volume (1000 m3)		23.10	
C & E Loss (m)	0.01	Cum SA (1000 m2)			

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile RPF 3

			Left OB	Channel	Right OB
E.G. Elev (m)	77.67	Element		0.040	
Vel Head (m)	[illegible]	Wt. n-Val.	39.56	56.58	58.50
W.S. Elev (m)	[illegible]	Reach Len. (m)		22.79	
Crit W.S. (m)	77.26	Flow Area (m2)		22.79	
E.G. Slope (m/m)	[illegible]	Area (m2)		23.88	
Q Total (m3/s)	23.88	Flow (m3/s)		32.18	
Top Width (m)	32.18	Top Width (m)		1.05	
Vel Total (m/s)	[illegible]	Avg. Vel. (m/s)		0.71	
Max Chl Dpth (m)	1.04	Hydr. Depth (m)		446.3	
Conv. Total (m3/s)	446.3	Conv. (m3/s)		32.87	
Length Wtd. (m)	[illegible]	Wetted Per. (m)		19.47	
Min Ch El (m)	76.56	Shear (N/m2)		20.40	
Alpha	1.00	Stream Power (N/m s)		22.87	
Frctn Loss (m)	0.11	Cum Volume (1000 m3)		24.49	
C & E Loss (m)	0.01	Cum SA (1000 m2)			

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile RPF 4

			Left OB	Channel	Right OB
E.G. Elev (m)	[illegible]	Element		0.040	
Vel Head (m)	[illegible]	Wt. n-Val.	39.56	56.58	58.50
W.S. Elev (m)	[illegible]	Reach Len. (m)		30.69	
Crit W.S. (m)	[illegible]	Flow Area (m2)		30.69	
E.G. Slope (m/m)	[illegible]	Area (m2)		34.10	
Q Total (m3/s)	34.10	Flow (m3/s)		34.17	
Top Width (m)	34.17	Top Width (m)		1.11	
Vel Total (m/s)	1.11	Avg. Vel. (m/s)		0.90	
Max Chl Dpth (m)	[illegible]	Hydr. Depth (m)		701.6	
Conv. Total (m3/s)	701.6	Conv. (m3/s)		35.10	
Length Wtd. (m)	56.58	Wetted Per. (m)		20.26	
Min Ch El (m)	76.58	Shear (N/m2)		22.51	
Alpha	1.00	Stream Power (N/m s)		29.52	
Frctn Loss (m)	[illegible]	Cum Volume (1000 m3)		26.40	
C & E Loss (m)	0.01	Cum SA (1000 m2)			

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile RPF 5

E.G. Elev (m)	78.14	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Vel.		0.040	
W.S. Elev (m)	78.07	Reach Len. (m)	39.56	56.58	58.50
Crit W.S. (m)	77.48	Flow Area (m2)		38.18	
E.G. Slope (m/m)	*0.002071	Area (m2)		38.18	
Q Total (m3/s)	44.39	Flow (m3/s)		44.39	
Top Width (m)	35.79	Top Width (m)		35.79	
Vel Total (m/s)	1.16	Avg. Vel. (m/s)		1.16	
Max Chl Dpth (m)	1.49	Hydr. Depth (m)		1.07	
Conv. Total (m3/s)	874.9	Conv. (m3/s)		874.9	
Length Wtd. (m)	56.58	Wetted Per. (m)		36.99	
Min Ch El (m)	76.58	Shear (N/m2)		20.99	
Alpha	1.00	Stream Power (N/m s)		24.40	
Frctn Loss (m)	0.08	Cum Volume (1000 m3)		35.46	
C & E Loss (m)	0.01	Cum SA (1000 m2)		27.76	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile RPF 6

E.G. Elev (m)	78.35	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Vel.		0.040	
W.S. Elev (m)	78.28	Reach Len. (m)	39.56	56.58	58.50
Crit W.S. (m)	77.58	Flow Area (m2)		45.78	
E.G. Slope (m/m)	*0.001889	Area (m2)		45.78	
Q Total (m3/s)	55.21	Flow (m3/s)		55.21	
Top Width (m)	37.71	Top Width (m)		37.71	
Vel Total (m/s)	1.21	Avg. Vel. (m/s)		1.21	
Max Chl Dpth (m)	1.70	Hydr. Depth (m)		1.21	
Conv. Total (m3/s)	1270.2	Conv. (m3/s)		1270.2	
Length Wtd. (m)	56.58	Wetted Per. (m)		38.15	
Min Ch El (m)	76.58	Shear (N/m2)		21.66	
Alpha	1.00	Stream Power (N/m s)		26.13	
Frctn Loss (m)	0.07	Cum Volume (1000 m3)		41.37	
C & E Loss (m)	0.01	Cum SA (1000 m2)		28.77	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile RPF 7

E.G. Elev (m)	78.56	Element	Left OB	Channel	Right OB
Vel Head (m)	0.08	Wt. n-Vel.		0.040	
W.S. Elev (m)	78.48	Reach Len. (m)	39.56	56.58	58.50
Crit W.S. (m)	77.67	Flow Area (m2)		53.66	
E.G. Slope (m/m)	*0.001742	Area (m2)		53.66	
Q Total (m3/s)	66.68	Flow (m3/s)		66.68	
Top Width (m)	39.61	Top Width (m)		39.61	
Vel Total (m/s)	1.24	Avg. Vel. (m/s)		1.24	
Max Chl Dpth (m)	1.90	Hydr. Depth (m)		1.35	
Conv. Total (m3/s)	1597.8	Conv. (m3/s)		1597.8	
Length Wtd. (m)	56.58	Wetted Per. (m)		41.29	
Min Ch El (m)	76.58	Shear (N/m2)		22.20	
Alpha	1.00	Stream Power (N/m s)		27.58	
Frctn Loss (m)	0.07	Cum Volume (1000 m3)		47.30	
C & E Loss (m)	0.01	Cum SA (1000 m2)		29.64	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile RPF 8

E.G. Elev (m)	78.28	Element	Left OB	Channel	Right OB
Vel Head (m)	0.08	Wt. n-Vel.		0.040	
W.S. Elev (m)	78.40	Reach Len. (m)	39.56	56.58	58.50
Crit W.S. (m)	77.73	Flow Area (m2)		58.50	
E.G. Slope (m/m)	*0.001660	Area (m2)		58.50	
Q Total (m3/s)	73.81	Flow (m3/s)		73.81	
Top Width (m)	40.74	Top Width (m)		40.74	
Vel Total (m/s)	1.26	Avg. Vel. (m/s)		1.26	
Max Chl Dpth (m)	2.02	Hydr. Depth (m)		1.44	
Conv. Total (m3/s)	1808.5	Conv. (m3/s)		1808.5	
Length Wtd. (m)	56.58	Wetted Per. (m)		42.54	
Min Ch El (m)	76.58	Shear (N/m2)		22.46	
Alpha	1.00	Stream Power (N/m s)		28.38	
Frctn Loss (m)	0.07	Cum Volume (1000 m3)		50.86	
C & E Loss (m)	0.01	Cum SA (1000 m2)		30.24	

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile RPF 9

E.G. Elev (m)	78.43	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Vel.		0.040	
W.S. Elev (m)	78.34	Reach Len. (m)	39.56	56.58	58.50
Crit W.S. (m)	77.84	Flow Area (m2)		68.36	
E.G. Slope (m/m)	*0.001513	Area (m2)		68.36	
Q Total (m3/s)	89.04	Flow (m3/s)		89.04	
Top Width (m)	42.12	Top Width (m)		42.12	
Vel Total (m/s)	1.30	Avg. Vel. (m/s)		1.30	
Max Chl Dpth (m)	2.26	Hydr. Depth (m)		1.63	
Conv. Total (m3/s)	2289.0	Conv. (m3/s)		2289.0	
Length Wtd. (m)	56.58	Wetted Per. (m)		44.42	
Min Ch El (m)	76.58	Shear (N/m2)		22.90	
Alpha	1.00	Stream Power (N/m s)		29.75	
Frctn Loss (m)	0.06	Cum Volume (1000 m3)		58.24	
C & E Loss (m)	0.01	Cum SA (1000 m2)		31.44	

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile RPF 10

E.G. Elev (m)	78.99	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Val.		0.040	
W.S. Elev (m)	78.91	Reach Len. (m)	39.54	56.58	58.50
Crit W.S. (m)	77.87	Flow Area (m2)		71.25	
E.G. Slope (m/m)	0.001493	Area (m2)		71.25	
Q Total (m3/s)	93.29	Flow (m3/s)		93.29	
Top Width (m)	42.49	Top Width (m)		42.49	
Vel Total (m/s)	1.31	Avg. Vel. (m/s)		1.31	
Max Chl Dpth (m)	2.33	Hydr. Depth (m)		1.68	
Conv. Total (m3/s)	2422.7	Conv. (m3/s)		2422.7	
Length Wtd. (m)	56.58	Wetted Per. (m)		44.91	
Min Ch El (m)	76.58	Shear (N/m2)		23.07	
Alpha	1.00	Stream Power (N/m s)		30.20	
Frctn Loss (m)	0.06	Cum Volume (1000 m3)		60.21	
C & E Loss (m)	0.01	Cum SA (1000 m2)		31.68	

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile RPF 11

E.G. Elev (m)	79.28	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Val.		0.040	
W.S. Elev (m)	79.19	Reach Len. (m)	39.54	56.58	58.50
Crit W.S. (m)	78.00	Flow Area (m2)		83.33	
E.G. Slope (m/m)	0.001371	Area (m2)		83.33	
Q Total (m3/s)	112.91	Flow (m3/s)		112.91	
Top Width (m)	44.08	Top Width (m)		44.08	
Vel Total (m/s)	1.35	Avg. Vel. (m/s)		1.35	
Max Chl Dpth (m)	2.61	Hydr. Depth (m)		1.89	
Conv. Total (m3/s)	3048.9	Conv. (m3/s)		3048.9	
Length Wtd. (m)	56.58	Wetted Per. (m)		47.07	
Min Ch El (m)	76.58	Shear (N/m2)		23.81	
Alpha	1.05	Stream Power (N/m s)		32.26	
Frctn Loss (m)	0.06	Cum Volume (1000 m3)		69.01	
C & E Loss (m)	0.01	Cum SA (1000 m2)		32.71	

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile RPF 12

E.G. Elev (m)	79.88	Element	Left OB	Channel	Right OB
Vel Head (m)	0.11	Wt. n-Val.		0.040	
W.S. Elev (m)	79.78	Reach Len. (m)	39.54	56.58	58.50
Crit W.S. (m)	78.58	Flow Area (m2)		110.45	
E.G. Slope (m/m)	0.001193	Area (m2)		110.45	
Q Total (m3/s)	158.71	Flow (m3/s)		158.71	
Top Width (m)	47.25	Top Width (m)		47.25	
Vel Total (m/s)	1.44	Avg. Vel. (m/s)		1.44	
Max Chl Dpth (m)	3.20	Hydr. Depth (m)		2.34	
Conv. Total (m3/s)	4595.5	Conv. (m3/s)		4595.5	
Length Wtd. (m)	56.58	Wetted Per. (m)		51.44	
Min Ch El (m)	76.58	Shear (N/m2)		25.11	
Alpha	1.08	Stream Power (N/m s)		36.09	
Frctn Loss (m)	0.05	Cum Volume (1000 m3)		88.59	
C & E Loss (m)	0.01	Cum SA (1000 m2)		35.92	

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile RPF 13

E.G. Elev (m)	80.14	Element	Left OB	Channel	Right OB
Vel Head (m)	0.19	Wt. n-Val.		0.040	
W.S. Elev (m)	80.14	Reach Len. (m)	39.54	56.58	58.50
Crit W.S. (m)	78.49	Flow Area (m2)		140.61	
E.G. Slope (m/m)	0.001301	Area (m2)		140.61	
Q Total (m3/s)	198.20	Flow (m3/s)		198.20	
Top Width (m)	82.89	Top Width (m)		82.89	
Vel Total (m/s)	1.41	Avg. Vel. (m/s)		1.41	
Max Chl Dpth (m)	3.64	Hydr. Depth (m)		1.77	
Conv. Total (m3/s)	4805.1	Conv. (m3/s)		4805.1	
Length Wtd. (m)	56.58	Wetted Per. (m)		87.99	
Min Ch El (m)	76.58	Shear (N/m2)		26.67	
Alpha	1.00	Stream Power (N/m s)		37.54	
Frctn Loss (m)	0.00	Cum Volume (1000 m3)		104.16	
C & E Loss (m)	0.01	Cum SA (1000 m2)		39.53	

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

SUMMARY OUTPUT

PROFILE: PLAN:PLAN1
REACH: CRR RS: 1

INPUT
Description:
Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
[illegible]	80.01	[illegible]	78.43	[illegible]	[illegible]	[illegible]	76.87	[illegible]	76.55
[illegible]	[illegible]	22.45	79.32	[illegible]	80.83	83.58	81.08	91.23	83.96
[illegible]	[illegible]	100.14	78.79	[illegible]	[illegible]	106.28	78.21	108.35	78.42
[illegible]	[illegible]	113.47	78.45	[illegible]	83.04	118.67	77.74	119.87	77.88
[illegible]	78.44	172.78	80.02						

Manning's n Values num= [illegible]

Sta	n Val	Sta	n Val	Sta	n Val
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Sta Ineff Left	Sta Ineff Right	Sta Blocked Left	Sta Blocked Right	Sta Eff Left	Sta Eff Right	Coeff Contr.	Expan.
	[illegible]		[illegible]	[illegible]	58.31	[illegible]	[illegible]

CROSS SECTION OUTPUT Profile RPF 1

E.G. Elev (m)	76.76	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.		0.040	
W.S. Elev (m)	76.76	Reach Len. (m)	51.65	74.52	78.31
Crit W.S. (m)		Flow Area (m2)		4.21	
E.G. Slope (m/m)	0.001724	Area (m2)		4.21	
Q Total (m3/s)	1.31	Flow (m3/s)		1.31	
Top Width (m)	25.42	Top Width (m)		25.42	
Vel Total (m/s)	0.31	Avg. Vel. (m/s)		0.31	
Max Chl Dpth (m)	0.34	Hydr. Depth (m)		0.17	
Conv. Total (m3/s)	31.5	Conv. (m3/s)		31.5	
Length Wtd. (m)	74.52	Wetted Per. (m)		25.63	
Min Ch El (m)	76.42	Shear (N/m2)		2.78	
Alpha	1.00	Stream Power (N/m s)		0.86	
Frctn Loss (m)	0.12	Cum Volume (1000 m3)		3.20	
C & E Loss (m)	0.00	Cum WA (1000 m2)		18.00	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile RPF 2

E.G. Elev (m)	77.28	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.040	
W.S. Elev (m)	77.26	Reach Len. (m)	51.65	74.52	78.31
Crit W.S. (m)		Flow Area (m2)		20.63	
E.G. Slope (m/m)	0.001576	Area (m2)		20.63	
Q Total (m3/s)	13.74	Flow (m3/s)		13.74	
Top Width (m)	36.77	Top Width (m)		36.77	
Vel Total (m/s)	0.67	Avg. Vel. (m/s)		0.67	
Max Chl Dpth (m)	0.84	Hydr. Depth (m)		0.56	
Conv. Total (m3/s)	346.1	Conv. (m3/s)		346.1	
Length Wtd. (m)	74.52	Wetted Per. (m)		37.51	
Min Ch El (m)	76.42	Shear (N/m2)		8.50	
Alpha	1.00	Stream Power (N/m s)		5.66	
Frctn Loss (m)	0.14	Cum Volume (1000 m3)		14.85	
C & E Loss (m)	0.00	Cum WA (1000 m2)		21.21	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile RPF 3

E.G. Elev (m)	77.56	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.040	
W.S. Elev (m)	77.53	Reach Len. (m)	51.65	74.52	78.31
Crit W.S. (m)		Flow Area (m2)		30.93	
E.G. Slope (m/m)	0.001127	Area (m2)		30.93	
Q Total (m3/s)	23.88	Flow (m3/s)		23.88	
Top Width (m)	38.54	Top Width (m)		38.54	
Vel Total (m/s)	0.77	Avg. Vel. (m/s)		0.77	
Max Chl Dpth (m)	1.11	Hydr. Depth (m)		0.80	
Conv. Total (m3/s)	655.6	Conv. (m3/s)		655.6	
Length Wtd. (m)	74.52	Wetted Per. (m)		39.62	
Min Ch El (m)	76.42	Shear (N/m2)		10.16	
Alpha	1.00	Stream Power (N/m s)		7.84	
Frctn Loss (m)	0.11	Cum Volume (1000 m3)		21.45	
C & E Loss (m)	0.00	Cum WA (1000 m2)		22.49	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile RPF 4

E.G. Elev (m)	77.82	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.		0.040	
W.S. Elev (m)	77.79	Reach Len. (m)	51.65	74.52	78.31
Crit W.S. (m)		Flow Area (m2)		41.04	
E.G. Slope (m/m)	0.001125	Area (m2)		41.04	
Q Total (m3/s)	34.10	Flow (m3/s)		34.10	
Top Width (m)	40.20	Top Width (m)		40.20	
Vel Total (m/s)	0.83	Avg. Vel. (m/s)		0.83	
Max Chl Dpth (m)	1.37	Hydr. Depth (m)		1.02	
Conv. Total (m3/s)	1016.7	Conv. (m3/s)		1016.7	
Length Wtd. (m)	74.52	Wetted Per. (m)		41.60	
Min Ch El (m)	76.42	Shear (N/m2)		10.98	
Alpha	1.00	Stream Power (N/m s)		9.04	
Frctn Loss (m)	0.10	Cum Volume (1000 m3)		27.49	
C & E Loss (m)	0.00	Cum WA (1000 m2)		24.30	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile RPF 5

E.G. Elev (m)	78.05	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.		0.040	
W.S. Elev (m)	78.01	Reach Len. (m)	51.65	74.52	78.31
Crit W.S. (m)		Flow Area (m2)		50.22	
E.G. Slope (m/m)	0.001037	Area (m2)		50.22	
Q Total (m3/s)	44.39	Flow (m3/s)		44.39	
Top Width (m)	42.01	Top Width (m)		42.01	
Vel Total (m/s)	0.88	Avg. Vel. (m/s)		0.88	
Max Chl Dpth (m)	1.59	Hydr. Depth (m)		1.20	
Conv. Total (m3/s)	1374.3	Conv. (m3/s)		1374.3	
Length Wtd. (m)	74.52	Wetted Per. (m)		43.66	
Min Ch El (m)	76.42	Shear (N/m2)		11.70	
Alpha	1.00	Stream Power (N/m s)		10.34	
Frctn Loss (m)	0.09	Cum Volume (1000 m3)		32.96	
C & E Loss (m)	0.00	Cum WA (1000 m2)		25.56	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 6

E.G. Elev (m)	78.27	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.		0.040	
W.S. Elev (m)	78.22	Reach Len. (m)	51.65	74.52	78.31
Crit W.S. (m)		Flow Area (m2)		59.38	
E.G. Slope (m/m)	+0.000860	Area (m2)		59.38	
Q Total (m3/s)	55.21	Flow (m3/s)		55.21	
Top Width (m)	43.97	Top Width (m)		43.97	
Vel Total (m/s)	0.93	Avg. Vel. (m/s)		0.93	
Max Chl Dpth (m)	1.80	Hydr. Depth (m)		1.35	
Conv. Total (m3/s)	1763.6	Conv. (m3/s)		1763.6	
Length Wtd. (m)	74.52	Wetted Per. (m)		45.86	
Min Ch El (m)	76.42	Shear (N/m2)		12.44	
Alpha	1.00	Stream Power (N/m s)		11.57	
Frctn Loss (m)	0.08	Cum Volume (1000 m3)		38.39	
C & E Loss (m)	0.00	Cum SA (1000 m2)		28.46	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 7

E.G. Elev (m)	78.48	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.		0.040	
W.S. Elev (m)	78.43	Reach Len. (m)	51.65	74.52	78.31
Crit W.S. (m)		Flow Area (m2)		68.78	
E.G. Slope (m/m)	+0.000931	Area (m2)		68.78	
Q Total (m3/s)	66.68	Flow (m3/s)		66.68	
Top Width (m)	45.90	Top Width (m)		45.90	
Vel Total (m/s)	0.97	Avg. Vel. (m/s)		0.97	
Max Chl Dpth (m)	2.01	Hydr. Depth (m)		1.50	
Conv. Total (m3/s)	2185.0	Conv. (m3/s)		2185.0	
Length Wtd. (m)	74.52	Wetted Per. (m)		48.01	
Min Ch El (m)	76.42	Shear (N/m2)		13.08	
Alpha	1.00	Stream Power (N/m s)		12.68	
Frctn Loss (m)	0.08	Cum Volume (1000 m3)		43.83	
C & E Loss (m)	0.00	Cum SA (1000 m2)		27.22	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 8

E.G. Elev (m)	78.61	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.		0.040	
W.S. Elev (m)	78.56	Reach Len. (m)	51.65	74.52	78.31
Crit W.S. (m)		Flow Area (m2)		74.48	
E.G. Slope (m/m)	+0.000892	Area (m2)		74.48	
Q Total (m3/s)	73.81	Flow (m3/s)		73.81	
Top Width (m)	46.33	Top Width (m)		46.33	
Vel Total (m/s)	0.99	Avg. Vel. (m/s)		0.99	
Max Chl Dpth (m)	2.14	Hydr. Depth (m)		1.61	
Conv. Total (m3/s)	2471.8	Conv. (m3/s)		2471.8	
Length Wtd. (m)	74.52	Wetted Per. (m)		48.70	
Min Ch El (m)	76.42	Shear (N/m2)		13.37	
Alpha	1.00	Stream Power (N/m s)		13.25	
Frctn Loss (m)	0.08	Cum Volume (1000 m3)		47.10	
C & E Loss (m)	0.00	Cum SA (1000 m2)		27.77	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 9

E.G. Elev (m)	78.86	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.		0.040	
W.S. Elev (m)	78.80	Reach Len. (m)	51.65	74.52	78.31
Crit W.S. (m)		Flow Area (m2)		86.11	
E.G. Slope (m/m)	+0.000840	Area (m2)		86.11	
Q Total (m3/s)	89.04	Flow (m3/s)		89.04	
Top Width (m)	47.60	Top Width (m)		47.60	
Vel Total (m/s)	1.03	Avg. Vel. (m/s)		1.03	
Max Chl Dpth (m)	2.38	Hydr. Depth (m)		1.81	
Conv. Total (m3/s)	3072.9	Conv. (m3/s)		3072.9	
Length Wtd. (m)	74.52	Wetted Per. (m)		50.45	
Min Ch El (m)	76.42	Shear (N/m2)		14.04	
Alpha	1.00	Stream Power (N/m s)		14.52	
Frctn Loss (m)	0.07	Cum Volume (1000 m3)		53.86	
C & E Loss (m)	0.00	Cum SA (1000 m2)		28.90	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 10

E.G. Elev (m)	78.92	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.		0.040	
W.S. Elev (m)	78.87	Reach Len. (m)	51.65	74.52	78.31
Crit W.S. (m)		Flow Area (m2)		89.20	
E.G. Slope (m/m)	+0.000830	Area (m2)		89.20	
Q Total (m3/s)	93.29	Flow (m3/s)		93.29	
Top Width (m)	47.96	Top Width (m)		47.96	
Vel Total (m/s)	1.05	Avg. Vel. (m/s)		1.05	
Max Chl Dpth (m)	2.45	Hydr. Depth (m)		1.86	
Conv. Total (m3/s)	3237.6	Conv. (m3/s)		3237.6	
Length Wtd. (m)	74.52	Wetted Per. (m)		50.99	
Min Ch El (m)	76.42	Shear (N/m2)		14.24	
Alpha	1.00	Stream Power (N/m s)		14.93	
Frctn Loss (m)	0.07	Cum Volume (1000 m3)		55.67	
C & E Loss (m)	0.00	Cum SA (1000 m2)		29.12	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 11

E.G. Elev (m)	79.21	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.		0.040	
W.S. Elev (m)	79.15	Reach Len. (m)	51.65	74.52	78.31
Crit W.S. (m)		Flow Area (m2)		103.00	
E.G. Slope (m/m)	+0.000796	Area (m2)		103.00	
Q Total (m3/s)	112.91	Flow (m3/s)		112.91	
Top Width (m)	49.55	Top Width (m)		49.55	
Vel Total (m/s)	1.10	Avg. Vel. (m/s)		1.10	
Max Chl Dpth (m)	2.73	Hydr. Depth (m)		2.08	
Conv. Total (m3/s)	4002.5	Conv. (m3/s)		4002.5	

Length Wtd. (m)	74.52	Wetted Per. (m)	53.15	
Min Ch El (m)	76.42	Shear (N/m2)	15.12	
Alpha	1.00	Stream Power (N/m s)	16.58	
Frctn Loss (m)	0.07	Cum Volume (1000 m3)	63.74	
C & E Loss (m)	0.00	Cum SA (1000 m2)	30.06	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 12

			Left OB	Channel	Right OB
E.G. Elev (m)	79.82	Element		0.040	
Vel Head (m)	0.07	Wt. n-Val.	51.65	74.52	78.31
W.S. Elev (m)	79.75	Reach Len. (m)		133.70	
Crit W.S. (m)		Flow Area (m2)		133.70	
E.G. Slope (m/m)	0.000735	Area (m2)		158.71	
Q Total (m3/s)	158.71	Flow (m3/s)		52.84	
Top Width (m)	52.84	Top Width (m)		1.19	
Vel Total (m/s)	1.19	Avg. Vel. (m/s)		2.53	
Max Chl Dpth (m)	3.33	Hydr. Depth (m)		5853.8	
Conv. Total (m3/s)	5853.8	Conv. (m3/s)		57.68	
Length Wtd. (m)	74.52	Wetted Per. (m)		16.71	
Min Ch El (m)	76.42	Shear (N/m2)		19.83	
Alpha	1.00	Stream Power (N/m s)		81.68	
Frctn Loss (m)	0.07	Cum Volume (1000 m3)		33.09	
C & E Loss (m)	0.00	Cum SA (1000 m2)			

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 13

			Left OB	Channel	Right OB
E.G. Elev (m)	80.28	Element		0.040	
Vel Head (m)	0.08	Wt. n-Val.	51.65	74.52	78.31
W.S. Elev (m)	80.20	Reach Len. (m)		157.69	
Crit W.S. (m)		Flow Area (m2)		157.69	
E.G. Slope (m/m)	0.000701	Area (m2)		198.20	
Q Total (m3/s)	198.20	Flow (m3/s)		54.36	
Top Width (m)	54.36	Top Width (m)		1.26	
Vel Total (m/s)	1.26	Avg. Vel. (m/s)		2.90	
Max Chl Dpth (m)	3.78	Hydr. Depth (m)		7486.0	
Conv. Total (m3/s)	7486.0	Conv. (m3/s)		60.26	
Length Wtd. (m)	74.52	Wetted Per. (m)		17.99	
Min Ch El (m)	76.42	Shear (N/m2)		22.61	
Alpha	1.00	Stream Power (N/m s)		95.93	
Frctn Loss (m)	0.07	Cum Volume (1000 m3)		35.65	
C & E Loss (m)	0.00	Cum SA (1000 m2)			

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: CAYAGUAS
REACH: ONE RS: 18

INPUT
Description:
Station Elevation Data num= 21

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	79.21	2.57	77.98	3.11	76.29	10.11	76.68	15.5	76.75
16.45	77.78	21.37	82.02	30.62	80.29	47.87	79.51	74.9	80.74
82.18	80.54	96	78.74	98.09	77.53	99.98	76.74	100.76	76.18
101.55	76.42	108.94	76.5	115.55	76.37	116.21	77.04	123.23	80.47
130.14	84.97								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	0	.04	123.23	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	123.23	35.03	30.24	14.86	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (m)	76.64	Element		0.040	
Vel Head (m)	0.01	Wt. n-Val.	35.03	30.24	14.86
W.S. Elev (m)	76.63	Reach Len. (m)		4.07	
Crit W.S. (m)		Flow Area (m2)		4.07	
E.G. Slope (m/m)	0.001617	Area (m2)		1.31	
Q Total (m3/s)	1.31	Flow (m3/s)		21.92	
Top Width (m)	21.92	Top Width (m)		0.32	
Vel Total (m/s)	0.32	Avg. Vel. (m/s)		0.19	
Max Chl Dpth (m)	0.45	Hydr. Depth (m)		32.6	
Conv. Total (m3/s)	32.6	Conv. (m3/s)		22.47	
Length Wtd. (m)	30.24	Wetted Per. (m)		2.87	
Min Ch El (m)	76.18	Shear (N/m2)		0.92	
Alpha	1.00	Stream Power (N/m s)		2.89	
Frctn Loss (m)	0.12	Cum Volume (1000 m3)		14.24	
C & E Loss (m)	0.00	Cum SA (1000 m2)			

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #PF 2

			Left OB	Channel	Right OB
E.G. Elev (m)	77.14	Element		0.040	
Vel Head (m)	0.03	Wt. n-Val.	35.03	30.24	14.86
W.S. Elev (m)	77.11	Reach Len. (m)		17.47	
Crit W.S. (m)		Flow Area (m2)		17.47	
E.G. Slope (m/m)	0.002182	Area (m2)		13.74	
Q Total (m3/s)	13.74	Flow (m3/s)		30.25	
Top Width (m)	30.25	Top Width (m)		0.79	
Vel Total (m/s)	0.79	Avg. Vel. (m/s)		0.54	
Max Chl Dpth (m)	0.93	Hydr. Depth (m)		294.1	
Conv. Total (m3/s)	294.1	Conv. (m3/s)		31.59	
Length Wtd. (m)	30.24	Wetted Per. (m)		11.83	
Min Ch El (m)	76.18	Shear (N/m2)		9.31	
Alpha	1.00	Stream Power (N/m s)			

* Frctn Loss (m)	* 0.07	* Cum Volume (1000 m3)	*	* 13.43	*
* C & E Loss (m)	* 0.00	* Cum SA (1000 m2)	*	* 18.72	*

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 3

* E.G. Elev (m)	* 77.44	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (m)	* 0.04	* Wt. n-Val.	*	* 0.040	*	*
* W.S. Elev (m)	* 77.40	* Reach Len. (m)	* 35.03	* 30.24	* 14.86	*
* Crit W.S. (m)	*	* Flow Area (m2)	*	* 26.67	*	*
* E.G. Slope (m/m)	*0.001755	* Area (m2)	*	* 26.67	*	*
* Q Total (m3/s)	* 23.88	* Flow (m3/s)	*	* 23.88	*	*
* Top Width (m)	* 31.94	* Top Width (m)	*	* 31.94	*	*
* Vel Total (m/s)	* 0.90	* Avg. Vel. (m/s)	*	* 0.90	*	*
* Max Chl Dpth (m)	* 1.22	* Hydr. Depth (m)	*	* 0.84	*	*
* Conv. Total (m3/s)	* 570.0	* Conv. (m3/s)	*	* 570.0	*	*
* Length Wtd. (m)	* 30.24	* Wetted Per. (m)	*	* 33.75	*	*
* Min Ch El (m)	* 76.18	* Shear (N/m2)	*	* 13.60	*	*
* Alpha	* 1.00	* Stream Power (N/m s)	*	* 12.18	*	*
* Frctn Loss (m)	* 0.05	* Cum Volume (1000 m3)	*	* 19.31	*	*
* C & E Loss (m)	* 0.00	* Cum SA (1000 m2)	*	* 19.86	*	*

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 4

* E.G. Elev (m)	* 77.72	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (m)	* 0.05	* Wt. n-Val.	*	* 0.040	*	*
* W.S. Elev (m)	* 77.68	* Reach Len. (m)	* 35.03	* 30.24	* 14.86	*
* Crit W.S. (m)	*	* Flow Area (m2)	*	* 35.61	*	*
* E.G. Slope (m/m)	*0.001470	* Area (m2)	*	* 35.61	*	*
* Q Total (m3/s)	* 34.19	* Flow (m3/s)	*	* 34.10	*	*
* Top Width (m)	* 33.40	* Top Width (m)	*	* 33.40	*	*
* Vel Total (m/s)	* 0.96	* Avg. Vel. (m/s)	*	* 0.96	*	*
* Max Chl Dpth (m)	* 1.50	* Hydr. Depth (m)	*	* 1.07	*	*
* Conv. Total (m3/s)	* 889.5	* Conv. (m3/s)	*	* 889.5	*	*
* Length Wtd. (m)	* 30.24	* Wetted Per. (m)	*	* 35.65	*	*
* Min Ch El (m)	* 76.18	* Shear (N/m2)	*	* 14.39	*	*
* Alpha	* 1.00	* Stream Power (N/m s)	*	* 13.78	*	*
* Frctn Loss (m)	* 0.05	* Cum Volume (1000 m3)	*	* 24.64	*	*
* C & E Loss (m)	* 0.00	* Cum SA (1000 m2)	*	* 21.56	*	*

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 5

* E.G. Elev (m)	* 77.96	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (m)	* 0.05	* Wt. n-Val.	*	* 0.040	*	*
* W.S. Elev (m)	* 77.91	* Reach Len. (m)	* 35.03	* 30.24	* 14.86	*
* Crit W.S. (m)	*	* Flow Area (m2)	*	* 43.38	*	*
* E.G. Slope (m/m)	*0.001366	* Area (m2)	*	* 43.38	*	*
* Q Total (m3/s)	* 44.39	* Flow (m3/s)	*	* 44.39	*	*
* Top Width (m)	* 34.60	* Top Width (m)	*	* 34.60	*	*
* Vel Total (m/s)	* 1.02	* Avg. Vel. (m/s)	*	* 1.02	*	*
* Max Chl Dpth (m)	* 1.73	* Hydr. Depth (m)	*	* 1.25	*	*
* Conv. Total (m3/s)	* 1201.2	* Conv. (m3/s)	*	* 1201.2	*	*
* Length Wtd. (m)	* 30.24	* Wetted Per. (m)	*	* 37.22	*	*
* Min Ch El (m)	* 76.18	* Shear (N/m2)	*	* 15.61	*	*
* Alpha	* 1.00	* Stream Power (N/m s)	*	* 15.97	*	*
* Frctn Loss (m)	* 0.04	* Cum Volume (1000 m3)	*	* 29.47	*	*
* C & E Loss (m)	* 0.00	* Cum SA (1000 m2)	*	* 22.70	*	*

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 6

* E.G. Elev (m)	* 78.14	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (m)	* 0.06	* Wt. n-Val.	*	* 0.040	*	*
* W.S. Elev (m)	* 78.12	* Reach Len. (m)	* 35.03	* 30.24	* 14.86	*
* Crit W.S. (m)	*	* Flow Area (m2)	*	* 50.97	*	*
* E.G. Slope (m/m)	*0.001310	* Area (m2)	*	* 50.97	*	*
* Q Total (m3/s)	* 55.21	* Flow (m3/s)	*	* 55.21	*	*
* Top Width (m)	* 36.05	* Top Width (m)	*	* 36.05	*	*
* Vel Total (m/s)	* 1.08	* Avg. Vel. (m/s)	*	* 1.08	*	*
* Max Chl Dpth (m)	* 1.94	* Hydr. Depth (m)	*	* 1.41	*	*
* Conv. Total (m3/s)	* 1525.6	* Conv. (m3/s)	*	* 1525.6	*	*
* Length Wtd. (m)	* 30.24	* Wetted Per. (m)	*	* 38.91	*	*
* Min Ch El (m)	* 76.18	* Shear (N/m2)	*	* 16.82	*	*
* Alpha	* 1.00	* Stream Power (N/m s)	*	* 18.22	*	*
* Frctn Loss (m)	* 0.04	* Cum Volume (1000 m3)	*	* 34.28	*	*
* C & E Loss (m)	* 0.00	* Cum SA (1000 m2)	*	* 23.48	*	*

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 7

* E.G. Elev (m)	* 78.40	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (m)	* 0.07	* Wt. n-Val.	*	* 0.040	*	*
* W.S. Elev (m)	* 78.33	* Reach Len. (m)	* 35.03	* 30.24	* 14.86	*
* Crit W.S. (m)	*	* Flow Area (m2)	*	* 58.71	*	*
* E.G. Slope (m/m)	*0.001261	* Area (m2)	*	* 58.71	*	*
* Q Total (m3/s)	* 66.68	* Flow (m3/s)	*	* 66.68	*	*
* Top Width (m)	* 37.46	* Top Width (m)	*	* 37.46	*	*
* Vel Total (m/s)	* 1.14	* Avg. Vel. (m/s)	*	* 1.14	*	*
* Max Chl Dpth (m)	* 2.15	* Hydr. Depth (m)	*	* 1.57	*	*
* Conv. Total (m3/s)	* 1877.7	* Conv. (m3/s)	*	* 1877.7	*	*
* Length Wtd. (m)	* 30.24	* Wetted Per. (m)	*	* 40.57	*	*
* Min Ch El (m)	* 76.18	* Shear (N/m2)	*	* 17.90	*	*
* Alpha	* 1.00	* Stream Power (N/m s)	*	* 20.33	*	*
* Frctn Loss (m)	* 0.04	* Cum Volume (1000 m3)	*	* 39.08	*	*
* C & E Loss (m)	* 0.00	* Cum SA (1000 m2)	*	* 24.11	*	*

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 8

* E.G. Elev (m)	* 78.53	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (m)	* 0.07	* Wt. n-Val.	*	* 0.040	*	*
* W.S. Elev (m)	* 78.46	* Reach Len. (m)	* 35.03	* 30.24	* 14.86	*
* Crit W.S. (m)	*	* Flow Area (m2)	*	* 63.45	*	*

E.G. Slope (m/m)	0.001231	Area (m2)		63.45	
Q Total (m3/s)	73.81	Flow (m3/s)		73.81	
Top Width (m)	38.30	Top Width (m)		38.30	
Vel Total (m/s)	1.16	Avg. Vel. (m/s)		1.16	
Max Chl Dpth (m)	2.29	Hydr. Depth (m)		1.66	
Conv. Total (m3/s)	2103.4	Conv. (m3/s)		2103.4	
Length Wtd. (m)	30.24	Wetted Per. (m)		41.56	
Min Ch El (m)	76.18	Shear (N/m2)		18.44	
Alpha	1.00	Stream Power (N/m s)		21.45	
Frctn Loss (m)	0.04	Cum Volume (1000 m3)		41.96	
C & E Loss (m)	0.00	Cum SA (1000 m2)		24.62	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #FF 9

			Left OB	Channel	Right OB
E.G. Elev (m)	78.76	Element			
Vel Head (m)	0.08	Wt. n-Val.		0.040	
W.S. Elev (m)	78.71	Reach Len. (m)	35.03	30.24	14.86
Crit W.S. (m)		Flow Area (m2)		73.22	
E.G. Slope (m/m)	0.001183	Area (m2)		73.22	
Q Total (m3/s)	89.04	Flow (m3/s)		89.04	
Top Width (m)	39.98	Top Width (m)		39.98	
Vel Total (m/s)	1.22	Avg. Vel. (m/s)		1.22	
Max Chl Dpth (m)	2.51	Hydr. Depth (m)		1.83	
Conv. Total (m3/s)	2589.3	Conv. (m3/s)		2589.3	
Length Wtd. (m)	30.24	Wetted Per. (m)		43.52	
Min Ch El (m)	76.18	Shear (N/m2)		19.51	
Alpha	1.00	Stream Power (N/m s)		23.72	
Frctn Loss (m)	0.04	Cum Volume (1000 m3)		47.92	
C & E Loss (m)	0.00	Cum SA (1000 m2)		25.64	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #FF 10

			Left OB	Channel	Right OB
E.G. Elev (m)	78.85	Element			
Vel Head (m)	0.08	Wt. n-Val.		0.040	
W.S. Elev (m)	78.77	Reach Len. (m)	35.03	30.24	14.86
Crit W.S. (m)		Flow Area (m2)		75.82	
E.G. Slope (m/m)	0.001174	Area (m2)		75.82	
Q Total (m3/s)	93.29	Flow (m3/s)		93.29	
Top Width (m)	40.41	Top Width (m)		40.41	
Vel Total (m/s)	1.23	Avg. Vel. (m/s)		1.23	
Max Chl Dpth (m)	2.59	Hydr. Depth (m)		1.88	
Conv. Total (m3/s)	2722.9	Conv. (m3/s)		2722.9	
Length Wtd. (m)	30.24	Wetted Per. (m)		44.04	
Min Ch El (m)	76.18	Shear (N/m2)		19.82	
Alpha	1.00	Stream Power (N/m s)		24.36	
Frctn Loss (m)	0.04	Cum Volume (1000 m3)		49.52	
C & E Loss (m)	0.00	Cum SA (1000 m2)		25.83	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #FF 11

			Left OB	Channel	Right OB
E.G. Elev (m)	79.14	Element			
Vel Head (m)	0.08	Wt. n-Val.		0.040	
W.S. Elev (m)	79.05	Reach Len. (m)	35.03	30.24	14.86
Crit W.S. (m)		Flow Area (m2)		87.56	
E.G. Slope (m/m)	0.001137	Area (m2)		87.56	
Q Total (m3/s)	112.91	Flow (m3/s)		112.91	
Top Width (m)	42.41	Top Width (m)		42.41	
Vel Total (m/s)	1.29	Avg. Vel. (m/s)		1.29	
Max Chl Dpth (m)	2.87	Hydr. Depth (m)		2.06	
Conv. Total (m3/s)	3145.6	Conv. (m3/s)		3145.6	
Length Wtd. (m)	30.24	Wetted Per. (m)		46.34	
Min Ch El (m)	76.18	Shear (N/m2)		21.10	
Alpha	1.00	Stream Power (N/m s)		27.21	
Frctn Loss (m)	0.04	Cum Volume (1000 m3)		56.64	
C & E Loss (m)	0.00	Cum SA (1000 m2)		26.61	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #FF 12

			Left OB	Channel	Right OB
E.G. Elev (m)	79.75	Element			
Vel Head (m)	0.10	Wt. n-Val.		0.040	
W.S. Elev (m)	79.65	Reach Len. (m)	35.03	30.24	14.86
Crit W.S. (m)		Flow Area (m2)		114.39	
E.G. Slope (m/m)	0.001215	Area (m2)		114.39	
Q Total (m3/s)	154.71	Flow (m3/s)		154.71	
Top Width (m)	51.69	Top Width (m)		51.69	
Vel Total (m/s)	1.35	Avg. Vel. (m/s)		1.35	
Max Chl Dpth (m)	3.47	Hydr. Depth (m)		2.20	
Conv. Total (m3/s)	4554.0	Conv. (m3/s)		4554.0	
Length Wtd. (m)	30.24	Wetted Per. (m)		56.93	
Min Ch El (m)	76.18	Shear (N/m2)		23.93	
Alpha	1.00	Stream Power (N/m s)		33.21	
Frctn Loss (m)	0.04	Cum Volume (1000 m3)		72.44	
C & E Loss (m)	0.07	Cum SA (1000 m2)		28.19	

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile #FF 13

			Left OB	Channel	Right OB
E.G. Elev (m)	80.20	Element			
Vel Head (m)	0.10	Wt. n-Val.		0.040	
W.S. Elev (m)	80.11	Reach Len. (m)	35.03	30.24	14.86
Crit W.S. (m)		Flow Area (m2)		143.11	
E.G. Slope (m/m)	0.001417	Area (m2)		143.11	
Q Total (m3/s)	198.20	Flow (m3/s)		198.20	
Top Width (m)	74.34	Top Width (m)		74.34	
Vel Total (m/s)	1.38	Avg. Vel. (m/s)		1.38	
Max Chl Dpth (m)	3.93	Hydr. Depth (m)		1.93	
Conv. Total (m3/s)	5265.5	Conv. (m3/s)		5265.5	
Length Wtd. (m)	30.24	Wetted Per. (m)		80.15	
Min Ch El (m)	76.18	Shear (N/m2)		24.81	
Alpha	1.00	Stream Power (N/m s)		34.36	
Frctn Loss (m)	0.04	Cum Volume (1000 m3)		84.72	
C & E Loss (m)	0.07	Cum SA (1000 m2)		30.85	

Warning: Divided flow computed for this cross-section.
Caution: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION

RIVER: CAYAGUAS
REACH: MAIN RS: 17

INPUT
Description:
Station Elevation Data num= 21

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-6	79.1	-4	78.16	2	76.89	6	76.28	8.38	76.51
9.36	76.62	8.75	76.33	11.73	76.44	12.63	78.18	14.56	79.06
45	80	85.92	89.5	89.44	91.7	91.51	77.49	93.36	76.7
94.34	76.18	94.81	76.19	102.12	76.48	105	76.33	112.21	80.43
117.59	86.12								

Manning's n Values num= 3

Sta	n Val	Sta	n Val
0	.04	112.21	.04

Bank Sta: Left Right
0 112.21

Lengths: Left	Channel	Right
45.55	31.67	32.65

Coeff Contr.	Expan.
.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
Elev	76.51	Element		0.040	
Vel Head	0.01	Wt. Total		31.67	32.65
W.S. Elev	76.48	Reach Len.	45.55	1.78	
Crit W.S.	76.47	Flow Area		1.78	
E.G. Slope	0.022259	Area		1.31	
Q Total	1.31	Flow		20.11	
Top Width	20.11	Top Width		0.74	
Vel Total	0.74	Avg. Vel.		0.09	
Max Chl Dpth	0.34	Hydr. Depth		0.8	
Conv. Total	0.8	Conv.		20.34	
Length Wtd.	31.67	Wetted Per.		19.11	
Min Ch El	76.14	Shear		14.06	
Alpha	1.00	Stream Power		2.60	
Frcln Loss	0.01	Cum Volume		13.00	
Cum Sa Loss	0.01	Cum Sa			

Warning: Divided flow computed for this cross-section.
Caution: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #PF 2

			Left OB	Channel	Right OB
Elev	[illegible]	[illegible]		0.040	
Vel Head	0.01	[illegible]		31.67	32.65
W.S. Elev	[illegible]	[illegible]	45.55	14.32	
Crit W.S.	[illegible]	[illegible]		16.32	
E.G. Slope	[illegible]	[illegible]		13.74	
Q Total	13.74	[illegible]		28.83	
Top Width	28.83	[illegible]		0.84	
Vel Total	0.84	[illegible]		0.57	
Max Chl Dpth	0.57	[illegible]		273.3	
Conv. Total	273.3	[illegible]		29.56	
Length Wtd.	29.56	[illegible]		13.39	
Min Ch El	29.14	[illegible]		11.44	
Alpha	[illegible]	[illegible]		12.92	
Frcln Loss	0.01	[illegible]		17.82	
Cum Sa Loss	0.01	[illegible]			

Warning: Divided flow computed for this cross-section.
Caution: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #PF 3

			Left OB	Channel	Right OB
Elev	[illegible]	[illegible]		0.040	
Vel Head	[illegible]	[illegible]		31.67	32.65
W.S. Elev	[illegible]	[illegible]	45.55	25.81	
Crit W.S.	[illegible]	[illegible]		[illegible]	
E.G. Slope	[illegible]	[illegible]		21.82	
Q Total	21.82	[illegible]		30.52	
Top Width	30.52	[illegible]		0.93	
Vel Total	0.93	[illegible]		0.84	
Max Chl Dpth	0.84	[illegible]		553.2	
Conv. Total	553.2	[illegible]		31.54	
Length Wtd.	31.54	[illegible]		12.66	
Min Ch El	26.11	[illegible]		13.66	
Alpha	1.00	[illegible]		18.52	
Frcln Loss	0.01	[illegible]		18.52	
Cum Sa Loss	0.01	[illegible]			

Warning: Divided flow computed for this cross-section.
Caution: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #PF 4

			Left OB	Channel	Right OB
Elev	[illegible]	[illegible]		0.040	
Vel Head	[illegible]	[illegible]		31.67	32.65
W.S. Elev	[illegible]	[illegible]	45.55	34.48	
Crit W.S.	[illegible]	[illegible]		24.48	
E.G. Slope	[illegible]	[illegible]		34.19	
Q Total	34.19	[illegible]		31.64	
Top Width	31.64	[illegible]		0.69	
Vel Total	0.69	[illegible]		1.04	
Max Chl Dpth	1.04	[illegible]		873.1	
Conv. Total	873.1	[illegible]		32.83	
Length Wtd.	32.83	[illegible]		15.25	
Min Ch El	15.25	[illegible]		15.09	
Alpha	1.00	[illegible]		23.57	
Frcln Loss	[illegible]	[illegible]		20.57	
Cum Sa Loss	[illegible]	[illegible]			

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 5

			Left OB	Channel	Right OB
E.G. Elev (m)	77.91	Element		0.040	
Vel Head (m)	0.06	Wt. n-Val.			
W.S. Elev (m)	77.86	Reach Len. (m)	45.55	31.67	32.65
Crit W.S. (m)		Flow Area (m2)		42.01	
E.G. Slope (m/m)	0.001417	Area (m2)		42.01	
Q Total (m3/s)	44.19	Flow (m3/s)		44.39	
Top Width (m)	33.06	Top Width (m)		33.06	
Vel Total (m/s)	1.06	Avg. Vel. (m/s)		1.06	
Max Chl Dpth (m)	1.72	Hydr. Depth (m)		1.27	
Conv. Total (m3/s)	1179.2	Conv. (m3/s)		1179.2	
Length Wtd. (m)	31.67	Wetted Per. (m)		35.31	
Min Ch El (m)	76.14	Shear (N/m2)		16.53	
Alpha	1.06	Stream Power (N/m s)		17.47	
Frctn Loss (m)	0.43	Cum Volume (1000 m3)		28.18	
C & E Loss (m)	0.01	Cum OA (1000 m2)		21.68	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 6

			Left OB	Channel	Right OB
E.G. Elev (m)	78.14	Element		0.040	
Vel Head (m)	0.06	Wt. n-Val.			
W.S. Elev (m)	78.08	Reach Len. (m)	45.55	31.67	32.65
Crit W.S. (m)		Flow Area (m2)		49.26	
E.G. Slope (m/m)	0.001367	Area (m2)		49.26	
Q Total (m3/s)	55.71	Flow (m3/s)		55.21	
Top Width (m)	34.09	Top Width (m)		34.09	
Vel Total (m/s)	1.12	Avg. Vel. (m/s)		1.12	
Max Chl Dpth (m)	1.94	Hydr. Depth (m)		1.45	
Conv. Total (m3/s)	1498.7	Conv. (m3/s)		1498.7	
Length Wtd. (m)	31.67	Wetted Per. (m)		36.69	
Min Ch El (m)	76.14	Shear (N/m2)		17.87	
Alpha	1.06	Stream Power (N/m s)		20.03	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)		32.77	
C & E Loss (m)	0.01	Cum OA (1000 m2)		22.41	

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #PF 7

			Left OB	Channel	Right OB
E.G. Elev (m)	78.4[illegible]	Element		0.040	
Vel Head (m)	0.1[illegible]	Wt. n-Val.			
W.S. Elev (m)	78.2[illegible]	Reach Len. (m)	45.55	31.67	32.65
Crit W.S. (m)		Flow Area (m2)		56.57	
E.G. Slope (m/m)	0.001375	Area (m2)		56.57	
Q Total (m3/s)	66.48	Flow (m3/s)		66.68	
Top Width (m)	35.43	Top Width (m)		35.47	
Vel Total (m/s)	1.18	Avg. Vel. (m/s)		1.18	
Max Chl Dpth (m)	2.15	Hydr. Depth (m)		1.59	
Conv. Total (m3/s)	1833.3	Conv. (m3/s)		1833.3	
Length Wtd. (m)	31.67	Wetted Per. (m)		38.33	
Min Ch El (m)	76.14	Shear (N/m2)		19.15	
Alpha	1.06	Stream Power (N/m s)		22.57	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)		37.14	
C & E Loss (m)	0.01	Cum OA (1000 m2)		23.01	

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #PF 8

			Left OB	Channel	Right OB
E.G. Elev (m)	78.1[illegible]	Element		0.040	
Vel Head (m)	0.0[illegible]	Wt. n-Val.			
W.S. Elev (m)	78.0[illegible]	Reach Len. (m)	45.55	31.67	32.65
Crit W.S. (m)		Flow Area (m2)		61.05	
E.G. Slope (m/m)	0.001[illegible]	Area (m2)		61.05	
Q Total (m3/s)	77.[illegible]	Flow (m3/s)		77.81	
Top Width (m)	36.44	Top Width (m)		36.44	
Vel Total (m/s)	1.2[illegible]	Avg. Vel. (m/s)		1.21	
Max Chl Dpth (m)	[illegible]	Hydr. Depth (m)		1.68	
Conv. Total (m3/s)	2044.9	Conv. (m3/s)		2044.9	
Length Wtd. (m)	31.67	Wetted Per. (m)		39.47	
Min Ch El (m)	76.14	Shear (N/m2)		19.98	
Alpha	1.06	Stream Power (N/m s)		23.42	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)		40.07	
C & E Loss (m)	0.01	Cum OA (1000 m2)		23.46	

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #PF 9

			Left OB	Channel	Right OB
E.G. Elev (m)	[illegible]	Element		[illegible]	
Vel Head (m)	[illegible]	Wt. n-Val.			
W.S. Elev (m)	[illegible]	Reach Len. (m)	45.55	31.67	32.65
Crit W.S. (m)		Flow Area (m2)		70.44	
E.G. Slope (m/m)	[illegible]	Area (m2)		70.44	
Q Total (m3/s)	[illegible]	Flow (m3/s)		89.04	
Top Width (m)	[illegible]	Top Width (m)		36.95	
Vel Total (m/s)	[illegible]	Avg. Vel. (m/s)		1.26	
Max Chl Dpth (m)	[illegible]	Hydr. Depth (m)		1.84	
Conv. Total (m3/s)	[illegible]	Conv. (m3/s)		2501.8	
Length Wtd. (m)	[illegible]	Wetted Per. (m)		41.41	
Min Ch El (m)	[illegible]	Shear (N/m2)		21.01	
Alpha	[illegible]	Stream Power (N/m s)		26.58	
Frctn Loss (m)	[illegible]	Cum Volume (1000 m3)		41.75	
C & E Loss (m)	[illegible]	Cum OA (1000 m2)		24.45	

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (m)	78.81	Element		0.040	
Vel Head (m)	0.08	Wt. n-Val.			
W.S. Elev (m)	78.73	Reach Len. (m)	45.55	31.67	32.65
Crit W.S. (m)		Flow Area (m2)		72.55	
E.G. Slope (m/m)	+0.001200	Area (m2)		75.85	
Q Total (m3/s)	93.74	Flow (m3/s)		93.25	
Top Width (m)	38.59	Top Width (m)		38.89	
Vel Total (m/s)	1.28	Avg. Vel. (m/s)		1.28	
Max Chl Dpth (m)	2.59	Hydr. Depth (m)		1.88	
Conv. Total (m3/s)	2427.6	Conv. (m3/s)		2427.6	
Length Wtd. (m)	31.67	Wetted Per. (m)		42.18	
Min Ch El (m)	76.14	Shear (N/m2)		21.28	
Alpha	1.00	Stream Power (N/m s)		27.34	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)		47.27	
C & E Loss (m)	0.02	Cum SA (1000 m2)		24.63	

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile RPF 11

			Left OB	Channel	Right OB
E.G. Elev (m)	79.10	Element		0.040	
Vel Head (m)	0.04	Wt. n-Val.			
W.S. Elev (m)	79.06	Reach Len. (m)	45.55	31.67	32.65
Crit W.S. (m)		Flow Area (m2)		84.32	
E.G. Slope (m/m)	+0.001232	Area (m2)		84.32	
Q Total (m3/s)	112.91	Flow (m3/s)		112.91	
Top Width (m)	41.15	Top Width (m)		41.15	
Vel Total (m/s)	1.34	Avg. Vel. (m/s)		1.34	
Max Chl Dpth (m)	2.87	Hydr. Depth (m)		2.05	
Conv. Total (m3/s)	3217.2	Conv. (m3/s)		3217.2	
Length Wtd. (m)	31.67	Wetted Per. (m)		44.72	
Min Ch El (m)	76.14	Shear (N/m2)		22.79	
Alpha	1.00	Stream Power (N/m s)		30.50	
Frctn Loss (m)	0.01	Cum Volume (1000 m3)		54.04	
C & E Loss (m)	0.07	Cum SA (1000 m2)		25.37	

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile RPF 12

			Left OB	Channel	Right OB
E.G. Elev (m)	79.31	Element		0.040	
Vel Head (m)	0.07	Wt. n-Val.			
W.S. Elev (m)	79.24	Reach Len. (m)	45.55	31.67	32.65
Crit W.S. (m)		Flow Area (m2)		115.48	
E.G. Slope (m/m)	+0.001062	Area (m2)		115.48	
Q Total (m3/s)	158.71	Flow (m3/s)		158.71	
Top Width (m)	63.81	Top Width (m)		63.81	
Vel Total (m/s)	1.37	Avg. Vel. (m/s)		1.37	
Max Chl Dpth (m)	3.17	Hydr. Depth (m)		1.81	
Conv. Total (m3/s)	4094.9	Conv. (m3/s)		4094.9	
Length Wtd. (m)	31.67	Wetted Per. (m)		68.33	
Min Ch El (m)	76.14	Shear (N/m2)		24.99	
Alpha	1.00	Stream Power (N/m s)		34.22	
Frctn Loss (m)	0.01	Cum Volume (1000 m3)		64.96	
C & E Loss (m)	0.07	Cum SA (1000 m2)		27.43	

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile RPF 13

			Left OB	Channel	Right OB
E.G. Elev (m)	[illegible]	Element		0.040	
Vel Head (m)	[illegible]	Wt. n-Val.			
W.S. Elev (m)	[illegible]	Reach Len. (m)	45.55	31.67	32.65
Crit W.S. (m)		Flow Area (m2)		149.57	
E.G. Slope (m/m)	[illegible]	Area (m2)		148.47	
Q Total (m3/s)	[illegible]	Flow (m3/s)		198.[illegible]	
Top Width (m)	[illegible]	Top Width (m)		84.65	
Vel Total (m/s)	1.33	Avg. Vel. (m/s)		1.33	
Max Chl Dpth (m)	3.83	Hydr. Depth (m)		1.75	
Conv. Total (m3/s)	[illegible]	Conv. (m3/s)		[illegible]	
Length Wtd. (m)	[illegible]	Wetted Per. (m)		[illegible]	
Min Ch El (m)	[illegible]	Shear (N/m2)		[illegible]	
Alpha	[illegible]	Stream Power (N/m s)		[illegible]	
Frctn Loss (m)	[illegible]	Cum Volume (1000 m3)		[illegible]	
C & E Loss (m)	[illegible]	Cum SA (1000 m2)		[illegible]	

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

[illegible]

[illegible]
[illegible] RPF [illegible]

INPUT
Flow Options
[illegible] Elevation [illegible] num [illegible]

[illegible]	Flow	[illegible]	Elev	[illegible]	Elev	[illegible]	Elev	[illegible]	Elev
[illegible]	[illegible]	1.64	[illegible]	[illegible]	[illegible]	[illegible]	78.2	8.88	[illegible]
[illegible]	[illegible]	11.20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	45	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	96.33	95.02	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	98.29		

[illegible] Volume num

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible] Right [illegible] Left Channel Right Coeff Contr. Expan.
[illegible] [illegible] [illegible] [illegible] [illegible] .1 .1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (m)	76.47	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.		0.040	
W.S. Elev (m)	76.41	Reach Len. (m)	35.24	14.38	14.83
Crit W.S. (m)		Flow Area (m2)		5.36	
E.G. Slope (m/m)	0.001007	Area (m2)		5.36	
Q Total (m3/s)	1.31	Flow (m3/s)		1.31	
Top Width (m)	31.16	Top Width (m)		31.16	
Vel Total (m/s)	0.24	Avg. Vel. (m/s)		0.24	
Max Chl Dpth (m)	0.27	Hydr. Depth (m)		0.17	
Conv. Total (m3/s)	41.3	Conv. (m3/s)		41.3	
Length Wtd. (m)	14.38	Wetted Per. (m)		31.33	
Min Ch El (m)	76.14	Shear (N/m2)		1.69	
Alpha	1.00	Stream Power (N/m s)		0.41	
Prior Loss (m)	0.02	Cum Volume (1000 m3)		2.69	
C & E Loss (m)	0.00	Cum DA (1000 m2)		12.79	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 2

E.G. Elev (m)	77.02	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.040	
W.S. Elev (m)	77.01	Reach Len. (m)	35.24	14.38	14.83
Crit W.S. (m)		Flow Area (m2)		26.82	
E.G. Slope (m/m)	0.000746	Area (m2)		26.82	
Q Total (m3/s)	13.74	Flow (m3/s)		13.74	
Top Width (m)	40.55	Top Width (m)		40.55	
Vel Total (m/s)	0.51	Avg. Vel. (m/s)		0.51	
Max Chl Dpth (m)	0.87	Hydr. Depth (m)		0.66	
Conv. Total (m3/s)	503.1	Conv. (m3/s)		503.1	
Length Wtd. (m)	14.38	Wetted Per. (m)		41.27	
Min Ch El (m)	76.14	Shear (N/m2)		4.75	
Alpha	1.00	Stream Power (N/m s)		2.43	
Prior Loss (m)	0.01	Cum Volume (1000 m3)		12.24	
C & E Loss (m)	0.00	Cum DA (1000 m2)		16.72	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 3

E.G. Elev (m)	77.35	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.040	
W.S. Elev (m)	77.33	Reach Len. (m)	35.24	14.38	14.83
Crit W.S. (m)		Flow Area (m2)		40.65	
E.G. Slope (m/m)	0.000659	Area (m2)		40.65	
Q Total (m3/s)	22.88	Flow (m3/s)		22.88	
Top Width (m)	45.38	Top Width (m)		45.38	
Vel Total (m/s)	0.59	Avg. Vel. (m/s)		0.59	
Max Chl Dpth (m)	1.19	Hydr. Depth (m)		0.90	
Conv. Total (m3/s)	831.2	Conv. (m3/s)		831.2	
Length Wtd. (m)	14.38	Wetted Per. (m)		46.45	
Min Ch El (m)	76.14	Shear (N/m2)		3.66	
Alpha	1.00	Stream Power (N/m s)		2.32	
Prior Loss (m)	0.01	Cum Volume (1000 m3)		17.47	
C & E Loss (m)	0.00	Cum DA (1000 m2)		17.72	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 4

E.G. Elev (m)	77.64	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.040	
W.S. Elev (m)	77.62	Reach Len. (m)	35.24	14.38	14.83
Crit W.S. (m)		Flow Area (m2)		57.21	
E.G. Slope (m/m)	0.000760	Area (m2)		57.21	
Q Total (m3/s)	34.10	Flow (m3/s)		34.10	
Top Width (m)	70.41	Top Width (m)		70.41	
Vel Total (m/s)	0.60	Avg. Vel. (m/s)		0.60	
Max Chl Dpth (m)	1.48	Hydr. Depth (m)		0.81	
Conv. Total (m3/s)	1224.9	Conv. (m3/s)		1224.9	
Length Wtd. (m)	14.38	Wetted Per. (m)		71.75	
Min Ch El (m)	76.14	Shear (N/m2)		4.61	
Alpha	1.00	Stream Power (N/m s)		2.54	
Prior Loss (m)	0.01	Cum Volume (1000 m3)		22.12	
C & E Loss (m)	0.00	Cum DA (1000 m2)		18.55	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 5

E.G. Elev (m)	77.87	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.040	
W.S. Elev (m)	77.85	Reach Len. (m)	35.24	14.38	14.83
Crit W.S. (m)		Flow Area (m2)		76.80	
E.G. Slope (m/m)	0.000705	Area (m2)		76.80	
Q Total (m3/s)	44.38	Flow (m3/s)		44.38	
Top Width (m)	82.93	Top Width (m)		82.93	
Vel Total (m/s)	0.58	Avg. Vel. (m/s)		0.58	
Max Chl Dpth (m)	1.77	Hydr. Depth (m)		0.93	
Conv. Total (m3/s)	1671.4	Conv. (m3/s)		1671.4	
Length Wtd. (m)	14.38	Wetted Per. (m)		84.55	
Min Ch El (m)	76.14	Shear (N/m2)		5.62	
Alpha	1.00	Stream Power (N/m s)		3.25	
Prior Loss (m)	0.01	Cum Volume (1000 m3)		26.30	
C & E Loss (m)	0.00	Cum DA (1000 m2)		19.64	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 6

E.G. Elev (m)	78.10	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.040	
W.S. Elev (m)	78.07	Reach Len. (m)	35.24	14.38	14.83
Crit W.S. (m)		Flow Area (m2)		99.15	
E.G. Slope (m/m)	0.000706	Area (m2)		99.15	
Q Total (m3/s)	55.21	Flow (m3/s)		55.21	
Top Width (m)	99.18	Top Width (m)		99.18	
Vel Total (m/s)	0.56	Avg. Vel. (m/s)		0.56	
Max Chl Dpth (m)	1.95	Hydr. Depth (m)		1.10	
Conv. Total (m3/s)	2419.0	Conv. (m3/s)		2419.0	

Length Wtd. (m)	14.38	Wetted Per. (m)		100.98		
Min Ch El (m)	76.14	Shear (N/m2)		4.90		
Alpha	1.00	Stream Power (N/m s)		2.73		
Frctn Loss (m)	0.01	Cum Volume (1000 m3)		30.42		
C & E Loss (m)	0.00	Cum SA (1000 m2)		20.30		

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile RPF 7

			Left OB	Channel	Right OB
E.G. Elev (m)	78.32	Element		0.040	
Vel Head (m)	0.02	Wt. n-Val.	35.24	14.38	14.83
W.S. Elev (m)	78.31	Reach Len. (m)		121.00	
Crit W.S. (m)		Flow Area (m2)		121.00	
E.G. Slope (m/m)	0.000385	Area (m2)		66.68	
Q Total (m3/s)	66.68	Flow (m3/s)		99.47	
Top Width (m)	99.47	Top Width (m)		0.55	
Vel Total (m/s)	0.55	Avg. Vel. (m/s)		1.22	
Max Chl Dpth (m)	2.17	Hydr. Depth (m)		3399.3	
Conv. Total (m3/s)	3399.3	Conv. (m3/s)		101.57	
Length Wtd. (m)	14.38	Wetted Per. (m)		4.50	
Min Ch El (m)	76.14	Shear (N/m2)		2.48	
Alpha	1.00	Stream Power (N/m s)		34.53	
Frctn Loss (m)	0.01	Cum Volume (1000 m3)		20.87	
C & E Loss (m)	0.00	Cum SA (1000 m2)			

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile RPF 8

			Left OB	Channel	Right OB
E.G. Elev (m)	78.45	Element		0.040	
Vel Head (m)	0.02	Wt. n-Val.	35.24	14.38	14.83
W.S. Elev (m)	78.44	Reach Len. (m)		133.92	
Crit W.S. (m)		Flow Area (m2)		133.92	
E.G. Slope (m/m)	0.000337	Area (m2)		73.81	
Q Total (m3/s)	73.81	Flow (m3/s)		99.47	
Top Width (m)	99.47	Top Width (m)		0.55	
Vel Total (m/s)	0.55	Avg. Vel. (m/s)		1.35	
Max Chl Dpth (m)	2.30	Hydr. Depth (m)		4018.7	
Conv. Total (m3/s)	4018.7	Conv. (m3/s)		101.83	
Length Wtd. (m)	14.38	Wetted Per. (m)		4.35	
Min Ch El (m)	76.14	Shear (N/m2)		2.40	
Alpha	1.00	Stream Power (N/m s)		36.99	
Frctn Loss (m)	0.01	Cum Volume (1000 m3)		21.34	
C & E Loss (m)	0.00	Cum SA (1000 m2)			

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile RPF 9

			Left OB	Channel	Right OB
E.G. Elev (m)	78.71	Element		0.040	
Vel Head (m)	0.02	Wt. n-Val.	35.24	14.38	14.83
W.S. Elev (m)	78.69	Reach Len. (m)		159.51	
Crit W.S. (m)		Flow Area (m2)		159.51	
E.G. Slope (m/m)	0.000278	Area (m2)		88.04	
Q Total (m3/s)	88.04	Flow (m3/s)		99.47	
Top Width (m)	99.47	Top Width (m)		0.56	
Vel Total (m/s)	0.56	Avg. Vel. (m/s)		1.60	
Max Chl Dpth (m)	2.55	Hydr. Depth (m)		5380.9	
Conv. Total (m3/s)	5380.9	Conv. (m3/s)		102.34	
Length Wtd. (m)	14.38	Wetted Per. (m)		4.22	
Min Ch El (m)	76.14	Shear (N/m2)		2.35	
Alpha	1.00	Stream Power (N/m s)		42.11	
Frctn Loss (m)	0.01	Cum Volume (1000 m3)		22.27	
C & E Loss (m)	0.00	Cum SA (1000 m2)			

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile RPF 10

			Left OB	Channel	Right OB
E.G. Elev (m)	78.17	Element		0.040	
Vel Head (m)	0.02	Wt. n-Val.	35.24	14.38	14.83
W.S. Elev (m)	78.16	Reach Len. (m)		166.13	
Crit W.S. (m)		Flow Area (m2)		166.13	
E.G. Slope (m/m)	0.000[illegible]	Area (m2)		93.29	
Q Total (m3/s)	93.29	Flow (m3/s)		99.47	
Top Width (m)	99.47	Top Width (m)		0.56	
Vel Total (m/s)	0.56	Avg. Vel. (m/s)		1.67	
Max Chl Dpth (m)	2.42	Hydr. Depth (m)		5731.3	
Conv. Total (m3/s)	5731.3	Conv. (m3/s)		102.48	
Length Wtd. (m)	14.38	Wetted Per. (m)		4.21	
Min Ch El (m)	76.14	Shear (N/m2)		2.37	
Alpha	1.00	Stream Power (N/m s)		43.49	
Frctn Loss (m)	0.01	Cum Volume (1000 m3)		22.44	
C & E Loss (m)	0.00	Cum SA (1000 m2)			

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile RPF 11

			Left OB	Channel	Right OB
E.G. Elev (m)	78.07	Element		0.040	
Vel Head (m)	0.02	Wt. n-Val.	35.24	14.38	14.83
W.S. Elev (m)	78.05	Reach Len. (m)		195.03	
Crit W.S. (m)		Flow Area (m2)		195.03	
E.G. Slope (m/m)	0.000229	Area (m2)		112.91	
Q Total (m3/s)	112.91	Flow (m3/s)		99.47	
Top Width (m)	99.47	Top Width (m)		0.58	
Vel Total (m/s)	0.58	Avg. Vel. (m/s)		1.96	
Max Chl Dpth (m)	2.91	Hydr. Depth (m)		7459.8	
Conv. Total (m3/s)	7459.8	Conv. (m3/s)		103.08	
Length Wtd. (m)	14.38	Wetted Per. (m)		4.25	
Min Ch El (m)	76.14	Shear (N/m2)		2.46	
Alpha	1.00	Stream Power (N/m s)		49.62	
Frctn Loss (m)	0.01	Cum Volume (1000 m3)		23.14	
C & E Loss (m)	0.00	Cum SA (1000 m2)			

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile RPF 12

			Left OB	Channel	Right OB
E.G. Elev (m)	79.67	Element		0.040	
Vel Head (m)	0.02	Wt. n-Val.		14.38	14.83
W.S. Elev (m)	79.65	Reach Len. (m)	35.24	255.05	
Crit W.S. (m)		Flow Area (m2)		255.05	
E.G. Slope (m/m)	+0.000188	Area (m2)		158.71	
Q Total (m3/s)	158.71	Flow (m3/s)		99.47	
Top Width (m)	99.47	Top Width (m)		0.62	
Vel Total (m/s)	0.62	Avg. Vel. (m/s)		2.56	
Max Chl Dpth (m)	3.51	Hydr. Depth (m)		11576.1	
Conv. Total (m3/s)	11576.1	Conv. (m3/s)		104.26	
Length Wtd. (m)	14.38	Wetted Per. (m)		4.51	
Min Ch El (m)	76.14	Shear (N/m2)		2.81	
Alpha	1.00	Stream Power (N/m s)		63.10	
Frctn Loss (m)	0.00	Cum Volume (1000 m3)		24.85	
C & E Loss (m)	0.00	Cum SA (1000 m2)			

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile RPF 13

			Left OB	Channel	Right OB
E.G. Elev (m)	80.13	Element		0.040	
Vel Head (m)	0.02	Wt. n-Val.		14.38	14.83
W.S. Elev (m)	80.10	Reach Len. (m)	35.24	299.90	
Crit W.S. (m)		Flow Area (m2)		299.90	
E.G. Slope (m/m)	+0.000173	Area (m2)		198.20	
Q Total (m3/s)	198.20	Flow (m3/s)		99.47	
Top Width (m)	99.47	Top Width (m)		0.66	
Vel Total (m/s)	0.66	Avg. Vel. (m/s)		3.01	
Max Chl Dpth (m)	3.96	Hydr. Depth (m)		15076.7	
Conv. Total (m3/s)	15076.7	Conv. (m3/s)		105.17	
Length Wtd. (m)	14.38	Wetted Per. (m)		4.83	
Min Ch El (m)	76.14	Shear (N/m2)		3.19	
Alpha	1.06	Stream Power (N/m s)		73.20	
Frctn Loss (m)	0.00	Cum Volume (1000 m3)		25.52	
C & E Loss (m)	0.00	Cum SA (1000 m2)			

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: CAYAGUAS
REACH: ONE RS: 15

INPUT
Description:

Station Elevation Data											
			num		13						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	78.8	3.37	76.68	4.5	76.57	5.16	76.27	10.02	76.22		
14.94	76.13	15.18	76.47	17.45	78.55	40.83	78.3	47.83	76.13		
47.98	76.14	62.9	76.3	63.49	76.48	64.43	76.52	65.07	76.86		
66.12	76.94	67.45	78.26								

Manning's n Values

			num		1	
Sta	n Val	Sta	n Val	Sta	n Val	
-	.035	0	.04	17.26	.035	

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	47.98	29.2	17.26	10.09	.1	.3

CROSS SECTION OUTPUT Profile RPF 1

			Left OB	Channel	Right OB
E.G. Elev (m)	76.40	Element		0.040	
Vel Head (m)	0.00	Wt. n-Val.		17.26	10.09
W.S. Elev (m)	76.40	Reach Len. (m)	29.20	4.71	
Crit W.S. (m)		Flow Area (m2)		4.71	
E.G. Slope (m/m)	+0.000751	Area (m2)		1.31	
Q Total (m3/s)	1.31	Flow (m3/s)		26.54	
Top Width (m)	26.54	Top Width (m)		0.28	
Vel Total (m/s)	0.28	Avg. Vel. (m/s)		0.18	
Max Chl Dpth (m)	0.27	Hydr. Depth (m)		37.0	
Conv. Total (m3/s)	37.0	Conv. (m3/s)		26.76	
Length Wtd. (m)	17.26	Wetted Per. (m)		2.16	
Min Ch El (m)	76.13	Shear (N/m2)		0.60	
Alpha	1.00	Stream Power (N/m s)		2.62	
Frctn Loss (m)	0.03	Cum Volume (1000 m3)		12.37	
C & E Loss (m)	0.00	Cum SA (1000 m2)			

Subcritical flooded flow computed for this cross section.

CROSS SECTION OUTPUT Profile RPF 2

			Left OB	Channel	Right OB
E.G. Elev (m)	77.01	Element		0.040	
Vel Head (m)	0.02	Wt. n-Val.		17.26	10.09
W.S. Elev (m)	76.99	Reach Len. (m)	29.20	22.73	
Crit W.S. (m)		Flow Area (m2)		22.73	
E.G. Slope (m/m)	+0.000128	Area (m2)		13.74	
Q Total (m3/s)	13.74	Flow (m3/s)		33.43	
Top Width (m)	33.43	Top Width (m)		0.60	
Vel Total (m/s)	0.60	Avg. Vel. (m/s)		0.67	
Max Chl Dpth (m)	0.86	Hydr. Depth (m)		428.5	
Conv. Total (m3/s)	428.5	Conv. (m3/s)		34.72	
Length Wtd. (m)	17.26	Wetted Per. (m)		6.60	
Min Ch El (m)	76.13	Shear (N/m2)		3.99	
Alpha	1.00	Stream Power (N/m s)		11.88	
Frctn Loss (m)	0.01	Cum Volume (1000 m3)		16.19	
C & E Loss (m)	0.01	Cum SA (1000 m2)			

Subcritical flooded flow computed for this cross section.

CROSS SECTION OUTPUT Profile #PF 3

E.G. Elev (m)	77.34	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.040	
W.S. Elev (m)	77.31	Reach Len. (m)	29.20	17.26	10.09
Crit W.S. (m)		Flow Area (m2)		34.05	
E.G. Slope (m/m)	0.000893	Area (m2)		34.05	
Q Total (m3/s)	23.88	Flow (m3/s)		23.88	
Top Width (m)	36.30	Top Width (m)		36.30	
Vel Total (m/s)	0.70	Avg. Vel. (m/s)		0.70	
Max Chl Dpth (m)	1.18	Hydr. Depth (m)		0.94	
Conv. Total (m3/s)	799.1	Conv. (m3/s)		799.1	
Length Wtd. (m)	17.26	Wetted Per. (m)		37.45	
Min Ch El (m)	76.13	Shear (N/m2)		7.96	
Alpha	1.00	Stream Power (N/m s)		5.58	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)		16.93	
C & E Loss (m)	0.00	Cum SA (1000 m2)		17.13	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 4

E.G. Elev (m)	77.62	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.040	
W.S. Elev (m)	77.59	Reach Len. (m)	29.20	17.26	10.09
Crit W.S. (m)		Flow Area (m2)		44.55	
E.G. Slope (m/m)	0.000808	Area (m2)		44.55	
Q Total (m3/s)	34.10	Flow (m3/s)		34.10	
Top Width (m)	38.36	Top Width (m)		38.36	
Vel Total (m/s)	0.77	Avg. Vel. (m/s)		0.77	
Max Chl Dpth (m)	1.46	Hydr. Depth (m)		1.16	
Conv. Total (m3/s)	1199.9	Conv. (m3/s)		1199.9	
Length Wtd. (m)	17.26	Wetted Per. (m)		39.83	
Min Ch El (m)	76.13	Shear (N/m2)		8.86	
Alpha	1.00	Stream Power (N/m s)		6.78	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)		21.39	
C & E Loss (m)	0.00	Cum SA (1000 m2)		18.17	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 5

E.G. Elev (m)	77.86	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.040	
W.S. Elev (m)	77.81	Reach Len. (m)	29.20	17.26	10.09
Crit W.S. (m)		Flow Area (m2)		53.72	
E.G. Slope (m/m)	0.000782	Area (m2)		53.72	
Q Total (m3/s)	44.39	Flow (m3/s)		44.39	
Top Width (m)	40.07	Top Width (m)		40.07	
Vel Total (m/s)	0.83	Avg. Vel. (m/s)		0.83	
Max Chl Dpth (m)	1.70	Hydr. Depth (m)		1.34	
Conv. Total (m3/s)	1586.9	Conv. (m3/s)		1586.9	
Length Wtd. (m)	17.26	Wetted Per. (m)		41.82	
Min Ch El (m)	76.13	Shear (N/m2)		9.86	
Alpha	1.00	Stream Power (N/m s)		8.15	
Frctn Loss (m)	0.01	Cum Volume (1000 m3)		25.36	
C & E Loss (m)	0.00	Cum SA (1000 m2)		18.73	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 6

E.G. Elev (m)	78.09	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.		0.040	
W.S. Elev (m)	78.05	Reach Len. (m)	29.20	17.26	10.09
Crit W.S. (m)		Flow Area (m2)		62.84	
E.G. Slope (m/m)	0.000761	Area (m2)		62.84	
Q Total (m3/s)	55.21	Flow (m3/s)		55.21	
Top Width (m)	41.71	Top Width (m)		41.71	
Vel Total (m/s)	0.88	Avg. Vel. (m/s)		0.88	
Max Chl Dpth (m)	1.92	Hydr. Depth (m)		1.51	
Conv. Total (m3/s)	2001.3	Conv. (m3/s)		2001.3	
Length Wtd. (m)	17.26	Wetted Per. (m)		43.71	
Min Ch El (m)	76.13	Shear (N/m2)		10.73	
Alpha	1.00	Stream Power (N/m s)		9.43	
Frctn Loss (m)	0.01	Cum Volume (1000 m3)		29.25	
C & E Loss (m)	0.00	Cum SA (1000 m2)		19.29	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 7

E.G. Elev (m)	78.31	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.		0.040	
W.S. Elev (m)	78.27	Reach Len. (m)	29.20	17.26	10.09
Crit W.S. (m)		Flow Area (m2)		72.03	
E.G. Slope (m/m)	0.000744	Area (m2)		72.03	
Q Total (m3/s)	66.68	Flow (m3/s)		66.68	
Top Width (m)	43.29	Top Width (m)		43.29	
Vel Total (m/s)	0.93	Avg. Vel. (m/s)		0.93	
Max Chl Dpth (m)	2.14	Hydr. Depth (m)		1.66	
Conv. Total (m3/s)	2444.8	Conv. (m3/s)		2444.8	
Length Wtd. (m)	17.26	Wetted Per. (m)		45.54	
Min Ch El (m)	76.13	Shear (N/m2)		11.54	
Alpha	1.00	Stream Power (N/m s)		10.66	
Frctn Loss (m)	0.01	Cum Volume (1000 m3)		33.14	
C & E Loss (m)	0.00	Cum SA (1000 m2)		19.85	

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile #PF 8

E.G. Elev (m)	78.44	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.		0.040	
W.S. Elev (m)	78.39	Reach Len. (m)	29.20	17.26	10.09
Crit W.S. (m)		Flow Area (m2)		78.01	
E.G. Slope (m/m)	0.000900	Area (m2)		78.01	
Q Total (m3/s)	73.81	Flow (m3/s)		73.81	
Top Width (m)	52.57	Top Width (m)		52.57	
Vel Total (m/s)	0.95	Avg. Vel. (m/s)		0.95	
Max Chl Dpth (m)	2.2[illegible]	Hydr. Depth (m)		1.48	

* Conv. Total (m3/s)	*	2441.0	* Conv. (m3/s)	*		*	2441.0	*	*
* Length Wtd. (m)	*	17.26	* Wetted Per. (m)	*		*	55.04	*	*
Min Ch El (m)	*	76.13	* Shear (N/m2)	*		*	12.59	*	*
Alpha	*	1.50	* Stream Power (N/m s)	*		*	11.93	*	*
Frctn Loss (m)	*	0.02	* Cum Volume (1000 m3)	*		*	35.44	*	*
* C & E Loss (m)	*	0.00	* Cum EA (1000 m2)	*		*	20.24	*	*

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile #PF 9

* E.G. Elev (m)	*	78.70	* Element	*	Left OB	*	Channel	*	Right OB *
* Vel Head (m)	*	0.05	* Wt. n-Val.	*		*	0.040	*	*
* W.S. Elev (m)	*	78.65	* Reach Len. (m)	*	29.20	*	17.26	*	10.09 *
* Crit W.S. (m)	*		* Flow Area (m2)	*		*	94.33	*	*
* E.G. Slope (m/m)	*	0.000968	* Area (m2)	*		*	94.33	*	*
* Q Total (m3/s)	*	89.04	* Flow (m3/s)	*		*	89.04	*	*
* Top Width (m)	*	67.70	* Top Width (m)	*		*	67.70	*	*
* Vel Total (m/s)	*	0.94	* Avg. Vel. (m/s)	*		*	0.94	*	*
* Max Chl Dpth (m)	*	2.52	* Hydr. Depth (m)	*		*	1.39	*	*
* Conv. Total (m3/s)	*	2861.8	* Conv. (m3/s)	*		*	2861.8	*	*
* Length Wtd. (m)	*	17.26	* Wetted Per. (m)	*		*	70.56	*	*
* Min Ch El (m)	*	76.13	* Shear (N/m2)	*		*	12.69	*	*
* Alpha	*	1.40	* Stream Power (N/m s)	*		*	11.98	*	*
* Frctn Loss (m)	*	0.02	* Cum Volume (1000 m3)	*		*	40.28	*	*
* C & E Loss (m)	*	0.00	* Cum EA (1000 m2)	*		*	21.57	*	*

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile #PF 10

* E.G. Elev (m)	*	78.77	* Element	*	Left OB	*	Channel	*	Right OB *
* Vel Head (m)	*	0.05	* Wt. n-Val.	*		*	0.043	*	*
* W.S. Elev (m)	*	78.72	* Reach Len. (m)	*	29.20	*	17.26	*	10.09 *
* Crit W.S. (m)	*		* Flow Area (m2)	*		*	98.87	*	*
* E.G. Slope (m/m)	*	0.000912	* Area (m2)	*		*	98.87	*	*
* Q Total (m3/s)	*	93.29	* Flow (m3/s)	*		*	93.29	*	*
* Top Width (m)	*	67.80	* Top Width (m)	*		*	67.80	*	*
* Vel Total (m/s)	*	0.94	* Avg. Vel. (m/s)	*		*	0.94	*	*
* Max Chl Dpth (m)	*	2.59	* Hydr. Depth (m)	*		*	1.46	*	*
* Conv. Total (m3/s)	*	3089.5	* Conv. (m3/s)	*		*	3089.5	*	*
* Length Wtd. (m)	*	17.26	* Wetted Per. (m)	*		*	70.78	*	*
* Min Ch El (m)	*	76.13	* Shear (N/m2)	*		*	12.49	*	*
* Alpha	*	1.40	* Stream Power (N/m s)	*		*	11.73	*	*
* Frctn Loss (m)	*	0.02	* Cum Volume (1000 m3)	*		*	41.58	*	*
* C & E Loss (m)	*	0.00	* Cum EA (1000 m2)	*		*	21.26	*	*

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile #PF 11

* E.G. Elev (m)	*	79.96	* Element	*	Left OB	*	Channel	*	Right OB *
* Vel Head (m)	*	0.60	* Wt. n-Val.	*		*	0.043	*	*
* W.S. Elev (m)	*	79.91	* Reach Len. (m)	*	29.20	*	17.26	*	10.09 *
* Crit W.S. (m)	*		* Flow Area (m2)	*		*	118.69	*	*
* E.G. Slope (m/m)	*	0.000715	* Area (m2)	*		*	118.69	*	*
* Q Total (m3/s)	*	112.61	* Flow (m3/s)	*		*	112.61	*	*
* Top Width (m)	*	67.93	* Top Width (m)	*		*	67.93	*	*
* Vel Total (m/s)	*	0.95	* Avg. Vel. (m/s)	*		*	0.95	*	*
* Max Chl Dpth (m)	*	2.69	* Hydr. Depth (m)	*		*	1.75	*	*
* Conv. Total (m3/s)	*	4183.5	* Conv. (m3/s)	*		*	4183.5	*	*
* Length Wtd. (m)	*	17.26	* Wetted Per. (m)	*		*	71.42	*	*
* Min Ch El (m)	*	76.13	* Shear (N/m2)	*		*	11.94	*	*
* Alpha	*	1.30	* Stream Power (N/m s)	*		*	11.42	*	*
* Frctn Loss (m)	*	0.01	* Cum Volume (1000 m3)	*		*	47.36	*	*
* C & E Loss (m)	*	0.00	* Cum EA (1000 m2)	*		*	21.94	*	*

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile #PF 12

* E.G. Elev (m)	*	79.12	* Element	*	Left OB	*	Channel	*	Right OB *
* Vel Head (m)	*	0.65	* Wt. n-Val.	*		*	0.040	*	*
* W.S. Elev (m)	*	79.14	* Reach Len. (m)	*	29.20	*	17.26	*	10.09 *
* Crit W.S. (m)	*		* Flow Area (m2)	*		*	159.44	*	*
* E.G. Slope (m/m)	*	0.000551	* Area (m2)	*		*	159.44	*	*
* Q Total (m3/s)	*	158.71	* Flow (m3/s)	*		*	158.71	*	*
* Top Width (m)	*	67.93	* Top Width (m)	*		*	67.93	*	*
* Vel Total (m/s)	*	0.99	* Avg. Vel. (m/s)	*		*	0.99	*	*
* Max Chl Dpth (m)	*	1.48	* Hydr. Depth (m)	*		*	2.35	*	*
* Conv. Total (m3/s)	*	6747.9	* Conv. (m3/s)	*		*	6747.9	*	*
* Length Wtd. (m)	*	17.26	* Wetted Per. (m)	*		*	72.62	*	*
* Min Ch El (m)	*	76.13	* Shear (N/m2)	*		*	11.23	*	*
* Alpha	*	1.00	* Stream Power (N/m s)	*		*	11.10	*	*
* Frctn Loss (m)	*	0.01	* Cum Volume (1000 m3)	*		*	60.12	*	*
* C & E Loss (m)	*	0.01	* Cum EA (1000 m2)	*		*	23.64	*	*

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile #PF 13

* E.G. Elev (m)	*	80.12	* Element	*	Left OB	*	Channel	*	Right OB *
* Vel Head (m)	*	0.06	* Wt. n-Val.	*		*	0.047	*	*
* W.S. Elev (m)	*	80.06	* Reach Len. (m)	*	29.20	*	17.26	*	10.09 *
* Crit W.S. (m)	*		* Flow Area (m2)	*		*	170.[illegible]	*	*
* E.G. Slope (m/m)	*	0.000499	* Area (m2)	*		*	169.[illegible]	*	*
* Q Total (m3/s)	*	188.20	* Flow (m3/s)	*		*	188.[illegible]	*	*
* Top Width (m)	*	67.93	* Top Width (m)	*		*	67.93	*	*
* Vel Total (m/s)	*	1.04	* Avg. Vel. (m/s)	*		*	1.04	*	*
* Max Chl Dpth (m)	*	3.43	* Hydr. Depth (m)	*		*	2.51	*	*
* Conv. Total (m3/s)	*	8954.2	* Conv. (m3/s)	*		*	8954.2	*	*
* Length Wtd. (m)	*	17.26	* Wetted Per. (m)	*		*	73.5[illegible]	*	*
* Min Ch El (m)	*	76.13	* Shear (N/m2)	*		*	12.43	*	*
* Alpha	*	1.00	* Stream Power (N/m s)	*		*	12.95	*	*
* Frctn Loss (m)	*	0.01	* Cum Volume (1000 m3)	*		*	69.67	*	*
* C & E Loss (m)	*	0.01	* Cum EA (1000 m2)	*		*	24.32	*	*

Warning: The cross-section end points had to be extended vertically for the computed water surface.

END DATA

RIVER: CAYAGUAS
REACH: MAIN RM: 14

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	77.2	7.1	76.16	12.77	76.21	14.09	77	15.44	76.12		
23.41	76.21	29.33	76.27	29.99	76.41	31.04	76.49	31.74	76.83		
32.68	76.96	34.93	78.73								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	0	.04	34.93	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	34.93	1.55	1.55	1.55	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (m)	76.37	Element			
Vel Head (m)	0.01	Wt. n-Val.		0.040	
W.S. Elev (m)	76.37	Reach Len. (m)	1.55	1.55	1.55
Crit W.S. (m)		Flow Area (m2)		3.59	
E.G. Slope (m/m)	0.002410	Area (m2)		3.59	
Q Total (m3/s)	1.31	Flow (m3/s)		1.31	
Top Width (m)	21.99	Top Width (m)		21.99	
Vel Total (m/s)	0.36	Avg. Vel. (m/s)		0.36	
Max Chl Dpth (m)	0.16	Hydr. Depth (m)		0.16	
Conv. Total (m3/s)	28.7	Conv. (m3/s)		28.7	
Length Wtd. (m)	1.55	Wetted Per. (m)		22.13	
Min Ch El (m)	76.12	Shear (N/m2)		3.83	
Alpha	1.00	Stream Power (N/m s)		1.40	
Frctn Loss (m)	0.03	Cum Volume (1000 m3)		2.54	
C & E Loss (m)	0.00	Cum OA (1000 m2)		11.96	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (m)	76.43	Element			
Vel Head (m)	0.12	Wt. n-Val.		0.040	
W.S. Elev (m)	76.30	Reach Len. (m)	1.55	1.55	1.55
Crit W.S. (m)		Flow Area (m2)		19.43	
E.G. Slope (m/m)	0.001531	Area (m2)		19.43	
Q Total (m3/s)	13.74	Flow (m3/s)		13.74	
Top Width (m)	31.12	Top Width (m)		31.12	
Vel Total (m/s)	0.71	Avg. Vel. (m/s)		0.71	
Max Chl Dpth (m)	0.64	Hydr. Depth (m)		0.62	
Conv. Total (m3/s)	350.1	Conv. (m3/s)		350.1	
Length Wtd. (m)	1.55	Wetted Per. (m)		31.75	
Min Ch El (m)	76.1	Shear (N/m2)		9.24	
Alpha	1.04	Stream Power (N/m s)		6.54	
Frctn Loss (m)	0.08	Cum Volume (1000 m3)		11.52	
C & E Loss (m)	0.00	Cum OA (1000 m2)		15.43	

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (m)	[illegible]	Element			
Vel Head (m)	[illegible]	Wt. n-Val.		0.040	
W.S. Elev (m)	[illegible]	Reach Len. (m)	1.55	1.55	1.55
Crit W.S. (m)		Flow Area (m2)		30.61	
E.G. Slope (m/m)	[illegible]	Area (m2)		30.61	
Q Total (m3/s)	[illegible]	Flow (m3/s)		23.88	
Top Width (m)	[illegible]	Top Width (m)		33.41	
Vel Total (m/s)	[illegible]	Avg. Vel. (m/s)		0.80	
Max Chl Dpth (m)	[illegible]	Hydr. Depth (m)		0.90	
Conv. Total (m3/s)	[illegible]	Conv. (m3/s)		687.9	
Length Wtd. (m)	1.55	Wetted Per. (m)		34.25	
Min Ch El (m)	[illegible]	Shear (N/m2)		10.37	
Alpha	1.00	Stream Power (N/m s)		8.24	
Frctn Loss (m)	0.00	Cum Volume (1000 m3)		16.28	
C & E Loss (m)	0.00	Cum OA (1000 m2)		16.53	

Warning: The energy equation could not be balanced within the specified number of iterations, and a vertically for the computed water surface.

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (m)	[illegible]	Element			
Vel Head (m)	[illegible]	Wt. n-Val.		0.040	
W.S. Elev (m)	[illegible]	Reach Len. (m)	1.55	1.55	1.55
Crit W.S. (m)		Flow Area (m2)		39.53	
E.G. Slope (m/m)	[illegible]	Area (m2)		39.53	
Q Total (m3/s)	34.10	Flow (m3/s)		34.10	
Top Width (m)	[illegible]	Top Width (m)		33.84	
Vel Total (m/s)	[illegible]	Avg. Vel. (m/s)		0.86	
Max Chl Dpth (m)	[illegible]	Hydr. Depth (m)		1.17	
Conv. Total (m3/s)	1070.4	Conv. (m3/s)		1070.3	
Length Wtd. (m)	1.55	Wetted Per. (m)		35.07	
Min Ch El (m)	[illegible]	Shear (N/m2)		11.22	
Alpha	[illegible]	Stream Power (N/m s)		9.68	
Frctn Loss (m)	[illegible]	Cum Volume (1000 m3)		20.63	
C & E Loss (m)	[illegible]	Cum OA (1000 m2)		17.54	

Warning: The energy equation could not be balanced within the specified number of iterations, and a vertically for the computed water surface.

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (m)	[illegible]	Element			
Vel Head (m)	[illegible]	Wt. n-Val.		0.040	
W.S. Elev (m)	[illegible]	Reach Len. (m)	1.55	1.55	1.55
Crit W.S. (m)		Flow Area (m2)		47.44	
E.G. Slope (m/m)	[illegible]	Area (m2)		47.44	
Q Total (m3/s)	44.39	Flow (m3/s)		44.39	
Top Width (m)	34.24	Top Width (m)		34.24	
Vel Total (m/s)	0.94	Avg. Vel. (m/s)		0.94	
Max Chl Dpth (m)	1.37	Hydr. Depth (m)		1.37	

Conv. Total (m3/s)	1432.5	Conv. (m3/s)		1432.5	
Length Wtd. (m)	1.55	Wetted Per. (m)		35.74	
Min Ch El (m)	76.12	Shear (N/m2)		12.50	
Alpha	1.00	Stream Power (N/m s)		11.69	
Frctn Loss (m)	0.00	Cum Volume (1000 m3)		24.49	
C & E Loss (m)	0.00	Cum SA (1000 m2)		18.09	

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile RPF 6

			Left OB	Channel	Right OB
E.G. Elev (m)	78.07	Element		0.040	
Vel Head (m)	0.05	Wt. n-Val.	1.55	1.55	1.55
W.S. Elev (m)	78.02	Reach Len. (m)		55.06	
Crit W.S. (m)		Flow Area (m2)		55.06	
E.G. Slope (m/m)	0.000926	Area (m2)		55.21	
Q Total (m3/s)	55.21	Flow (m3/s)		34.60	
Top Width (m)	34.60	Top Width (m)		1.00	
Vel Total (m/s)	1.00	Avg. Vel. (m/s)		1.59	
Max Chl Dpth (m)	1.90	Hydr. Depth (m)		1814.4	
Conv. Total (m3/s)	1814.4	Conv. (m3/s)		36.38	
Length Wtd. (m)	1.55	Wetted Per. (m)		13.74	
Min Ch El (m)	76.12	Shear (N/m2)		13.78	
Alpha	1.00	Stream Power (N/m s)		28.23	
Frctn Loss (m)	0.00	Cum Volume (1000 m3)		18.63	
C & E Loss (m)	0.00	Cum SA (1000 m2)			

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile RPF 7

			Left OB	Channel	Right OB
E.G. Elev (m)	78.29	Element		0.040	
Vel Head (m)	0.06	Wt. n-Val.	1.55	1.55	1.55
W.S. Elev (m)	78.24	Reach Len. (m)		62.50	
Crit W.S. (m)		Flow Area (m2)		62.50	
E.G. Slope (m/m)	0.000905	Area (m2)		66.68	
Q Total (m3/s)	66.68	Flow (m3/s)		34.93	
Top Width (m)	34.93	Top Width (m)		1.07	
Vel Total (m/s)	1.07	Avg. Vel. (m/s)		1.79	
Max Chl Dpth (m)	2.12	Hydr. Depth (m)		2216.0	
Conv. Total (m3/s)	2216.0	Conv. (m3/s)		37.00	
Length Wtd. (m)	1.55	Wetted Per. (m)		15.00	
Min Ch El (m)	76.12	Shear (N/m2)		16.00	
Alpha	1.00	Stream Power (N/m s)		31.98	
Frctn Loss (m)	0.00	Cum Volume (1000 m3)		19.17	
C & E Loss (m)	0.00	Cum SA (1000 m2)			

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile RPF 8

			Left OB	Channel	Right OB
E.G. Elev (m)	78.42	Element		0.040	
Vel Head (m)	0.06	Wt. n-Val.	1.55	1.55	1.55
W.S. Elev (m)	78.36	Reach Len. (m)		66.83	
Crit W.S. (m)		Flow Area (m2)		66.83	
E.G. Slope (m/m)	0.000895	Area (m2)		73.81	
Q Total (m3/s)	73.81	Flow (m3/s)		34.93	
Top Width (m)	34.93	Top Width (m)		1.10	
Vel Total (m/s)	1.10	Avg. Vel. (m/s)		1.91	
Max Chl Dpth (m)	2.24	Hydr. Depth (m)		2466.8	
Conv. Total (m3/s)	2466.8	Conv. (m3/s)		37.25	
Length Wtd. (m)	1.55	Wetted Per. (m)		15.75	
Min Ch El (m)	76.12	Shear (N/m2)		17.40	
Alpha	1.00	Stream Power (N/m s)		34.21	
Frctn Loss (m)	0.00	Cum Volume (1000 m3)		19.49	
C & E Loss (m)	0.00	Cum SA (1000 m2)			

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile RPF 9

			Left OB	Channel	Right OB
E.G. Elev (m)	78.68	Element		0.040	
Vel Head (m)	0.07	Wt. n-Val.	1.55	1.55	1.55
W.S. Elev (m)	78.61	Reach Len. (m)		75.51	
Crit W.S. (m)		Flow Area (m2)		75.51	
E.G. Slope (m/m)	0.000883	Area (m2)		89.04	
Q Total (m3/s)	89.04	Flow (m3/s)		34.93	
Top Width (m)	34.93	Top Width (m)		1.19	
Vel Total (m/s)	1.19	Avg. Vel. (m/s)		2.16	
Max Chl Dpth (m)	2.49	Hydr. Depth (m)		2997.0	
Conv. Total (m3/s)	2997.0	Conv. (m3/s)		37.74	
Length Wtd. (m)	1.55	Wetted Per. (m)		17.32	
Min Ch El (m)	76.12	Shear (N/m2)		20.42	
Alpha	1.00	Stream Power (N/m s)		38.82	
Frctn Loss (m)	0.00	Cum Volume (1000 m3)		20.18	
C & E Loss (m)	0.00	Cum SA (1000 m2)			

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile RPF 10

			Left OB	Channel	Right OB
E.G. Elev (m)	78.75	Element		0.040	
Vel Head (m)	0.07	Wt. n-Val.	1.55	1.55	1.55
W.S. Elev (m)	78.67	Reach Len. (m)		77.77	
Crit W.S. (m)		Flow Area (m2)		77.77	
E.G. Slope (m/m)	0.000882	Area (m2)		93.29	
Q Total (m3/s)	93.29	Flow (m3/s)		34.93	
Top Width (m)	34.93	Top Width (m)		1.20	
Vel Total (m/s)	1.20	Avg. Vel. (m/s)		2.23	
Max Chl Dpth (m)	2.55	Hydr. Depth (m)		3140.9	
Conv. Total (m3/s)	3140.9	Conv. (m3/s)		37.87	
Length Wtd. (m)	1.55	Wetted Per. (m)		17.76	
Min Ch El (m)	76.12	Shear (N/m2)		21.31	
Alpha	1.00	Stream Power (N/m s)		40.06	
Frctn Loss (m)	0.00	Cum Volume (1000 m3)		20.35	
C & E Loss (m)	0.00	Cum SA (1000 m2)			

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile RPF 11

E.G. Elev (m)	79.04	Element	Left OB	Channel	Right OB	
Vel Head (m)	0.08	Wt. n-Val.		0.040		
W.S. Elev (m)	78.90	Reach Len. (m)	1.55	1.55	1.55	
Crit W.S. (m)		Flow Area (m2)		87.61		
E.G. Slope (m/m)	0.000886	Area (m2)		87.61		
Q Total (m3/s)	112.91	Flow (m3/s)		112.91		
Top Width (m)	34.93	Top Width (m)		34.93		
Vel Total (m/s)	1.28	Avg. Vel. (m/s)		1.28		
Max Chl Dpth (m)	2.84	Hydr. Depth (m)		2.51		
Conv. Total (m3/s)	3793.6	Conv. (m3/s)		3793.6		
Length Wtd. (m)	1.55	Wetted Per. (m)		38.44		
Min Ch El (m)	76.12	Shear (N/m2)		19.86		
Alpha	1.00	Stream Power (N/m s)		25.52		
Frctn Loss (m)	0.00	Cum Volume (1000 m3)		45.58		
C & E Loss (m)	0.00	Cum SA (1000 m2)		21.05		

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile RPF 12

E.G. Elev (m)	79.65	Element	Left OB	Channel	Right OB	
Vel Head (m)	0.11	Wt. n-Val.		0.040		
W.S. Elev (m)	79.54	Reach Len. (m)	1.55	1.55	1.55	
Crit W.S. (m)		Flow Area (m2)		107.91		
E.G. Slope (m/m)	0.000909	Area (m2)		107.91		
Q Total (m3/s)	158.71	Flow (m3/s)		158.71		
Top Width (m)	34.93	Top Width (m)		34.93		
Vel Total (m/s)	1.47	Avg. Vel. (m/s)		1.47		
Max Chl Dpth (m)	3.42	Hydr. Depth (m)		3.09		
Conv. Total (m3/s)	5263.4	Conv. (m3/s)		5263.4		
Length Wtd. (m)	1.55	Wetted Per. (m)		39.60		
Min Ch El (m)	76.12	Shear (N/m2)		24.30		
Alpha	1.00	Stream Power (N/m s)		35.74		
Frctn Loss (m)	0.00	Cum Volume (1000 m3)		57.81		
C & E Loss (m)	0.00	Cum SA (1000 m2)		22.78		

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile RPF 13

E.G. Elev (m)	80.19	Element	Left OB	Channel	Right OB	
Vel Head (m)	0.13	Wt. n-Val.		0.040		
W.S. Elev (m)	79.97	Reach Len. (m)	1.55	1.55	1.55	
Crit W.S. (m)		Flow Area (m2)		122.94		
E.G. Slope (m/m)	0.000945	Area (m2)		122.94		
Q Total (m3/s)	198.20	Flow (m3/s)		198.20		
Top Width (m)	34.93	Top Width (m)		34.93		
Vel Total (m/s)	1.61	Avg. Vel. (m/s)		1.61		
Max Chl Dpth (m)	3.85	Hydr. Depth (m)		3.52		
Conv. Total (m3/s)	6447.8	Conv. (m3/s)		6447.8		
Length Wtd. (m)	1.55	Wetted Per. (m)		40.46		
Min Ch El (m)	76.12	Shear (N/m2)		28.16		
Alpha	1.00	Stream Power (N/m s)		45.39		
Frctn Loss (m)	0.00	Cum Volume (1000 m3)		66.97		
C & E Loss (m)	0.00	Cum SA (1000 m2)		23.43		

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION

RIVER: CAYAGUAS
REACH: UNK RS: 13

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	76.57	[illegible]	76.19	1.94	76.12
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	22.19	76.25	27.77	76.42
[illegible]	[illegible]	33.04	78.[illegible]						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
[illegible]	[illegible]	0	.04	33.33	.045

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

	0	33.04	16.8	17.03	15.37	.1 .3

CROSS SECTION OUTPUT Profile RPF 1

E.G. Elev (m)	76.37	Element	Left OB	Channel	Right OB	
Vel Head (m)	0.01	Wt. n-Val.		0.040		
W.S. Elev (m)	76.36	Reach Len. (m)	16.80	17.03	15.37	
Crit W.S. (m)		Flow Area (m2)		3.85		
E.G. Slope (m/m)	0.000237	Area (m2)		3.85		
Q Total (m3/s)	1.21	Flow (m3/s)		1.21		
Top Width (m)	25.93	Top Width (m)		25.93		
Vel Total (m/s)	0.34	Avg. Vel. (m/s)		0.34		
Max Chl Dpth (m)	0.24	Hydr. Depth (m)		0.15		
Conv. Total (m3/s)	26.5	Conv. (m3/s)		26.5		
Length Wtd. (m)	17.01	Wetted Per. (m)		28.09		
Min Ch El (m)	76.12	Shear (N/m2)		3.44		
Alpha	1.00	Stream Power (N/m s)		1.17		
Frctn Loss (m)	0.05	Cum Volume (1000 m3)		2.54		
C & E Loss (m)	0.00	Cum SA (1000 m2)		11.92		

CROSS SECTION OUTPUT Profile RPF 2

E.G. Elev (m)	76.48	Element	Left OB	Channel	Right OB	
Vel Head (m)	0.02	Wt. n-Val.		0.040		
W.S. Elev (m)	76.46	Reach Len. (m)	16.80	17.03	15.37	
Crit W.S. (m)		Flow Area (m2)		20.89		
E.G. Slope (m/m)	0.000118	Area (m2)		20.89		
Total (m3/s)	13.34	Flow (m3/s)		13.34		
Top Width (m)	30.99	Top Width (m)		30.80		
Vel Total (m/s)	0.64	Avg. Vel. (m/s)		0.64		
Max Chl Dpth (m)	0.34	Hydr. Depth (m)		0.68		
Conv. Total (m3/s)	400.0	Conv. (m3/s)		400.0		
Length Wtd. (m)	17.03	Wetted Per. (m)		31.19		
Min Ch El (m)	76.12	Shear (N/m2)		7.75		

	1.00	Stream Power (N/m s)	5.10	
	0.03	Cum Volume (1000 m3)	11.48	
	0.00	Cum SA (1000 m2)	15.58	

conveyance ratio (upstream conveyance divided by downstream conveyance) is less than ".7" or greater than 1.4. This may indicate the need for additional cross sections.

SECTION OUTPUT Profile #FF 3

		Left OB	Channel	Right OB
Elev (m)	77.32	Element	0.040	
Head (m)	0.03	Wt. n-Val.	17.03	15.37
Elev (m)	77.29	Reach Len. (m)	31.11	
W.S. (m)		Flow Area (m2)	31.11	
Slope (m/m)	+0.000998	Area (m2)	23.88	
Total (m3/s)	23.88	Flow (m3/s)	31.82	
Top Width (m)	11.82	Top Width (m)	0.77	
Total (m/s)	0.77	Avg. Vel. (m/s)	0.98	
Max Ch Dpth (m)	1.17	Hydr. Depth (m)	756.1	
Conv. Total (m3/s)	756.1	Conv. (m3/s)	32.46	
Length Wtd. (m)	27.03	Wetted Per. (m)	8.38	
Min Ch El (m)	76.12	Shear (N/m2)	3.20	
Alpha	1.30	Stream Power (N/m s)	16.33	
Frctn Loss (m)	0.62	Cum Volume (1000 m3)	16.48	
C & E Loss (m)	0.00	Cum SA (1000 m2)		

The cross-section end points had to be extended vertically for the computed water surface.
The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than ".7" or greater than 1.4. This may indicate the need for additional cross sections.

SECTION OUTPUT Profile #FF 4

		Left OB	Channel	Right OB
Elev (m)	77.43	Element	0.040	
Head (m)	0.04	Wt. n-Val.	17.03	15.37
Elev (m)	77.39	Reach Len. (m)	40.16	
W.S. (m)		Flow Area (m2)	40.16	
Slope (m/m)	+0.000869	Area (m2)	34.10	
Total (m3/s)	34.10	Flow (m3/s)	32.34	
Top Width (m)	32.34	Top Width (m)	0.85	
Total (m/s)	0.85	Avg. Vel. (m/s)	1.24	
Max Ch Dpth (m)	1.45	Hydr. Depth (m)	1136.5	
Conv. Total (m3/s)	1136.5	Conv. (m3/s)	33.34	
Length Wtd. (m)	17.03	Wetted Per. (m)	10.63	
Min Ch El (m)	76.12	Shear (N/m2)	9.03	
Alpha	1.00	Stream Power (N/m s)	20.60	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	17.49	
C & E Loss (m)	0.00	Cum SA (1000 m2)		

The cross-section end points had to be extended vertically for the computed water surface.
The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than ".7" or greater than 1.4. This may indicate the need for additional cross sections.

SECTION OUTPUT Profile #FF 5

		Left OB	Channel	Right OB
Elev (m)	77.84	Element	0.040	
Head (m)	0.04	Wt. n-Val.	17.03	15.37
Elev (m)	77.80	Reach Len. (m)	47.71	
W.S. (m)		Flow Area (m2)	47.71	
Slope (m/m)	+0.000864	Area (m2)	44.39	
Total (m3/s)	44.39	Flow (m3/s)	32.77	
Top Width (m)	32.77	Top Width (m)	0.93	
Total (m/s)	0.93	Avg. Vel. (m/s)	1.46	
Max Ch Dpth (m)	1.68	Hydr. Depth (m)	1493.2	
Conv. Total (m3/s)	1493.2	Conv. (m3/s)	34.06	
Length Wtd. (m)	17.03	Wetted Per. (m)	12.14	
Min Ch El (m)	76.12	Shear (N/m2)	11.29	
Alpha	1.00	Stream Power (N/m s)	24.42	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	18.04	
C & E Loss (m)	0.01	Cum SA (1000 m2)		

The cross-section end points had to be extended vertically for the computed water surface.
The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than ".7" or greater than 1.4. This may indicate the need for additional cross sections.

SECTION OUTPUT Profile #FF 6

		Left OB	Channel	Right OB
Elev (m)	78.07	Element	0.040	
Head (m)	0.05	Wt. n-Val.	17.03	15.37
Elev (m)	78.02	Reach Len. (m)	54.99	
W.S. (m)		Flow Area (m2)	54.99	
Slope (m/m)	+0.000874	Area (m2)	55.21	
Total (m3/s)	55.21	Flow (m3/s)	33.18	
Top Width (m)	33.18	Top Width (m)	1.00	
Total (m/s)	1.00	Avg. Vel. (m/s)	1.66	
Max Ch Dpth (m)	1.90	Hydr. Depth (m)	1867.2	
Conv. Total (m3/s)	1867.2	Conv. (m3/s)	34.75	
Length Wtd. (m)	17.03	Wetted Per. (m)	13.57	
Min Ch El (m)	76.12	Shear (N/m2)	13.62	
Alpha	1.00	Stream Power (N/m s)	28.15	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	18.58	
C & E Loss (m)	0.01	Cum SA (1000 m2)		

The cross-section end points had to be extended vertically for the computed water surface.
The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

SECTION OUTPUT Profile #FF 7

		Left OB	Channel	Right OB
Elev (m)	78.29	Element	0.040	
Head (m)	0.06	Wt. n-Val.	17.03	15.37
Elev (m)	78.23	Reach Len. (m)	62.11	
W.S. (m)		Flow Area (m2)	62.11	
Slope (m/m)	+0.000872	Area (m2)	66.68	
Total (m3/s)	66.68	Flow (m3/s)	33.57	
Top Width (m)	33.57	Top Width (m)	1.07	
Total (m/s)	1.07	Avg. Vel. (m/s)	1.85	
Max Ch Dpth (m)	2.11	Hydr. Depth (m)	2258.5	
Conv. Total (m3/s)	2258.5	Conv. (m3/s)	35.41	
Length Wtd. (m)	17.03	Wetted Per. (m)	14.99	
Min Ch El (m)	76.12	Shear (N/m2)	16.10	
Alpha	1.00	Stream Power (N/m s)	31.89	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	19.12	
C & E Loss (m)	0.01	Cum SA (1000 m2)		

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Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile RPF 6

			Left OB	Channel	Right OB
E.G. Elev (m)	78.42	Element			
Vel Head (m)	0.06	Wt. n-Val.		0.040	
W.S. Elev (m)	78.36	Reach Len. (m)	16.80	17.03	15.37
Crit W.S. (m)		Flow Area (m2)		66.27	
E.G. Slope (m/m)	0.000870	Area (m2)		66.27	
Q Total (m3/s)	73.81	Flow (m3/s)		73.81	
Top Width (m)	33.64	Top Width (m)		33.64	
Vel Total (m/s)	1.11	Avg. Vel. (m/s)		1.11	
Max Chl Dpth (m)	2.24	Hydr. Depth (m)		1.97	
Conv. Total (m3/s)	2502.6	Conv. (m3/s)		2502.6	
Length Wtd. (m)	17.03	Wetted Per. (m)		35.69	
Min Ch El (m)	76.12	Shear (N/m2)		15.84	
Alpha	1.00	Stream Power (N/m s)		17.64	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)		34.11	
C & E Loss (m)	0.01	Cum XA (1000 m2)		19.44	

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile RPF 7

			Left OB	Channel	Right OB
E.G. Elev (m)	78.68	Element			
Vel Head (m)	0.07	Wt. n-Val.		0.040	
W.S. Elev (m)	78.61	Reach Len. (m)	16.80	17.03	15.37
Crit W.S. (m)		Flow Area (m2)		74.60	
E.G. Slope (m/m)	0.000864	Area (m2)		74.60	
Q Total (m3/s)	89.04	Flow (m3/s)		89.04	
Top Width (m)	33.64	Top Width (m)		33.64	
Vel Total (m/s)	1.19	Avg. Vel. (m/s)		1.19	
Max Chl Dpth (m)	2.49	Hydr. Depth (m)		2.22	
Conv. Total (m3/s)	3021.1	Conv. (m3/s)		3021.1	
Length Wtd. (m)	17.03	Wetted Per. (m)		36.18	
Min Ch El (m)	76.12	Shear (N/m2)		17.54	
Alpha	1.00	Stream Power (N/m s)		20.96	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)		38.70	
C & E Loss (m)	0.01	Cum XA (1000 m2)		20.13	

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile RPF 10

			Left OB	Channel	Right OB
E.G. Elev (m)	78.75	Element			
Vel Head (m)	0.08	Wt. n-Val.		0.040	
W.S. Elev (m)	78.67	Reach Len. (m)	16.80	17.03	15.37
Crit W.S. (m)		Flow Area (m2)		76.78	
E.G. Slope (m/m)	0.000871	Area (m2)		76.78	
Q Total (m3/s)	93.29	Flow (m3/s)		93.29	
Top Width (m)	33.64	Top Width (m)		33.64	
Vel Total (m/s)	1.22	Avg. Vel. (m/s)		1.22	
Max Chl Dpth (m)	2.55	Hydr. Depth (m)		2.28	
Conv. Total (m3/s)	3161.5	Conv. (m3/s)		3161.5	
Length Wtd. (m)	17.03	Wetted Per. (m)		36.32	
Min Ch El (m)	76.12	Shear (N/m2)		18.05	
Alpha	1.00	Stream Power (N/m s)		21.93	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)		39.94	
C & E Loss (m)	0.01	Cum XA (1000 m2)		20.30	

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile RPF 11

			Left OB	Channel	Right OB
E.G. Elev (m)	79.04	Element			
Vel Head (m)	0.09	Wt. n-Val.		0.040	
W.S. Elev (m)	78.95	Reach Len. (m)	16.80	17.03	15.37
Crit W.S. (m)		Flow Area (m2)		86.22	
E.G. Slope (m/m)	0.000884	Area (m2)		86.22	
Q Total (m3/s)	112.91	Flow (m3/s)		112.91	
Top Width (m)	33.64	Top Width (m)		33.64	
Vel Total (m/s)	1.31	Avg. Vel. (m/s)		1.31	
Max Chl Dpth (m)	2.83	Hydr. Depth (m)		2.56	
Conv. Total (m3/s)	3797.2	Conv. (m3/s)		3797.2	
Length Wtd. (m)	17.03	Wetted Per. (m)		36.88	
Min Ch El (m)	76.12	Shear (N/m2)		20.27	
Alpha	1.00	Stream Power (N/m s)		26.55	
Frctn Loss (m)	0.07	Cum Volume (1000 m3)		45.45	
C & E Loss (m)	0.01	Cum XA (1000 m2)		21.00	

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile RPF 12

			Left OB	Channel	Right OB
E.G. Elev (m)	79.45	Element			
Vel Head (m)	0.11	Wt. n-Val.		0.040	
W.S. Elev (m)	79.34	Reach Len. (m)	16.80	17.03	15.37
Crit W.S. (m)		Flow Area (m2)		105.70	
E.G. Slope (m/m)	0.000923	Area (m2)		105.70	
Q Total (m3/s)	158.71	Flow (m3/s)		158.71	
Top Width (m)	33.64	Top Width (m)		33.64	
Vel Total (m/s)	1.50	Avg. Vel. (m/s)		1.50	
Max Chl Dpth (m)	3.41	Hydr. Depth (m)		3.14	
Conv. Total (m3/s)	5223.2	Conv. (m3/s)		5223.2	
Length Wtd. (m)	17.03	Wetted Per. (m)		38.04	
Min Ch El (m)	76.12	Shear (N/m2)		25.16	
Alpha	1.00	Stream Power (N/m s)		37.78	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)		57.64	
C & E Loss (m)	0.01	Cum XA (1000 m2)		22.70	

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile RPF 13

E.G. Elev (m)	80.10	Element	Left OB	Channel	Right OB	
Vel Head (m)	0.14	Wt. n-Val.		0.040		
W.S. Elev (m)	79.96	Reach Len. (m)	16.80	17.03	15.37	
Crit W.S. (m)		Flow Area (m2)		120.11		
E.G. Slope (m/m)	0.000969	Area (m2)		120.11		
Q Total (m3/s)	198.20	Flow (m3/s)		198.20		
Top Width (m)	33.64	Top Width (m)		33.64		
Vel Total (m/s)	1.65	Avg. Vel. (m/s)		1.65		
Max Chl Dpth (m)	3.84	Hydr. Depth (m)		3.57		
Conv. Total (m3/s)	6367.9	Conv. (m3/s)		6367.9		
Length Wtd. (m)	17.03	Wetted Per. (m)		38.90		
Min Ch El (m)	76.12	Shear (N/m2)		29.34		
Alpha	1.00	Stream Power (N/m s)		48.41		
Frctn Loss (m)	0.02	Cum Volume (1000 m3)		66.78		
C & E Loss (m)	0.01	Cum DA (1000 m2)		23.38		

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: CAYAGUAS
REACH: ONE RS: 12

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	80.06	8.34	78.67	8.8	78.11	16.62	76.13	24.77	76.16
29.49	76.18	27.31	76.32	27.69	76.70	33.36	81.87		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	0	.04	33.36	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
8	33.36	87.69	90.67	95.98	.1	.3

CROSS SECTION OUTPUT Profile RPF 1

E.G. Elev (m)	76.32	Element	Left OB	Channel	Right OB	
Vel Head (m)	0.01	Wt. n Val.		0.040		
W.S. Elev (m)	76.31	Reach Len. (m)	87.69	90.67	95.98	
Crit W.S. (m)		Flow Area (m2)		2.84		
E.G. Slope (m/m)	0.001565	Area (m2)		2.84		
Q Total (m3/s)	1.31	Flow (m3/s)		1.31		
Top Width (m)	16.42	Top Width (m)		16.42		
Vel Total (m/s)	0.46	Avg. Vel. (m/s)		0.46		
Max Chl Dpth (m)	0.26	Hydr. Depth (m)		0.17		
Conv. Total (m3/s)	21.4	Conv. (m3/s)		21.9		
Length Wtd. (m)	90.67	Wetted Per. (m)		16.55		
Min Ch El (m)	76.11	Shear (N/m2)		6.00		
Alpha	1.00	Stream Power (N/m s)		2.77		
Frctn Loss (m)	0.23	Cum Volume (1000 m3)		2.48		
C & E Loss (m)	0.00	Cum DA (1000 m2)		11.56		

CROSS SECTION OUTPUT Profile RPF 7

E.G. Elev (m)	76.95	Element	Left OB	Channel	Right OB	
Vel Head (m)	0.00	Wt. n Val.		0.040		
W.S. Elev (m)	76.95	Reach Len. (m)	87.69	90.67	95.98	
Crit W.S. (m)		Flow Area (m2)		14.21		
E.G. Slope (m/m)	0.002468	Area (m2)		14.21		
Q Total (m3/s)	13.74	Flow (m3/s)		13.74		
Top Width (m)	20.09	Top Width (m)		20.09		
Vel Total (m/s)	0.97	Avg. Vel. (m/s)		0.97		
Max Chl Dpth (m)	0.79	Hydr. Depth (m)		0.71		
Conv. Total (m3/s)	276.6	Conv. (m3/s)		276.6		
Length Wtd. (m)	90.67	Wetted Per. (m)		20.65		
Min Ch El (m)	76.11	Shear (N/m2)		16.63		
Alpha	1.00	Stream Power (N/m s)		16.08		
Frctn Loss (m)	0.18	Cum Volume (1000 m3)		11.19		
C & E Loss (m)	0.00	Cum DA (1000 m2)		15.15		

CROSS SECTION OUTPUT Profile RPF 3

E.G. Elev (m)	77.29	Element	Left OB	Channel	Right OB	
Vel Head (m)	0.07	Wt. n Val.		0.040		
W.S. Elev (m)	77.22	Reach Len. (m)	87.69	90.67	95.98	
Crit W.S. (m)		Flow Area (m2)		20.73		
E.G. Slope (m/m)	0.002298	Area (m2)		20.73		
Q Total (m3/s)	23.88	Flow (m3/s)		23.88		
Top Width (m)	21.22	Top Width (m)		21.22		
Vel Total (m/s)	1.15	Avg. Vel. (m/s)		1.15		
Max Chl Dpth (m)	1.11	Hydr. Depth (m)		0.98		
Conv. Total (m3/s)	498.2	Conv. (m3/s)		498.2		
Length Wtd. (m)	90.67	Wetted Per. (m)		21.99		
Min Ch El (m)	76.11	Shear (N/m2)		21.24		
Alpha	1.59	Stream Power (N/m s)		24.47		
Frctn Loss (m)	0.17	Cum Volume (1000 m3)		15.89		
C & E Loss (m)	0.00	Cum DA (1000 m2)		16.03		

CROSS SECTION OUTPUT Profile RPF 4

E.G. Elev (m)	77.58	Element	Left OB	Channel	Right OB	
Vel Head (m)	0.02	Wt. n Val.		0.040		
W.S. Elev (m)	77.56	Reach Len. (m)	87.69	90.67	95.98	
Crit W.S. (m)		Flow Area (m2)		26.68		
E.G. Slope (m/m)	0.002166	Area (m2)		26.68		
Q Total (m3/s)	34.10	Flow (m3/s)		34.10		
Top Width (m)	22.19	Top Width (m)		22.19		
Vel Total (m/s)	1.28	Avg. Vel. (m/s)		1.28		
Max Chl Dpth (m)	1.28	Hydr. Depth (m)		1.20		

Conv. Total (m3/s)	733.6	Conv. (m3/s)			733.6		
Length Wtd. (m)	90.67	Wetted Per. (m)			23.13		
Min Ch El (m)	76.11	Shear (N/m2)			24.44		
Alpha	1.00	Stream Power (N/m s)			31.24		
Frctn Loss (m)	0.17	Cum Volume (1000 m3)			20.04		
C & E Loss (m)	0.00	Cum AA (1000 m2)			17.03		

CROSS SECTION OUTPUT Profile #PF 5

E.G. Elev (m)	77.82	Element	Left OB	Channel	Right OB		
Vel Head (m)	0.10	Wt. n-Val.		0.040			
W.S. Elev (m)	77.72	Reach Len. (m)	87.69	90.67	95.98		
Crit W.S. (m)		Flow Area (m2)		31.69			
E.G. Slope (m/m)	0.002172	Area (m2)		31.69			
Q Total (m3/s)	44.39	Flow (m3/s)		44.39			
Top Width (m)	22.99	Top Width (m)		22.99			
Vel Total (m/s)	1.40	Avg. Vel. (m/s)		1.40			
Max Chl Dpth (m)	1.61	Hydr. Depth (m)		1.38			
Conv. Total (m3/s)	952.4	Conv. (m3/s)		952.4			
Length Wtd. (m)	90.67	Wetted Per. (m)		24.05			
Min Ch El (m)	76.11	Shear (N/m2)		28.07			
Alpha	1.00	Stream Power (N/m s)		39.32			
Frctn Loss (m)	0.17	Cum Volume (1000 m3)		23.74			
C & E Loss (m)	0.00	Cum AA (1000 m2)		17.56			

CROSS SECTION OUTPUT Profile #PF 6

E.G. Elev (m)	78.04	Element	Left OB	Channel	Right OB		
Vel Head (m)	0.12	Wt. n-Val.		0.040			
W.S. Elev (m)	77.91	Reach Len. (m)	87.69	90.67	95.98		
Crit W.S. (m)		Flow Area (m2)		36.64			
E.G. Slope (m/m)	0.002174	Area (m2)		36.64			
Q Total (m3/s)	55.21	Flow (m3/s)		55.21			
Top Width (m)	23.74	Top Width (m)		23.74			
Vel Total (m/s)	1.51	Avg. Vel. (m/s)		1.51			
Max Chl Dpth (m)	1.82	Hydr. Depth (m)		1.54			
Conv. Total (m3/s)	1184.1	Conv. (m3/s)		1184.1			
Length Wtd. (m)	90.67	Wetted Per. (m)		24.93			
Min Ch El (m)	76.11	Shear (N/m2)		31.34			
Alpha	1.00	Stream Power (N/m s)		47.22			
Frctn Loss (m)	0.17	Cum Volume (1000 m3)		27.27			
C & E Loss (m)	0.00	Cum AA (1000 m2)		18.10			

CROSS SECTION OUTPUT Profile #PF 7

E.G. Elev (m)	78.26	Element	Left OB	Channel	Right OB		
Vel Head (m)	0.13	Wt. n-Val.		0.040			
W.S. Elev (m)	78.13	Reach Len. (m)	87.69	90.67	95.98		
Crit W.S. (m)		Flow Area (m2)		41.57			
E.G. Slope (m/m)	0.002177	Area (m2)		41.57			
Q Total (m3/s)	66.68	Flow (m3/s)		66.68			
Top Width (m)	24.47	Top Width (m)		24.47			
Vel Total (m/s)	1.60	Avg. Vel. (m/s)		1.60			
Max Chl Dpth (m)	2.02	Hydr. Depth (m)		1.70			
Conv. Total (m3/s)	1429.0	Conv. (m3/s)		1429.0			
Length Wtd. (m)	90.67	Wetted Per. (m)		25.78			
Min Ch El (m)	76.11	Shear (N/m2)		34.41			
Alpha	1.00	Stream Power (N/m s)		55.21			
Frctn Loss (m)	0.18	Cum Volume (1000 m3)		31.00			
C & E Loss (m)	0.00	Cum AA (1000 m2)		18.63			

CROSS SECTION OUTPUT Profile #PF 8

E.G. Elev (m)	78.39	Element	Left OB	Channel	Right OB		
Vel Head (m)	0.14	Wt. n-Val.		0.040			
W.S. Elev (m)	78.25	Reach Len. (m)	87.69	90.67	95.98		
Crit W.S. (m)		Flow Area (m2)		44.49			
E.G. Slope (m/m)	0.002181	Area (m2)		44.49			
Q Total (m3/s)	77.81	Flow (m3/s)		77.81			
Top Width (m)	24.90	Top Width (m)		24.90			
Vel Total (m/s)	1.66	Avg. Vel. (m/s)		1.66			
Max Chl Dpth (m)	2.14	Hydr. Depth (m)		1.79			
Conv. Total (m3/s)	1580.6	Conv. (m3/s)		1580.6			
Length Wtd. (m)	90.67	Wetted Per. (m)		26.27			
Min Ch El (m)	76.11	Shear (N/m2)		38.22			
Alpha	1.00	Stream Power (N/m s)		60.05			
Frctn Loss (m)	0.18	Cum Volume (1000 m3)		33.17			
C & E Loss (m)	0.00	Cum AA (1000 m2)		18.94			

CROSS SECTION OUTPUT Profile #PF 9

E.G. Elev (m)	78.65	Element	Left OB	Channel	Right OB		
Vel Head (m)	0.16	Wt. n-Val.		0.040			
W.S. Elev (m)	78.49	Reach Len. (m)	87.69	90.67	95.98		
Crit W.S. (m)		Flow Area (m2)		50.53			
E.G. Slope (m/m)	0.002182	Area (m2)		50.53			
Q Total (m3/s)	89.04	Flow (m3/s)		89.04			
Top Width (m)	25.75	Top Width (m)		25.75			
Vel Total (m/s)	1.76	Avg. Vel. (m/s)		1.76			
Max Chl Dpth (m)	2.48	Hydr. Depth (m)		1.96			
Conv. Total (m3/s)	1906.3	Conv. (m3/s)		1906.3			
Length Wtd. (m)	90.67	Wetted Per. (m)		27.26			
Min Ch El (m)	76.11	Shear (N/m2)		39.66			
Alpha	1.00	Stream Power (N/m s)		69.89			
Frctn Loss (m)	0.18	Cum Volume (1000 m3)		37.64			
C & E Loss (m)	0.00	Cum AA (1000 m2)		19.63			

CROSS SECTION OUTPUT Profile #PF 10

E.G. Elev (m)	78.71	Element	Left OB	Channel	Right OB		
Vel Head (m)	0.16	Wt. n-Val.		0.040			
W.S. Elev (m)	78.55	Reach Len. (m)	87.69	90.67	95.98		
Crit W.S. (m)		Flow Area (m2)		52.13			
E.G. Slope (m/m)	0.002188	Area (m2)		52.13			
Q Total (m3/s)	93.23	Flow (m3/s)		93.23			
Top Width (m)	25.97	Top Width (m)		25.97			
Vel Total (m/s)	1.79	Avg. Vel. (m/s)		1.79			
Max Chl Dpth (m)	2.48	Hydr. Depth (m)		2.01			
Conv. Total (m3/s)	1995.5	Conv. (m3/s)		1995.5			
Length Wtd. (m)	90.67	Wetted Per. (m)		27.51			
Min Ch El (m)	76.11	Shear (N/m2)		40.61			

* Alpha	*	1.00	* Stream Power (N/m s)	*		*	72.67	*	*
* Frctn Loss (m)	*	0.18	* Cum Volume (1000 m3)	*		*	38.84	*	*
* C & E Loss (m)	*	0.00	* Cum XA (1000 m2)	*		*	19.79	*	*

CROSS SECTION OUTPUT Profile RPF 11

* E.G. Elev (m)	*	79.01	* Element	*	Left OB	*	Channel	*	Right OB *
* Vel Head (m)	*	0.18	* Wt. n-Vel.	*		*	0.040	*	*
* W.S. Elev (m)	*	78.82	* Reach Len. (m)	*	87.69	*	90.47	*	95.98 *
* Crit W.S. (m)	*		* Flow Area (m2)	*		*	59.27	*	*
* E.G. Slope (m/m)	*	0.002201	* Area (m2)	*		*	59.27	*	*
* Q Total (m3/s)	*	112.91	* Flow (m3/s)	*		*	112.91	*	*
* Top Width (m)	*	26.93	* Top Width (m)	*		*	26.93	*	*
* Vel Total (m/s)	*	1.90	* Avg. Vel. (m/s)	*		*	1.90	*	*
* Max Chl Dpth (m)	*	2.71	* Hydr. Depth (m)	*		*	2.20	*	*
* Conv. Total (m3/s)	*	2404.9	* Conv. (m3/s)	*		*	2404.9	*	*
* Length Wtd. (m)	*	90.67	* Wetted Per. (m)	*		*	28.63	*	*
* Min Ch El (m)	*	76.11	* Shear (N/m2)	*		*	44.67	*	*
* Alpha	*	1.00	* Stream Power (N/m s)	*		*	85.10	*	*
* Frctn Loss (m)	*	0.19	* Cum Volume (1000 m3)	*		*	44.21	*	*
* C & E Loss (m)	*	0.00	* Cum XA (1000 m2)	*		*	20.48	*	*

CROSS SECTION OUTPUT Profile RPF 12

* E.G. Elev (m)	*	79.61	* Element	*	Left OB	*	Channel	*	Right OB *
* Vel Head (m)	*	0.23	* Wt. n-Vel.	*		*	0.040	*	*
* W.S. Elev (m)	*	79.38	* Reach Len. (m)	*	87.69	*	97.67	*	95.98 *
* Crit W.S. (m)	*		* Flow Area (m2)	*		*	74.93	*	*
* E.G. Slope (m/m)	*	0.002208	* Area (m2)	*		*	74.93	*	*
* Q Total (m3/s)	*	158.71	* Flow (m3/s)	*		*	158.71	*	*
* Top Width (m)	*	28.93	* Top Width (m)	*		*	28.93	*	*
* Vel Total (m/s)	*	2.12	* Avg. Vel. (m/s)	*		*	2.12	*	*
* Max Chl Dpth (m)	*	3.27	* Hydr. Depth (m)	*		*	2.59	*	*
* Conv. Total (m3/s)	*	3376.9	* Conv. (m3/s)	*		*	3376.9	*	*
* Length Wtd. (m)	*	90.67	* Wetted Per. (m)	*		*	30.96	*	*
* Min Ch El (m)	*	76.11	* Shear (N/m2)	*		*	92.43	*	*
* Alpha	*	1.00	* Stream Power (N/m s)	*		*	111.04	*	*
* Frctn Loss (m)	*	0.19	* Cum Volume (1000 m3)	*		*	94.10	*	*
* C & E Loss (m)	*	0.00	* Cum XA (1000 m2)	*		*	22.17	*	*

CROSS SECTION OUTPUT Profile RPF 13

* E.G. Elev (m)	*	80.06	* Element	*	Left OB	*	Channel	*	Right OB *
* Vel Head (m)	*	0.26	* Wt. n-Vel.	*		*	0.040	*	*
* W.S. Elev (m)	*	79.80	* Reach Len. (m)	*	87.69	*	97.67	*	95.98 *
* Crit W.S. (m)	*		* Flow Area (m2)	*		*	87.29	*	*
* E.G. Slope (m/m)	*	0.002227	* Area (m2)	*		*	87.29	*	*
* Q Total (m3/s)	*	198.20	* Flow (m3/s)	*		*	198.20	*	*
* Top Width (m)	*	30.42	* Top Width (m)	*		*	30.42	*	*
* Vel Total (m/s)	*	2.27	* Avg. Vel. (m/s)	*		*	2.27	*	*
* Max Chl Dpth (m)	*	3.69	* Hydr. Depth (m)	*		*	2.87	*	*
* Conv. Total (m3/s)	*	4200.1	* Conv. (m3/s)	*		*	4200.1	*	*
* Length Wtd. (m)	*	90.67	* Wetted Per. (m)	*		*	32.69	*	*
* Min Ch El (m)	*	76.11	* Shear (N/m2)	*		*	59.31	*	*
* Alpha	*	1.00	* Stream Power (N/m s)	*		*	132.43	*	*
* Frctn Loss (m)	*	0.19	* Cum Volume (1000 m3)	*		*	98.02	*	*
* C & E Loss (m)	*	0.00	* Cum XA (1000 m2)	*		*	22.93	*	*

CROSS SECTION

RIVER: CAYAGUAS
REACH: CHK RS: 11

INPUT
Description:

Station Elevation Data	num=										
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
[illegible]											

Manning's n Values num=

Sta	n Val	Sta	n Val	Sta	n Val
[illegible]					

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

CROSS SECTION OUTPUT Profile RPF 1

* E.G. Elev (m)	*	[illegible]	* Element	*	Left OB	*	Channel	*	Right OB *
* Vel Head (m)	*	[illegible]	* Wt. n-Vel.	*		*	[illegible]	*	*
* W.S. Elev (m)	*	[illegible]	* Reach Len. (m)	*	81.16	*	[illegible]	*	76.15 *
* Crit W.S. (m)	*		* Flow Area (m2)	*		*	[illegible]	*	*
* E.G. Slope (m/m)	*	[illegible]	* Area (m2)	*		*	[illegible]	*	*
* Q Total (m3/s)	*	[illegible]	* Flow (m3/s)	*		*	[illegible]	*	*
* Top Width (m)	*	[illegible]	* Top Width (m)	*		*	[illegible]	*	*
* Vel Total (m/s)	*	[illegible]	* Avg. Vel. (m/s)	*		*	[illegible]	*	*
* Max Chl Dpth (m)	*	[illegible]	* Hydr. Depth (m)	*		*	[illegible]	*	*
* Conv. Total (m3/s)	*	[illegible]	* Conv. (m3/s)	*		*	[illegible]	*	*
* Length Wtd. (m)	*	[illegible]	* Wetted Per. (m)	*		*	[illegible]	*	*
* Min Ch El (m)	*	[illegible]	* Shear (N/m2)	*		*	[illegible]	*	*
* Alpha	*	[illegible]	* Stream Power (N/m s)	*		*	[illegible]	*	*
* Frctn Loss (m)	*	[illegible]	* Cum Volume (1000 m3)	*		*	[illegible]	*	*
* C & E Loss (m)	*	[illegible]	* Cum XA (1000 m2)	*		*	[illegible]	*	*

CROSS SECTION OUTPUT Profile RPF 2

* E.G. Elev (m)	*	[illegible]	* Element	*	Left OB	*	Channel	*	Right OB *
* Vel Head (m)	*	[illegible]	* Wt. n-Vel.	*		*	[illegible]	*	*
* W.S. Elev (m)	*	[illegible]	* Reach Len. (m)	*	81.16	*	[illegible]	*	76.15 *
* Crit W.S. (m)	*		* Flow Area (m2)	*		*	[illegible]	*	*
* E.G. Slope (m/m)	*	[illegible]	* Area (m2)	*		*	[illegible]	*	*
* Q Total (m3/s)	*	[illegible]	* Flow (m3/s)	*		*	[illegible]	*	*
* Top Width (m)	*	[illegible]	* Top Width (m)	*		*	[illegible]	*	*
* Vel Total (m/s)	*	[illegible]	* Avg. Vel. (m/s)	*		*	[illegible]	*	*
* Max Chl Dpth (m)	*	[illegible]	* Hydr. Depth (m)	*		*	[illegible]	*	*
* Conv. Total (m3/s)	*	[illegible]	* Conv. (m3/s)	*		*	[illegible]	*	*
* Length Wtd. (m)	*	[illegible]	* Wetted Per. (m)	*		*	[illegible]	*	*
* Min Ch El (m)	*	[illegible]	* Shear (N/m2)	*		*	[illegible]	*	*
* Alpha	*	[illegible]	* Stream Power (N/m s)	*		*	[illegible]	*	*
* Frctn Loss (m)	*	[illegible]	* Cum Volume (1000 m3)	*		*	[illegible]	*	*
* C & E Loss (m)	*	[illegible]	* Cum XA (1000 m2)	*		*	[illegible]	*	*