FINAL

PRELIMINARY

DRAINAGE REPORT
FOR
HOUGHTON ROAD,
5TH STREET TO OLD SPANISH TRAIL

SUBMITTED TO:

CITY OF TUCSON DEPARTMENT OF TRANSPORTATION
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COT JOB NO. SR1C
COT PLAN NO. I-2007-019

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1.0

INTRODUCTION

1.1 Project Description

Houghton Road is located on the east side of Tucson, Arizona and extends from Snyder Road within the Catalina Mountain foothills to the south approximately 26 miles to the Santa Rita Mountain foothills just south of Sahuarita Road. Houghton Road is a major thoroughfare for east Tucson which provides I-10 traffic access to the east and northeast portions of Tucson. This project is the northern most project included in the "Houghton Road – Tanque Verde to Interstate 10" corridor projects.

This project consists of preparing a conceptual cross drainage design to be included in a Design Concept Report for approximately a 1.8 mile segment of Houghton Road, from 5th Street to Old Spanish Trail. The Houghton Road Corridor is located on the section line located along the division of Sections 14 and 13, Township 15 South, Range 14 East of the Gila and Salt River Meridian, within southeast Tucson, Arizona. Figure 1 provides a schematic layout showing the project limits. This portion of Houghton Road will be upgraded from an uncurbed 2 & 3 lane roadway to a 6 lane divided roadway with a raised median, 6 inch curbs and two 5 foot bicycle lanes. As a result, both onsite (pavement) and offsite (cross-drainage) drainage facilities will be required to mitigate runoff hazards within the project limits. However, only the cross drainage will be evaluated in this report. The pavement drainage will be evaluated during the design segment of this project. However, a estimated construction cost was necessary for the DCR. As a result, a conceptual design onsite pavement drainage systems was approximated based on experience using a standard inlet spacing and approximate stormdrain size based on the number of inlets contributing to the segment of stormdrain. Due to the approximate nature of the stormdrain, it is not documented in this report.

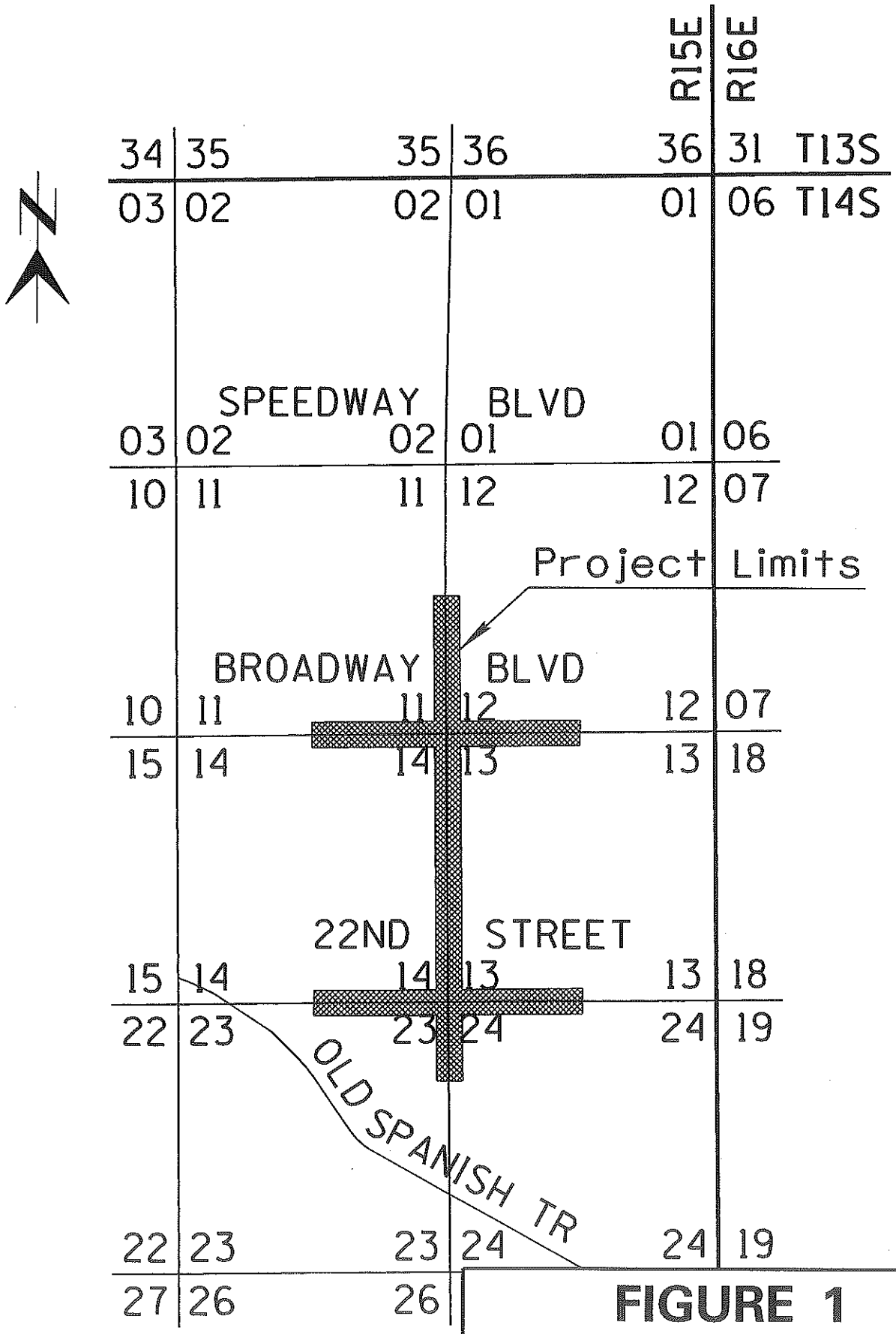


FIGURE 1

HOUGHTON ROAD
SPEEDWAY BLVD TO OLD SPANISH TRAIL
PROJECT LOCATION & LIMITS

1.2 Key Points of Interest

Most of the drainage patterns throughout the project are typical in nature. However, a few locations warrant further discussion.

CORONADO RIDGE WASH

Coronado Ridge Wash crosses both Broadway Boulevard east of Houghton Road and Houghton Road a few hundred feet north of Broadway Boulevard. This wash is one of the more complex drainages encountered in this project. The main branch of the wash begins south of 22nd Street and east of Melpomine Way. The approximately 2-mile long watercourse flows in a northwestern direction towards the Safeway shopping center located on the southeast corner of Houghton Road and Broadway Boulevard where runoff is conveyed through a 600-foot long CONARCH culvert and outlets just upstream of the 4 cell 8'x3' CBC under Broadway Boulevard. Once through the CBC under Broadway Boulevard the wash continues north around the Walgreen's located on the north east corner of Houghton Road and Broadway Boulevard. Just a few hundred feet north of the Walgreen's site, the wash turns west and crosses Houghton Road through an at grade crossing. Downstream of the crossing the wash changes direction again and heads north-northwest towards Tanque Verde Creek.

Upstream of the Broadway crossing two tributaries, one minor and one major, combine with the main branch of the wash. From the west, a minor roadside swale draining mainly Houghton Road and a portion of the right-of-way behind the curb conveys runoff to the inlet of the CBC at Broadway. In addition, this minor swale conveys flows from a divided storage basin on the gas station property at the corner of the intersection. Similarly, the east tributary is a major roadside channel which conveys runoff along the north edge of the Safeway shopping center parking lot. There are two CONARCH culverts, under the two driveways into the shopping center, that convey runoff towards the CBC at Broadway Boulevard.

It is anticipated that both the roadside swale and channel will require improvements due to the widening of both Houghton Road and Broadway Boulevard. More than likely, the swale will be replaced by stormdrain and it will be necessary to reconstruct the channel paralleling Broadway.

BASHAS' COMMERCIAL CENTER

This commercial parcel on the southwest corner of Broadway & Houghton intersection conveys flows from the east side of Houghton Road to a detention basin located north of Broadway Boulevard. Review of the development plan shows that runoff generated east of Houghton Road is conveyed through a system of open channels and culverts to the entrance of a stormdrain system located on the east side of the parcel. Local runoff generated onsite is captured by catch basins and directed to the stormdrain or swales off the property to the north or west, respectively.

Prior to crossing Houghton Road, runoff that is generated east of Houghton Road drains towards Cowhead Saddle Lane to the north between Houghton Road and Barrio Rincon residential development, and continues north towards the Safeway commercial center opposite of Bashas' Shopping Center. Through this area there are two culverts, 4-24" pipes under Cowhead Saddle Lane and a CONARCH culvert under the southern most driveway to the Safeway Center. Flows are then directed towards Houghton Road and enter a 36" CMP under Houghton Road directing runoff to the east side of the Bashas' center.

KENSINGTON WASH

Kensington Drive, which is approximately 1000-feet south of Broadway Boulevard, is the northern boundary for an unnamed wash that is identified in the TSMS as node MG-N0080. The wash conveys flows from the east across Houghton Road through three 42" corrugated metal pipes.

ESTE WASH

Este Wash is located just south of 22nd Street, This wash is the only FEMA Regulated wash within the study limits addressed in this report. This wash conveys runoff from the southeast to the north-northwest and crosses both Houghton Road and 22nd Street through at grade dip crossings. The FEMA study begins at Houghton Road and terminates at the confluence with the Tanque Verde Creek. The proposed culverts are not expected to change the existing FEMA floodplain much, so a CLOMR or LOMR is not expected for the FEMA model. A copy of the Flood Insurance Rate Map (FIRM) is included in Appendix B-6.

1.3 Scope of Work

The purpose of this report is to document the analyses and conceptual design for drainage considerations and calculations made in conjunction with the engineering conceptual design of this roadway project. The drainage design proposes to accommodate both onsite and offsite runoff, and is described in qualitative terms within the body of this report. Only offsite (Major Cross Drainage) drainage analyses are evaluated for this preliminary drainage report. Onsite (Pavement) drainage analyses will be addressed during the design segment(s) of the project. All applicable offsite hydrologic and hydraulic computations are included in the appendices.

More specifically, the scope of work for the drainage portion of this project is as follows:

A. To determine the quantity of runoff affecting this project based on future projections for growth in this area. The methods used are:

    1. The City of Tucson Stormwater Management Study (TSMS), Reference 1, which generates the currently accepted value for the 100-year peak flows, as well as the 10-year event peak flows. Additional information regarding the TSMS is included in the hydrologic analysis portion of this report.

    2. The City of Tucson Method for Estimating Flood Peaks and Flood Hydrographs, Reference 2, herein referred to as the City of Tucson Method. This hydrologic analysis was used to generate both offsite and onsite peak discharge rates. The concept of Balanced watersheds provides that the current "existing" conditions will be the same as those in the future.

B. To design new conveyance structures, typically concrete box culverts, to replace existing dip crossings located throughout the project limits.

C. To provide adequate design for ERZ regulatory washes where feasible; which, include structure height requirements.

1.4 Basis of Survey Control

The project basis of survey for location and elevation parameters is as follows:

BASIS OF BEARING

The Basis of Bearing is a straight line along Houghton Road between a found BCSM in casing at 22nd Street and a found BCSM in casing at 29th Street. Said Bearing being South 00°36'51" East.

BASIS OF ELEVATION

COT BM 339E Field Book 1989E1, Page 29 "X" on wheel chair ramp. Said Elevation = 2750.78. Also COT BM 895E, Field Book 1989E2, Page 6. RR Spike "14 & 54". Said Elevation = 2841.70. All elevations pertaining to this project are based on NAVD88 datum with the exception of the Este Wash FEMA analysis which has an original datum of NGVD29. More detailed description is included in the Este Wash section of this report.

1.5 Design Criteria

In general the drainage improvements designed and documented in this report shall meet the following criteria:

OFFSITE/CROSS DRAINAGE

1. Cross Drainage facilities shall be designed such that the 100-Year event will be conveyed under the roadway providing for "All Weather Access". The City of Tucson Drainage Manual identifies "All Weather Access" as flow being conveyed through a culvert or no deeper than one-foot over the roadway, Reference 1. However, due to the arterial classification of this roadway with projected high traffic volume and its urban configuration (curbs, raised median and pedestrian facilities), PB will design the cross drainage culverts to convey the 100-Year event under the roadway.
2. Proposed water surface elevations for regulatory washes shall not increase more than 0.1-feet in accordance with Section 26-5.2 of the City of Tucson Floodplain and Erosion Hazard Area Regulations. A possible solution to an increased water surface elevation, is to purchase an easement to surround the limits of the increase.
3. Culverts shall be designed such that the structure will convey the sediment load of the upstream segment. Sediment carrying capacity will be analyzed during the design stage of this project in accordance with Section 11.5, Reference 2.
4. ERZ/WASH Ordinance washes shall be designed in accordance with current regulations, Chapter 23 and Chapter 29 of the City of Tucson Code, with the exception of the structure height requirement. This project is in the process of obtaining a variance for structure height. It is expected that some areas will not meet the required structure height due to roadway profile limitations. Each area will be evaluated to determine if the structure height can meet the requirements.
5. Culverts shall have a minimum height requirement of 4-feet for reinforced concrete boxes and a minimum diameter of 24-inches for pipe culverts in accordance with Section 11.2, Reference 2.
6. Culvert material shall be reinforced concrete unless extending an existing culvert In accordance with section 10.3, Reference 2. Culvert extensions shall match the existing culvert material given that the existing culvert is in good condition. Each non concrete culvert will be evaluated to determine its condition. If the existing culvert is found to be in poor condition, it will be replaced with reinforced concrete.

2.0

HYDROLOGIC ANALYSIS

2.1 General

Houghton Road is a north-south arterial roadway located in southeastern Tucson, Arizona. In general, runoff typically flows from the southeast to the northwest throughout the project limits. Existing facilities include dip crossings (at grade), culverts and stormdrain systems. There are a few instances where runoff parallels the existing roadway in channels or swales to a point where it crosses the roadway in either existing dip crossings or through existing drainage structures.

Two approaches are applied to the hydrologic analyses for this project. The first uses TSMS flow rates obtained from the City of Tucson. The second approach evaluates local watersheds for runoff discharge rates using either previous drainage reports and/or the City of Tucson's Flood Peak Estimator to establish both existing and proposed conditions. Due to the change in project limits, the hydrologic analyses terminate at the Coronado Ridge Wash. Analyses north of this location will be addressed in a separate report for the northern project segment.

2.2 TSMS Hydrologic Data

The project limits fall within two major watersheds identified in the Tucson Stormwater Management Study (TSMS). The first is the Reyes Wash watershed and the second is the Este Wash watershed. A number of sub-watersheds directly impact Houghton Road, Broadway Boulevard and 22nd Street. Figure 2 provides an aerial view identifying the location of each TSMS node directly impacting the project. No direct hydrologic computations are included in this report for these TSMS nodes. The City of Tucson's Storm Water Group conducted all verification and hydrologic computations regarding the TSMS nodes. Table 1, below, provides all TSMS flow rates, node descriptions and locations that impact this project. The column listed as "adjusted 100-Year discharge" in the table below show the estimated increase in discharge that is expected of future development. The estimated increases were recommended by the City of Tucson Stormwater Group. Increases were only recommended for those nodes that have expected significant increases in runoff due to future development. For the other nodes, the same TSMS flow rates are adequate to use for existing and proposed conditions. Emails documenting the recommendations and the coordination with the city are included in Appendix A.

TABLE 1 (TSMS HYDROLOGIC SUMMARY)

TSMS NODE	Description	10-YEAR DISCHARGE (ft^3/sec)	100- YEAR DISCHARGE (ft^3/sec)	Adjusted 100- YEAR DISCHARGE (ft^3/sec)
MG-N0170 (Este)	Coronado Ridge Wash NW of Houghton Road Crossing, 500-feet Upstream of 5th Street.	388	951	N/A
MG-N0160 (Este)	Coronado Ridge Wash @ Broadway Blvd. Just East of Houghton Road.	383	947	N/A
MC-N0080 (Reyes)	Un-Named Wash Crossing @ Broadway Blvd. 2000-feet East of Houghton Road.	56	151	N/A
MG-N0100 (Este)	Bashas' Stormdrain Outlet @ Broadway Blvd. 600-feet West of Houghton Road.	55	118	N/A
MG-N0090 (Este)	Un-Named Wash Crossing @ Broadway Blvd. 1200-feet West of Houghton Road.	232	567	N/A
MG-N0095 (Este)	Concentration Point North of Broadway 1700-feet West of Houghton Road.	57	137	N/A
MG-N0080 (Este)	Un-Named Wash Crossing Houghton Road @ Kensington Drive – Existing 3-36"CMP	184	465	N/A
MG-N0040 (Este)	Un-Named Wash Crossing Houghton Road 400-feet North of 22nd Street (Sump Condition)	71	202	243
MG-N0045 (Este)	Este Wash Confluence with R-O from TSMS Node MG-N0040 500-Downstream of Houghton Road.	439	1142	N/A
MG-N0030 (Este)	Este Wash Crossing Houghton Road 500-feet South of 22nd Street.	412	1098	1208

Please note that TSMS Node MG-N0030 is located at Este Wash where it crosses Houghton Road. Este Wash, as previously mentioned, is also a FEMA regulated wash. The FEMA Regulatory flow rate is 1974-ft^3/sec for the 100-Year event, Reference 3. At the request of the City of Tucson both 100-Year flow rates, FEMA and TSMS, will be evaluated for conceptual design of the drainage culverts under Houghton Road and 22nd Street. This analysis will be addressed in more detail under the Hydraulics Section of this report.

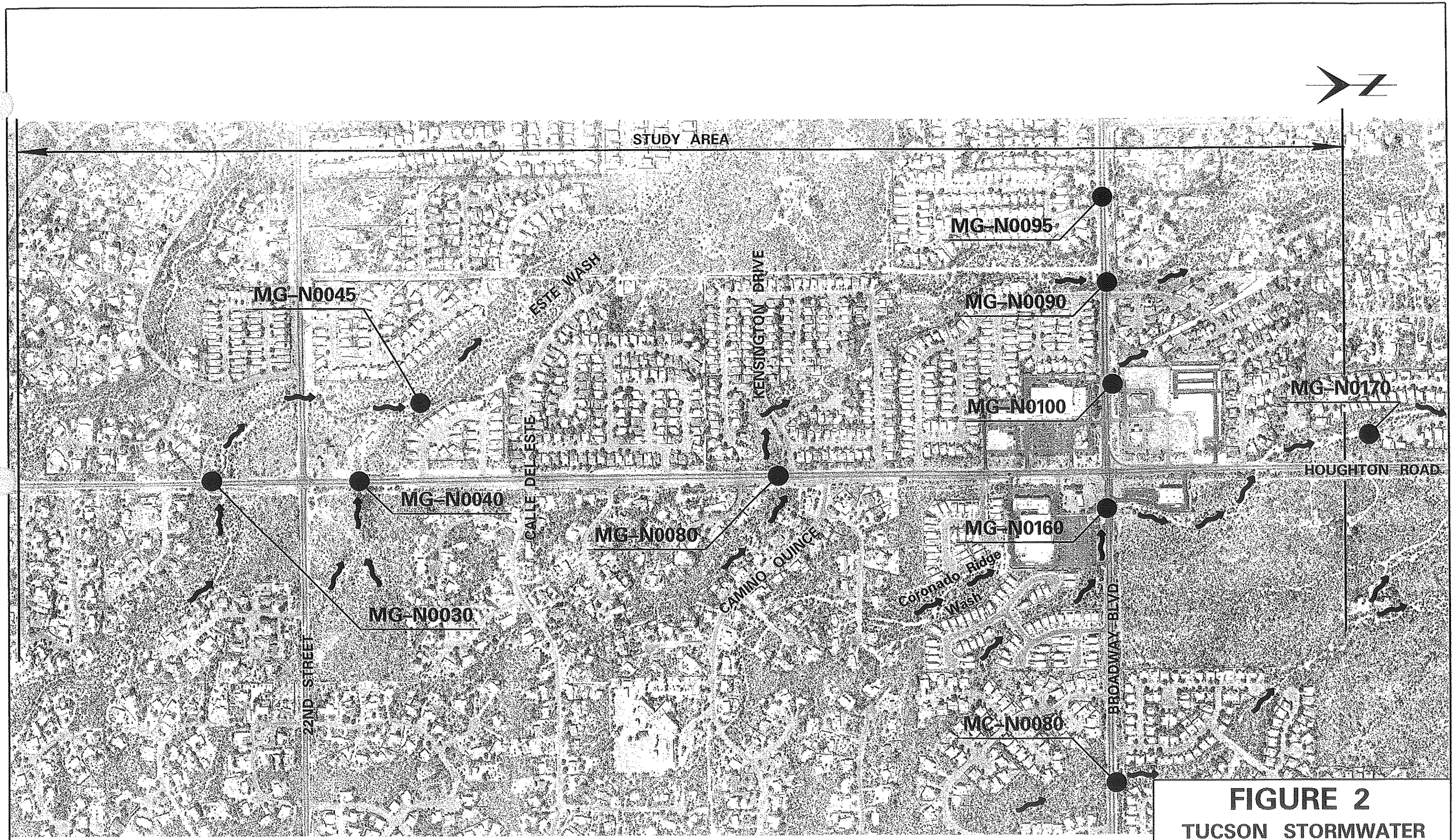


FIGURE 2

TUCSON STORMWATER MANAGEMENT STUDY NODE LOCATIONS

3/31/2008 r:\Houghton_Speedway-DST\Drainage\Report Figures\Draft 30%\11515_FIGURE02.dgn

2.3 Offsite Hydrologic Analyses

Hydrologic analyses compute flow rates for offsite watersheds contributing runoff to the project. Delineation of watershed boundaries is necessary in order to conduct the hydrologic analysis, discharge calculation. The mapping used in the analysis was the project aerial survey, flown specifically for this project, and 1998 2-foot contour mapping provided through the Pima Association of Governments (PAG). Aerial photographs from both sources were combined along with the topography for the analyses. Key concentration points were identified based on the existing and conceptual roadway layout.

Some watersheds must have a number of logical concentration points either upstream or downstream in series. This typically occurs when flow parallels Houghton Road. When this condition occurs; the procedure to compute flow rates is to use the Flood Peak Estimator for each concentration point (CP) in series. Typically, a downstream CP includes the upstream area and land use in addition to the longest flow-path length. No hydrologic routing was applied to this analysis. In most cases some type of hydraulic structure is located at each CP.

The majority of the offsite hydrologic computations can be used for both the existing and proposed conditions analyses. However, some drainage areas paralleling roadways that will be widened and have a significant amount of runoff contributed by the roadway will need hydrologic computations for the proposed conditions. The new roadway will increase the impervious area of the watershed and result in increased flow rates. All hydrologic computations are included in Appendix A. Figure 3 provides an overview of the existing conditions hydrology. Summary tables are provided on the figure showing flow rates for Existing Condition analysis. No figure is provided for the proposed conditions analyses due to the conceptual nature of the proposed condition.

3.0

HYDRAULIC ANALYSIS

3.1 General

Typical engineering methods are applied to determine the hydraulic response for both existing and proposed drainage facilities. Swales and channels were evaluated using Manning's Equation and/or HECRAS. Channel and swale characteristics were matched to the table of typical Manning's roughness, "n", values in the City of Tucson Drainage Design Manual. These values are applied to the existing and proposed geometry for each to determine the hydraulic characteristics for open channel flow. When modeling culverts and abrupt changes in channel alignment, a 1:1 contraction and 1.5:1 expansion rates are used for HECRAS models to describe the effective flow regions. Generally, channels with flow rates of 100-ft^3/sec or greater, a HECRAS model is necessary to establish water surface elevations to account for backwater effects. In addition, some special circumstances can warrant split flow analysis. In this case HECRAS modeling is necessary to evaluate the amount of flowing water leaving the channel.

Areas that are considered onsite will be evaluated during the design stage of this project. At this point only flow rates have been identified for existing onsite conditions. These values are not included in this document; however, they will be used in future design of the pavement drainage system. Onsite/pavement drainage design will be addressed during the design stage for this project.

3.2 Existing Conditions

Coronado Ridge Wash/Safeway Shopping Center

The hydraulic analysis for this wash was divided into three separate hydraulic analyses. The first HECRAS model is for the main wash from Broadway Boulevard to Houghton Road. The second is for the west tributary segment that begins at CP GE1 and terminates at the Broadway Blvd. CBC inlet. The third and final segment is for the East tributary that begins east of the Safeway Commercial Center and parallels Broadway Boulevard ending at the CBC inlet at Broadway Blvd.

The main wash segment is the downstream control for both tributaries. A HECRAS model including split flow was used to evaluate the existing conditions of this wash. A tail-water condition of normal depth was used as a starting condition west of Houghton Road. After examining the results from the initial model, it was determined that water will break out of the main channel to both the north and south just upstream of the Houghton Road dip crossing. Breakout flow to the south will be conveyed along Houghton Road and reenter the main channel at the existing dip crossing located at Houghton Road and Coronado Ridge Wash crossing. However on the other side of the channel, flow that breaks out to the north will continue north towards Speedway Boulevard. Lateral weirs were set at the top of bank and/or over-bank to model the split flow. Results show that 279-ft^3/sec breaks out to the south and 230-ft^3/sec to the north leaving 441-ft^3/sec in the main channel. Additional cross sections were used for the northern break-out to estimate the floodplain. A total of three (3) cross sections were evaluated using Manning's normal depth. The main channel hydraulic model terminates just upstream of the box culvert at Broadway Boulevard. The resulting water surface elevation at the inlet of the CBC is 2749.18-ft. This headwater elevation location at the inlet of the culvert is the starting condition for both tributary analyses;

however, to account for additional losses due to tributary alignments the total energy of 2750.23-ft will be used for the tributary analyses starting conditions.

The west tributary does not convey a significant amount of flow to the CBC; only 28-ft^3/sec reaches the CBC at Broadway Blvd. The total flow entering the west tributary includes local runoff of 23-ft^3/sec and 51-ft^3/sec breakout flow from CP GE1 resulting in a total combined flow rate of 74-ft^3/sec. This flow rate overwhelms the capacity of the existing channel resulting in approximately 47-ft^3/sec breaking out of the channel at the bend of the channel located on the southeast corner of the intersection. The breakout flow enters onto Houghton Road at the Broadway Blvd. intersection and continues northwesterly across the intersection. HECRAS modeling provides the necessary computation to evaluate the backwater and split flow for this segment.

The east tributary conveys approximately 171-ft^3/sec parallel to Broadway Boulevard. The majority of the runoff is generated south east of the commercial center. Only minor flows are generated from the commercial center, which contribute to the roadside channel. Rather than using a series of discharge changes in the HECRAS model, the maximum flow determined at the outlet was used to model the entire reach. Results show that the majority of the channel conveys the 100-Year flow rate. However, the segment between the two CONARCH culverts shows minor breakout onto Broadway Blvd. Approximately 15-ft^3/sec breaks out of the channel onto Broadway Blvd. A portion of this breakout flow will ultimately reach the downstream reach of Coronado Ridge Wash once it crosses Broadway Blvd or it will reenter the east tributary near the CBC inlet. The direction of the breakout flow was not evaluated; it was assumed to cross the roadway and enter the main channel downstream of the CBC north of Broadway Blvd.

Calculations supporting the results for the analyses are included in Appendix B-1. Figure 4 provides an overview of the existing conditions drainage configuration for the Coronado Ridge Wash including both the west and east tributaries. The Tables below provide results from the hydraulic analyses for the Coronado Wash main channel and its two tributaries.

TABLE 2A (Coronado Ridge Wash Main Channel Existing Condition)

River Station (RS)	Flow Rate (Q)	Water Surface Elevation (WSE)	Channel Velocity (V)	WEIR FLOW LEFT BANK (Q_{WEIR})	WEIR FLOW RIGHT BANK (Q_{WEIR})
(--)	(ft^3/sec)	(feet)	(ft/sec)	(ft^3/sec)	(ft^3/sec)
2250	950	2749.18	8.2		
2245	950	2748.77	6.1		
2155	950	2746.92	8.6		
2080	950	2746.28	8.1		
2000	950	2745.64	7.8		
1890	950	2742.87	4.2		
1750	950	2739.45	7.5		
1610	950	2736.60	8.2		
1480	950	2733.35	7.3		
1358	908.6	2730.85	7.0	41.4	
1248	823.6	2728.41	6.9	85.0	0
1146	566.1	2725.58	6.5	152.8	107.3
1050	723.6	2722.98	7.1		122.7
940	723.6	2720.07	7.9		
830	723.6	2717.40	7.3		
700	723.6	2714.61	6.9		
600	723.6	2712.18	6.9		

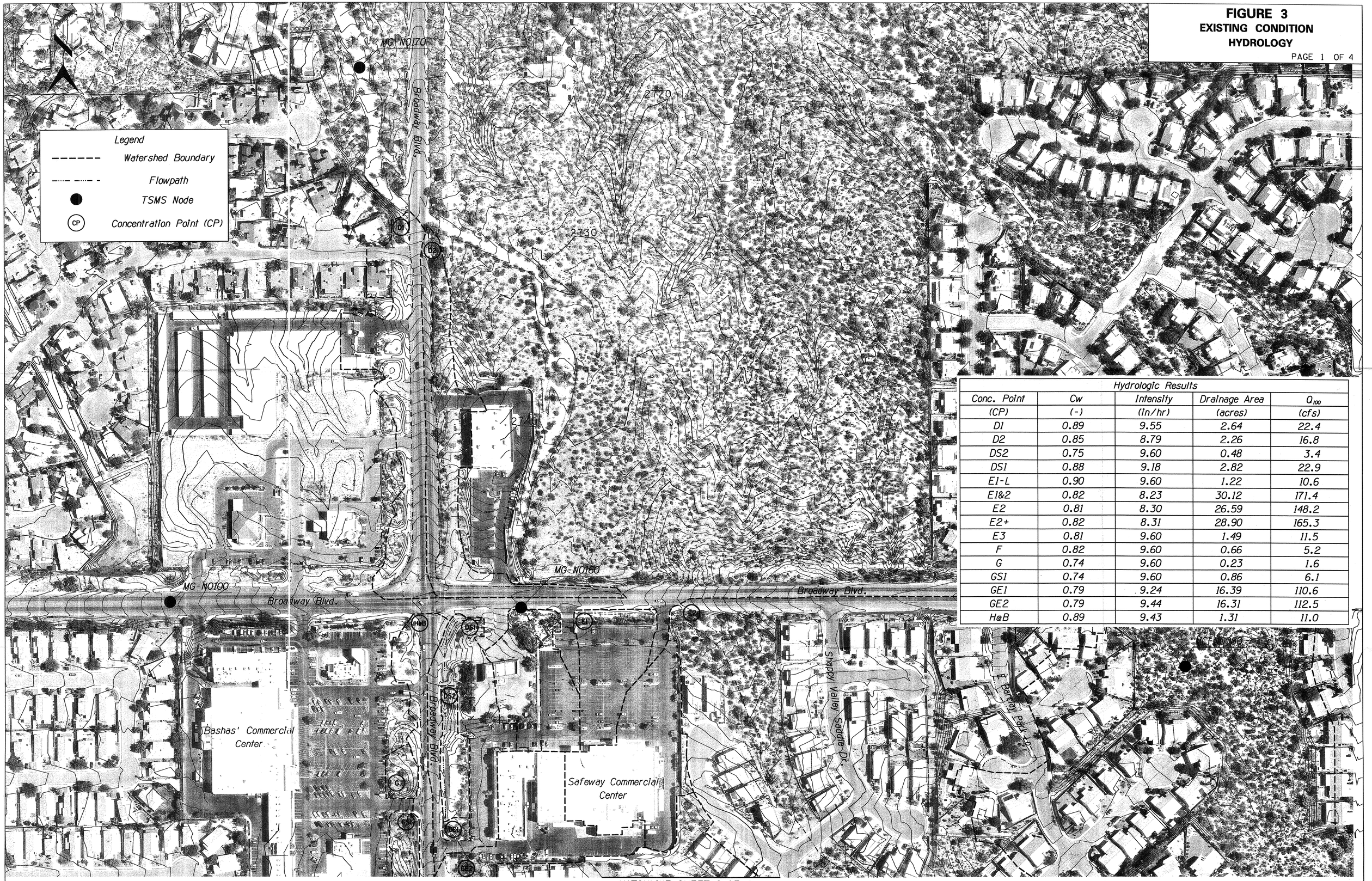
TABLE 2B (Coronado Ridge Wash West Tributary Existing Condition)

River Station (RS)	Flow Rate (Q)	Water Surface Elevation (WSE)	Channel Velocity (V)	WEIR FLOW LEFT BANK (Q_{WEIR})	WEIR FLOW RETURNING
(--)	(ft^3/sec)	(feet)	(ft/sec)	(ft^3/sec)	(--)
420	74	2755.85	2.7		
360	51.3	2754.46	1.8	22.7	RS 240
335	51.3	2752.59	5.9		
290	51.3	2752.39	1.8		
240	74	2751.62	5.5		
180	65.1	2751.51	2.2	8.8	N/A
120	27.7	2751.47	1.4	38.2	N/A
35	27.7	2750.23	2.4		

TABLE 2C (Coronado Ridge Wash East Tributary Existing Condition)

River Station (RS)	Flow Rate (Q)	Water Surface Elevation (WSE)	Channel Velocity (V)	WEIR FLOW RIGHT BANK (Q_{WEIR})	WEIR FLOW RETURNING
(--)	(ft^3/sec)	(feet)	(ft/sec)	(ft^3/sec)	(--)
1000	171	2769.41	5.0		
810	171	2763.97	5.6		
640	171	2759.50	2.7		
550	171	2757.19	4.1		
460	171	2756.27	1.8		
385	171	2756.11	2.7		
325	171	2753.58	5.6		
289	171	2753.31	5.1		
160	159.0	2753.18	2.5	12.1	N/A
135	156.2	2752.78	5.2	2.8	N/A
82	156.2	2750.65	7.2		

FIGURE 3
EXISTING CONDITION HYDROLOGY

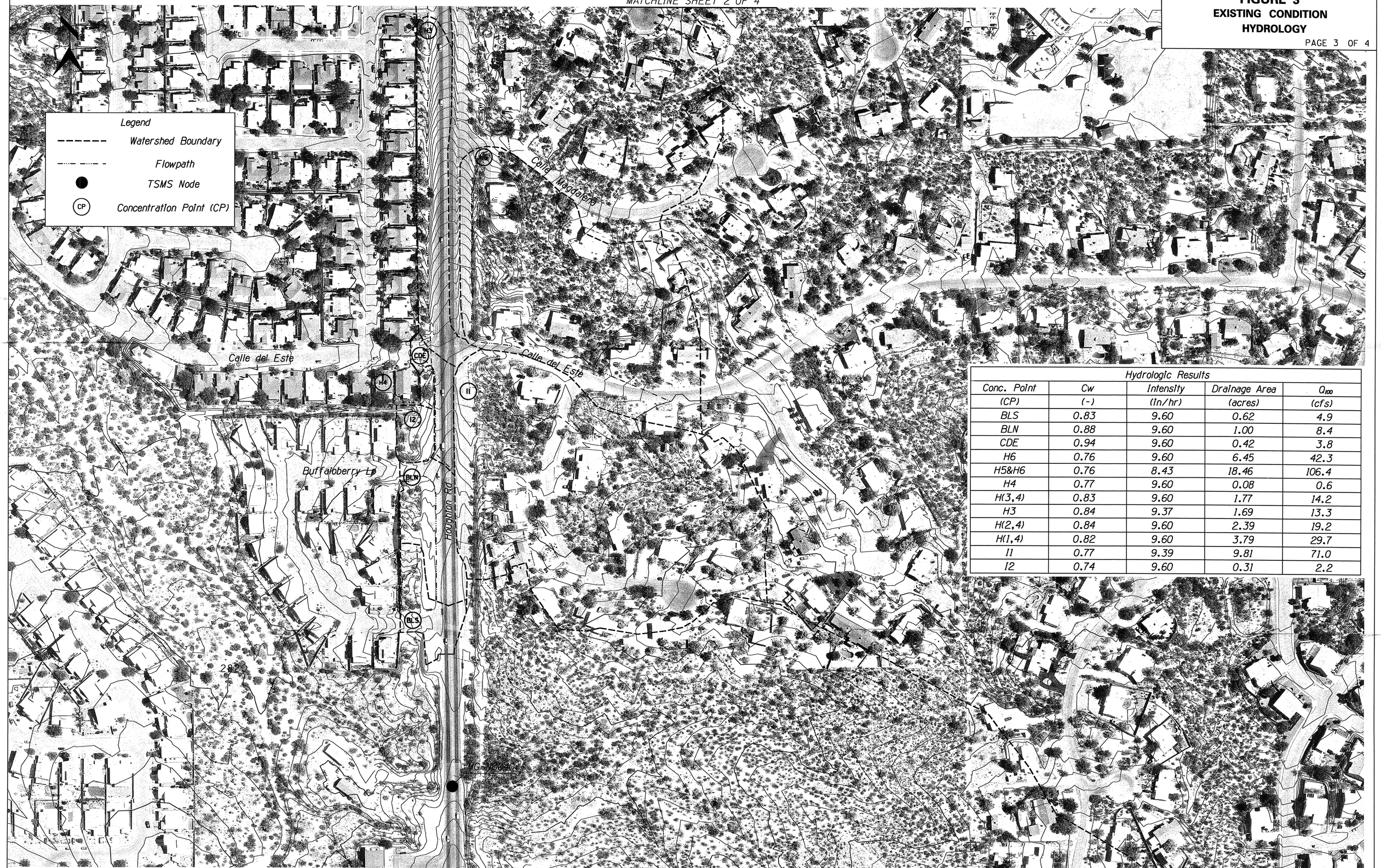


Hydrologic Results				
Conc. Point	Cw	Intensity	Drainage Area	Q_{100}
(CP)	(-)	(In/hr)	(acres)	(cfs)
D1	0.89	9.55	2.64	22.4
D2	0.85	8.79	2.26	16.8
DS2	0.75	9.60	0.48	3.4
DS1	0.88	9.18	2.82	22.9
E1-L	0.90	9.60	1.22	10.6
E1&2	0.82	8.23	30.12	171.4
E2	0.81	8.30	26.59	148.2
E2+	0.82	8.31	28.90	165.3
E3	0.81	9.60	1.49	11.5
F	0.82	9.60	0.66	5.2
G	0.74	9.60	0.23	1.6
GS1	0.74	9.60	0.86	6.1
GE1	0.79	9.24	16.39	110.6
GE2	0.79	9.44	16.31	112.5
H&B	0.89	9.43	1.31	11.0

FIGURE 3
EXISTING CONDITION HYDROLOGY

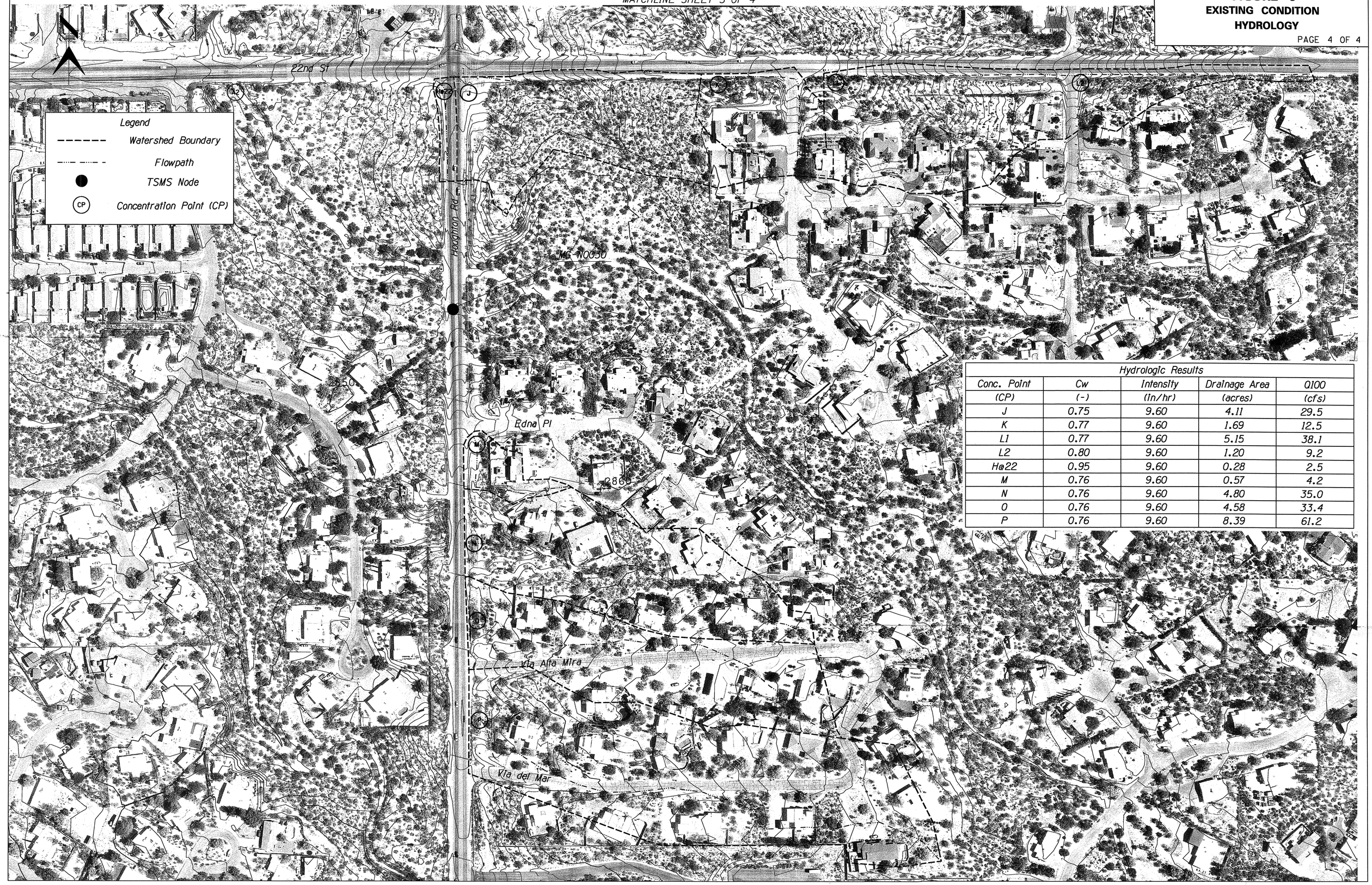
Hydrologic Results				
Conc. Point	Cw	Intensity	Drainage Area	Q_{100}
(CP)	(-)	(in/hr)	(acres)	(cfs)
FMD	0.83	9.45	1.15	9.0
SHD	0.83	9.60	0.30	2.4
GS2	0.74	9.60	0.48	3.4
GE3	0.91	9.60	1.45	11.3
GE4	0.76	9.39	12.71	83.5
H5	0.76	8.42	12.01	76.8
H5&H6	0.76	8.43	18.46	106.4
H(2,4)	0.84	9.60	2.39	19.2
H2	0.84	9.60	0.62	5.0
H(1,4)	0.82	9.60	3.79	29.7
H1	0.78	9.60	1.40	10.5

FIGURE 3
EXISTING CONDITION HYDROLOGY



Hydrologic Results				
Conc. Point	Cw	Intensity	Drainage Area	Q_{100}
(CP)	(-)	(In/hr)	(acres)	(cfs)
BLS	0.83	9.60	0.62	4.9
BLN	0.88	9.60	1.00	8.4
CDE	0.94	9.60	0.42	3.8
H6	0.76	9.60	6.45	42.3
H5&H6	0.76	8.43	18.46	106.4
H4	0.77	9.60	0.08	0.6
H(3,4)	0.83	9.60	1.77	14.2
H3	0.84	9.37	1.69	13.3
H(2,4)	0.84	9.60	2.39	19.2
H(1,4)	0.82	9.60	3.79	29.7
I1	0.77	9.39	9.81	71.0
I2	0.74	9.60	0.31	2.2

FIGURE 3
EXISTING CONDITION HYDROLOGY



Hydrologic Results				
Conc. Point	Cw	Intensity	Drainage Area	Q100
(CP)	(-)	(In/hr)	(acres)	(cfs)
J	0.75	9.60	4.11	29.5
K	0.77	9.60	1.69	12.5
L1	0.77	9.60	5.15	38.1
L2	0.80	9.60	1.20	9.2
Ha22	0.95	9.60	0.28	2.5
M	0.76	9.60	0.57	4.2
N	0.76	9.60	4.80	35.0
O	0.76	9.60	4.58	33.4
P	0.76	9.60	8.39	61.2

FIGURE 4

HOUGHTON ROAD
CORONADO RIDGE WASH
EXISTING CONDITIONS

Bashas' Shopping Center

The Bashas' shopping center is located on the southwestern corner of Houghton Road and Broadway Boulevard. The general drainage pattern includes runoff from the southeast suburban residences east of Houghton Road and minor local drainages along the west side of Houghton Road in addition to the local runoff from the shopping center. Both the south and east drainages direct runoff towards the Bashas' stormdrain entrance located at CP-G. CP-G is located along the west parkway of Houghton Road just north of the middle driveway to the Bashas' parking lot. Stormdrain pipes, culverts, and open channels convey runoff emanating from the southeast under Houghton Road to the inlet of the commercial development's stormdrain facility.

The current (existing) configuration of drainage structures are linked hydraulically to one another. As a result, the system was evaluated as a whole to determine the existing drainage patterns. Concentration Points G, GS1 and GE1 were evaluated using rating curves and culvert/weir hydraulics. Rating curves were computed for each structure using the headwater from the downstream structure as the tail water rating curve for the next upstream structure. Since the downstream most structure (CP-G) is the entrance to the storm drain system, it was imperative that a review of the existing design calculations be conducted to determine the hydraulic nature of the stormdrain. Review of the drainage report addendum(s) for this commercial development show that the inlet pipe was designed for a total of 80-ft^3/sec and that the pipe is under inlet control, Reference 4. Therefore, this pipe was evaluated for inlet control to generate a rating table to be used as the tail water condition for the next upstream structure.

Water surface elevations and flow distributions were determined using the rating curves. Once the headwater elevation was established for CP GE1, a HECRAS model was generated to determine the remaining upstream floodplain and flow profile. Figure 5 shows the results of the hydraulic analysis for this area and Table 3 below provides the results of the HECRAS analysis for CP GE1 through CP GE4. All calculations are available in Appendix B-2.

TABLE 3 (CP GE4 – CP GE1 HECRAS)

River Station (RS)	Flow Rate (Q)	Water Surface Elevation (WSE)	Channel Velocity (V)
(--)	(ft^3/sec)	(feet)	(ft/sec)
1695	84	2773.06	4.9
1635	84	2771.31	4.7
1500	84	2767.90	4.6
1400	84	2766.61	1.6
1345	84	2766.56	1.6
1275	113	2763.21	6.8
1200	113	2762.49	1.2
1142	113	2762.28	3.0
1077	113	2761.93	1.6
1048	113	2761.89	1.9

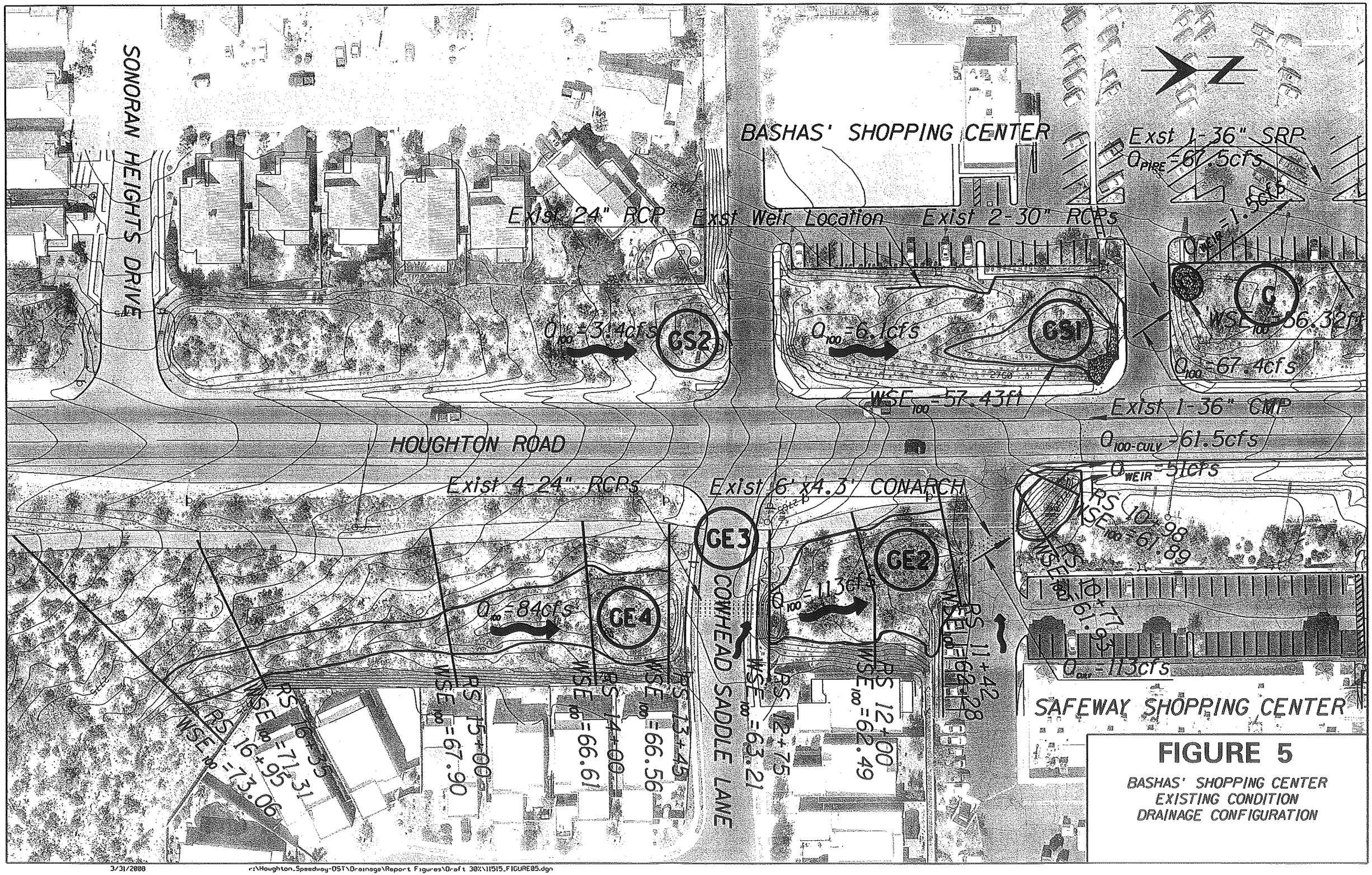


FIGURE 5

BASHAS' SHOPPING CENTER
EXISTING CONDITION
DRAINAGE CONFIGURATION

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Kensington Wash - CP H

CP H is the region draining to the wash along the south side of Kensington Drive. This wash will be designated as Kensington Wash from this point forward. This area was split into two separate analyses because the tributaries to the main wash have computed discharge rates and the main wash is a TSMS node.

Tributary watersheds south of the wash on both the east side and west side of Houghton Road ultimately drain to Kensington Wash. The drainages along the west side of Houghton Road typically have minor flow rates; whereas, the ones along the east side exceeds 100-ft^3/sec. The east side drainages (CP H5 & H6) appear to be directed to the upstream side of Houghton road and enter the wash east of Houghton Road. Also approximately 500-ft south of the wash there is an existing 30" CMP that directs a portion of the runoff to the existing channel along the west side of Houghton Road.

Preliminary investigation shows that the 30" culvert and swale along the east side of Houghton Road cannot contain the total 100-year flow rate. As a result, HECRAS was used to create a split flow model to determine the configuration of the drainage patterns along the east side of Houghton Road. As shown on Figure 6, significant amount of flow breaks out across Houghton Road from the east swale with only a fraction of the original flow rate reaching the wash on the east side of Houghton Road. Table 4A provides the results from the HECRAS split flow analysis. Please note that the table only includes cross sections that are subject to flow rates exceeding 100-ft^3/sec. Additional results are included with the calculations located in Appendix B-3.

TABLE 4A (CP H5 & H6 Existing Condition)

River Station (RS)	Flow Rate (Q)	Water Surface Elevation (WSE)	Channel Velocity (V)	WEIR FLOW LEFT BANK (Q_{WEIR})	CULVERT FLOW
(--)	(ft^3/sec)	(feet)	(ft/sec)	(ft^3/sec)	(ft^3/sec)
18250	106	2797.24	3.9		
18200	106	2796.23	4.1		
18150	106	2794.81	4.3		
18100	106	2793.59	3.8		
18050	106	2792.88	2.8		
18000	106	2792.70	2.3		
17950	79.6	2792.47	2.3	0.0	26.4
17900	70.2	2792.20	1.7	9.4	
17850	52.2	2791.84	4.3	18.2	
17800	39.9	2791.28	3.9	12.3	
17750	33.6	2790.69	3.5	6.4	
17700	24.7	2789.72	2.6	8.9	
17650	24.7	2788.60	2.8		
17600	24.7	2787.20	3.0		

The main wash (Kensington Wash) is a TSMS node (MG-N0080) with a 100-Year flow rate of 465-ft3/sec. The wash begins east of Houghton Road and crosses the roadway through three existing 42" CMPs. Downstream of the existing culvert, the wash crosses Kensington Drive to the northwest through an existing box culvert. A separate analysis was conducted for this main wash to establish the existing flow profile and flood limits. To establish the existing condition for this wash, it was necessary to establish a starting condition. Since the size and invert elevations of the culvert under Kensington Drive are unknown at this time, it was decided to start the modeling with a conservative approach by using the water surface elevation based on the weir flow elevation over Kensington Drive. The outlet invert of the existing Houghton Road culvert is higher than the low point in Kensington Drive; therefore, the starting condition should have minimal impact on the water surface profile upstream of Kensington Drive.

HECRAS was used to compute the water surface elevations through the Kensington Wash. Results from the 100-Year flow rate of 465-ft^3/sec show that only 142-ft^3/sec is conveyed through the existing 3-42" CMP's with the remaining 323-ft^3/sec overtopping Houghton Road. Figure 6 provides an aerial view of the flood limits and water surface elevations. Table 4B provides results from the hydraulic analysis. Calculations are included as Appendix B-3.

TABLE 4B (TSMS Node MG-N0080, Kensington Wash Existing Condition)

River Station (RS)	Flow Rate (Q)	Water Surface Elevation (WSE)	Channel Velocity (V)
(--)	(ft^3/sec)	(feet)	(ft/sec)
1440	465	2792.87	3.0
1290	465	2790.46	3.5
1165	465	2788.47	2.8
1131	465	2787.45	4.7
1075	465	2786.52	2.5
1030	465	2786.58	0.9
945	465	2784.44	9.5
865	465	2780.06	1.2
745	465	2780.06	0.6
640	465	2780.06	0.0

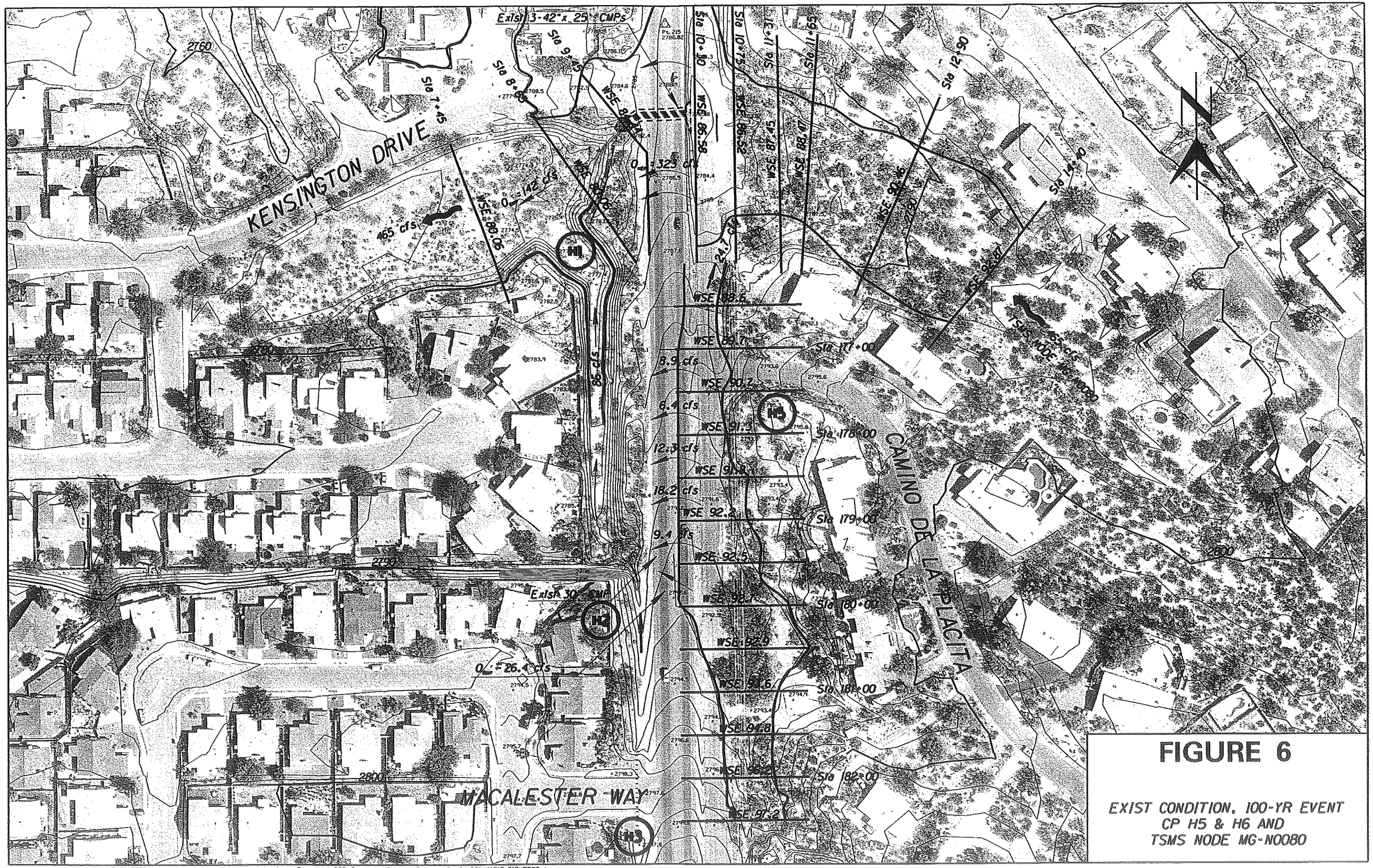

FIGURE 6

EXIST CONDITION, 100-YR EVENT
CP H5 & H6 AND
TSMS NODE MG-N0080

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Concentration Point I

CP-I is located along the east side of Houghton Road just south of Calle Del Este. There are currently 2-45"x29" horizontal elliptical pipes with a concrete drop inlet at this location. The existing conditions analysis shows that the entire 100-year event (71-ft^3/sec) is conveyed under the roadway at a headwater elevation of 2826.73-ft. The approach to analyze this structure includes hydraulic grade line computation, culvert hydraulics and submerged weir calculation. It was determined that the grade differential within the manholes was sufficient to result in the upstream pipes unsealing. Therefore, the headwater was computed using culvert hydraulics. The resulting headwater elevation was determined to be above the weir elevation necessitating a submerged weir calculation to obtain the resulting water surface elevation. Figure 7 shows the results of the existing condition hydraulic analyses including the ponding limits for the inlet. Calculations are included in Appendix B-4.

TSMS Node MG-N0040

TSMS Node MG-N0040 is located just north of the 22nd street and Houghton Road intersection. Currently, there is a depression on the east side of the roadway where runoff ponds to a depth of approximately 3 feet. Once the water surface rises to the roadway elevation, it will break out to the west across Houghton Road. HECRAS was used to model the existing condition with Houghton Road being represented by an inline weir. The 100-Yr. flow rate of 243-ft^3/sec was modeled to determine the backwater effect of the roadway. Results show that a water surface elevation of 2835.58-feet at the road crossing will be reached to pass the 100-Year event. Figure 8 provides an overview of the existing drainage configuration and floodplain delineation for this location. Table 5 shows the results from the HECRAS model. Calculations are included in Appendix B-5.

TABLE 5 (TSMS Node MG-N0040 Existing Condition)

River Station (RS)	Flow Rate (Q)	Water Surface Elevation (WSE)	Channel Velocity (V)
(--)	(ft^3/sec)	(feet)	(ft/sec)
1250	243	2835.59	2.5
1150	243	2835.59	0.7
1050	243	2835.58	0.6
950	243	2830.25	3.7
790	243	2825.87	3.4

FIGURE 7

CP I
EXISTING CONDITION
HYDRAULIC ANALYSIS

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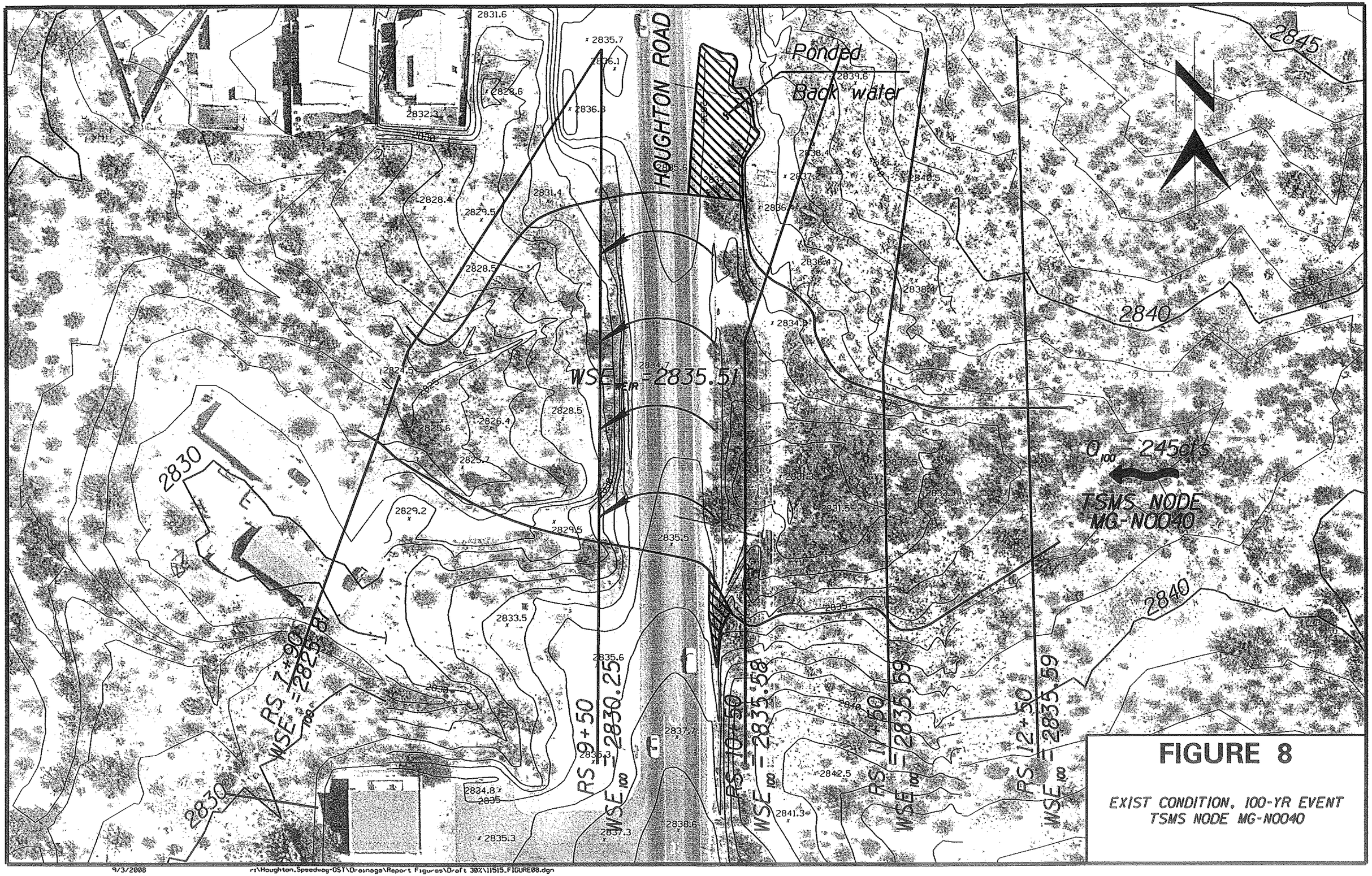

FIGURE 8

EXIST CONDITION, 100-YR EVENT
TSMS NODE MG-N0040

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Este Wash

Este Wash is located just south of 22nd Street and is the only FEMA regulated wash within the project limits. The 100-Year FEMA regulatory flow rate is 1974-ft^3/sec. The City of Tucson requested that in addition to the FEMA analysis; that the future condition 100-Year TSMS flow rates be used to determine if construction cost savings would be enough to justify the use of the reduced flow rate. The future condition 100-Year TSMS flow rate is 1208-ft^3/sec. Please note that the FEMA flow rate and the TSMS flow rate do not occur in the same location. The FEMA flow rate as described in the FIS is the total flow rate at Broadway Blvd; whereas, the TSMS flow rate is located at Houghton Road.

For the purpose of this report, both the FEMA and TSMS analyses are provided for cost comparison purposes. In order to evaluate the proposed condition designs it is necessary to establish the existing conditions for both scenarios.

FEMA Analysis –

The Este Wash has a regulatory Flood Emergency Management Agency (FEMA) 100-year Floodplain for the reach of the wash that extends from the confluence with Tanque Verde Wash upstream to the Houghton Road dip crossing. The FEMA floodplain was delineated during the FEMA Flood Insurance Study (FIS) that was published in 1999. The hydraulic analysis of the Este Wash in the FIS was performed with the HEC-2 hydraulic computer program, and 200 scale 2-foot contour interval aerial topographic mapping flown in 1983 was used for the cross-section geometry. The HEC-2 data input file from the FEMA FIS was provided to PB by the City of Tucson Floodplain Department.

For this Houghton Road project, an existing conditions HEC-RAS model was created using new topography that has cross-sections at the same locations and alignments as the regulatory FEMA model. The new topography consists of the 1 foot contour interval aerial photo topographic mapping that was flow in 2007 for the Houghton Road project where the contours are available (200 feet along either side of the Houghton Road construction centerline, and 150-feet along either side of the 22nd Street construction centerline). The remaining new topography consists of the 2-foot contour interval PAG topo from a 1999 flight, superimposed onto the Houghton Road project 2007 aerial photo.

The contours used in the FEMA FIS were based on the NGVD 29 vertical datum. The vertical datum used for the Houghton Road project contours is NAVD 89, which is 2.23 feet higher than the NGVD 29 datum at this location. To compare the regulatory FEMA HEC-2 model with the new existing conditions HEC-RAS model, the elevations in the cross-section data points in the regulatory FEMA HEC-2 model were raised by 2.23 feet. Comparison of the 100-year WSE's from the regulatory HEC-2 model adjusted to the NAVD 89 datum, with the new existing conditions HEC-RAS model is presented in Table 6A. The regulatory FEMA 100-year discharge in the reach of Este Wash that includes the crossings at Houghton Road and at 22nd Street is 1,974-ft^3/sec.

The model results show that the 100-year discharge in the wash is flowing at critical or supercritical depth along the entire reach modeled. The new existing conditions HEC-RAS model begins at the FEMA designated cross-section AJ which is located 2,200 feet downstream of 22nd Street. The new existing conditions model results are close to the regulatory model results (less than about ½ foot difference in the channel inverts and WSEs) for the reach from Houghton Road to 22nd Street. Downstream of 22nd Street the channel inverts and 100-year WSEs in the new existing condition model are noticeably lower that the regulatory model (from 1 to 3 feet lower). This is most likely the result of higher flow velocities and channel down cutting that was caused by the new subdivision that was built along the east side of the wash after the FEMA FIS was performed. The block wall along

the east side of this subdivision restricts the allowable floodplain flow width, causing the higher flow velocities. HECRAS models, calculations and copies of the original FIS work maps for this area are included in Appendix B-6. Figure 9 provides an aerial view of the existing FEMA flow rate analysis.

TSMS Analysis –

The existing conditions HEC-RAS model was updated with the TSMS flow rate, and the proposed conditions HEC-RAS model was updated with the TSMS flow rate and the new proposed culverts. Comparison of the existing conditions model results using the TSMS flow rate with the existing conditions model results using the FEMA discharge showed that the WSEs averaged about 0.5 feet lower, and the floodplain width averaged about 20 feet narrower with the lower TSMS flow rate. Results are provided in Table 6B.

TABLE 6a (Este Wash Existing Condition, *FEMA Q*)

River Station (RS)	Flow Rate (Q)	Water Surface Elevation (WSE)	Channel Velocity (V)
(--)	(ft^3/sec)	(feet)	(ft/sec)
0	1974	2794.96	9.96
425	1974	2801.90	8.72
815	1974	2809.02	8.71
1175	1974	2814.90	7.12
1465	1974	2819.76	7.97
1865	1974	2825.51	9.90
2000	1974	2827.73	10.12
2146	1974	2830.01	9.69
2180	1974	2830.81	8.53
2220	1974	2831.25	5.77
2295	1974	2833.72	11.43
2340	1974	2834.26	10.04
2495	1974	2835.69	8.90
2795	1974	2839.58	8.48
2975	1974	2843.08	10.08
3050	1974	2844.32	7.06
3125	1974	2845.49	7.89
3160	1974	2846.40	10.44
3230	1974	2847.79	6.22
3350	1974	2849.00	5.53
3490	1974	2850.72	6.91
3640	1974	2852.64	8.63
3810	1974	2855.60	8.67
4085	1974	2859.33	10.19

TABLE 6b (Este Wash Existing Condition, *TSMS Q*)

River Station (RS)	Flow Rate (Q)	Water Surface Elevation (WSE)	Channel Velocity (V)
(--)	(ft^3/sec)	(feet)	(ft/sec)
0	1256	2794.59	8.40
425	1256	2801.54	7.34
815	1256	2808.67	7.51
1175	1256	2814.55	6.13
1465	1256	2819.21	6.95
1865	1208	2824.55	8.96
2000	1208	2826.89	8.92
2146	1208	2829.51	8.20
2180	1208	2829.98	8.43
2220	1208	2830.66	5.75
2295	1208	2833.05	9.69
2340	1208	2833.58	8.36
2495	1208	2835.11	7.69
2795	1208	2839.00	7.30
2975	1208	2842.31	9.31
3050	1208	2843.88	6.15
3125	1208	2845.05	6.74
3160	1208	2845.85	8.77
3230	1208	2847.12	5.82
3350	1208	2848.59	4.17
3490	1208	2850.38	5.87
3640	1208	2852.24	7.32
3810	1208	2855.16	7.26
4085	1208	2858.91	8.56

FIGURE 9

ESTE WASH
EXISTING CONDITIONS
100-YEAR FLOODPLAIN (FEMA Q)

Concentration Points N, O & P

These final three mid-sized concentration points are located south of the Este Wash crossing. Runoff generated from each watershed pools along the east side of Houghton Road until the elevation increases to allow the flow to break over the roadway or the watershed divides. Hydraulic analyses show that each of the three CPs act similarly. Irregular weir analyses were used to compute the pond depth and flow diversion at each concentration point. Rating tables were generated for each potential weir. The individual tables were combined to create a total rating table for each concentration point. Results are provided on Figure 10 and computations are included in Appendix B-7.

Results show that at CP-P, the 100-Year flow rate of 61.2-ft^3/sec reaches Houghton Road and that the runoff ponds to an elevation of 2854.46-ft producing 59.3-ft^3/sec weir flow across Houghton Road and 1.9-ft^3/sec north to CP-O. The break-out flow from CP-P is added to CP-O's peak flow rate of 33.4-ft^3/sec resulting in a total flow rate of 35.3-ft^3/sec. Here, the water ponds to an elevation of 2854.16-ft resulting in 23.7-ft^3/sec overtopping Houghton Road and 11.6-ft^3/sec breaking north to CP-N. The peak runoff rate at CP-N of 35-ft^3/sec is combined with the break-out flow from CP-O resulting in 46.6-ft^3/sec. The combined flow rate ponds to an elevation of 2852.86 which resulting in 39.6-ft^3/sec overtopping Houghton Road and 7-ft^3/sec breaking to the north.

No further analyses were conducted north of CP-N due to the small watershed area and proximity to Este Wash.

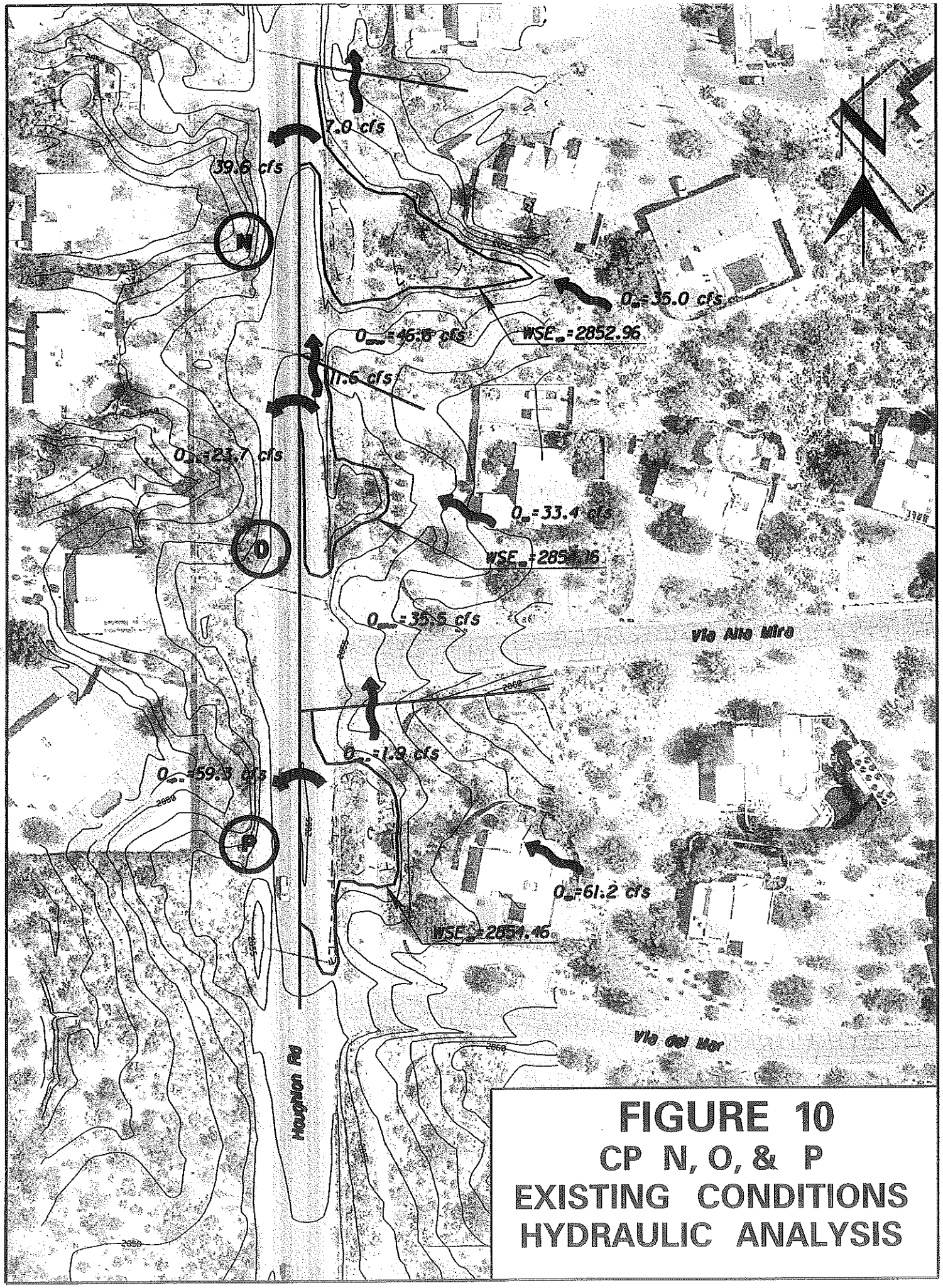


FIGURE 10
CP N, O, & P
EXISTING CONDITIONS
HYDRAULIC ANALYSIS

3.3 Proposed Conditions

At this point in the project, the conceptual roadway layout has been established and includes six lanes, 3 in each direction, with a sidewalk along the west side and a multi-use path along the east side of the roadway. The footprint of the conceptual roadway will require drainage improvements to accommodate the drainage impacting Houghton Road. Roadway improvements will extend east and west of Houghton Road for both 22nd Street and Broadway Blvd.

A few of the proposed cross drainage facilities created backwater increases which exceed the allowable 0.1-foot increase. These can typically result from ineffective flow areas used in hydraulic models to identify the contraction into and expansion out of culverts. The ineffective flow areas "squeeze" the flow into a narrower cross section resulting in an increase in water surface. Two possible solutions are available to mitigate the increase in water surface elevation; one is to grade to a point where the 0.1-foot increase is met and the other is to use a drainage easement to surround the area of increase. It was PB's approach to minimize the impacts to the existing washes, so drainage easements were chosen to surround the water surface increases. During the design segment(s) for this project, grading will be further investigated to determine the overall impact to the washes where current increases have been identified.

The following descriptions show the planned drainage improvements for this project. It should be noted that once under design there will be a stormdrain system located within the new roadway. This "on-site" drainage will be addressed under the design portions of the project and not within this document. This section of the report addresses conceptual design at a 30% level for the major cross drainage facilities. Specifics for each location grouping follow below.

Coronado Ridge Wash/Safeway Shopping Center

As described in the existing conditions section of this report, Coronado Wash is divided into multiple segments for analysis. The main reach from Houghton Road to Broadway Blvd. includes two improvements. The first improvement is at Houghton Road and replaces the existing at grade crossing with a 3-8'x4' RCBC with a sloped inlet and downstream grading. The second improvement is at the culvert under Broadway Blvd., which will be extended both in the upstream and downstream direction. To better align the culvert with the channel, angle points are suggested for both extensions. Also, to adjust to the lower channel elevation on the downstream side of the box, the downstream extension will be made with a taller box culvert. This approach will require structural design of a retaining wall segment below the existing culvert outlet. A HECRAS model was created to model the proposed drainage facilities for this reach.

The existing conditions HECRAS model was updated with the new geometry of the culverts and grading. It should be noted that the City of Tucson has requested that the proposed culvert at the Houghton Road crossing be sized to accept the entire 100-Year event. As a result the culvert was initially designed to pass the entire 950-ft^3/sec. This approach will allow for future improvements that may reduce or eliminate the current break out at this location. The modeling of this channel still accounts for the breakout that was determined from the existing condition analysis. Similar to the existing condition analysis, lateral weirs to define the top of bank/over-bank were used to model the breakout to the north. Under proposed conditions the break-out to the north is reduced by 21.2ft^3/sec to a total of 208.8-ft^3/sec. This is greater than a 5% decrease in break-out flow rate and results in a 3% increase in flow rate downstream of Houghton Road. It should also be noted that the

development downstream of Houghton Road, Marquette Place, was designed to convey the entire TSMS flowrate at this point. The modeling approach for the left over-bank changed from evaluating for break-out to allow flow to be conveyed along the new roadway embankment and enter the proposed box culvert. The roadway configuration creates a berm effect such that water will flow against the embankment to the proposed culvert. Table 7A, below, provides results from the proposed conditions analysis and compares the proposed water surface elevations to those determined in the existing conditions analysis. The objective of this analysis was to determine an adequate size of culvert to replace the existing at grade crossing for Houghton Road. For those water surface elevation increases exceeding the allowable 0.1-foot increase, a drainage easement was used to encompass the area of increase. The water surface elevation for the proposed condition at River Station 11+45 has increased by 0.42'. This increase resulted from modification to this cross section. The cross section was reduced in order to model the breakout along the North top of bank. Under existing condition, flow that would breakout from this cross section was conveyed across Houghton Road; where as under proposed condition, breakout flow will be directed north along the Houghton Road embankment and eventually combine with the upstream breakout flow.

The upstream culvert at Broadway Blvd. was modeled using Culvert Master. This approach is necessary to account for the additional head loss resulting from the angle points in the extended portions of the culvert. The resulting headwater elevation is 2755.44 and is the starting condition for the tributary analyses. The inlet of the Broadway Blvd. culvert will be reconstructed as an open junction structure with the proposed culvert to the east and the CONARCH from under the shopping center both out-letting into the structure.

It should be mentioned that PB has evaluated two alternatives for the Broadway Blvd box culvert. Removing the existing culvert and realigning a proposed culvert was preliminary investigated. The second option was to extend the existing culvert and connect the other structures using an open Junction Structure. The first alternative was eliminated early due to two main reasons: 1) Cost and 2) Connection to existing structures. PB did not perform a full cost comparison but by judgment evaluated the increased concrete for an entirely new culvert and enclosed Junction Structure. In addition, the difficulties with connecting the large CONARCH culvert to an enclosed Junction Structure would be complex and costly. In addition, the proposed culvert paralleling Broadway Blvd would connect to the closed system potentially over loading the newest cell of the cross culvert. Even though aesthetics would benefit with a closed system, it was PB's position that the cost would exceed the benefit. No cost was associated with the aesthetics, however, it was a consideration. As a result this option was eliminated and the second option chosen as shown on the plans and described in this report.

The east tributary channel paralleling Broadway Blvd. will be significantly covered by the new roadway embankment due to the increase width of the roadway. As a result, a new 10'x4' RCBC is proposed to replace the channel and existing CONARCH culverts. It is anticipated that a small swale with area inlets will be required above the box culvert to capture flow from the shopping center. Preliminary computations show that the flow rate from the shopping center will be conveyed less than a foot deep in a trapezoidal cross section with 3:1 and 4:1 side slopes and a 4-foot bottom width. One or two catch basins will be sufficient to capture this flow and direct it to the new box culvert.

A broken-back culvert hydraulic analysis was used to evaluate the new headwater elevation at the inlet of the culvert. This headwater elevation was used as the starting condition of the HECRAS model used to determine the upstream backwater effect due to the culvert. Table

7B shows the results from the HECRAS hydraulic analysis and a comparison of the existing and proposed conditions results.

The west tributary was not addressed for this proposed conditions analysis. The roadway footprint virtually eliminates the roadside channel on the southeast corner of Houghton Road and Broadway Blvd. As a result any flows entering the right-of-way will be addressed under the design portion of this project as onsite flows. These flows will be incorporated in to the stormdrain design. Apparatuses required for the detention basin at the gas station will also be addressed under the design portion of the project.

Calculations supporting the analyses described above are located in Appendix C-1. Figure 11 provides an overview of the results and proposed drainage facilities for this region.

TABLE 7A (Coronado Ridge Wash Proposed Condition – Main Channel)

	Existing Condition			Proposed Condition				Existing	Proposed
River Station (RS)	Flow Rate (Q)	Water Surface Elevation (WSE)	Channel Velocity (V)	Flow Rate (Q)	Water Surface Elevation (WSE)	Channel Velocity (V)	WSE CHANGE	WEIR FLOW RIGHT BANK (Q_{WEIR})	WEIR FLOW RIGHT BANK (Q_{WEIR})
(--)	(ft^3/sec)	(feet)	(ft/sec)		(feet)	(ft/sec)	(ft)	(ft^3/sec)	(ft^3/sec)
2250	950	2749.18	8.2	950	N/A	8.2	N/A		
2245	950	2748.77	6.1	950	N/A	6.1	N/A		
2155	950	2746.92	8.6	950	2746.92	8.7	--		
2080	950	2746.28	8.1	950	2746.30	8.0	0.02		
2000	950	2745.64	7.8	950	2745.62	7.9	-0.02		
1890	950	2742.87	4.2	950	2742.90	7.1	0.03		
1750	950	2739.45	7.5	950	2739.45	7.5	--		
1610	950	2736.60	8.2	950	2736.60	8.2	--		
1480	950	2733.35	7.3	950	2733.35	7.3	--		
1358	908.6	2730.85	7.0	950	2730.87	7.0	0.02		0
1248	823.5	2728.41	6.9	950	2728.52	6.9	0.11	107.3	0
1146	566.1	2725.58	6.5	752.5	2726.00	7.6	0.42	122.7	197.7
1115		*2724.74	--	741.4	2723.14	4.6	*-1.6		11.1
1050	723.6	2722.98	7.1	741.4	N/A	N/A	N/A		
940	723.6	2720.07	7.9	741.4	N/A	N/A	N/A		
898		*2719.05		741.4	2718.35	9.0	*-0.70		
830	723.6	2717.40	7.3	741.4	2717.23	7.7	-0.17		
772		*2716.16	--	741.4	2716.47	7.2	0.31		
700	723.6	2714.61	6.9	741.4	2714.63	7.0	0.02		
600	723.6	2712.18	6.9	741.4	2712.22	6.9	0.04		

** Denotes Interpolated Values*

TABLE 7B (Coronado Ridge Wash Proposed Condition – East Tributary)

	Existing Condition			Proposed Condition			
River Station (RS)	Flow Rate (Q)	Water Surface Elevation (WSE)	Channel Velocity (V)	Flow Rate (Q)	Water Surface Elevation (WSE)	Channel Velocity (V)	WSE CHANGE
(--)	(ft^3/sec)	(feet)	(feet/sec)	(ft^3/sec)	(feet)	(feet/sec)	(ft)
1000	171	2769.41	5.0	171	2769.41	5.0	--
810	171	2763.97	5.6	171	2763.97	5.6	--
640	171	2759.50	2.7	171	2759.49	2.7	-0.01
550	171	2757.19	4.1	171	2757.21	4.0	0.02
460	171	2756.27	1.8	171	2756.22	3.0	-0.05
400	171	*2756.14	--	171	2755.44	6.3	-0.70
385	171	2756.11	2.7	171	N/A	N/A	N/A
325	171	2753.58	5.6	171	N/A	N/A	N/A
289	171	2753.31	5.1	171	N/A	N/A	N/A

** Denotes Interpolated Values*

XS	RS	WSE_{100}
A	4+18	56.21
B	4+04	56.05
C	4+11	55.44

FIGURE 11
HOUGHTON ROAD
CORONADO RIDGE WASH
PROPOSED CONDITIONS

Bashas' Shopping Center

The conceptual roadway footprint will require modifications to the existing drainage structures while maintaining the existing drainage patterns. Modifications will include extending the 4-24" RCPs and reconstructing the existing spillway/scupper at Cowhead Saddle Lane (CP GE-3), replacing the existing CONARCH culvert at CP-GE2 with a new 6'x4' box culvert and replacing the system of pipe culverts with a new storm sewer system from CP-GE1 to CP-G. A 42" RCP is initially proposed to parallel northbound Houghton Road on the east and a new 36" RCP is proposed to cross Houghton road. Both pipes will originate from a junction structure at the outlet of the new 6'x4' CBC. The new 36" RCP will ultimately connect to the existing 36" Bashas' stormdrain. Provisions will be made for area inlets to capture flow from the west side of Houghton Road. Only the junction structure portion and exit pipes are addressed at this time. The remaining stormdrain design and analysis will be addressed during the design stage of the project.

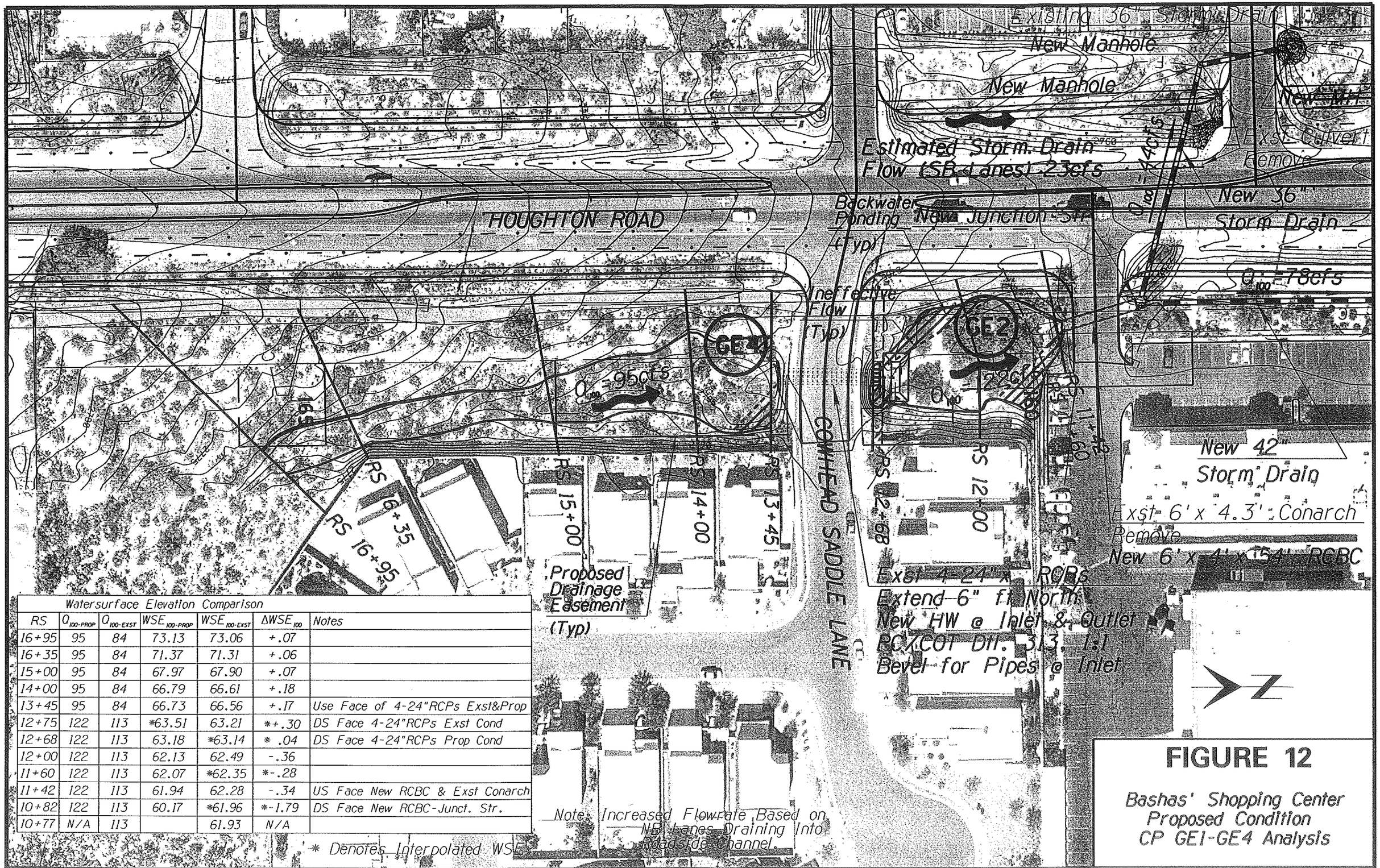
It was assumed that the northbound lanes pavement drainage system would outlet to the roadside channel along the east side of Houghton Road. As a result, there is a slight increase in discharge in the channel. Due to the increased flow rate and the necessity to maintain the existing drainage patterns, a junction structure is proposed at CP-GE1 to provide a flow diversion. In addition, it is anticipated that the south bound lanes pavement drainage stormdrain system will ultimately outlet into the Bashas' stormdrain system. As a result, the additional flow generated from the increased pavement will have to be directed elsewhere in order to maintain the maximum flow rate entering the Bashas' stormdrain system as determined in the existing conditions analysis. Calculations for the storm drain system and diversion are included in Appendix C.

Manning's Equation was used to preliminarily size the 36" and 42" stormdrain pipes based on normal depth flow using an approximate pipe slope. The flow diversion was evaluated based on inlet control to provide the corresponding flow diversion. Inlet headwater at the diversion was used as the starting condition for the hydraulic analysis for the upstream portion of the roadside channel. HECRAS was used to model backwater effects from the flow diversion through the box culvert and 4-24" RCPs to the beginning of the analysis. The maximum increase in WSE is 0.30', which remains approximately 5' below adjacent residential pads. Since there is a slight increase in flow rate within the roadside channel, it is expected that the water surface elevations will increase. As a result a drainage easement is proposed to envelop the area of increased water surface elevation. Table 8 provides a comparison of proposed water surfaces to those found during the existing condition analysis. Figure 12 provides an overview of the conceptual drainage improvements. Appendix C-2 contains the calculations for the proposed condition analysis.

TABLE 8 (Bashas CP GE1 to CP GE4 Proposed Condition)

	Existing Condition			Proposed Condition			
River Station (RS)	100-Yr. Flow Rate (Q)	Water Surface Elevation (WSE)	Channel Velocity (V)	100-Yr. Flow Rate (Q)	Water Surface Elevation (WSE)	Channel Velocity (V)	WSE CHANGE
(--)	(ft^3/sec)	(feet)	(ft/sec)	(ft^3/sec)	(feet)	(ft/sec)	(ft)
1695	84	2773.06	4.9	95	2773.13	5.0	0.07
1635	84	2771.31	4.7	95	2771.37	4.9	0.06
1500	84	2767.90	4.6	95	2767.97	4.7	0.07
1400	84	2766.61	1.6	95	2766.79	1.5	0.18
1345	84	2766.56	1.6	95	2766.73	1.7	0.17
1275	113	2763.21	6.8	122	*2763.51	--	*0.30
1267.9	113	*2763.14	--	122	2763.18	7.1	*0.04
1200	113	2762.49	1.2	122	2762.13	1.8	-0.36
1160	113	*2762.35	--	122	2762.07	1.6	*-0.28
1142	113	2762.28	3.0	122	2761.94	2.8	-0.34
1082	113	*2761.96	--	122	2760.17	3.3	*-1.79
1077	113	2761.93	1.6	N/A	N/A	--	N/A
1048	113	2761.89	1.9	N/A	N/A	--	N/A

** Denotes Interpolated Values*



Watersurface Elevation Comparison

RS	$Q_{100\text{-}PROP}$	$Q_{100\text{-}EXST}$	$WSE_{100\text{-}PROP}$	$WSE_{100\text{-}EXST}$	ΔWSE_{100}	Notes
16+95	95	84	73.13	73.06	+.07	
16+35	95	84	71.37	71.31	+.06	
15+00	95	84	67.97	67.90	+.07	
14+00	95	84	66.79	66.61	+.18	
13+45	95	84	66.73	66.56	+.17	Use Face of 4-24"RCPs Exst&Prop
12+75	122	113	*63.51	63.21	*+.30	DS Face 4-24"RCPs Exst Cond
12+68	122	113	63.18	*63.14	* .04	DS Face 4-24"RCPs Prop Cond
12+00	122	113	62.13	62.49	-.36	
11+60	122	113	62.07	*62.35	*-.28	
11+42	122	113	61.94	62.28	-.34	US Face New RCBC & Exst Conarch
10+82	122	113	60.17	*61.96	*-1.79	DS Face New RCBC-Junct. Str.
10+77	N/A	113		61.93	N/A	

* Denotes Interpolated WSE

FIGURE 12

Bashas' Shopping Center
Proposed Condition
CP GE1-GE4 Analysis

Kensington Wash - CP H

The proposed roadway warrants revising the existing drainage configuration to minimize flooding. The conceptual roadway prism covers the roadside swale along the east side of Houghton Road from Calle de la Placita to Calle Magdalena. Under existing conditions this swale was overwhelmed and flow would overtop Houghton Road. Since the new roadway will be higher in elevation and have a wider footprint, the flow could adversely affect the residences east of the swale. Due to the location of the right-of-way, a new drainage concept will capture the runoff and direct it to Kensington Wash.

Three area inlets are planned for this reach. The first is located just south of Calle Magdalena (CP-H6). Here a double grated inlet will have a grate elevation of 2805.00-feet. The catch basin will capture about ¾ of the total runoff, 30-ft^3/sec, reaching this point at an elevation of 2806.43-feet. This water surface elevation is higher than the adjacent roadway. As a result, the remaining 13-ft^3/sec will cross Calle Magdalena and continue north to CP H5b. CP-H5 was subdivided to calculate the runoff discharge rate for each area. At CP-H5b, the flow rate generated by the contributing area and the bypass flow from CP-H6 combine to create a total of 28-ft^3/sec. A 3-grate catch basin with a grate elevation of 2798.00, will capture the total flow reaching this point at a water surface ponding elevation of 2799.23-feet. The remaining contributing area of CP H5a generates 45-ft^3/sec. The third inlet, with 4 grates, is located south of Calle de la Placita. The grate elevation is 2791.40-feet and will capture the flow with no impact to the residences, with a ponding elevation of 2792.63-feet. Both inlets located in CP-H5 will have earthen berms on the downstream side of the inlet. These berms will allow water to pond to the elevation required without flooding the nearby residences. It should be noted that each of the inlets analyzed on this project have a 50% clogging factor applied to the open area and perimeter.

Each of the inlets will have stormdrain pipes that will convey the captured runoff to Kensington Wash. These pipes will be further evaluated under the design phase of the project. The stormdrain system connected to these pipes will convey the 100-Year event. Further investigation during the design phase will determine if a single stormdrain system or multiple systems will be necessary for this area. In either configuration, the system or systems will outlet at the Kensington Wash.

The Kensington Wash cross drainage structure requires upgrading as well. The existing conditions analysis showed that the current drainage structure does not have the capacity to convey the 100-Year event (465-ft^3/sec) under the roadway. As a result, the existing culvert needs to be upgraded in order to provide all weather access at this location. A new 10'x6' concrete box culvert will provide the conveyance necessary for an all weather access crossing. In addition, the six foot height will meet the ERZ requirements for this location. This location is one of the three culverts that have the available clearance to provide the six foot height requirement for the ERZ.

HECRAS was used to compute the water surface profile for this location. The existing conditions model was revised to include the new roadway section and proposed culvert. Table 9 provides a comparison of the existing conditions to proposed conditions. Figure 13 provides an overview of the proposed conceptual design. Calculations are included as Appendix C-3.

TABLE 9 (TSMS Node MG-N0080, Kensington Wash Proposed Condition)

	Existing Condition			Proposed Condition			
River Station (RS)	Flow Rate (Q)	Water Surface Elevation (WSE)	Channel Velocity (V)	Flow Rate (Q)	Water Surface Elevation (WSE)	Channel Velocity (V)	WSE CHANGE
(--)	(ft^3/sec)	(feet)	(ft/sec)	(ft^3/sec)	(feet)	(ft/sec)	(feet)
1440	465	2792.87	3.0	465	2792.90	3.0	0.03
1290	465	2790.46	3.5	465	2790.42	3.7	-0.04
1165	465	2788.47	2.8	465	2788.52	2.6	0.05
1131	465	2787.45	4.7	465	2787.53	5.0	0.08
1106	465	*2787.03	--	465	2784.80	3.2	*-2.23
1102	465	*2786.97	--	465	2784.55	4.7	*-2.42
1075	465	2786.52	2.5	465	N/A	N/A	N/A
1030	465	2786.58	0.9	465	N/A	N/A	N/A
945	465	2784.44	9.5	465	N/A	N/A	N/A
865	465	2780.06	1.2	465	2780.00	3.1	-0.06
745	465	2780.06	0.6	465	2780.06	0.6	--
640	465	2780.06	0.0	465	2780.06	0.7	--

**Denotes Interpolated Values*

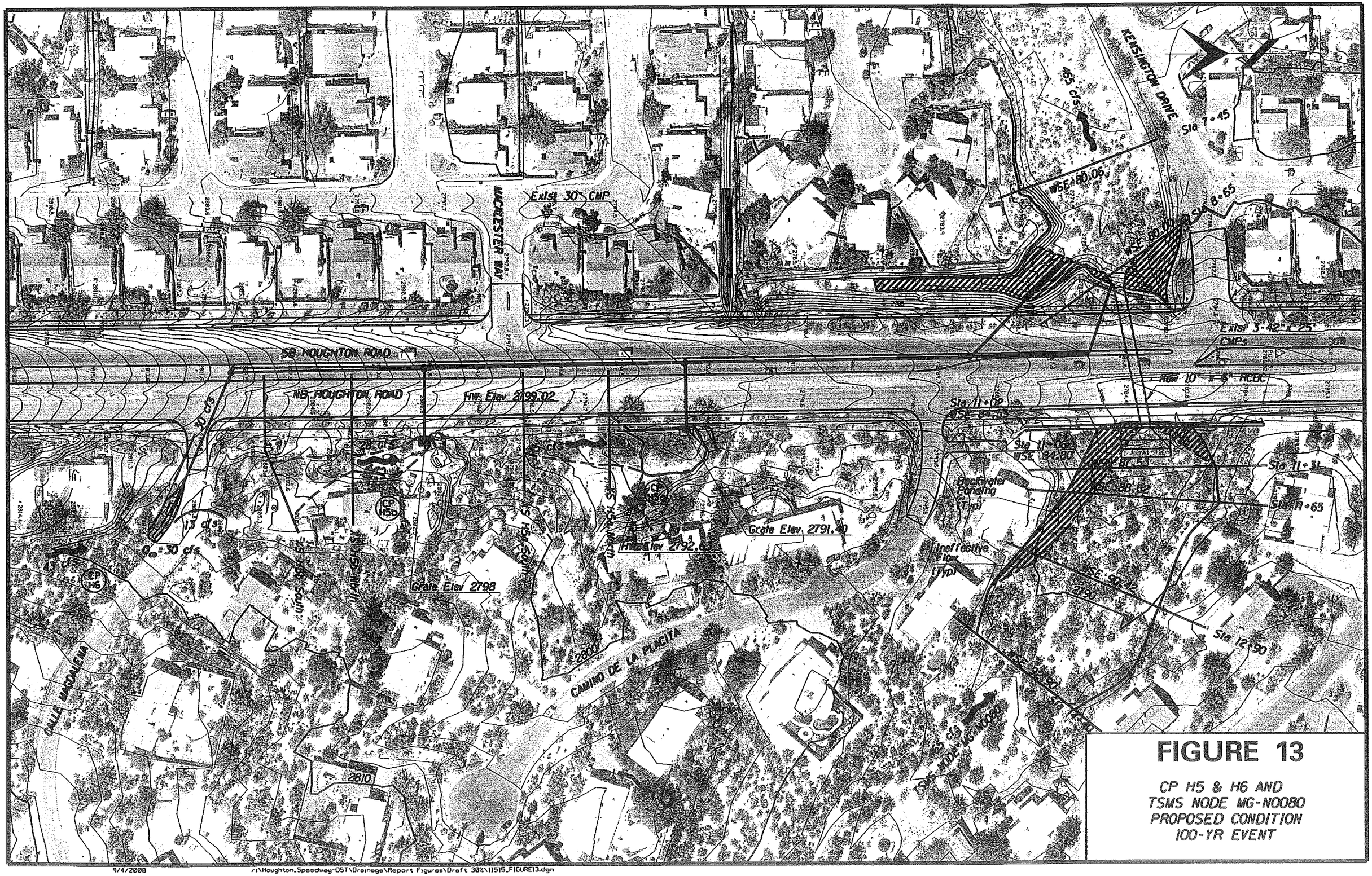


FIGURE 13

CP H5 & H6 AND
TSMS NODE MG-N0080
PROPOSED CONDITION
100-YR EVENT

9/4/2008 r:\Houghton_Speedway-DST\Drainage\Report Figures\Draft 30%\11515_FIGURE13.dgn

Concentration Point I

This point of concentration, as previously stated in this report, has two existing pipes under Houghton Road with manholes on the west side of the roadway and two pipes extending to the outlet 500-feet west of the road. The concept for this structure will minimize the impact to the exiting structure by removing the existing headwall and drop structure and extending the inlet to accommodate the new roadway width. An extension of eight feet to the existing pipes and reconstructing the drop inlet will allow the 100-year event to be conveyed through the structure without increasing the headwater. Due to the increased elevation, it was necessary to lower the entrance coefficient to 0.2 in the hydraulic analysis to represent a beveled inlet. A larger weir section is required in order to provide the necessary conveyance into the structure. The proposed condition headwater elevation is 2826.71-feet and at that elevation the weir segment can convey 71-ft^3/sec. This configuration will exceed the design requirements for this location as shown in Figure 14. The proposed condition analysis is provided in Appendix C-4.

TSMS Node MG-N0040

This location did not have an existing drainage structure and under existing conditions the runoff would overtop Houghton Road. It is necessary to provide a structure that will convey the 100-Year event under Houghton Road. As a result, it is recommended that a culvert be placed under Houghton Road to convey the flow from the east side of Houghton Road to the west side with out overtopping the roadway. Hydraulic analyses show that 3-48"x198' RCPs will adequately convey the 100-year event without increasing the upstream water surface elevation. As shown on Figure 15, the culvert will require an inlet structure and a riprap outlet to mitigate for the higher velocities to prevent scour. Table 10 shows the results from the hydraulic analysis. Also included is a comparison to the existing conditions showing an overall reduction in water surface elevations. Calculations are included in Appendix C-5.

TABLE 10 (TSMS Node MG-N0040, Proposed Condition)

	Existing Condition			Proposed Condition			
River Station (RS)	Flow Rate (Q)	Water Surface Elevation (WSE)	Channel Velocity (V)	Flow Rate (Q)	Water Surface Elevation (WSE)	Channel Velocity (V)	WSE CHANGE
(--)	(ft^3/sec)	(feet)	(ft/sec)	(ft^3/sec)	(feet)	(ft/sec)	(ft)
1250	243	2835.59	2.5	243	2835.17	4.4	-0.42
1150	243	2835.59	0.6	243	2835.10	1.2	-0.49
1050	243	2835.58	--	243	N/A	N/A	N/A
950	243	2830.25	--	243	N/A	N/A	N/A
886	243	*2828.50	--	243	2828.00	5.1	-0.50
790	243	2825.87	3.4	243	2825.87	3.4	--

** Denotes Interpolated Value.*

FIGURE 14

CP I
PROPOSED CONDITION
HYDRAULIC ANALYSIS

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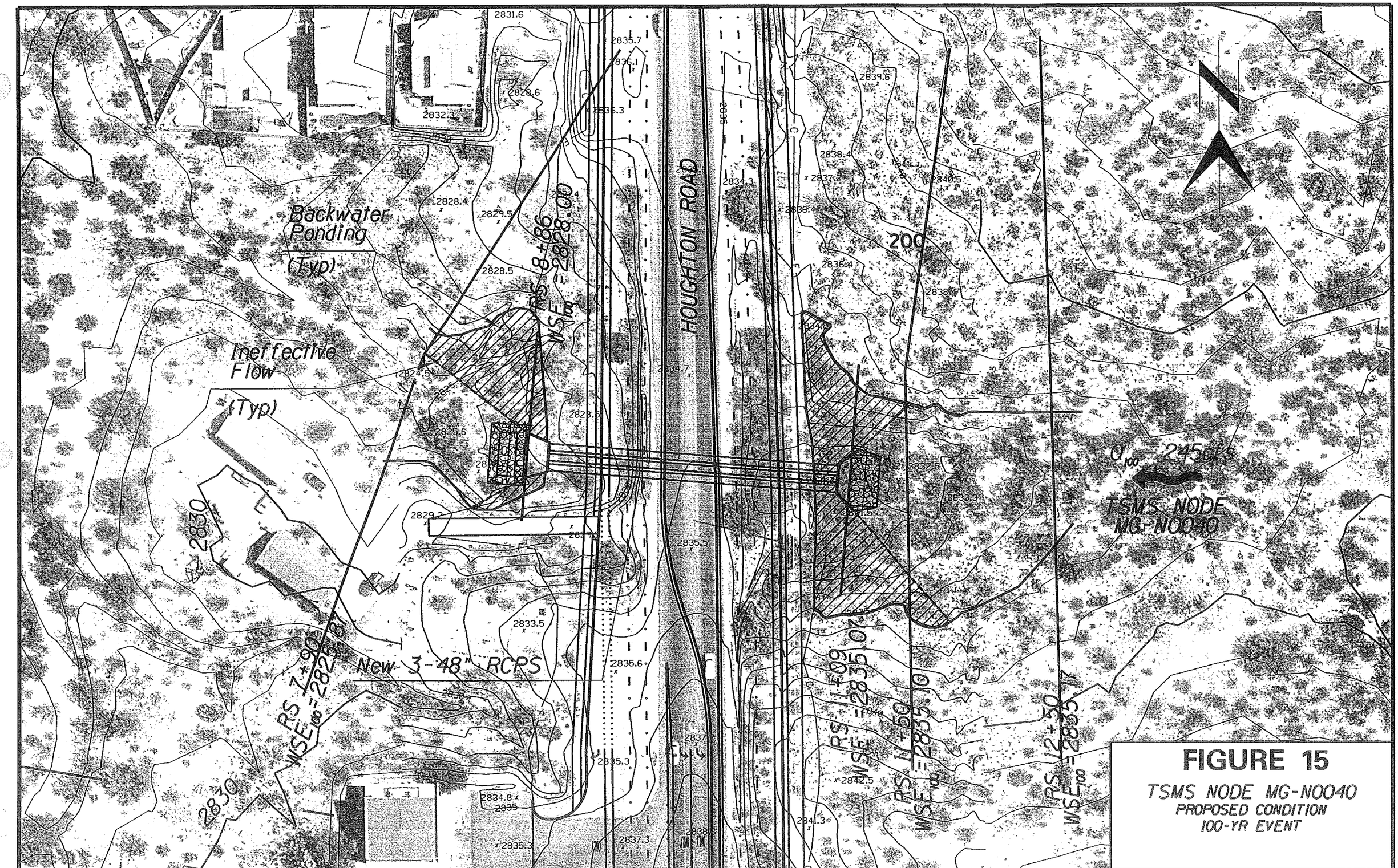

FIGURE 15

TSMS NODE MG-N0040
PROPOSED CONDITION
100-YR EVENT

9/3/2008 r:\Houghton_Speedway-DST\Drainage\Report Figures\Draft 30%\11515_FIGURE15.dgn

Este Wash

FEMA Analysis –

The Este Wash analysis includes culvert design to provide all weather access for both Houghton Road and 22nd Street. At both locations, new 4-10'X6' RCBCs are adequate to provide conveyance under each roadway. The "new" existing conditions HECRAS model was revised to include the box culverts.

The model results for the regulatory FEMA 100-year discharge of 1,974-ft^3/sec at the Houghton Road culvert crossing show that the proposed conditions water surface elevations are lower than the existing condition elevations at the cross-section located at the inlet of the culvert (cross-section 3160: 1.49 ft. lower) and at the next cross-section upstream of the inlet (cross-section 3230: 0.52 ft. lower). At the next upstream cross-section (cross-section 3350), which is located 190 feet upstream of the culvert inlet, the proposed conditions water surface elevation is 0.27 ft. higher than the existing condition. The reason for the increase in the water surface elevation is due to the ineffective flow used to model the 1:1 flow contraction into the culvert. This slight increase in the water surface elevation results in the flow top width increasing from 424-feet to 434-feet. This increase is not significant since the 100-year WSEL remains at least four feet below the pad for the existing house along the south side of the wash at this location. At the next upstream cross-section the proposed conditions water surface elevation is lower than the existing conditions (cross-section 3490: 0.20 ft. lower). At the next upstream cross-section (cross-section 3640), which is located 480 feet upstream of the culvert inlet, the proposed conditions water surface elevation is 0.13 ft. higher than the existing conditions. This slight increase in the water surface elevation results in the flow top width increasing from 281-feet to 286-feet. This increase is not significant since the 100-year WSEL remains at least three feet below the pad for the existing house along the south side of the wash at this location. Upsizing the culvert to a 5-10'X6' RCBC did not eliminate the increases in water surface elevations. Interpolated cross-sections were added upstream and downstream of cross-section 3640, however this did not eliminate the warning message that the conveyance ratio is less than 0.7 or greater than 1.4, and did not eliminate the warning message that the energy loss is greater than 1.0 feet. During the next stage of design (60%) PB will investigate alternatives to eliminate the increase in water surface elevations upstream of the proposed culvert.

The model results for the regulatory FEMA 100-year discharge of 1,974-ft^3/sec at the 22nd Street culvert crossing show that the proposed conditions water surface elevations are lower than the existing conditions water surface elevations at the cross-section located at the inlet of the culvert (cross-section 2295: 0.28 ft. lower) and at the next cross-section upstream of the inlet (cross-section 2340: 0.19 ft. lower). Similar to Houghton Road above, at the next upstream cross-section (cross-section 2495), which is located 200 feet upstream of the culvert inlet, the proposed conditions water surface elevation is 0.20 ft. higher than the existing conditions elevation. The reason for the increase is the same as above; the increase is due to the ineffective flow used to model the 1:1 flow contraction into the culvert. This slight increase in elevation results in the flow top width increasing from 265-feet to 281-feet. This increase is not significant since the 100-year WSEL remains at least five feet below Discovery Lane at this location, and at least ten feet below the pad for the existing house along the southwest side of the wash at this location. The model results for the regulatory FEMA 100-year discharge of 1,974-ft^3/sec at the 22nd Street culvert crossing also show that the proposed conditions water surface elevations are higher than the existing conditions water surface elevations at the cross-section located at the outlet of the culvert (cross-section 2146: 0.51 ft. higher). At the next downstream cross-section (cross-section

2000), which is located 146 feet downstream of the outlet, the proposed conditions water surface elevation is equal to the existing conditions. The reason for the increase in the water surface elevation at the culvert outlet is due to the ineffective flow at the culvert outlet. This slight increase in elevation results in the flow top width increasing from 270-feet to 295-feet. This increase is not significant since the 100-year WSEL remains at least 1.5 feet below the pad for the existing house along the west side of the wash at this location. Table 11A provides a summary of the proposed conditions hydraulic analysis results in addition to a comparison to the existing conditions results. Figure 16 shows these results graphically in an aerial view.

TABLE 11A (Este Wash Proposed Condition, *FEMA*)

	Existing Condition			Proposed Condition			
River Station (RS)	Flow Rate (Q)	Water Surface Elevation (WSE)	Channel Velocity (V)	Flow Rate (Q)	Water Surface Elevation (WSE)	Channel Velocity (V)	WSE CHANGE
(--)	(ft^3/sec)	(feet)	(ft/sec)	(ft^3/sec)	(feet)	(ft/sec)	(ft)
0	1974	2794.96	9.96	1974	2794.96	9.96	--
425	1974	2801.9	8.72	1974	2801.90	8.72	--
815	1974	2809.02	8.71	1974	2809.02	8.71	--
1175	1974	2814.9	7.12	1974	2814.90	7.12	--
1465	1974	2819.76	7.97	1974	2819.76	7.97	--
1865	1974	2825.51	9.90	1974	2825.51	9.90	--
2000	1974	2827.73	10.12	1974	2827.73	10.12	--
2146	1974	2830.01	9.69	1974	2830.52	11.43	0.51
2295	1974	2833.72	11.43	1974	2833.44	7.78	-0.28
2300	1974	*2833.88	N/A	1974	2834.04	5.63	*0.16
2340	1974	2834.26	10.04	1974	2834.07	12.61	-0.19
2495	1974	2835.69	8.90	1974	2835.89	7.84	0.20
2795	1974	2839.58	8.48	1974	2839.55	8.60	-0.03
2975	1974	2843.08	10.08	1974	2842.02	11.43	-1.06
3160	1974	2846.40	10.44	1974	2844.91	7.76	-1.49
3166	1974	*2846.56	N/A	1974	2845.54	5.49	*-1.02
3230	1974	2847.79	6.22	1974	2847.27	9.96	-0.52
3350	1974	2849.00	5.53	1974	2849.27	4.81	0.27
3490	1974	2850.72	6.91	1974	2850.52	8.27	-0.20
3640	1974	2852.64	8.63	1974	2852.77	7.89	0.13
3810	1974	2855.60	8.67	1974	2855.60	8.67	--
4085	1974	2859.33	10.19	1974	2859.33	10.19	--

** Denotes Interpolated Value.*

TSMS Analysis –

The regulatory Tucson Stormwater Management Study (TSMS) 100-year discharge for Este Wash in the reach that includes the crossings at Houghton Road and at 22nd Street is 1,098-ft^3/sec. As part of this design concept study for the Houghton Road project, the City directed PB to analyze the proposed crossings at Houghton Road and at 22nd Street using the TSMS future condition 100-Year flow rate of 1,208-ft^3/sec, for comparison with the crossings designed using the FEMA 100-Year flow rate of 1,974-ft^3/sec. The analysis showed that using the TSMS flow rate, the proposed culverts at both the Houghton Road and at the 22nd Street crossings can be reduced to 3-10'x6' RCBCs from the 4-10'x6' RCBCs sized using the FEMA flow rate. This results in a savings of about $250,000 in construction costs. However, because this is a regulatory FEMA Floodplain, design using the TSMS flow rate would require a Letter of Map Revision (LOMR) from FEMA.

The proposed conditions FEMA HECRAS model was updated with the TSMS flow rate and new proposed culverts. Results for the TSMS future condition 100-year discharge of 1,208-ft^3/sec at the Houghton Road culvert crossing show that the proposed conditions WSEs are lower than the existing conditions elevations at the cross-section located at the inlet of the culvert (cross-section 3160: 1.75-ft. lower) and at the next cross-section upstream of the inlet (cross-section 3230: 0.26-ft. lower). The next upstream cross-section (cross-section 3350), which is located 190 feet upstream of the culvert inlet, the proposed conditions WSEL is 0.20-ft. higher than the existing condition elevation. The reason for the increase is due to the ineffective flow used to model the 1:1 flow contraction into the culvert. This slight increase in elevation results in the flow top width increasing from 409 feet to 416 feet. This increase in WSEL is not significant since the 100-year water surface elevation remains at least four feet below the pad for the existing house along the south side of the wash at this location. At the next upstream cross-section the proposed conditions water surface elevation is lower than the existing conditions (cross-section 3490: 0.15 ft. lower). At the next upstream cross-section (cross-section 3640), which is located 480 feet upstream of the culvert inlet, the proposed conditions water surface elevation is 0.10 ft. higher than the existing conditions. This slight increase in the water surface elevation results in the flow top width increasing from 265-feet to 269-feet. This increase is not significant since the 100-year WSEL remains at least three feet below the pad for the existing house along the south side of the wash at this location. Upsizing the culvert to a 4-10'X6' RCBC did not eliminate the increases in water surface elevations. Interpolated cross-sections were added upstream and downstream of cross-section 3640, however this did not eliminate the warning message that the conveyance ratio is less than 0.7 or greater than 1.4, and did not eliminate the warning message that the energy loss is greater than 1.0 feet. During the next stage of design (60%) PB will investigate alternatives to eliminate the increase in water surface elevations upstream of the proposed culvert.

The model results for the regulatory TSMS 100-year discharge of 1208 cfs at the 22nd Street culvert crossing show that the proposed conditions WSEs are lower than the existing condition water surface elevations at the cross-section located at the inlet of the culvert (cross-section 2295: 0.42-ft. lower) and at the next cross-section upstream of the inlet (cross-section 2340: 0.23 ft. lower). The next two upstream cross-sections (cross-sections 2495 an 2795), which are located 200 feet and 500 feet respectively upstream of the culvert inlet, have minimal change in water surface elevation (<0.03-ft.) when compared to the existing condition analysis. The model results for the regulatory FEMA 100-year discharge of 1,974-ft^3/sec at the 22nd Street culvert crossing also show that the proposed conditions water surface elevations are higher than the existing conditions water surface elevations at the cross-section located at the outlet of the culvert (cross-section 2146: 0.52 ft. higher). At

the next downstream cross-section (cross-section 2000), which is located 146 feet downstream of the outlet, the proposed conditions water surface elevation is equal to the existing conditions. The reason for the increase in the water surface elevation at the culvert outlet is due to the ineffective flow at the culvert outlet. This slight increase in elevation results in the flow top width increasing from 270-feet to 295-feet. This increase is not significant since the 100-year WSEL remains at least 1.5 feet below the pad for the existing house along the west side of the wash at this location. Table 11B provides a summary of the TSMS proposed condition analysis and compares the water surface elevations to the existing TSMS analysis.

Concentration Points N, O & P

Under proposed condition no analyses were conducted for these concentration points. Due to their relatively small size and flow rates, it is anticipated that these areas will be captured within a stormdrain system and directed to Este Wash. The proposed condition analyses will be address during the design stage of this project.

TABLE 11B (Este Wash Proposed Condition, *TSMS*)

	Existing Condition			Proposed Condition			
River Station (RS)	Flow Rate (Q)	Water Surface Elevation (WSE)	Channel Velocity (V)	Flow Rate (Q)	Water Surface Elevation (WSE)	Channel Velocity (V)	WSE CHANGE
(--)	(ft^3/sec)	(feet)	(feet/sec)	(ft^3/sec)	(feet)	(feet/sec)	(ft)
0	1256	2794.59	8.40	1256	2794.59	8.40	--
425	1256	2801.54	7.34	1256	2801.54	7.34	--
815	1256	2808.67	7.51	1256	2808.67	7.51	--
1175	1256	2814.55	6.13	1256	2814.55	6.13	--
1465	1256	2819.21	6.95	1256	2819.21	6.95	--
1865	1208	2824.55	8.96	1208	2824.55	8.96	--
2000	1208	2826.89	8.92	1208	2826.89	8.92	--
2146	1208	2829.51	8.20	1208	2830.03	10.70	0.52
2295	1208	2833.05	9.69	1208	2832.63	7.42	-0.42
2300	1208	*2833.11	--	1208	2833.25	5.00	*0.14
2340	1208	2833.58	8.36	1208	2833.35	10.57	-0.23
2495	1208	2835.11	7.69	1208	2835.12	7.65	0.01
2795	1208	2839.00	7.30	1208	2838.97	7.34	-0.03
2975	1208	2842.31	9.31	1208	2841.53	10.70	-0.78
3160	1208	2845.85	8.77	1208	2844.10	7.41	-1.75
3166	1208	*2845.96	--	1208	2844.83	4.41	*-1.13
3230	1208	2847.12	5.82	1208	2846.86	8.63	-0.26
3350	1208	2848.59	4.17	1208	2848.79	3.72	0.20
3490	1208	2850.38	5.87	1208	2850.20	7.28	-0.18
3640	1208	2852.25	7.30	1208	2852.37	6.55	0.12
3810	1208	2855.16	7.27	1208	2855.16	7.26	-0.01
4085	1208	2858.91	8.56	1208	2858.91	8.56	--

** Denotes Interpolated Value.*

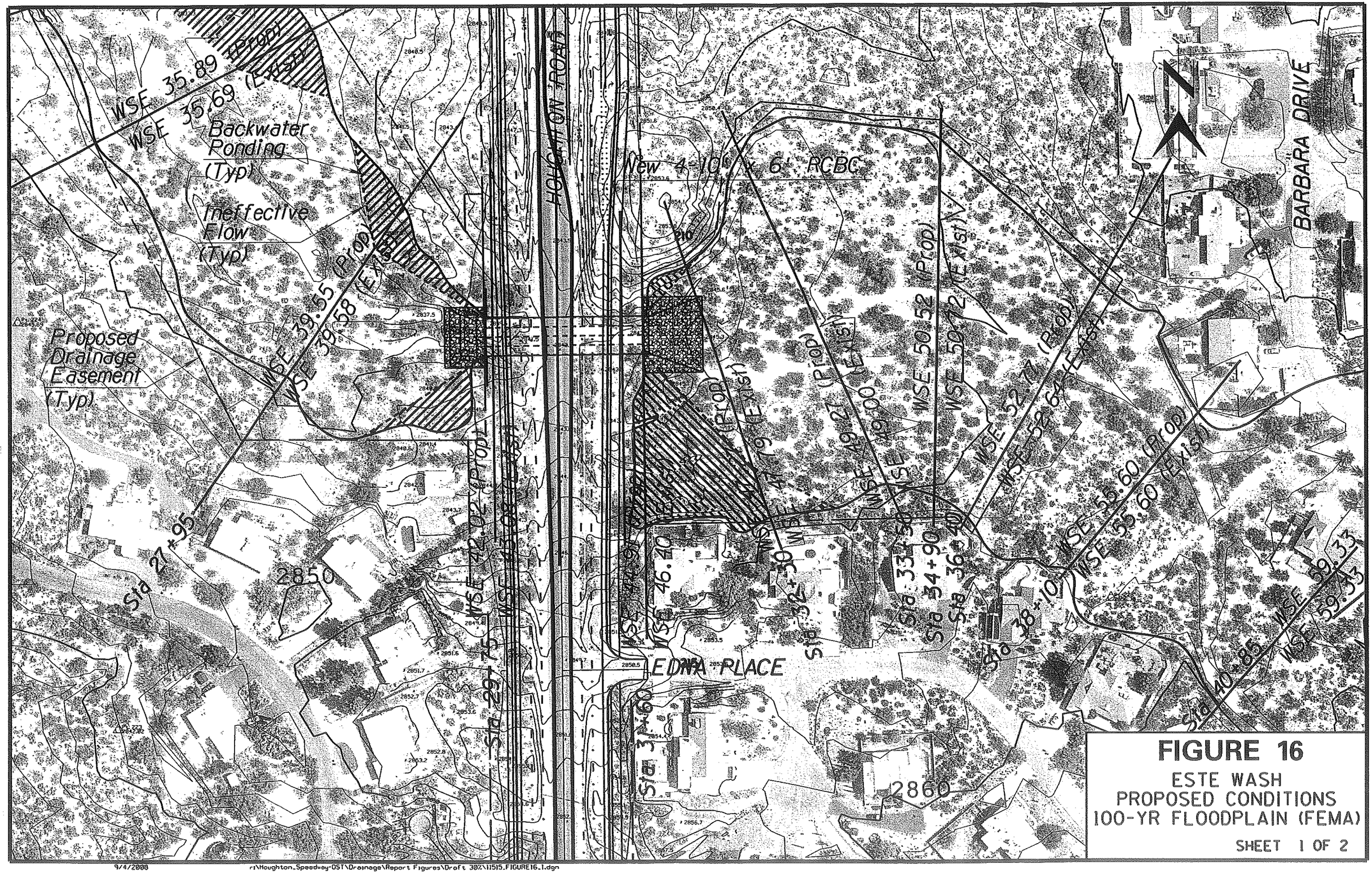

FIGURE 16

ESTE WASH
PROPOSED CONDITIONS
100-YR FLOODPLAIN (FEMA)

SHEET 1 OF 2

9/4/2008 r:\Houghton_Speedway-DST\Drainage\Report Figures\Draft 30%\11515_FIGURE16_1.dgn

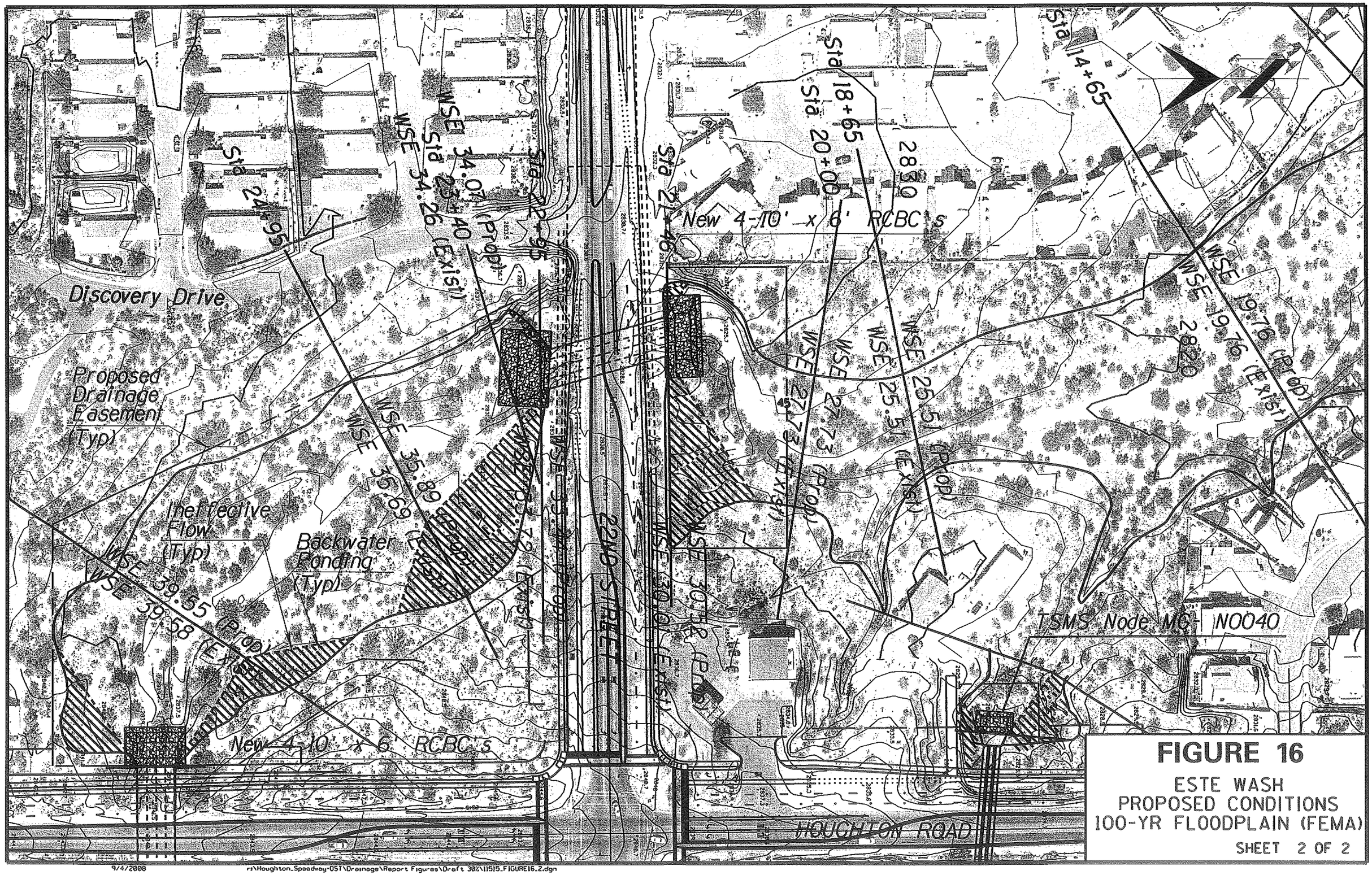

FIGURE 16

ESTE WASH
PROPOSED CONDITIONS
100-YR FLOODPLAIN (FEMA)

SHEET 2 OF 2

9/4/2008 r:\Houghton_Speedway-OST\Drainage\Report Figures\Draft 30%\11515_FIGURE16_2.dgn

4.0
SUMMARY & CONCLUSIONS

The layout of the conceptual roadway for Houghton Road, 5th Street to Old Spanish Trail, warrants significant drainage improvements in order to provide all weather access for this project. "All Weather Access" for this project is designated as conveying 100-Year flows under the roadway. Due to the urban nature of the proposed roadway, curbs and raised median, no portion of the flow event was allowed to overtop the roadway. Improvements for the offsite drainage include box culverts, pipe culverts and stormdrain pipes with special inlets and/or catch basins. The table below provides a summary of the existing drainage facilities and the proposed structures required to provide all weather access for the roadway. In addition to the structures identified in the table, stormdrain systems will be necessary for this project to address on-site drainage. Although not addressed at this stage, it is anticipated that as many as five (5) separate stormdrain systems will be utilized within the project limits. This preliminary drainage report, however, only addresses off-site drainage.

The proposed drainage improvements for the Coronado Ridge Wash segment, Broadway Blvd. and Safeway shopping center to 5th Street, will include replacing one at grade crossing and two existing CONARCH culverts with new box culverts. In addition, the existing box culvert under Broadway Blvd. will be extended to accommodate the new roadway footprint. At the upstream end of the box extension, the proposed improvement will include an open junction structure to combine flows from each tributary and direct the flow under Broadway Blvd. The existing roadside swale at the southeast corner of the Houghton Road and Broadway Blvd. intersection will be most likely replaced with a stormdrain system with area inlets to capture local runoff.

The proposed improvements at Bashas' shopping center begin at Cowhead Saddle Lane and terminate along the west side of Houghton Road at the middle driveway entrance of the Bashas' shopping center. The existing culverts at Cowhead Saddle Lane will be extended to accommodate the new roadway. The existing CONARCH culvert at the Safeway driveway will be replaced with a new box culvert. Finally, the system of culverts that convey flow from the east side of Houghton Road to the Bashas' stormdrain will be upgraded to a closed stormdrain system including manholes and area inlets.

The segment of Houghton Road from Cowhead Saddle Lane to the Houghton Road and 22nd Street intersection currently contains three existing pipe culvert crossings and one at-grade crossing. Analyses show that two of the three culvert crossings do not have capacity to provide all weather access. The two undersized culvert crossings will be upgraded to a box culvert and a pipe culvert to provide all weather access. The last culvert crossing in this section will be extended and the at-grade crossing will replaced with a new multi-pipe culvert.

The final segment addressed of this project is from the Houghton Road and 22nd Street intersection south to the project limit, which is approximately 1800-feet south of 22nd Street. Through this segment, only at-grade drainage crossings are present today. Este Wash crosses both Houghton Road and 22nd Street. Box culverts are proposed for both crossings. The area south of Este Wash will be upgraded with a stormdrain system to capture and convey the flow to the Este Wash.

Summary of Drainage Improvements

Location	Existing Structure	Preliminary Structure	Comments
Sta 143+15 Houghton Rd	At-Grade Crossing	3-8'x4' RCBC	Replace at grade structure with new RCBC.
Sta 52+55 Broadway Blvd.	4-8'x3' RCBC	Extend Exist RCBC with New 4-8'x6' RCBC south & New 4-8'x3' RCBC north	New concrete open Junction to direct flow from tributaries to Broadway Blvd. Culvert.
Sta 52+60 to Sta 56+53, Rt Broadway Blvd.	Channel & two 8'x4' CONARCH Culverts	10'x4' RCBC	Embankment fills existing channel provide new RCBC to encompass length of channel north of shopping center. Provide swale to capture shopping center runoff.
Sta 159+53, Lt Houghton Rd	6'x4' CONARCH	6'x4' RCBC 42" RCP 36" RCP	Replace existing CONARCH Culvert. Enclosed junction structure @ outlet connects RCPs 42" RCP north to Coronado Ridge Wash and 36" RCP to Bashas' stormdrain
Sta 11+30 Cowhead Saddle Lane	4-24" RCPs	Extend 6' north	New inlet & outlet headwalls and riprap plunge basin. Beveled inlet headwall.
Sta 174+90 Houghton Rd	3-42" CMPs	10'x6' RCBC	Inlet & Outlet Grading
Sta 180+10, Lt Houghton Rd	Roadside Swale 30" CMP	CB & SD	Off Roadway Inlet & 100-Year Stormdrain & New Dike
Sta 183+15, Lt Houghton Rd	Roadside Swale	CB & SD	Off Roadway Inlet & 100-Year Stormdrain & New Dike
Sta 11+68 Calle Magdalena	At-Grade Crossing	CB & SD	Off Roadway Inlet & 100-Year Stormdrain
Sta 192+23 Houghton Rd	2-45"x29" HERCPs	Extend 2-45"x29" HERCPs 8' East	New concrete drop inlet @ inlet(east) end of Culvert
Sta 201+55 Houghton Road	Raised Roadway-Weir	3-48" RCPs	Inlet & Outlet Grading Outlet riprap plunge basin.
Sta 44+40 22nd Street	At-Grade Crossing	4-10'x6' RCBC	FEMA Analysis – Inlet & Outlet grading. Outlet riprap plunge basin.
Sta 211+55 Houghton Road	At-Grade Crossing	4-10'x6' RCBC	FEMA Analysis – Inlet & Outlet grading. Outlet riprap plunge basin.

As a result of the proposed drainage improvements identified for this early stage of the project, the future roadway will now have all-weather access. Cross drainage structures were preliminarily designed to accommodate runoff without significant impact to the existing washes and adjacent residences. At each of the existing dip crossings new culverts will convey the 100-year peak flow under the roadway resulting in all weather access for these locations.

During the next stage of this project (design stage), more detailed analyses will be performed. The design segment for this project will, most likely, be broken into multiple smaller segments. This report will be referenced for each of those segments. It is expected that minor tweaks may be needed once the additional analyses are incorporated into the project. This is most apparent for the areas that will incorporate stormdrain into the project. For instance, some of the proposed box culverts may have scuppers added to them to accommodate the pavement drainage system. Also, storm drains out letting into structures may necessitate an increased structure size.

The Este Wash analyses showed that there can be a slight reduction in construction costs if the TSMS flow rate were used for design rather than the FEMA flow rate. However if the TSME flow rate is used for design, additional costs will be incurred by the City of Tucson for the required LOMR process. Regardless of the flow rate used, Este Wash will be designed for all weather access for both Houghton Road and 22nd Street.

5.0
REFERENCES

1) *Tucson Stormwater Management Study, Phase II, Stormwater Master Plan (Task 11),* Simons, Li & Associates, Inc., December 15, 1995.

2) *Standards Manual For Drainage Design And Floodplain Management in Tucson, Arizona*, Simons, Li & Associates, December 1989, updated July 29, 1998.

3) *Flood Insurance Study, Pima County Arizona and Incorporated Areas Vol 1 of 3,* Federal Emergency Management Agency, February 8, 1999.

4) *Addendum to the Drainage Report – Retail Center, Broadway and Houghton*, WLB Group, March 18, 1998.

APPENDIX A

HYDROLOGY

A-1

TSMS HYDROLOGY

Bambauer, Gregory

From: Frank Sousa [Frank.Sousa@tucsonaz.gov]
Sent: Thursday, January 03, 2008 4:54 PM
To: Bambauer, Gregory
Cc: Blau, Jeff; Pargas, Rick; MJ Dillard
Subject: RE: Houghton Road TSMS Modeling

MG009510.DAT (3 KB) MC00610T.DAT (7 KB) MC00700T.DAT (3 KB) MC00710T.DAT (3 KB) MC00800T.DAT (3 KB) MC00810T.DAT (3 KB) MC00900T.DAT (5 KB)

MC00910T.DAT (5 KB) MC01100T.DAT (3 KB) MC01110T.DAT (3 KB) MC0120.CR2 (11 KB) MG004500.DAT (6 KB) MG004510.DAT (3 KB) MG0090.CR2 (4 KB)

MG00900T.DAT (4 KB) MG00910T.DAT (4 KB) MG0095.CR2 (2 KB) MG009500.DAT (3 KB) MC00600T.DAT (7 KB) MG00510T.DAT (6 KB) MG00500T.DAT (6 KB)

MG0050.CR2 (6 KB) houghton 22nd north sheds2.shx... houghton 22nd north lusoilsshe... houghton 22nd north lusoilsshe... houghton 22nd north lusoilsshe... houghton 22nd north sheds2.dbf... houghton 22nd north sheds2.shp...

houghton 22nd north lusheds2.x...

Here is the requested data.

Node		
Speedway Blvd.	Q100	Q10
MC-N0060	905 cfs	341 cfs
MC-N0090	480 cfs	192 cfs
MC-N0110	295 cfs	112 cfs

Broadway Blvd.	Q100	Q10
MC-N0080	151cfs	56 cfs
MC-N0070	193 cfs	77 cfs
MG-N0045	1,142 cfs	439 cfs
MG-N0090	567 cfs	232 cfs
MG-N0095	137 cfs	57 cfs

Attached are the HEC-1 input files (.dat), watershed summary reports (.CR2), shape file sets for the additional watersheds west of Houghton Rd.(houghton 22nd north sheds2,....), and an excel spreadsheet with the updated watershed data.

future condition changes:

MG-N0095, same as for MG0N0080, little expected change unless redeveloped MG-N0090 some undeveloped property exists. Probable 10% or less increase in discharge.

The new discharge rates will not be posted on the web page until tomorrow or Monday.

Let me know if you need anything else. All are labeled as verified 7/07

Francis X. Sousa

Lead Hydrologist
Office of Conservation and Sustainable Development City of Tucson 520-837-6581, voice 520-791-4373, fax frank.sousa@tucsonaz.gov

>>> "Bambauer, Gregory" <Bambauer@pbworld.com> 12/5/2007 10:51 AM >>>
Mr. Sousa;
I would like to extend my thanks for your previous assistance with the above referenced project. Upon further investigation on the roadway limits, we have found the need for additional information on TSMS nodes.
We have identified that the extent of roadway improvements may impact the washes with the following TSMS nodes:

Node
Speedway Blvd.
MC-N0060
MC-N0090
MC-N0110

Broadway Blvd.
MC-N0080
MC-N0070
MG-N0090
MG-N0095

If possible can you please provide us with the same information on the previous nodes?
Your assistance is greatly appreciated.

Best Regards

Gregory A. Bambauer, PE

PB
177 N. Church Avenue, Suite 500
Tucson, Arizona 85701

Direct: 520.838.3410
Cellular: 520.403.6241
Fax: 520.822.8830
Email: bambauer@pbworld.com

www.pbworld.com

-----Original Message-----
From: Blau, Jeff
Sent: Wednesday, September 05, 2007 9:14 AM
To: Bambauer, Gregory
Subject: FW: Houghton Road TSMS Modeling

FYI

-----Original Message-----
From: Frank Sousa [mailto:Frank.Sousa@tucsonaz.gov]
Sent: Tuesday, June 26, 2007 3:50 PM
To: Blau, Jeff
Subject: RE: Houghton Road TSMS Modeling

Here are the 10-year results. Attached are the HEC-1 input files.

Node	Q100	Q10
MC-N0100	370 cfs	146 cfs
MC-N0120	1584 cfs	616 cfs

MG-N0030	1098 cfs	412 cfs
MG-N0040	202 cfs	71 cfs
MG-N0080	465 cfs	184 cfs
MG-N0100	118 cfs	55 cfs
MG-N0160	947 cfs	383 cfs
MG-N0170	951 cfs	388 cfs

>>> "Blau, Jeff" <Blau@pbworld.com> 6/26/2007 8:57 AM >>>
Frank,

Thank-you for doing this verification and getting me the results so quickly.

Will you be able to also give me the 10-year models?

Thanks,
Jeff

-----Original Message-----
From: Frank Sousa [mailto:Frank.Sousa@tucsonaz.gov]
Sent: Monday, June 25, 2007 3:09 PM
To: Blau, Jeff
Cc: Pargas, Rick
Subject: Re: Houghton Road TSMS Modeling

Hi Jeff

Verification of TSMS hydrology for the requested locations is complete.

Land uses and soils changed, subwatershed areas changes little. Routing parameters did not change due to watercourse preservation by new developments. Non contributing area verification was densified and updated.

The flow rates are for existing conditions.

Node	Q100
MC-N0100	370 cfs
MC-N0120	1584 cfs
MG-N0030	1098 cfs
MG-N0040	202 cfs
MG-N0080	465 cfs
MG-N0100	118 cfs
MG-N0160	947 cfs
MG-N0170	951 cfs

Most flow rates changed little since the last verification for the watersheds in 2001.

Future conditions corrections:

Vacant land parcels were classified (true or false in the "developabl" column in the "Houghton rd speedway south lusouls sheds" shape file) as developable or non-developable (NUOS, common area, etc.). The attached image (Houghton Rd vacant land inventory) shows the vacant land distribution with developable land shown in yellow, and non-developable land shown in green. Recommended future conditions corrections are as follows:

Node MG-N0030 has significant vacant land that probably will not be developed unless the Tucson Catholic Diocese sells the land, Since the downstream land is already developed and there are no 100-yr drainage structures in place, development of the properties would require detention to mitigate adverse impacts downstream. Worst case, add 10%

Node MG-N0040 has significant percentages of developable land. Changing the vacant land to RETAIL (as with most intersection lots) increases the flow rate from 202 cfs to 243 cfs assuming no detention/retention and not changing the overland flow data values. Revised overland flow data would increase the flow rate further. The site will undoubtedly be required to provide detention/retention so using the 243 cfs should be adequate (about

10%).

Node MG-N0080 flow rates could only change if the existing housing was demolished and redeveloped. No flow change for this location is anticipated barring redevelopment.

Nodes MG-N0160 is fully developed and node N0170 has only a small portion of developable land just upstream of Houghton Rd. No changes are anticipated for these locations withou redevelopment of existing uses.

The watershed for node MC-N0100 is 65.5% developable vacant land. The watershed is non-designated. The Silverado Hills subdivision did not provide detention. Future development will have to provide detention/retention as per the Houghton East Basin Management Plan. Section 3.4 states that most of this area should be treated as a critical basin with a 10% reduction from existing in discharge rates.
Section 5 requires detention/retention unless no adverse impact can be demonstrated. A 10% future flow rate safety factor appears adequate.

Node MC-0120 is subject to the same conditions as MC-N0100.

Attachments

Attached are the HEC-1 input files (.dat) watershed summary reports (.cr2)

Attached is an Excel spread sheet with the land use and soil percentages (Houghton rd speedway south lusouls sheds.xls)

Also attached are the following ArcView shape files (three files, .dbf, .shp, and .shx)

Houghton 22 north sheds (mislabeled) = subwatersheds only for the study Houghton rd speedway south lusouls sheds = subwatershed with soils and land uses breakdowns.

Let me know if you need more information.
Enjoy!!!

Francis X. Sousa
Lead Hydrologist
Department of Transportation
Engineering Division
Stormwater Section
City of Tucson
520-837-6581, voice
520-791-4373, fax
frank.sousa@tucsonaz.gov

>>> "Blau, Jeff" <Blau@pbworld.com> 6/7/2007 9:22 AM >>>

Frank,

As a follow up to our phone conversation yesterday, you said that you will do the TSMS model verification and future conditions parameter estimates for the TSMS nodes impacting the Houghton Road Speedway to Old Spanish Trail segment project. Your estimated time to finish the verification, data input and model runs is about 2 weeks.

Following are the TSMS Nodes that we will need the Q10 and Q100 discharges for:

MC-N0100, MC-N0120, MG-N0030, MG-N0040, MG-N0080, MG-N0160 and MG-N0170.

As we discussed on the phone, we will need the existing conditions as well as the future conditions discharges.
Also, in addition to the HEC-1 model output, can we please get an electronic copy of the watershed mapping including aerial photos with contours.

Please let me know if you need anything from me or have any questions.

Thank-you,

Jeff Blau, PE
Drainage Engineer

PB
177 N. Church Avenue, Suite 500
Tucson, Arizona 85701

Direct: 520-838-3412
Fax: 520-882-8830
E-mail: blau@pbworld.com <mailto:blau@pbworld.com>

www.pbworld.com

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Bambauer, Gregory

From: Blau, Jeff
Sent: Wednesday, September 05, 2007 9:14 AM
To: Bambauer, Gregory
Subject: FW: Houghton Road TSMS Modeling

MG01710T.DAT (5 KB) MC01210T.DAT (10 KB) MG00310T.DAT (5 KB) MG00410T.DAT (3 KB) MG00810T.DAT (3 KB) MG01010T.DAT (3 KB) MG01610T.DAT (4 KB)

MC01010T.DAT (3 KB)

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To: Blau, Jeff
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Vacant land parcels were classified (true or false in the "developabl" column in the "Houghton rd speedway south lusouls sheds" shape file) as developable or non-developable (NUOS, common area, etc.). The attached image (Houghton Rd vacant land inventory) shows the vacant land distribution with developable land shown in yellow, and non-developable land shown in green. Recommended future conditions corrections are as follows:

Node MG-N0030 has significant vacant land that probably will not be developed unless the Tucson Catholic Diocese sells the land, Since the downstream land is already developed and there are no 100-yr drainage structures in place, development of the properties would require detention to mitigate adverse impacts downstream. Worst case, add 10%

Node MG-N0040 has significant percentages of developable land. Changing the vacant land to RETAIL (as with most intersection lots) increases the flow rate from 202 cfs to 243 cfs assuming no detention/retention and not changing the overland flow data values. Revised overland flow data would increase the flow rate further. The site will undoubtedly be required to provide detention/retention so using the 243 cfs should be adequate (about 10%).

Node MG-N0080 flow rates could only change if the existing housing was demolished and redeveloped. No flow change for this location is anticipated barring redevelopment.

Nodes MG-N0160 is fully developed and node N0170 has only a small portion of developable land just upstream of Houghton Rd. No changes are anticipated for these locations without redevelopment of existing uses.

The watershed for node MC-N0100 is 65.5% developable vacant land. The watershed is non-designated. The Silverado Hills subdivision did not provide detention. Future development will have to provide detention/retention as per the Houghton East Basin Management Plan. Section 3.4 states that most of this area should be treated as a critical basin with a 10% reduction from existing in discharge rates.
Section 5 requires detention/retention unless no adverse impact can be demonstrated. A 10% future flow rate safety factor appears adequate.

Node MC-0120 is subject to the same conditions as MC-N0100.

Attachments

Attached are the HEC-1 input files (.dat) watershed summary reports (.cr2)

Attached is an Excel spread sheet with the land use and soil percentages (Houghton rd speedway south lusouls sheds.xls)

Also attached are the following ArcView shape files (three files, .dbf, .shp, and .shx)

Houghton 22 north sheds (mislabeled) = subwatersheds only for the study Houghton rd speedway south lusouls sheds = subwatershed with soils and land uses breakdowns.

Let me know if you need more information.
Enjoy!!!

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>>> "Blau, Jeff" <Blau@pbworld.com> 6/7/2007 9:22 AM >>>

Frank,

As a follow up to our phone conversation yesterday, you said that you will do the TSMS model verification and future conditions parameter estimates for the TSMS nodes impacting the Houghton Road Speedway to Old Spanish Trail segment project. Your estimated time to finish the verification, data input and model runs is about 2 weeks.

Following are the TSMS Nodes that we will need the Q10 and Q100 discharges for:

MC-N0100, MC-N0120, MG-N0030, MG-N0040, MG-N0080, MG-N0160 and MG-N0170.

As we discussed on the phone, we will need the existing conditions as well as the future conditions discharges.
Also, in addition to the HEC-1 model output, can we please get an electronic copy of the watershed mapping including aerial photos with contours.

Please let me know if you need anything from me or have any questions.

Thank-you,

Jeff Blau, PE
Drainage Engineer

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A-2

EXISTING CONDITION HYDROLOGY

PB Project No.: **11515**
Project Name: **HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL**
CP Desc: **HOUGHTON PVMT DRN TO BUFFALOBERRY LOOP (SOUTH)**

CONCENTRATION POINT	C_{100} (--)	Intensity in/hr	DRAINAGE AREA (acres)	Q_{100} (ft^3/sec)
D1	0.89	9.55	2.64	22.4
D2	0.85	8.79	2.26	16.8
DS2	0.75	9.60	0.48	3.4
DS1	0.88	9.18	2.82	22.9
D4-L	0.91	9.60	1.50	13.1
E1-L	0.90	9.60	1.22	10.6
E1&2	0.82	8.23	30.12	171.4
E2	0.81	8.30	26.59	148.2
E2+	0.82	8.31	28.90	165.3
E3	0.81	9.60	1.49	11.5
F	0.82	9.60	0.66	5.2
G	0.74	9.60	0.23	1.6
GS1	0.74	9.60	0.86	6.1
GS2	0.74	9.60	0.48	3.4
GE1	0.79	9.24	16.39	110.6
GE2	0.79	9.44	16.31	112.5
H@B	0.89	9.43	1.31	11.0
FMD	0.83	9.45	1.15	9.0
SHD	0.83	9.60	0.30	2.4
GE3	0.91	9.60	1.45	11.3
GE4	0.76	9.39	12.71	83.5
H5	0.76	8.42	12.01	76.8
H5&H6	0.76	8.43	18.46	106.4
H(2,4)	0.84	9.60	2.39	19.2
H2	0.84	9.60	0.62	5.0
H(1,4)	0.82	9.60	3.79	29.7
H1	0.78	9.60	1.40	10.5
BLS	0.83	9.60	0.62	4.9
BLN	0.88	9.60	1.00	8.4
CDE	0.94	9.60	0.42	3.8
H6	0.76	9.60	6.45	42.3
H4	0.77	9.60	0.08	0.6
H(3,4)	0.83	9.60	1.77	14.2
H3	0.84	9.37	1.69	13.3
I1	0.77	9.39	9.81	71.0
I2	0.74	9.60	0.31	2.2
J	0.75	9.60	4.11	29.5
K	0.77	9.60	1.69	12.5

PB Project No.: **11515**

Project Name: **HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL**

CP Desc: **HOUGHTON PVMT DRN TO BUFFALOBERRY LOOP (SOUTH)**

CONCENTRATION POINT	C_{100}	Intensity	DRAINAGE AREA	Q_{100}
	(--)	in/hr	(acres)	(ft^3/sec)
L1	0.77	9.60	5.15	38.1
L2	0.80	9.60	1.20	9.2
H@22	0.95	9.60	0.28	2.5
M	0.76	9.60	0.57	4.2
N	0.76	9.60	4.80	35.0
O	0.76	9.60	4.58	33.4
P	0.76	9.60	8.39	61.2

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	BLS	HOUGHTON PVMT DRN TO BUFFALOBERRY LOOP (SOUTH)
	EXISTING CONDITION, PAVEMENT & PARKWAY TO BRDWY -- AREA FROM HOUGHTION & PARKWAY	

DA:	0.62	-Acres
Lc:	205.0	-Feet
Lca:	50.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	60.0	3.2	0.0533
	135.0	1.0	0.0074
	10.0	1.0	0.1000
Lc:	205.0	Sc:	0.0121

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Commercial/Indus	DF	0.048	0.90
Commercial/Indus	DF	0.048	0.90
Commercial/Indus	DF	0.048	0.90
	n_{bw100}:	0.048	F_{ACW}: 0.90

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Commercial/Indust	0.62			65	0.70	35	0.77	45	0.96	0.83
										Cw:	0.83

	Calc'd	Used
T_{C100}=	3.11	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{B100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Commercial/Indus	0.62	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.22	0.35	0.50	0.70	0.90	0.90

Q_{100}=	4.9
Q_{50}=	4.4
Q_{25}=	3.5
Q_{10}=	2.5
Q_5=	1.7
Q_2=	1.1

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	BLN	HOUGHTON PVMT DRN TO BUFFALOBERRY LOOP (NORTH)
	EXISTING CONDITION, PAVEMENT & PARKWAY TO BRDWY -- AREA FROM HOUGHTION & PARKWAY	

DA:	1.00	-Acres
Lc:	389.0	-Feet
Lca:	206.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	215.0	1.8	0.0084
	174.0	5.5	0.0316
Lc:	389.0	Sc:	0.0137

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Commercial/Indus	DF	0.048	0.90
Commercial/Indus	DF	0.048	0.90
n_{bw100}:		0.048	F_{ACW}: 0.90

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Commercial/Indust	1.00			65	0.70	35	0.77	65	0.96	0.88
										Cw:	0.88

	Calc'd	Used
T_{C100}=	4.50	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{ir100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C\,100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Commercial/Indus	1.00	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.22	0.35	0.50	0.70	0.90	0.90

Q_{100}=	8.4
Q_{50}=	7.6
Q_{25}=	5.9
Q_{10}=	4.2
Q_5=	2.9
Q_2=	1.9

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	CDE	HOUGHTON PVMT DRN TOCAMINO DEL ESTE
	EXISTING CONDITION, PAVEMENT & PARKWAY TO BRDWY -- AREA FROM HOUGHTION & PARKWAY	

DA:	0.42	-Acres
Lc:	339.0	-Feet
Lca:	169.5	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	339.0	7.0	0.0206
Lc:	339.0	Sc:	0.0206

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Commercial/Indus	DF	0.048	0.90
		n_{bw100}: 0.048	F_{ACW}: 0.90

$P_{1\text{-}100}$: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Commercial/Indust	0.42			65	0.70	35	0.77	90	0.96	0.94
										Cw:	0.94

	Calc'd	Used
T_{C100}=	3.65	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{iF100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Commercial/Indus	0.42	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.22	0.35	0.50	0.70	0.90	0.90

Q_{100}=	3.8
Q_{50}=	3.4
Q_{25}=	2.6
Q_{10}=	1.9
Q_5=	1.3
Q_2=	0.8

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	S/F	HOUGHTON PVMT DRN TO ALLEY/SWALE BETWEEN SHD & FMD
	EXISTING CONDITION, PAVEMENT & PARKWAY TO BRDWY -- AREA FROM HOUGHTION & PARKWAY	

DA:	0.45	-Acres
Lc:	100.0	-Feet
Lca:	50.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	100.0	2.0	0.0200
Lc:	100.0	Sc:	0.0200

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Commercial/Indus	DF	0.048	0.90
	n_{bw100}:	0.048	F_{ACW}: 0.90

$P_{1\text{-}100}$: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Commercial/Indust	0.45			65	0.70	35	0.77	25	0.96	0.78
										Cw:	0.78

	Calc'd	Used
T_{C100}=	2.56	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{F100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C\,100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Commercial/Indus	0.45	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.22	0.35	0.50	0.70	0.90	0.90

Q_{100}=	3.4
Q_{50}=	3.0
Q_{25}=	2.4
Q_{10}=	1.7
Q_5=	1.2
Q_2=	0.7

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	H@B	HOUGHTON @ BROADWAY SOUTH INTERSECTION -- PAVEMENT DRAINAGE
		EXISTING CONDITION, PAVEMENT & PARKWAY TO BRDWY -- POTENTIAL SPLIT INTO RETAIL ALONG

DA:	1.31	-Acres
Lc:	1183.0	-Feet
Lca:	500.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	80.0	2.0	0.0250
	308.0	8.0	0.0260
	795.0	18.0	0.0226
Lc:	1183.0	Sc:	0.0236

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Commercial/Indus	DF	0.048	0.90
Commercial/Indus	IC	0.022	0.90
Commercial/Indus	DF	0.048	0.90
	n_{bw100}:	0.042	F_{ACW}: 0.90

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Commercial/Indust	1.31			65	0.70	35	0.77	70	0.96	0.89
										Cw:	0.89

	Calc'd	Used
T_{C100}=	5.45	5.45

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{IF100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.43

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C\,100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Commercial/Indus	1.31	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.22	0.35	0.50	0.70	0.90	0.90

Q_{100}=	11.0
Q_{50}=	9.9
Q_{25}=	7.7
Q_{10}=	5.5
Q_5=	3.8
Q_2=	2.4

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	FMD	HOUGHTON PVMT DRN TO FOXMOOR DRIVE
	EXISTING CONDITION, PAVEMENT & PARKWAY TO BRDWY -- AREA FROM HOUGHTION & PARKWAY	

DA:	1.15	-Acres
Lc:	536.0	-Feet
Lca:	265.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	246.0	2.0	0.0081
	290.0	6.0	0.0207
Lc:	536.0	Sc:	0.0128

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Commercial/Indus	DF	0.048	0.90
Commercial/Indus	DF	0.048	0.90
	n_{bw100}:	0.048	F_{ACW}: 0.90

$P_{1\text{-}100}$: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Commercial/Indust	1.15			65	0.70	35	0.77	45	0.96	0.83
										Cw:	0.83

	Calc'd	Used
T_{C100}=	5.40	5.40

$$T_{C\text{-}100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.5}}{(ScP_{1,100} C_{B100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.45

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Commercial/Indus	1.15	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.22	0.35	0.50	0.70	0.90	0.90

Q_{100}=	9.0
Q_{50}=	8.1
Q_{25}=	6.3
Q_{10}=	4.5
Q_5=	3.2
Q_2=	2.0

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	SHD	HOUGHTON PVMT DRN TO SONORAN HEIGHTS DRIVE
	EXISTING CONDITION, PAVEMENT & PARKWAY TO BRDWY -- AREA FROM HOUGHTION & PARKWAY	

DA:	0.30	-Acres
Lc:	197.0	-Feet
Lca:	70.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	197.0	6.2	0.0315
Lc:	197.0	Sc:	0.0315

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Commercial/Indus	DF	0.048	0.90
	n_{bw100}:	0.048	F_{ACW}: 0.90

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Commercial/Industr	0.30			65	0.70	35	0.77	45	0.96	0.83
										Cw:	0.83

	Calc'd	Used
T_{C100}=	2.68	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{W100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Commercial/Indus	0.30	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.22	0.35	0.50	0.70	0.90	0.90

Q_{100}=	2.4
Q_{50}=	2.2
Q_{25}=	1.7
Q_{10}=	1.2
Q_5=	0.8
Q_2=	0.5

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	B1	SOUTHEAST CORNER OF HOUGHTON & SPEEDWAY
	B, NORTH EAST Vee DITCH ALONG HOUGHTON TO CMP @ SPEEDWAY	

DA:	1.55	-Acres
Lc:	1055.0	-Feet
Lca:	593.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	156.0	7.0	0.0449
	899.0	35.1	0.0390
Lc:	1055.0	Sc:	0.0398

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Natural/Rural	IC	0.024	1.00
Natural/Rural	IC	0.024	1.00
		n_{bw100}:	0.024
		F_{ACW}:	1.00

$P_{1\text{-}100}$: 3.00 Inches

Soils---

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Natural/Rural	1.55	24	0.60	49	0.70	27	0.77	26	0.96	0.76
										Cw:	0.76

	Calc'd	Used
T_{C100}=	3.30	5.00

$$T_{C\text{-}100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{B100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\ T_{C\,100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	CAF
Natural/Rural	1.55	0.10	0.23	0.37	0.58	0.77	1.00
Weighted Average:		0.10	0.23	0.37	0.58	0.77	1.00

Q_{100}=	11.4
Q_{50}=	8.8
Q_{25}=	6.6
Q_{10}=	4.2
Q_5=	2.6
Q_2=	1.1

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	B2	MINOR ROADSIDE SWALE ALONG HOUGHTON @ SPEEDWAY - NORTHBOUND
	B, HOUGHTON & SPEEDWAY INTERSECTION	

DA:	1.28	-Acres
Lc:	1302.0	-Feet
Lca:	617.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	1302.0	49.3	0.0379
Lc:	1302.0	Sc:	0.0379

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Natural/Rural	IC	0.024	1.00
	n_{bw100}:	0.024	F_{ACW}: 1.00

P_{1-100}: 3.00 Inches

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Natural/Rural	1.28	38	0.60	40	0.70	22	0.77	87	0.96	0.92
										Cw:	0.92

	Calc'd	Used
T_{C100}=	3.34	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{B100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	CAF
Natural/Rural	1.28	0.10	0.23	0.37	0.58	0.77	1.00
Weighted Average:		0.10	0.23	0.37	0.58	0.77	1.00

Q_{100}=	11.3
Q_{50}=	8.7
Q_{25}=	6.6
Q_{10}=	4.2
Q_5=	2.6
Q_2=	1.1

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	B3	MINOR ROADSIDE SWALE ALONG HOUGHTON @ SPEEDWAY - SOUTHBOUND
	B, HOUGHTON & SPEEDWAY INTERSECTION	

DA:	0.87	-Acres
Lc:	1053.0	-Feet
Lca:	448.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	1053.0	39.0	0.0370
Lc:	1053.0	Sc:	0.0370

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Natural/Rural	IC	0.024	1.00
	n_{bw100}:	0.024	F_{ACW}: 1.00

P_{1-100}: 3.00 Inches

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Natural/Rural	0.87	59	0.60	27	0.70	14	0.77	61	0.96	0.84
										Cw:	0.84

	Calc'd	Used
T_{C100}=	3.12	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{W100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C\,100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	CAF
Natural/Rural	0.87	0.10	0.23	0.37	0.58	0.77	1.00
Weighted Average:		0.10	0.23	0.37	0.58	0.77	1.00

Q_{100}=	7.0
Q_{50}=	5.4
Q_{25}=	4.1
Q_{10}=	2.6
Q_5=	1.6
Q_2=	0.7

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	C6	SOUTHWEST CROSSING @ 5TH & HOUGHTON
	C -- EXISTING CONDITION, UPPERMOST CONTRIBUTING SUBBASIN	

DA:	2.88	-Acres
Lc:	1507.0	-Feet
Lca:	613.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
6	1507.0	42.0	0.0279
Lc:	1507.0	Sc:	0.0279

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Natural/Rural	IC	0.024	1.00
	n_{bw100}:	0.024	F_{ACW}: 1.00

P_{1-100}: 3.00 Inches

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
6	Natural/Rural	2.88			65	0.70	35	0.77	25	0.96	0.78
										Cw:	0.78

	Calc'd	Used
T_{C100}=	3.88	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{B100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	CAF
Natural/Rural	2.88	0.10	0.23	0.37	0.58	0.77	1.00
Weighted Average:		0.10	0.23	0.37	0.58	0.77	1.00

Q_{100}=	21.7
Q_{50}=	16.7
Q_{25}=	12.6
Q_{10}=	8.0
Q_5=	5.0
Q_2=	2.2

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	C5	DIRT DRIVEWAY NORTH OF 5TH STREET WEST SIDE OF HOUGHTON
	C -- EXISTING CONDITION, NEXT LOWER SUBBASIN (C6 UPSTREAM)	

DA:	5.78	-Acres
Lc:	2883.0	-Feet
Lca:	1376.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
6	1507.0	42.0	0.0279
5	481.0	13.0	0.0270
5	545.0	18.0	0.0330
5	260.0	9.0	0.0346
5	90.0	8.0	0.0889
Lc:	2883.0	Sc:	0.0300

Land Use --

Description	Channel Type	Basin Factor		Area Factor
Natural/Rural	IC	0.024		1.00
Natural/Rural	IC	0.024		1.00
Natural/Rural	IC	0.024		1.00
Natural/Rural	IC	0.024		1.00
Natural/Rural	IC	0.024		1.00
		n_{bw100}:	0.024	F_{ACW}: 1.00

P_{1-100}: 3.00 Inches

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
6	Natural/Rural	2.88			65	0.70	35	0.77	23	0.96	0.78
5	Natural/Rural	2.90			65	0.70	35	0.77	31	0.96	0.80
										Cw:	0.79

	Calc'd	Used
T_{C100}=	5.33	5.33

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{B100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.47

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	CAF
Natural/Rural	2.88	0.10	0.23	0.37	0.58	0.77	1.00
Natural/Rural	2.90	0.10	0.23	0.37	0.58	0.77	1.00
Weighted Average:		0.10	0.23	0.37	0.58	0.77	1.00

Q_{100}=	43.2
Q_{50}=	33.2
Q_{25}=	25.0
Q_{10}=	16.0
Q_5=	9.9
Q_2=	4.3

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	C4	DIRT DRIVEWAY NORTH OF 5TH STREET WEST SIDE OF HOUGHTON
	C -- EXISTING CONDITION, SUBDIVISION WEST OF CHANNEL ->DRAINS TO CHANNEL	

DA:	12.85	-Acres
Lc:	1406.0	-Feet
Lca:	569.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
4	150.0	3.0	0.0200
4	1256.0	37.0	0.0295
Lc:	1406.0	Sc:	0.0282

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Moderately Urban	DF	0.048	0.70
Moderately Urban	DF	0.048	0.70
		n_{bw100}: 0.048	F_{ACW}: 0.70

P_{1-100}: 3.00 Inches

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
4	Moderately Urban	12.85			65	0.70	35	0.77	35	0.96	0.81
										Cw:	0.81

	Calc'd	Used
T_{C100}=	6.56	6.56

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{B100})^{0.3}} + 1.31 \right)$$

i_{100}=	9.04

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	CAF
Moderately Urban	12.85	0.18	0.30	0.46	0.65	0.85	0.70
Weighted Average:		0.18	0.30	0.46	0.65	0.85	0.70

Q_{100}=	65.6
Q_{50}=	55.7
Q_{25}=	42.6
Q_{10}=	30.2
Q_5=	19.7
Q_2=	11.8

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	C3	CONFLUENCE OF SUBDIVISION AND CHANNEL NORTH OF 5TH STREET
	C -- EXISTING CONDITION, (C5 & C4 UPSTREAM)	

DA:	19.42	-Acres
Lc:	3306.0	-Feet
Lca:	1140.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
6	1507.0	42.0	0.0279
5	481.0	13.0	0.0270
5	545.0	18.0	0.0330
5	260.0	9.0	0.0346
5	90.0	8.0	0.0889
3	423.0	13.0	0.0307
Lc:	3306.0	Sc:	0.0301

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Natural/Rural	IC	0.024	1.00
Natural/Rural	IC	0.024	1.00
Natural/Rural	IC	0.024	1.00
Natural/Rural	IC	0.024	1.00
Natural/Rural	IC	0.024	1.00
Natural/Rural	IC	0.024	1.00
	n_{bw100}:	0.024	F_{ACW}: 1.00

$P_{1\text{-}100}$: 3.00 Inches

F_{ACW} OVERRIDE: 0.80

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
6	Natural/Rural	2.88			65	0.70	35	0.77	23	0.96	0.78
5	Natural/Rural	2.90			65	0.70	35	0.77	31	0.96	0.80
4	Moderately Urban	12.85			65	0.70	35	0.77	35	0.96	0.81
3	Natural/Rural	0.79			65	0.70	35	0.77	50	0.96	0.84
		19.42								Cw:	0.80

	Calc'd	Used
T_{C100}=	5.22	5.22

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100}C_{B100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.52

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Natural/Rural	2.88	0.10	0.23	0.37	0.58	0.77	1.00
Natural/Rural	2.90	0.10	0.23	0.37	0.58	0.77	1.00
Moderately Urban	12.85	0.18	0.30	0.46	0.65	0.85	0.70
Natural/Rural	0.79	0.10	0.23	0.37	0.58	0.77	1.00
Weighted Average:		0.15	0.28	0.43	0.63	0.82	0.80

Q_{100}=	118.9
Q_{50}=	97.8
Q_{25}=	74.5
Q_{10}=	51.1
Q_5=	32.9
Q_2=	18.2

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	**11515**	
Project Name:	**HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL**	
CP Desc:	**C2**	**SOUTHERN MOST CIRCLE K DRIVEWAY CROSSING**
	C -- EXISTING CONDITION, NEXT LOWER SUBBASIN - (C3 UPSTREAM)	

DA:	20.59	-Acres
Lc:	3950.0	-Feet
Lca:	1140.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
6	1507.0	42.0	0.0279
5	481.0	13.0	0.0270
5	545.0	18.0	0.0330
5	260.0	9.0	0.0346
5	90.0	8.0	0.0889
3	423.0	13.0	0.0307
2	78.0	1.2	0.0154
2	566.0	22.0	0.0389
Lc:	**3950.0**	**Sc:**	**0.0306**

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Natural/Rural	IC	0.024	1.00
Natural/Rural	IC	0.024	1.00
Natural/Rural	IC	0.024	1.00
Natural/Rural	IC	0.024	1.00
Natural/Rural	IC	0.024	1.00
Natural/Rural	IC	0.024	1.00
Natural/Rural	IC	0.024	1.00
Natural/Rural	IC	0.024	1.00
	n_{bw100}:	**0.024**	F_{ACW}: **1.00**

$P_{1\text{-}100}$: 3.00 Inches

F_{ACW} **OVERRIDE:** **0.81**

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
6	Natural/Rural	2.88			65	0.70	35	0.77	23	0.96	0.78
5	Natural/Rural	2.90			65	0.70	35	0.77	31	0.96	0.80
4	Moderately Urban	12.85			65	0.70	35	0.77	35	0.96	0.81
3	Natural/Rural	0.79			65	0.70	35	0.77	50	0.96	0.84
2	Natural/Rural	1.17			65	0.70	35	0.77	30	0.96	0.80
										Cw:	**0.80**

	Calc'd	Used
T_{C100}=	5.44	5.44

$$T_{C\text{-}100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{W100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.44

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C\,100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Natural/Rural	2.88	0.10	0.23	0.37	0.58	0.77	1.00
Natural/Rural	2.90	0.10	0.23	0.37	0.58	0.77	1.00
Moderately Urban	12.85	0.18	0.30	0.46	0.65	0.85	0.70
Natural/Rural	0.79	0.10	0.23	0.37	0.58	0.77	1.00
Natural/Rural	1.17	0.10	0.23	0.37	0.58	0.77	1.00
Weighted Average:		0.15	0.27	0.43	0.62	0.82	0.81

Q_{100}=	126.7
Q_{50}=	103.9
Q_{25}=	79.0
Q_{10}=	54.0
Q_5=	34.7
Q_2=	19.0

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	C1	GRATED INLET @ SW CORNER OF HOUGHTON ROAD & SPEEDWAY

DA:	23.93	-Acres
Lc:	3950.0	-Feet
Lca:	1140.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
6	1507.0	42.0	0.0279
5	481.0	13.0	0.0270
5	545.0	18.0	0.0330
5	260.0	9.0	0.0346
5	90.0	8.0	0.0889
3	423.0	13.0	0.0307
2	78.0	1.2	0.0154
2	566.0	22.0	0.0389
	Lc: 3950.0	**Sc:**	**0.0306**

$P_{1\text{-}100}$: 3.00 Inches

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Natural/Rural	IC	0.024	1.00
Natural/Rural	IC	0.024	1.00
Natural/Rural	IC	0.024	1.00
Natural/Rural	IC	0.024	1.00
Natural/Rural	IC	0.024	1.00
Natural/Rural	IC	0.024	1.00
Natural/Rural	IC	0.024	1.00
Natural/Rural	IC	0.024	1.00
	n_{bw100}:	**0.024**	F_{ACW}: **1.00**

F_{ACW} OVERRIDE: **0.84**

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
6	Natural/Rural	2.88			65	0.70	35	0.77	23	0.96	0.78
5	Natural/Rural	2.90			65	0.70	35	0.77	31	0.96	0.80
4	Moderately Urban	12.85			65	0.70	35	0.77	35	0.96	0.81
3	Natural/Rural	0.79			65	0.70	35	0.77	50	0.96	0.84
2	Natural/Rural	1.17			65	0.70	35	0.77	30	0.96	0.80
1	Commercial/Industi	3.34	100	0.60					90	0.96	0.92
										Cw:	0.82

	Calc'd	Used
T_{C100}=	5.40	5.40

$$T_{C\text{-}100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{F100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.45

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C\,100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Natural/Rural	2.88	0.10	0.23	0.37	0.58	0.77	1.00
Natural/Rural	2.90	0.10	0.23	0.37	0.58	0.77	1.00
Moderately Urban	12.85	0.18	0.30	0.46	0.65	0.85	0.70
Natural/Rural	0.79	0.10	0.23	0.37	0.58	0.77	1.00
Natural/Rural	1.17	0.10	0.23	0.37	0.58	0.77	1.00
Commercial/Indus	3.34	0.22	0.35	0.50	0.70	0.90	1.00
Weighted Average:		0.16	0.28	0.44	0.63	0.83	0.84

Q_{100}=	155.4
Q_{50}=	129.2
Q_{25}=	98.6
Q_{10}=	67.8
Q_5=	44.2
Q_2=	24.8

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	D1	BROADWAY TO CORONADO RIDGE WASH SB LANES CONTRIBUTING TO DIP
	EXISTING CONDITION, INCLUDES SOME PARKWAY AND DEVELOPED AREA WEST OF HOUGHTON	

DA:	2.64	-Acres
Lc:	953.0	-Feet
Lca:	450.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	953.0	30.0	0.0315
Lc:	953.0	Sc:	0.0315

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Commercial/Indus	DF	0.048	0.90
		n_{bw100}: 0.048	F_{ACW}: 0.90

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Commercial/Indust	2.64			65	0.70	35	0.77	70	0.96	0.89
										Cw:	0.89

	Calc'd	Used
T_{C100}=	5.14	5.14

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{B100})^{0.3}} + 1.31 \right)$$

i_{100}=	9.55

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Commercial/Indus	2.64	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.22	0.35	0.50	0.70	0.90	0.90

Q_{100}=	22.4
Q_{50}=	20.2
Q_{25}=	15.7
Q_{10}=	11.2
Q_5=	7.8
Q_2=	4.9

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	D2	BROADWAY TO CORONADO RIDGE WASH NB LANES CONTRIBUTING TO DIP
	EXISTING CONDITION, INCLUDES SOME PARKWAY AND DEVELOPED AREA EAST OF HOUGHTON	

DA:	2.26	-Acres
Lc:	1383.0	-Feet
Lca:	579.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	369.0	12.0	0.0325
	562.0	16.0	0.0285
	452.0	3.0	0.0066
Lc:	1383.0	Sc:	0.0160

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Natural/Rural	IC	0.024	1.00
Commercial/Indus	DF	0.048	0.90
Commercial/Indus	DF	0.048	0.90
		n_{bw100}:	0.044
		F_{ACW}:	0.92

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Natural/Rural	25.00			65	0.70	35	0.77	25	0.96	0.78
	Commercial/Industr	75.00			65	0.70	35	0.77	60	0.96	0.87
										Cw:	0.85

	Calc'd	Used
T_{C100}=	7.30	7.30

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (Lcl.ca)^{0.3}}{(ScP_{1,100} C_{F100})^{0.4}} + 1.31 \right)$$

i_{100}=	8.79

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C\,100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Natural/Rural	25.00	0.10	0.23	0.37	0.58	0.77	1.00
Commercial/Indus	75.00	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.19	0.32	0.47	0.67	0.87	0.93

Q_{100}=	16.8
Q_{50}=	14.6
Q_{25}=	11.3
Q_{10}=	7.9
Q_5=	5.4
Q_2=	3.2

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

B Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	DS2	EXISTING CONDITION - PARKWAY AREA EAST OF HOUGHTON & WEST OF SMITHS COMMER
		CENTER SOUTH OF BROADWAY BLVD. DRAINING TO CP DS1 THEN TO CP D4

DA:	0.48	-Acres
Lc:	337.0	-Feet
Lca:	168.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	337.0	9.4	0.0279
Lc:	337.0	Sc:	0.0279

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Natural/Rural	IC	0.024	1.00
	n_{bw100}:	0.024	F_{ACW}: 1.00

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Natural/Rural	0.48			65	0.70	35	0.77	10	0.96	0.75
										Cw:	0.75

	Calc'd	Used
T_{C100}=	2.48	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{B100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Natural/Rural	0.48	0.10	0.23	0.37	0.58	0.77	1.00
Weighted Average:		0.10	0.23	0.37	0.58	0.77	1.00

Q_{100}=	3.4
Q_{50}=	2.7
Q_{25}=	2.0
Q_{10}=	1.3
Q_5=	0.8
Q_2=	0.3

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

B Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	DS1	EXISTING CONDITION, PARKWAY AREA EAST OF HOUGHTON & WEST OF CHEVERON
		CENTER - DRAINS TO CP D4 CORONADO RIDGE WASH - INCLUDES AREA FROM CP DS2

DA:	2.82	-Acres
Lc:	779.0	-Feet
Lca:	389.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
DS1	313.0	1.4	0.0045
	139.0	6.0	0.0432
	12.0	2.7	0.2250
	315.0	4.3	0.0137
Lc:	779.0	Sc:	0.0093

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Commercial/Indus	DF	0.048	0.90
Commercial/Indus	DF	0.048	0.90
Natural/Rural	IC	0.024	1.00
Natural/Rural	IC	0.024	1.00
		n_{bw100}:	0.040
		F_{ACW}:	0.93

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
DS2	Natural/Rural	0.48			65	0.70	35	0.77	10	0.96	0.75
DS1	Commercial/Indust	2.34			65	0.70	35	0.77	80	0.96	0.91
										Cw:	0.88

	Calc'd	Used
T_{C100}=	6.14	6.14
T_{R100}=	14.20	

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{IF100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.18

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C\,100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Natural/Rural	0.48	0.10	0.23	0.37	0.58	0.77	1.00
Commercial/Indus	2.34	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.20	0.33	0.48	0.68	0.88	0.92

Q_{100}=	22.9
Q_{50}=	20.1
Q_{25}=	15.6
Q_{10}=	10.9
Q_5=	7.5
Q_2=	4.6

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	D4-L	EXISTING CONDITION, LOCAL R/O FROM COMMERCIAL AREAS - CHEVERON & SMITHS CENT

DA:	1.50	-Acres
Lc:	364.0	-Feet
Lca:	102.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	364.0	9.0	0.0247
Lc:	364.0	Sc:	0.0247

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Commercial/Indus	DF	0.048	0.90
		n_{bw100}: 0.048	F_{ACW}: 0.90

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Commercial/Indust	1.50			65	0.70	35	0.77	80	0.96	0.91
										Cw:	0.91

	Calc'd	Used
T_{C100}=	3.23	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{B100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Commercial/Indus	1.50	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.22	0.35	0.50	0.70	0.90	0.90

Q_{100}=	13.1
Q_{50}=	11.8
Q_{25}=	9.2
Q_{10}=	6.6
Q_5=	4.6
Q_2=	2.9

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	E1-L	EXISTING CONDITION, LOCAL R/O FROM COMMERCIAL AREA -SMITHS CENTER

DA:	1.22	-Acres
Lc:	305.0	-Feet
Lca:	102.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	305.0	7.5	0.0246
Lc:	305.0	Sc:	0.0246

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Commercial/Indus	DF	0.048	0.90
	n_{bw100}:	0.048	F_{ACW}: 0.90

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Commercial/Industr	1.22			65	0.70	35	0.77	75	0.96	0.90
										Cw:	0.90

	Calc'd	Used
T_{C100}=	3.14	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{IF100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Commercial/Indus	1.22	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.22	0.35	0.50	0.70	0.90	0.90

Q_{100}=	10.6
Q_{50}=	9.5
Q_{25}=	7.4
Q_{10}=	5.3
Q_5=	3.7
Q_2=	2.3

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	E1&2	TOTAL FLOW RATE TO CP DE2 INCLUDES R/O FROM CP DE1
	EXISTING CONDITION	

DA:	30.12	-Acres
Lc:	2418.0	-Feet
Lca:	1209.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	124.0	14.0	0.1129
	397.0	22.0	0.0554
	391.0	6.0	0.0153
	1227.0	38.0	0.0310
	279.0	3.0	0.0108
Lc:	2418.0	Sc:	0.0264

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Natural/Rural	DF	0.055	1.00
Natural/Rural	DF	0.055	1.00
Natural/Rural	DF	0.055	1.00
Natural/Rural	NC	0.045	1.00
Commercial/Indus	IC	0.022	0.90
	n_{bw100}:	0.044	F_{ACW}: 0.98

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 0.84

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Natural/Rural	7.75			65	0.70	35	0.77	10	0.96	0.75
	Suburban	1.02			65	0.70	35	0.77	15	0.96	0.76
	Moderately Urban	8.13			65	0.70	35	0.77	35	0.96	0.81
	Highly Urban	9.69			65	0.70	35	0.77	60	0.96	0.87
	Commercial/Indust	2.31			65	0.70	35	0.77	90	0.96	0.94
	Commercial/Indust	1.22			65	0.70	35	0.77	75	0.96	0.90
										Cw:	0.82

	Calc'd	Used
T_{C100}=	9.15	9.15
T_{R100}=	17.05	

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{W100})^{0.4}} + 1.31 \right)$$

i_{100}=	8.23

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Natural/Rural	7.75	0.10	0.23	0.37	0.58	0.77	1.00
Suburban	1.02	0.13	0.28	0.41	0.61	0.79	0.90
Moderately Urban	8.13	0.18	0.30	0.46	0.65	0.85	0.70
Highly Urban	9.69	0.22	0.35	0.50	0.70	0.90	0.80
Commercial/Indus	2.31	0.22	0.35	0.50	0.70	0.90	0.90
Commercial/Indus	1.22	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.18	0.30	0.45	0.65	0.85	0.84

Q_{100}=	171.4
Q_{50}=	145.6
Q_{25}=	111.9
Q_{10}=	77.6
Q_5=	52.0
Q_2=	30.0

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	E2	R/O FROM BARRIO RINCON TO EASTERN MOST CULVERT UNDER DRIVEWAY SMITHS COMM
	EXISTING CONDITION	

DA:	26.59	-Acres
Lc:	2139.0	-Feet
Lca:	1069.5	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	124.0	14.0	0.1129
	397.0	22.0	0.0554
	391.0	6.0	0.0153
	1227.0	38.0	0.0310
Lc:	2139.0	Sc:	0.0308

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Natural/Rural	DF	0.055	1.00
Natural/Rural	DF	0.055	1.00
Natural/Rural	DF	0.055	1.00
Natural/Rural	NC	0.045	1.00
	n_{bw100}:	0.049	F_{ACW}: 1.00

P_{1-100}: 3.00 Inches

F_{ACW} USED: 0.83

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Natural/Rural	7.75			65	0.70	35	0.77	10	0.96	0.75
	Suburban	1.02			65	0.70	35	0.77	15	0.96	0.76
	Moderately Urban	8.13			65	0.70	35	0.77	35	0.96	0.81
	Highly Urban	9.69			65	0.70	35	0.77	60	0.96	0.87
										Cw:	0.81

	Calc'd	Used
T_{C100}=	8.93	8.93

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{B100})^{0.4}} + 1.31 \right)$$

i_{100}=	8.30

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Q_{100}=	148.2
Q_{50}=	124.9
Q_{25}=	95.8
Q_{10}=	66.2
Q_5=	44.0
Q_2=	25.1

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Natural/Rural	7.75	0.10	0.23	0.37	0.58	0.77	1.00
Suburban	1.02	0.13	0.28	0.41	0.61	0.79	0.90
Moderately Urban	8.13	0.18	0.30	0.46	0.65	0.85	0.70
Highly Urban	9.69	0.22	0.35	0.50	0.70	0.90	0.80
Weighted Average:		0.17	0.30	0.45	0.65	0.84	0.83

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	E2+	R/O FROM BARRIO RINCON TO EASTERN MOST CULVERT UNDER DRIVEWAY SMITHS COMM
	EXISTING CONDITION, INCLUDES AREA FROM SMITHS COMMERCIAL CENTER	

DA:	28.90	-Acres
Lc:	2139.0	-Feet
Lca:	1069.5	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	124.0	14.0	0.1129
	397.0	22.0	0.0554
	391.0	6.0	0.0153
	1227.0	38.0	0.0310
Lc:	2139.0	Sc:	0.0308

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Natural/Rural	DF	0.055	1.00
Natural/Rural	DF	0.055	1.00
Natural/Rural	DF	0.055	1.00
Natural/Rural	NC	0.045	1.00
	n_{bw100}:	0.049	F_{ACW}: 1.00

P_{1-100}: 3.00 Inches

F_{ACW} USED: 0.84

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Natural/Rural	7.75			65	0.70	35	0.77	10	0.96	0.75
	Suburban	1.02			65	0.70	35	0.77	15	0.96	0.76
	Moderately Urban	8.13			65	0.70	35	0.77	35	0.96	0.81
	Highly Urban	9.69			65	0.70	35	0.77	60	0.96	0.87
	Commercial/Indust	2.31			65	0.70	35	0.77	90	0.96	0.94
										Cw:	0.82

	Calc'd	Used
T_{C100}=	8.88	8.88

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{B100})^{0.4}} + 1.31 \right)$$

i_{100}=	8.31

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Q_{100}=	165.3
Q_{50}=	140.1
Q_{25}=	107.6
Q_{10}=	74.5
Q_5=	49.8
Q_2=	28.7

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Natural/Rural	7.75	0.10	0.23	0.37	0.58	0.77	1.00
Suburban	1.02	0.13	0.28	0.41	0.61	0.79	0.90
Moderately Urban	8.13	0.18	0.30	0.46	0.65	0.85	0.70
Highly Urban	9.69	0.22	0.35	0.50	0.70	0.90	0.80
Commercial/Indus	2.31	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.17	0.30	0.45	0.65	0.85	0.84

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	E3	STREET R/O FROM BRENTWOOD HILLS - BARKLAY PARK LOOP ROAD
	EXISTING CONDITION, SOUTHEASTERN MOST SUB WATERSHED FOR CP D	

DA:	1.49	-Acres
Lc:	637.0	-Feet
Lca:	235.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	416.0	21.0	0.0505
	211.0	3.0	0.0142
X	Lc: 627.0	Sc:	0.0300

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Moderately Urban	DF	0.048	0.70
Moderately Urban	DF	0.048	0.70
		n_{bw100}: 0.048	F_{ACW}: 0.70

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Moderately Urban	1.49			65	0.70	35	0.77	35	0.96	0.81
										Cw:	0.81

	Calc'd	Used
T_{C100}=	4.19	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} \left(Lc Lca \right)^{0.3}}{\left(Sc P_{1,100} C_{B100} \right)^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{\left(1 + 0.05\, T_{C100} \right)}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Moderately Urban	1.49	0.18	0.30	0.46	0.65	0.85	0.70
Weighted Average:		0.18	0.30	0.46	0.65	0.85	0.70

Q_{100}=	11.5
Q_{50}=	9.8
Q_{25}=	7.5
Q_{10}=	5.3
Q_5=	3.5
Q_2=	2.1

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	F	SHEETFLOW FROM BRENTWOOD HILLS TO BROADWAY BLVD
	EXISTING CONDITION, NO MAIN CONCENTRATION POINT - ONLY SHEET FLOW	

DA:	0.66	-Acres
Lc:		-Feet
Lca:		-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	953.0	30.0	0.0315
X	Lc: 953.0	Sc:	0.0315

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Moderately Urban	DF	0.048	0.70
Natural/Rural	DF	0.055	1.00
		n_{bw100}: 0.048	F_{ACW}: 0.70

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Moderately Urban	0.36			65	0.70	35	0.77	70	0.96	0.89
	Natural/Rural	0.30			65	0.70	35	0.77	5	0.96	0.74
										Cw:	0.82

	Calc'd	Used
T_{C100}=		5.00

Sheet flow min Tc ^

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{B100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Moderately Urban	0.36	0.18	0.30	0.46	0.65	0.85	0.70
Natural/Rural	0.30	0.10	0.23	0.37	0.58	0.77	1.00
Weighted Average:		0.14	0.27	0.42	0.62	0.81	0.84

Q_{100}=	5.2
Q_{50}=	4.2
Q_{25}=	3.2
Q_{10}=	2.2
Q_5=	1.4
Q_2=	0.7

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	G	SHEETFLOW FROM PARKWAY TO CMP -- RETAIL CENTER, BROADWAY & HOUGHTON
		EXISTING CONDITION, WEST SIDE OF HOUGHTON NORTH OF MIDDLE ENTRANCES

DA:	0.23	-Acres
Lc:	120.0	-Feet
Lca:	60.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
G	120.0	6.0	0.0500
Lc:	120.0	Sc:	0.0500

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Natural/Rural	DF	0.055	1.00
	n_{bw100}:	0.055	F_{ACW}: 1.00

$P_{1\text{-}100}$: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
G	Commercial/Industi	0.23			65	0.70	35	0.77	5	0.96	0.74
										Cw:	0.74

	Calc'd	Used
T_{C100}=	2.46	5.00

Sheet flow min Tc ^

$$T_{C\text{-}100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{B100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Commercial/Indus	0.23	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.22	0.35	0.50	0.70	0.90	0.90

Q_{100}=	1.6
Q_{50}=	1.5
Q_{25}=	1.1
Q_{10}=	0.8
Q_5=	0.6
Q_2=	0.4

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	GS1	SHEETFLOW FROM PARKWAY TO CMP -- RETAIL CENTER, BROADWAY & HOUGHTON
	EXISTING CONDITION, WEST SIDE OF HOUGHTON BETWEEN TWO SOUTHERN ENTRANCES INCLUDI	

DA:	0.86	-Acres
Lc:	612.0	-Feet
Lca:	300.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
GS2	342.0	15.0	0.0439
GS1	270.0	11.0	0.0407
Lc:	612.0	Sc:	0.0424

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Commercial/Indus	DF	0.048	0.90
Commercial/Indus	IC	0.022	0.90
	n_{bw100}:	0.036	F_{ACW}: 0.90

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
GS2	Commercial/Indust	0.48			65	0.70	35	0.77	5	0.96	0.74
GS1	Commercial/Indust	0.38			65	0.70	35	0.77	5	0.96	0.74
										Cw:	0.74

	Calc'd	Used
T_{C100}=	3.37	5.00

Sheet flow min Tc ^

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100}C_{W100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C\,100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Commercial/Indus	0.48	0.22	0.35	0.50	0.70	0.90	0.90
Commercial/Indus	0.38	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.22	0.35	0.50	0.70	0.90	0.90

Q_{100}=	6.1
Q_{50}=	5.5
Q_{25}=	4.3
Q_{10}=	3.0
Q_5=	2.1
Q_2=	1.3

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	GS2	SHEETFLOW FROM PARKWAY -- RETAIL CENTER, BROADWAY & HOUGHTON
	EXISTING CONDITION, WEST SIDE OF HOUGHTON SOUTH OF SOUTHERN ENTERANCE TO SHOPPIN	

DA:	0.48	-Acres
Lc:	342.0	-Feet
Lca:	170.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	342.0	15.0	0.0439
Lc:	342.0	Sc:	0.0439

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Commercial/Indus	DF	0.048	0.90
	n_{bw100}:	0.048	F_{ACW}: 0.90

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Commercial/Indust	0.48			65	0.70	35	0.77	5	0.96	0.74
										Cw:	0.74

	Calc'd	Used
T_{C100}=	3.21	5.00

Sheet flow min Tc ^

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{if100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Commercial/Indus	0.48	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.22	0.35	0.50	0.70	0.90	0.90

Q_{100}=	3.4
Q_{50}=	3.1
Q_{25}=	2.4
Q_{10}=	1.7
Q_5=	1.2
Q_2=	0.7

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	GS3	EXISTING CONDITION, SOUTHWEST CORNER OF SMITHS COMMERCIAL CENTER
		INCLUDES AREAS FROM CP GS3, GS4, GS5, GS6 & SMITHS COMMERCIAL CENTER
DA:	16.39	-Acres
Lc:	1559.0	-Feet
Lca:	779.5	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
GS6	698.0	22.0	0.0315
GS6	557.0	14.4	0.0259
GS4	208.0	5.2	0.0250
GS3	96.0	0.9	0.0094
Lc:	1559.0	Sc:	0.0258

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Suburban	DF	0.052	0.90
Highly Urban	IC	0.022	0.80
Commercial/Indus	IC	0.022	0.90
Commercial/Indus	DF	0.048	0.90
	n_{bw100}:	0.037	F_{ACW}: 0.86

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 0.92

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
GS6	Highly Urban	0.81			65	0.70	35	0.77	60	0.96	0.87
GS6	Natural/Rural	3.44			65	0.70	35	0.77	5	0.96	0.74
GS6	Suburban	8.46			65	0.70	35	0.77	15	0.96	0.76
GS4	Commercial/Indust	1.59			65	0.70	35	0.77	95	0.96	0.95
GS4	Commercial/Indust	0.56			65	0.70	35	0.77	45	0.96	0.83
GS5	Highly Urban	0.76			65	0.70	35	0.77	60	0.96	0.87
GS5	Commercial/Indust	0.69			65	0.70	35	0.77	100	0.96	0.96
GS3	Commercial/Indust	0.08			65	0.70	35	0.77	5	0.96	0.74
		16.39								Cw:	0.79

	Calc'd	Used
T_{C100}=	5.98	5.98

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{II100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.24

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Highly Urban	0.81	0.22	0.35	0.50	0.70	0.90	0.80
Natural/Rural	3.44	0.10	0.23	0.37	0.58	0.77	1.00
Suburban	8.46	0.13	0.28	0.41	0.61	0.79	0.90
Commercial/Indus	1.59	0.22	0.35	0.50	0.70	0.90	0.90
Commercial/Indus	0.56	0.22	0.35	0.50	0.70	0.90	0.90
Highly Urban	0.76	0.22	0.35	0.50	0.70	0.90	0.80
Commercial/Indus	0.69	0.22	0.35	0.50	0.70	0.90	0.90
Commercial/Indus	0.08	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.15	0.29	0.43	0.63	0.82	0.91

Q_{100}=	110.6
Q_{50}=	90.2
Q_{25}=	69.5
Q_{10}=	47.1
Q_5=	31.9
Q_2=	16.4

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	GS4	EXISTING CONDITION, SOUTHWEST CORNER OF SMITHS COMMERCIAL CENTER
		INCLUDES AREAS FROM CP GS4, GS5, GS6 & SMITHS COMMERCIAL CENTER
DA:	16.31	-Acres
Lc:	1463.0	-Feet
Lca:	731.5	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	698.0	22.0	0.0315
	557.0	14.4	0.0259
	208.0	5.2	0.0250
Lc:	1463.0	Sc:	0.0282

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Suburban	DF	0.052	0.90
Highly Urban	IC	0.022	0.80
Commercial/Indus	IC	0.022	0.90
	n_{bw100}:	0.036	F_{ACW}: 0.86

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 0.92

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
GS6	Highly Urban	0.81			65	0.70	35	0.77	60	0.96	0.87
GS6	Natural/Rural	3.44			65	0.70	35	0.77	5	0.96	0.74
GS6	Suburban	8.46			65	0.70	35	0.77	15	0.96	0.76
GS4	Commercial/Indust	1.59			65	0.70	35	0.77	95	0.96	0.95
GS4	Commercial/Indust	0.56			65	0.70	35	0.77	45	0.96	0.83
GS5	Highly Urban	0.76			65	0.70	35	0.77	60	0.96	0.87
GS5	Commercial/Indust	0.69			65	0.70	35	0.77	100	0.96	0.96
		16.31								Cw:	0.79

	Calc'd	Used
T_{C100}=	5.43	5.43

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{B100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.44

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Highly Urban	0.81	0.22	0.35	0.50	0.70	0.90	0.80
Natural/Rural	3.44	0.10	0.23	0.37	0.58	0.77	1.00
Suburban	8.46	0.13	0.28	0.41	0.61	0.79	0.90
Commercial/Indus	1.59	0.22	0.35	0.50	0.70	0.90	0.90
Commercial/Indus	0.56	0.22	0.35	0.50	0.70	0.90	0.90
Highly Urban	0.76	0.22	0.35	0.50	0.70	0.90	0.80
Commercial/Indus	0.69	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.15	0.29	0.43	0.63	0.82	0.91

Q_{100}=	112.5
Q_{50}=	91.7
Q_{25}=	70.6
Q_{10}=	47.9
Q_5=	32.4
Q_2=	16.6

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	GS5	EASTERN MOST SEGMENT OF BARRIO RINCON DRAINING TO SCUPPER ON COWHEAD SADI
	EXISTING CONDITION, EAST SIDE OF HOUGHTON ROAD &	

DA:	1.45	-Acres
Lc:	590.0	-Feet
Lca:	295.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	200.0	4.0	0.0200
	250.0	4.6	0.0184
	140.0	5.5	0.0393
Lc:	590.0	Sc:	0.0222

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Highly Urban	DF	0.048	0.80
Commercial/Indus	DF	0.048	1.00
Highly Urban	DF	0.048	0.80
		n_{bw100}: 0.048	F_{ACW}: 0.89

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 0.89

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Highly Urban	0.76			65	0.70	35	0.77	60	0.96	0.87
	Commercial/Indust	0.69			65	0.70	35	0.77	100	0.96	0.96
										Cw:	0.91

	Calc'd	Used
T_{C100}=	4.59	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{IF100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Highly Urban	0.76	0.22	0.35	0.50	0.70	0.90	0.80
Commercial/Indus	0.69	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.22	0.35	0.50	0.70	0.90	0.85

Q_{100}=	11.3
Q_{50}=	10.2
Q_{25}=	7.9
Q_{10}=	5.7
Q_5=	4.0
Q_2=	2.5

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	GS6	WEST SIDE OF BARRIO RINCON ALONG EAST SIDE OF HOUGHTON ROAD
	EXISTING CONDITION, DRAINAGE TO CULVERTS UNDER COWHEAD SADDLE LANE	

DA:	12.71	-Acres
Lc:	1255.0	-Feet
Lca:	727.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	698.0	22.0	0.0315
	557.0	14.4	0.0259
Lc:	1255.0	Sc:	0.0288

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Suburban	DF	0.052	0.90
Highly Urban	IC	0.022	0.80
	n_{bw100}:	0.038	F_{ACW}: 0.85

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 0.92

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Highly Urban	0.81			65	0.70	35	0.77	60	0.96	0.87
	Natural/Rural	3.44			65	0.70	35	0.77	5	0.96	0.74
	Suburban	8.46			65	0.70	35	0.77	15	0.96	0.76
										Cw:	0.76

	Calc'd	Used
T_{C100}=	5.56	5.56

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100}C_{IF100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.39

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C\,100})}$$

Q_{100}=	83.5
Q_{50}=	66.1
Q_{25}=	50.8
Q_{10}=	33.8
Q_5=	22.6
Q_2=	10.7

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Highly Urban	0.81	0.22	0.35	0.50	0.70	0.90	0.80
Natural/Rural	3.44	0.10	0.23	0.37	0.58	0.77	1.00
Suburban	8.46	0.13	0.28	0.41	0.61	0.79	0.90
Weighted Average:		0.13	0.27	0.40	0.61	0.79	0.92

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	H5	AREA EAST SIDE HOUGHTON SOUTH OF CAMINO DE LA PLACITA
	EXISTING CONDITION, CONTRIBUTING SUBBASIN DRAINS ACROSSLA PLACITA TO NORTH CP H5 - T	

DA:	12.01	-Acres
Lc:	1307.0	-Feet
Lca:	734.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	238.0	16.0	0.0672
	605.0	18.0	0.0298
	195.0	3.0	0.0154
	269.0	2.0	0.0074
Lc:	1307.0	Sc:	0.0206

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Suburban	DF	0.052	0.90
Suburban	DF	0.052	0.90
Suburban	DF	0.052	0.90
Commercial/Indus	DF	0.048	0.90
		n_{bw100}:	0.051
		F_{ACW}:	0.90

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Suburban	12.01			65	0.70	35	0.77	15	0.96	0.76
										Cw:	0.76

	Calc'd	Used
T_{C100}=	8.50	8.50

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{W100})^{0.4}} + 1.31 \right)$$

i_{100}=	8.42

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Suburban	12.01	0.13	0.28	0.41	0.61	0.79	0.90
Weighted Average:		0.13	0.28	0.41	0.61	0.79	0.90

Q_{100}=	76.8
Q_{50}=	60.7
Q_{25}=	46.9
Q_{10}=	31.5
Q_5=	21.5
Q_2=	10.0

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	H6	AREA EAST SIDE HOUGHTON SOUTH OFCALLE MAGDALENA
	EXISTING CONDITION, CONTRIBUTING SUBBASIN DRAINS ACROSS MAGDALENA TO NORTH CP H6	

DA:	6.45	-Acres
Lc:	832.0	-Feet
Lca:	415.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
H7	837.0	33.0	0.0394
X	Lc: 837.0	Sc:	0.0394

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Suburban	NC	0.042	0.90
	n_{bw100}:	0.042	F_{ACW}: 0.90

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 0.90

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
H7	Suburban	6.45			65	0.70	35	0.77	15	0.96	0.76
										Cw:	0.76

	Calc'd	Used
T_{C100}=	4.29	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{B100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	CAF
Suburban	6.45	0.13	0.28	0.41	0.61	0.79	0.90
Weighted Average:		0.13	0.28	0.41	0.61	0.79	0.90

Q_{100}=	42.3
Q_{50}=	33.5
Q_{25}=	25.8
Q_{10}=	17.4
Q_5=	11.9
Q_2=	5.5

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	H5&H6	AREA EAST SIDE HOUGHTON SOUTH OF CAMINO DE LA PLACITA - INCLUDES DA H7
	EXISTING CONDITION, CONTRIBUTING SUBBASIN DRAINS ACROSSLA PLACITA TO NORTH CP H5 - T	

DA:	18.46	-Acres
Lc:	1722.0	-Feet
Lca:	870.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
H7	837.0	33.0	0.0394
H6	328.0	8.0	0.0244
H6	557.0	7.0	0.0126
Lc:	1722.0	Sc:	0.0233

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Suburban	NC	0.042	0.90
Suburban	NC	0.042	0.90
Suburban	DF	0.052	0.90
n_{bw100}:		0.046	F_{ACW}: 0.90

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 0.90

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
H7	Suburban	6.45			65	0.70	35	0.77	15	0.96	0.76
H6	Suburban	12.01			65	0.70	35	0.77	15	0.96	0.76
										Cw:	0.76

	Calc'd	Used
T_{C100}=	8.47	8.47

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{B100})^{0.4}} + 1.31 \right)$$

i_{100}=	8.43

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C\,100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	CAF
Suburban	6.45	0.13	0.28	0.41	0.61	0.79	0.90
Suburban	12.01	0.13	0.28	0.41	0.61	0.79	0.90
Weighted Average:		0.13	0.28	0.41	0.61	0.79	0.90

Q_{100}=	106.4
Q_{50}=	84.1
Q_{25}=	64.9
Q_{10}=	43.6
Q_5=	29.8
Q_2=	13.8

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	H4	PARKWAY AREA WEST SIDE HOUGHTON SOUTH OF CALLE DEL ESTE
	EXISTING CONDITION, UPPERMOST CONTRIBUTING SUBBASIN DRAINS TO CDP-H4 VIA SMALL CULV	

DA:	0.08	-Acres
Lc:	105.0	-Feet
Lca:	50.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	30.0	2.0	0.0667
	75.0	1.0	0.0133
Lc:	105.0	Sc:	0.0188

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Commercial/Indus	DF	0.048	0.90
Commercial/Indus	DF	0.048	0.90
		n_{bw100}: 0.048	F_{ACW}: 0.90

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Commercial/Industr	0.08			65	0.70	35	0.77	20	0.96	0.77
										Cw:	0.77

	Calc'd	Used
T_{C100}=	2.61	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{W100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	CAF
Commercial/Indus	0.08	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.22	0.35	0.50	0.70	0.90	0.90

Q_{100}=	0.6
Q_{50}=	0.5
Q_{25}=	0.4
Q_{10}=	0.3
Q_5=	0.2
Q_2=	0.1

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	H(3,4)	PARKWAY AREA WEST SIDE HOUGHTON SOUTH OF MACALESTER WAY & H4'
	EXISTING CONDITION, CONTRIBUTING SUBBASIN DRAINS TO CDP-H3 VIA SMALL CULVERT	

DA:	1.77	-Acres
Lc:	1002.0	-Feet
Lca:	500.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
H4'	30.0	2.0	0.0667
H4'	75.0	1.0	0.0133
H4	128.0	2.0	0.0156
H4	769.0	25.5	0.0332
Lc:	1002.0	Sc:	0.0278

Land Use --

Description	Channel Type	Basin Factor		Area Factor
Commercial/Indus	DF	0.048		0.90
Commercial/Indus	DF	0.048		0.90
Commercial/Indus	IC	0.022		0.90
Commercial/Indus	IC	0.022		0.90
		n_{bw100}:	0.025	F_{ACW}: 0.90

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
H4'	Commercial/Industr	0.08			65	0.70	35	0.77	20	0.96	0.77
H4	Commercial/Industr	1.69			65	0.70	35	0.77	48	0.96	0.84
										Cw:	0.83

	Calc'd	Used
T_{C100}=	3.50	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{B100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	CAF
Commercial/Indus	0.08	0.22	0.35	0.50	0.70	0.90	0.90
Commercial/Indus	1.69	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.22	0.35	0.50	0.70	0.90	0.90

Q_{100}=	14.2
Q_{50}=	12.8
Q_{25}=	9.9
Q_{10}=	7.1
Q_5=	5.0
Q_2=	3.1

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	H3	PARKWAY AREA WEST SIDE HOUGHTON SOUTH OF MACALESTER WAY
	EXISTING CONDITION, CONTRIBUTING SUBBASIN DRAINS TO CDP-H3 VIA SMALL CULVERT	

DA:	1.69	-Acres
Lc:	1002.0	-Feet
Lca:	500.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
H4	128.0	2.0	0.0156
H4	769.0	25.5	0.0332
X	Lc: 897.0	Sc:	0.0292

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Commercial/Indus	DF	0.048	0.90
Commercial/Indus	DF	0.048	0.90
	n_{bw100}:	0.048	F_{ACW}: 0.90

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
H4	Commercial/Indust	1.69			65	0.70	35	0.77	48	0.96	0.84
										Cw:	0.84

	Calc'd	Used
T_{C100}=	5.61	5.61

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{W100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.37

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	CAF
Commercial/Indus	1.69	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.22	0.35	0.50	0.70	0.90	0.90

Q_{100}=	13.3
Q_{50}=	11.9
Q_{25}=	9.3
Q_{10}=	6.6
Q_5=	4.6
Q_2=	2.9

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL
CP Desc:	H(2,4) PARKWAY AREA WEST SIDE HOUGHTON SOUTH OF MACALESTER WAY - COMBINED AREA
	EXISTING CONDITION, CONTRIBUTING SUBBASIN DRAINS TO CDP-H2 VIA SMALL CULVERT

DA:	2.39	-Acres
Lc:	1312.0	-Feet
Lca:	655.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
H4'	30.0	2.0	0.0667
H4'	75.0	1.0	0.0133
H4	128.0	2.0	0.0156
H4	769.0	25.5	0.0332
H3	269.0	7.5	0.0279
H3	41.0	3.0	0.0732
Lc:	1312.0	Sc:	0.0285

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Commercial/Indus	DF	0.048	0.90
Commercial/Indus	DF	0.048	0.90
Commercial/Indus	IC	0.022	0.90
Commercial/Indus	IC	0.022	0.90
Commercial/Indus	IC	0.022	0.90
Commercial/Indus	IC	0.022	0.90
	n_{bw100}:	0.025	F_{ACW}: 0.90

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
H4'	Commercial/Indust	0.08			65	0.70	35	0.77	20	0.96	0.77
H4	Commercial/Indust	1.69			65	0.70	35	0.77	48	0.96	0.84
H3	Commercial/Indust	0.62			65	0.70	35	0.77	50	0.96	0.84
										Cw:	0.84

	Calc'd	Used
T_{C100}=	3.79	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{B100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}:
Commercial/Indus	0.08	0.22	0.35	0.50	0.70	0.90	0.90
Commercial/Indus	1.69	0.22	0.35	0.50	0.70	0.90	0.90
Commercial/Indus	0.62	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.22	0.35	0.50	0.70	0.90	0.90

Q_{100}=	19.2
Q_{50}=	17.3
Q_{25}=	13.4
Q_{10}=	9.6
Q_5=	6.7
Q_2=	4.2

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	H2	PARKWAY AREA WEST SIDE HOUGHTON SOUTH OF MACALESTER WAY | CP-H3 ONLY
	EXISTING CONDITION, CONTRIBUTING SUBBASIN DRAINS TO CDP-H2 VIA SMALL CULVERT	

DA:	0.62	-Acres
Lc:	310.0	-Feet
Lca:	155.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
H3	269.0	7.5	0.0279
H3	41.0	3.0	0.0732
Lc:	310.0	Sc:	0.0309

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Commercial/Indus	IC	0.022	0.90
Commercial/Indus	IC	0.022	0.90
	n_{bw100}:	0.022	F_{ACW}: 0.90

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
H3	Commercial/Indust	0.62			65	0.70	35	0.77	50	0.96	0.84
										Cw:	0.84

	Calc'd	Used
T_{C100}=	2.27	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{B100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}:
Commercial/Indus	0.62	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.22	0.35	0.50	0.70	0.90	0.90

Q_{100}=	5.0
Q_{50}=	4.5
Q_{25}=	3.5
Q_{10}=	2.5
Q_5=	1.8
Q_2=	1.1

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	H(1,4)	PARKWAY AREA WEST SIDE HOUGHTON SOUTH OF MACALESTER WAY | COMBINED AREA (
	EXISTING CONDITION, CONTRIBUTING SUBBASIN DRAINS TO CDP-H2 VIA SMALL CULVERT	

DA:	3.79	-Acres
Lc:	1767.0	-Feet
Lca:	884.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
H4'	30.0	2.0	0.0667
H4'	75.0	1.0	0.0133
H4	128.0	2.0	0.0156
H4	769.0	25.5	0.0332
H3	269.0	7.5	0.0279
H3	41.0	3.0	0.0732
H2	49.0	4.0	0.0816
H2	406.0	7.6	0.0187
Lc:	1767.0	Sc:	0.0262

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Commercial/Indus	DF	0.048	0.90
Commercial/Indus	DF	0.048	0.90
Commercial/Indus	IC	0.022	0.90
Commercial/Indus	IC	0.022	0.90
Commercial/Indus	IC	0.022	0.90
Commercial/Indus	IC	0.022	0.90
Commercial/Indus	IC	0.022	0.90
Commercial/Indus	IC	0.022	0.90
	n_{bw100}:	0.024	F_{ACW}: 0.90

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
H4'	Commercial/Industri	0.08			65	0.70	35	0.77	20	0.96	0.77
H4	Commercial/Industri	1.69			65	0.70	35	0.77	48	0.96	0.84
H3	Commercial/Industri	0.62			65	0.70	35	0.77	50	0.96	0.84
H2	Commercial/Industri	1.40			65	0.70	35	0.77	25	0.96	0.78
										Cw:	0.82

	Calc'd	Used
T_{C100}=	4.36	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{W100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	CAF
Commercial/Indus	0.08	0.22	0.35	0.50	0.70	0.90	0.90
Commercial/Indus	1.69	0.22	0.35	0.50	0.70	0.90	0.90
Commercial/Indus	0.62	0.22	0.35	0.50	0.70	0.90	0.90
Commercial/Indus	1.40	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.22	0.35	0.50	0.70	0.90	0.90

Q_{100}=	29.7
Q_{50}=	26.8
Q_{25}=	20.8
Q_{10}=	14.9
Q_5=	10.4
Q_2=	6.5

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	H1	PARKWAY AREA WEST SIDE HOUGHTON SOUTH OF MACALESTER WAY
	EXISTING CONDITION, CONTRIBUTING SUBBASIN DRAINS TO CDP-H2 VIA SMALL CULVERT	

DA:	1.40	-Acres
Lc:	455.0	-Feet
Lca:	227.5	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
H2	49.0	4.0	0.0816
H2	406.0	7.6	0.0187
Lc:	455.0	Sc:	0.0210

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Commercial/Indus	IC	0.022	0.90
Commercial/Indus	IC	0.022	0.90
	n_{bw100}:	0.022	F_{ACW}: 0.90

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
H2	Commercial/Indust	1.40			65	0.70	35	0.77	25	0.96	0.78
										Cw:	0.78

	Calc'd	Used
T_{C100}=	2.69	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{B100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	CAF
Commercial/Indus	1.40	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.22	0.35	0.50	0.70	0.90	0.90

Q_{100}=	10.5
Q_{50}=	9.5
Q_{25}=	7.4
Q_{10}=	5.3
Q_5=	3.7
Q_2=	2.3

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	I1	AREA EAST OF HOUGHTON ACROSS FROM CELLE ESTE
	EXISTING CONDITION, AREA DRAINS TO SD INLET THAT IS DIRECTED DOWN EASMENT SOUTH OF C	

DA:	9.81	-Acres
Lc:	987.0	-Feet
Lca:	413.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	811.0	28.0	0.0345
	176.0	5.5	0.0313
Lc:	987.0	Sc:	0.0339

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Suburban	DF	0.052	0.90
Suburban	DF	0.052	0.90
		n_{bw100}:	0.052
		F_{ACW}:	0.90

$P_{1\text{-}100}$: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Suburban	9.81			65	0.70	35	0.77	20	0.96	0.77
										Cw:	0.77

	Calc'd	Used
T_{C100}=	5.57	5.57

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{W100})^{0.1}} + 1.31 \right)$$

i_{100}=	9.39

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C\,100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	CAF
Suburban	9.81	0.13	0.28	0.41	0.61	0.79	0.90
Weighted Average:		0.13	0.28	0.41	0.61	0.79	0.90

Q_{100}=	71.0
Q_{50}=	56.1
Q_{25}=	43.3
Q_{10}=	29.1
Q_5=	19.9
Q_2=	9.2

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	I2	AREA WEST OF HOUGHTON BETWEEN CALLE ESTE & BUFFALOBERRY LOOP NORTH
	EXISTING CONDITION, AREA DRAINS TO SWALE/EASEMENT BETWEEN RESIDENCES ALONG ROADS	
DA:	0.31	-Acres
Lc:	N/A	-Feet
Lca:	N/A	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	100.0	2.0	0.0200
X	Lc: 100.0	Sc:	0.0200

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Natural/Rural	DF	0.055	1.00
	n_{bw100}:	0.055	F_{ACW}: 1.00

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Suburban	0.31			65	0.70	35	0.77	5	0.96	0.74
										Cw:	0.74

	Calc'd	Used
T_{C100}=		5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{W100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	CAF
Suburban	0.31	0.13	0.28	0.41	0.61	0.79	0.90
Weighted Average:		0.13	0.28	0.41	0.61	0.79	0.90

Q_{100}=	2.2
Q_{50}=	1.7
Q_{25}=	1.3
Q_{10}=	0.9
Q_5=	0.6
Q_2=	0.3

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	J	SOUTHEAST CORNER OF HOUGHTON & 22ND INTERSECTION
		R/O COLLECTS & CROSSES 22ND @ GRADE TO NORTH
DA:	4.11	-Acres
Lc:	668.0	-Feet
Lca:	300.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	320.0	5.2	0.0163
	348.0	13.0	0.0374
Lc:	668.0	Sc:	0.0240

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Natural/Rural	NC	0.045	1.00
Natural/Rural	NC	0.045	1.00
	n_{bw100}:	0.045	F_{ACW}: 1.00

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Natural/Rural	4.11			65	0.70	35	0.77	10	0.96	0.75
										Cw:	0.75

	Calc'd	Used
T_{C100}=	4.68	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LeLca)^{0.3}}{(ScP_{1,100} C_{B100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	CAF
Natural/Rural	4.11	0.10	0.23	0.37	0.58	0.77	1.00
Weighted Average:		0.10	0.23	0.37	0.58	0.77	1.00

Q_{100}=	29.5
Q_{50}=	22.7
Q_{25}=	17.1
Q_{10}=	10.9
Q_5=	6.8
Q_2=	3.0

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	K	700' EAST OF 22ND STREET, 170' WEST OF BARBARA DRIVE
	R/O COLLECTS ALONG SOUTH SIDE OF 22ND & CROSSES 22ND @ GRADE	

DA:	1.69	-Acres
Lc:	500.0	-Feet
Lca:	296.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	206.0	3.2	0.0155
	95.0	4.0	0.0421
	125.0	3.0	0.0240
	20.0	4.0	0.2000
	54.0	3.0	0.0556
Lc:	500.0	Sc:	0.0245

Land Use --

Description	Channel Type	Basin Factor		Area Factor
Natural/Rural	IC	0.024		1.00
Suburban	DF	0.052		0.90
Suburban	DF	0.052		0.90
Suburban	DF	0.052		0.90
Suburban	DF	0.052		0.90
	n_{bw100}:	0.038	F_{ACW}:	0.95

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Suburban	5.15			65	0.70	35	0.77	20	0.96	0.77
										Cw:	0.77

	Calc'd	Used
T_{C100}=	3.76	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{B100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	CAF
Suburban	5.15	0.13	0.28	0.41	0.61	0.79	0.90
Weighted Average:		0.13	0.28	0.41	0.61	0.79	0.90

Q_{100}=	12.5
Q_{50}=	9.9
Q_{25}=	7.6
Q_{10}=	5.1
Q_5=	3.5
Q_2=	1.6

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	L1	970' EAST HOUGHTON ON 22ND STREET
	COLLECT R/O FROM X2 AND X1 AND DIRECTS FLOW NORTH AC5ROSS 22ND AT GRADE	

DA:	5.15	-Acres
Lc:	1191.0	-Feet
Lca:	388.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
X2	596.0	22.0	0.0369
X1	622.0	20.0	0.0322
X	Lc: 1218.0	Sc:	0.0344

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Natural/Rural	IC	0.024	1.00
Natural/Rural	IC	0.024	1.00
	n_{bw100}:	0.024	F_{ACW}: 1.00

P_{1-100}: 3.00 Inches

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Natural/Rural	5.15			65	0.70	35	0.77	20	0.96	0.77
										Cw:	0.77

	Calc'd	Used
T_{C100}=	3.23	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{ir100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C\,100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	CAF
Natural/Rural	5.15	0.10	0.23	0.37	0.58	0.77	1.00
Weighted Average:		0.10	0.23	0.37	0.58	0.77	1.00

Q_{100}=	38.1
Q_{50}=	29.4
Q_{25}=	22.1
Q_{10}=	14.1
Q_5=	8.8
Q_2=	3.8

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	L2	AVENIDA CONALEA CROSSING
	UPPERMOST CONTRIBUTING SUB-WATERSHED TO CP X AT GRADE CROSSING TO WEST	

DA:	1.20	-Acres
Lc:	596.0	-Feet
Lca:	180.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	596.0	22.0	0.0369
Lc:	596.0	Sc:	0.0369

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Natural/Rural	IC	0.024	1.00
	n_{bw100}:	0.024	F_{ACW}: 1.00

P_{1-100}: 3.00 Inches

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Natural/Rural	1.20			65	0.70	35	0.77	30	0.96	0.80
										Cw:	0.80

	Calc'd	Used
T_{C100}=	2.53	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{IF100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C\,100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	CAF
Natural/Rural	1.20	0.10	0.23	0.37	0.58	0.77	1.00
Weighted Average:		0.10	0.23	0.37	0.58	0.77	1.00

Q_{100}=	9.2
Q_{50}=	7.1
Q_{25}=	5.3
Q_{10}=	3.4
Q_5=	2.1
Q_2=	0.9

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	H@22	SOUTHWEST CORNER OF HOUGHTON & 22ND INTERSECTION
	MAINLY STREET FLOW THAT COLLECTS & FLOWS WEST ALOING 22ND	

DA:	0.28	-Acres
Lc:	262.0	-Feet
Lca:	130.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	262.0	2.2	0.0084
Lc:	262.0	Sc:	0.0084

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Commercial/Indus	DF	0.048	0.90
		n_{bw100}: 0.048	F_{ACW}: 0.90

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Commercial/Indust	0.28			65	0.70	35	0.77	95	0.96	0.95
										Cw:	0.95

	Calc'd	Used
T_{C100}=	4.19	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{IF100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	CAF
Commercial/Indus	0.28	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.22	0.35	0.50	0.70	0.90	0.90

Q_{100}=	2.5
Q_{50}=	2.3
Q_{25}=	1.8
Q_{10}=	1.3
Q_5=	0.9
Q_2=	0.6

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	M	East of Houghton, Small wathershed North of three watersheds between 22nd and Discovery D

DA:	0.57	-Acres
Lc:	375.3	-Feet
Lca:	180.8	-Feet

Calc'd:	Ruvalcaba	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	241.1	4.0	0.0166
	134.2	4.5	0.0335
Lc:	375.3	Sc:	0.0208

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Suburban	DF	0.052	0.90
		n_{bw100}:	0.037
		F_{ACW}:	0.65

$P_{1\text{-}100}$: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Suburban	0.57			65	0.70	35	0.77	15	0.96	0.76
										Cw:	0.76

	Calc'd	Used
T_{C100}=	3.38	5.00

$$T_{C\text{-}100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100}C_{W100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	CAF
Suburban	0.57	0.13	0.28	0.41	0.61	0.79	0.90
Weighted Average:		0.13	0.28	0.41	0.61	0.79	0.90

Q_{100}=	4.2
Q_{50}=	3.3
Q_{25}=	2.5
Q_{10}=	1.7
Q_5=	1.2
Q_2=	0.5

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	N	East of Houghton, Northern most of three watersheds between 22nd and Discovery Drive

DA:	4.80	-Acres
Lc:	954.8	-Feet
Lca:	409.2	-Feet

Calc'd:	Ruvalcaba	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	762.0	19.0	0.0249
	192.8	2.4	0.0124
Lc:	954.8	Sc:	0.0212

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Suburban	DF	0.052	0.90
		n_{bw100}:	0.038
		F_{ACW}:	0.66

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Suburban	4.80			65	0.70	35	0.77	15	0.96	0.76
										Cw:	0.76

	Calc'd	Used
T_{C100}=	5.00	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{W100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	CAF
Suburban	4.80	0.13	0.28	0.41	0.61	0.79	0.90
Weighted Average:		0.13	0.28	0.41	0.61	0.79	0.90

Q_{100}=	35.0
Q_{50}=	27.7
Q_{25}=	21.4
Q_{10}=	14.4
Q_5=	9.8
Q_2=	4.6

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	O	East of Houghton, middle of three watersheds between 22nd and Discovery Drive

DA:	4.58	-Acres
Lc:	1026.8	-Feet
Lca:	482.0	-Feet

Calc'd:	Ruvalcaba	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	863.1	38.5	0.0446
	163.8	4.4	0.0269
Lc:	1026.8	Sc:	0.0408

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Suburban	DF	0.052	0.90
		n_{bw100}:	0.042
		F_{ACW}:	0.72

$P_{1\text{-}100}$: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Suburban	4.58			65	0.70	35	0.77	15	0.96	0.76
										Cw:	0.76

	Calc'd	Used
T_{C100}=	4.60	5.00

$$T_{C\text{-}100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{B100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	CAF
Suburban	4.58	0.13	0.28	0.41	0.61	0.79	0.90
Weighted Average:		0.13	0.28	0.41	0.61	0.79	0.90

Q_{100}=	33.4
Q_{50}=	26.4
Q_{25}=	20.4
Q_{10}=	13.7
Q_5=	9.4
Q_2=	4.3

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	P	East of Houghton, Southern most of three watersheds between 22nd and Discovery Drive

DA:	8.39	-Acres
Lc:	1320.4	-Feet
Lca:	604.6	-Feet

Calc'd:	Ruvalcaba	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	1054.1	48.0	0.0455
	132.2	1.0	0.0076
	56.4	1.0	0.0177
	77.8	3.1	0.0399
Lc:	1320.4	Sc:	0.0330

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Suburban	DF	0.052	0.90
		n_{bw100}:	0.035
		F_{ACW}:	0.61

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 1.00

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Suburban	8.39			65	0.70	35	0.77	15	0.96	0.76
										Cw:	0.76

	Calc'd	Used
T_{C100}=	4.83	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{IF100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	CAF
Suburban	8.39	0.13	0.28	0.41	0.61	0.79	0.90
Weighted Average:		0.13	0.28	0.41	0.61	0.79	0.90

Q_{100}=	61.2
Q_{50}=	48.3
Q_{25}=	37.3
Q_{10}=	25.1
Q_5=	17.1
Q_2=	8.0

A-3

PROPOSED CONDITION HYDROLOGY

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	GE2	SOUTHWEST CORNER OF SMITHS COMMERCIAL CENTER
	PROPOSED CONDITION, INCLUDES INCREASED PAVEMENT AREA FROM P[ROPOSED ROADWAY, NB	

DA:	17.40	-Acres
Lc:	1463.0	-Feet
Lca:	731.5	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	698.0	22.0	0.0315
	557.0	14.4	0.0259
	208.0	5.2	0.0250
Lc:	1463.0	Sc:	0.0282

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Suburban	DF	0.052	0.90
Highly Urban	IC	0.022	0.80
Commercial/Indus	IC	0.022	0.90
		n_{bw100}: 0.036	F_{ACW}: 0.86

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 0.92

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
GS6	Commercial/Indust	1.98			65	0.70	35	0.77	80	0.96	0.91
GS6	Natural/Rural	3.40			65	0.70	35	0.77	5	0.96	0.74
GS6	Suburban	8.46			65	0.70	35	0.77	15	0.96	0.76
GS4	Commercial/Indust	1.59			65	0.70	35	0.77	95	0.96	0.95
GS4	Commercial/Indust	0.56			65	0.70	35	0.77	45	0.96	0.83
GS5	Highly Urban	0.76			65	0.70	35	0.77	60	0.96	0.87
GS5	Commercial/Indust	0.65			65	0.70	35	0.77	100	0.96	0.96
		17.40								Cw:	0.80

	Calc'd	Used
T_{C100}=	5.41	5.41

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{W100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.45

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Q_{100}=	121.6
Q_{50}=	99.9
Q_{25}=	77.0
Q_{10}=	52.4
Q_5=	35.6
Q_2=	18.6

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Commercial/Indus	1.98	0.22	0.35	0.50	0.70	0.90	0.90
Natural/Rural	3.40	0.10	0.23	0.37	0.58	0.77	1.00
Suburban	8.46	0.13	0.28	0.41	0.61	0.79	0.90
Commercial/Indus	1.59	0.22	0.35	0.50	0.70	0.90	0.90
Commercial/Indus	0.56	0.22	0.35	0.50	0.70	0.90	0.90
Highly Urban	0.76	0.22	0.35	0.50	0.70	0.90	0.80
Commercial/Indus	0.65	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.15	0.29	0.43	0.63	0.82	0.92

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	GE3	EASTERN MOST SEGMENT OF BARRIO RINCON DRAINING TO SCUPPER ON COWHEAD SADI
	PROPOSED CONDITION,	

DA:	1.40	-Acres
Lc:	590.0	-Feet
Lca:	295.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	200.0	4.0	0.0200
	250.0	4.6	0.0184
	140.0	5.5	0.0393
Lc:	590.0	Sc:	0.0222

Land Use --

Description	Channel Type	Basin Factor	Area Factor	
Highly Urban	DF	0.048	0.80	
Commercial/Indus	DF	0.048	1.00	*Pvmt
Highly Urban	DF	0.048	0.80	
		n_{bw100}:	0.048	F_{ACW}: 0.89

$P_{1\text{-}100}$: 3.00 Inches

F_{ACW} OVERRIDE: 0.89

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Highly Urban	0.76			65	0.70	35	0.77	60	0.96	0.87
	Commercial/Industr	0.65			65	0.70	35	0.77	100	0.96	0.96
										Cw:	0.91

	Calc'd	Used
T_{C100}=	4.59	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{W100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Highly Urban	0.76	0.22	0.35	0.50	0.70	0.90	0.80
Commercial/Indus	0.65	0.22	0.35	0.50	0.70	0.90	0.90
Weighted Average:		0.22	0.35	0.50	0.70	0.90	0.85

Q_{100}=	10.9
Q_{50}=	9.8
Q_{25}=	7.6
Q_{10}=	5.5
Q_5=	3.8
Q_2=	2.4

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	GE4	WEST SIDE OF BARRIO RINCON ALONG EAST SIDE OF HOUGHTON ROAD
	PROPOSED CONDITION , INCLUDES INCREASED PAVEMENT AREA FROM PROPOSED ROADWAY NB	

DA:	13.84	-Acres
Lc:	1255.0	-Feet
Lca:	727.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
GS6	698.0	22.0	0.0315
GS6	557.0	14.4	0.0259
Lc:	1255.0	Sc:	0.0288

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Suburban	DF	0.052	0.90
Highly Urban	IC	0.022	0.80
	n_{bw100}:	0.038	F_{ACW}: 0.85

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 0.94

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
GS6 Roadway	Commercial/Indust	1.98			65	0.70	35	0.77	80	0.96	0.91
GS6	Natural/Rural	3.40			65	0.70	35	0.77	5	0.96	0.74
	Suburban	8.46			65	0.70	35	0.77	15	0.96	0.76
										Cw:	0.78

	Calc'd	Used
T_{C100}=	5.52	5.52

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{B100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.40

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Commercial/Indus	1.98	0.22	0.35	0.50	0.70	0.90	1.00 *Pvmt
Natural/Rural	3.40	0.10	0.23	0.37	0.58	0.77	1.00
Suburban	8.46	0.13	0.28	0.41	0.61	0.79	0.90
Weighted Average:		0.14	0.28	0.41	0.62	0.80	0.94

Q_{100}=	94.8
Q_{50}=	75.9
Q_{25}=	58.4
Q_{10}=	39.2
Q_5=	26.3
Q_2=	12.8

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	H5-A	AREA EAST SIDE HOUGHTON SOUTH OF CAMINO DE LA PLACITA
	PROPOSED CONDITION, REMOVES PAVEMENT AREA FROM CONTRIBUTING SUBBASIN	

DA:	7.10	-Acres
Lc:	1026.0	-Feet
Lca:	540.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	828.0	38.0	0.0459
	198.0	4.5	0.0227
Lc:	1026.0	Sc:	0.0393

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Suburban	DF	0.052	0.90
Suburban	DF	0.052	0.90
n_{bw100}:		0.052	F_{ACW}: 0.90

$P_{1\text{-}100}$: 3.00 Inches

F_{ACW} OVERRIDE: 0.90

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_i (-)	C (-)
	Suburban	7.10			65	0.70	35	0.77	15	0.96	0.76
										Cw:	0.76

	Calc'd	Used
T_{C100}=	5.77	5.77

$$T_{C\text{-}100} = \left(\frac{0.23 n_{bw100} (LcLca)^{0.3}}{(ScP_{1,100} C_{IF100})^{0.3}} + 1.31 \right)$$

i_{100}=	9.31

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C\,100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Suburban	7.10	0.13	0.28	0.41	0.61	0.79	0.90
Weighted Average:		0.13	0.28	0.41	0.61	0.79	0.90

Q_{100}=	45.2
Q_{50}=	35.7
Q_{25}=	27.6
Q_{10}=	18.5
Q_5=	12.7
Q_2=	5.9

CITY OF TUCSON
HYDROLOGIC DATA SHEET FOR COMPUTING 100-YEAR PEAK DISCHARGE (Qp100)

PB Project No.:	11515	
Project Name:	HOUGHTON ROAD - SPEEDWAY TO OLD SPANISH TRAIL	
CP Desc:	H5-B	AREA EAST SIDE HOUGHTON SOUTH OF CAMINO DE LA PLACITA
	PROPOSED CONDITION, REMOVES PAVEMENT AREA FROM CONTRIBUTING SUBBASIN	

DA:	2.25	-Acres
Lc:	682.0	-Feet
Lca:	332.0	-Feet

Calc'd:	Bambauer	Date:	
Chk'd:		Date:	

Slope Computation --

CPi	Dli	Dhi	Si
	127.0	2.1	0.0165
	109.0	4.0	0.0367
	90.0	11.0	0.1222
	356.0	26.0	0.0730
Lc:	682.0	Sc:	0.0474

Land Use --

Description	Channel Type	Basin Factor	Area Factor
Suburban	DF	0.052	0.90
Suburban	DF	0.052	0.90
Suburban	DF	0.052	0.90
Suburban	DF	0.052	0.90
	n_{bw100}:	0.052	F_{ACW}: 0.90

P_{1-100}: 3.00 Inches

F_{ACW} OVERRIDE: 0.90

Soils--

CPi	Description	Sub-area (acres)	B (%)	C_B (-)	C (%)	C_C (-)	D (%)	C_D (-)	I (%)	C_I (-)	C (-)
	Suburban	2.25			65	0.70	35	0.77	15	0.96	0.76
										Cw:	0.76

	Calc'd	Used
T_{C100}=	4.33	5.00

$$T_{C-100} = \left(\frac{0.23 n_{bw100} (Lc.Lca)^{0.3}}{(Sc P_{1,100} C_{W100})^{0.4}} + 1.31 \right)$$

i_{100}=	9.60

$$i_{100} = \frac{4 \times P_{1,100}}{(1 + 0.05\, T_{C100})}$$

Aerial Weight Computation --

Description	Area (Ac)	2-Yr Ratio	5-Yr Ratio	10-Yr Ratio	25-Yr Ratio	50-Yr Ratio	F_{ACW}
Suburban	2.25	0.13	0.28	0.41	0.61	0.79	0.90
Weighted Average:		0.13	0.28	0.41	0.61	0.79	0.90

Q_{100}=	14.8
Q_{50}=	11.7
Q_{25}=	9.0
Q_{10}=	6.1
Q_5=	4.1
Q_2=	1.9

APPENDIX B

EXISTING CONDITION HYDRAULICS

B-1

CORONADO RIDGE WASH

PB PROJ No. 11515
Coronado Ridge Wash *(Main Branch)*
Existing Condition Analysis

HEC-RAS Version 3.1.3 May 2005
U.S. Army Corp 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: CRW (ERZ) Broadway to Houghton Main
Project File : CRW_MAIN.prj
Run Date and Time: 2/27/2008 9:45:40 AM

Project in English units

Project Description:
Coronado Ridge Wash
Limits of Study:
Main Reach--
US Broadway Blvd. Culvert
to 500' DS of Houghton Road

XSECs Developed from Project Mapping &
Supplimented with PAG 1998 Contours

PLAN DATA

Plan Title: CRW (ERZ) MAIN EXST
Plan File : l:\11515\Drainage\HECRAS\Coronado Ridge Wash (ERZ) Restored\CRW_MAIN.p02

Geometry Title: CRW (ERZ) MAIN EXST
Geometry File : l:\11515\Drainage\HECRAS\Coronado Ridge Wash (ERZ) Restored\CRW_MAIN.g02

Flow Title : CRW (ERZ) MAIN TSMS
Flow File : l:\11515\Drainage\HECRAS\Coronado Ridge Wash (ERZ) Restored\CRW_MAIN.f01

Plan Description:
Main Branch of Coronado Ridge Wash
Existing Condition Split Flow Analysis

Plan Summary Information:

Number of:	Cross Sections =	17	Multiple Openings =	0
	Culverts =	1	Inline Structures =	0
	Bridges =	0	Lateral Structures =	6

Computational Information

Water surface calculation tolerance =	0.01
Critical depth calculation tolerance =	0.01
Maximum number of iterations =	20
Maximum difference tolerance =	0.3
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: Subcritical Flow

PB PROJ No. 11515
Coronado Ridge Wash *(Main Branch)*
Existing Condition Analysis

FLOW DATA

Flow Title: CRW (ERZ) MAIN TSMS
Flow File : l:\11515\Drainage\HECRAS\Coronado Ridge Wash (ERZ) Restored\CRW_MAIN.f01

Flow Data (cfs)

River	Reach	RS	TSMS100Yr
Coronado Ridge	MAIN	2250	950

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Coronado Ridge	MAIN	TSMS100Yr	Critical	Normal S = 0.025

GEOMETRY DATA

Geometry Title: CRW (ERZ) MAIN EXST
Geometry File : l:\11515\Drainage\HECRAS\Coronado Ridge Wash (ERZ) Restored\CRW_MAIN.g02

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 2250

INPUT
Description:
Station Elevation Data num= 51

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2751	0	2747.58	.23	2747.55	5.05	2747.07	9.48	2747.01
9.73	2747	13.64	2747.01	14.03	2747	19.02	2746.99	19.28	2746.99
23.82	2746.94	24.12	2746.95	28.4	2746.92	32.78	2746.96	33.52	2746.97
33.76	2746.96	38.32	2747.04	38.63	2747.04	42.77	2747.17	46.99	2747.19
47.31	2747.2	51.89	2747.2	52	2747.2	56.4	2747.12	58.02	2747.16
62.18	2747.23	62.91	2747.33	63.42	2747.39	66.63	2747.59	67.87	2748.2
71.12	2748.37	72.35	2748.7	72.72	2748.78	76.36	2749.32	77.79	2749.45
80.92	2749.6	82.64	2749.68	85.61	2749.79	87.32	2749.72	89.88	2749.76
92.45	2749.86	94.15	2749.58	94.71	2749.53	98.13	2749.61	99.28	2749.63
101.11	2749.71	103.08	2749.66	104.09	2750.21	106.03	2750.79	107.84	2750.83
108.74	2750.86								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	0	.02	77.79	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	77.79	5	5	5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	5.5	2750.97	F
59.8	108.74	2750.91	F

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2750.23	Element			
Vel Head (ft)	1.05	Wt. n-Val.		0.020	
W.S. Elev (ft)	2749.18	Reach Len. (ft)	5.00	5.00	5.00
Crit W.S. (ft)	2749.18	Flow Area (sq ft)		115.31	
E.G. Slope (ft/ft)	0.004506	Area (sq ft)		143.98	
Q Total (cfs)	950.00	Flow (cfs)		950.00	
Top Width (ft)	75.39	Top Width (ft)		75.39	
Vel Total (ft/s)	8.24	Avg. Vel. (ft/s)		8.24	
Max Chl Dpth (ft)	2.26	Hydr. Depth (ft)		2.12	
Conv. Total (cfs)	14151.9	Conv. (cfs)		14151.9	
Length Wtd. (ft)	5.00	Wetted Per. (ft)		54.31	
Min Ch El (ft)	2746.92	Shear (lb/sq ft)		0.60	
Alpha	1.00	Stream Power (lb/ft s)		4.92	
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	0.91	3.50	2.14
C & E Loss (ft)	0.24	Cum SA (acres)	1.06	1.79	2.77

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

PB PROJ No. 11515
Coronado Ridge Wash *(Main Branch)*
Existing Condition Analysis

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 2245

INPUT
Description:
Station Elevation Data num= 32

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2749.98	1.43	2749.32	7.81	2748.41	8.2	2748.6	8.2	2744.89
34.4	2745.24	62.9	2745.75	62.9	2748.5	65.4	2748.52	68.66	2748.86
71.6	2749.38	73.79	2750.14	75.02	2750.46	77.16	2750.9	77.68	2750.96
81.52	2751.27	86.3	2751.41	90.44	2751.15	90.72	2751.15	91.03	2751.16
94.96	2750.49	96.21	2750.36	98.27	2750.39	100.89	2750.4	102.04	2750.44
104.97	2750.34	106.04	2750.35	108.32	2750.1	108.92	2749.94	109.97	2749.66
110.01	2749.79	110.69	2749.71						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	8.2	.02	62.9	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
8.2	62.9	90	90	90	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	12.3	2750.97	F
56.9	110.69	2750.91	F

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2749.34	Element			
Vel Head (ft)	0.57	Wt. n-Val.		0.020	
W.S. Elev (ft)	2748.77	Reach Len. (ft)	90.00	90.00	90.00
Crit W.S. (ft)	2747.70	Flow Area (sq ft)		156.13	
E.G. Slope (ft/ft)	0.001262	Area (sq ft)	0.56	190.36	0.94
Q Total (cfs)	950.00	Flow (cfs)		950.00	
Top Width (ft)	62.49	Top Width (ft)	2.91	54.70	4.89
Vel Total (ft/s)	6.08	Avg. Vel. (ft/s)		6.08	
Max Chl Dpth (ft)	3.88	Hydr. Depth (ft)		3.50	
Conv. Total (cfs)	26741.6	Conv. (cfs)		26741.6	
Length Wtd. (ft)	90.00	Wetted Per. (ft)		44.61	
Min Ch El (ft)	2744.89	Shear (lb/sq ft)		0.28	
Alpha	1.00	Stream Power (lb/ft s)		1.68	
Frctn Loss (ft)		Cum Volume (acre-ft)	0.91	3.49	2.14
C & E Loss (ft)		Cum SA (acres)	1.06	1.78	2.77

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CULVERT

RIVER: Coronado Ridge
REACH: MAIN RS: 2240

INPUT
Description:
Distance from Upstream XS = 11
Deck/Roadway Width = 65
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 11

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2751.53		1.4	2751.56		8.4	2751.48	
10.7	2750.97		35.3	2750.99		43.2	2750.91	
52.4	2751.34		74.1	2751.51		84.2	2751.98	
92.1	2751.95		117.4	2752.63				

Upstream Bridge Cross Section Data
Station Elevation Data num= 32

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2749.98	1.43	2749.32	7.81	2748.41	8.2	2748.6	8.2	2744.89
34.4	2745.24	62.9	2745.75	62.9	2748.5	65.4	2748.52	68.66	2748.86
71.6	2749.38	73.79	2750.14	75.02	2750.46	77.16	2750.9	77.68	2750.96
81.52	2751.27	86.3	2751.41	90.44	2751.15	90.72	2751.15	91.03	2751.16
94.96	2750.49	96.21	2750.36	98.27	2750.39	100.89	2750.4	102.04	2750.44
104.97	2750.34	106.04	2750.35	108.32	2750.1	108.92	2749.94	109.97	2749.66
110.01	2749.79	110.69	2749.71						

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Coronado Ridge Wash *(Main Branch)*
Existing Condition Analysis

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	8.2	.02	62.9	.04

Bank Sta: Left	Right	Coeff Contr.	Expan.
8.2	62.9	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	12.3	2750.97	F
56.9	110.69	2750.91	F

Downstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2750.95		20.6	2751.13		35.1	2751.22	
41.6	2750.85		123.7	2751.44		125.4	2751.86	
158	2751.55							

Downstream Bridge Cross Section Data
Station Elevation Data num= 50

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2750.8	.64	2750.8	.75	2751.2	4.18	2751.03	5.13	2750.65
9.2	2749.44	12.47	2748.39	13.91	2748.14	14.44	2748.09	14.9	2747.96
15.91	2747.85	16.9	2747.61	17.36	2747.57	18.15	2747.28	18.89	2747.22
22.02	2745.55	22.23	2745.53	23.07	2745	23.39	2744.77	23.53	2744.62
24.61	2744.74	33.73	2744.71	39.93	2744.43	41.72	2743.95	42.41	2743.77
53.85	2743.42	60.9	2743.88	61.31	2744.3	61.52	2745.61	61.72	2746.92
61.77	2746.91	63.99	2747.96	64.61	2747.91	68.81	2748.47	73.48	2748.36
79.11	2748.38	83.53	2748.47	84.55	2748.43	89.31	2748.35	95.69	2747.94
100.62	2747.97	105.59	2748.1	110.7	2748.15	120	2748.14	124.59	2748.06
140.83	2747.92	142.33	2747.86	145.71	2747.85	150.64	2747.72	157.32	2747.72

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	4.18	.035	68.81	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
4.18	68.81	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	21.6	2750	F
62.2	157.32	2750	F

Upstream Embankment side slope = 5 horiz. to 1.0 vertical
Downstream Embankment side slope = 5 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Box	3	8

FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG

Culvert Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
5	78	.013	.013	0	.2	1

Number of Barrels = 4
Upstream Elevation = 2744
Centerline Stations

Sta.	Sta.	Sta.	Sta.
20.8	29.6	38.3	47.1

Downstream Elevation = 2744
Centerline Stations

Sta.	Sta.	Sta.	Sta.
28.8	37.5	46.3	55

CULVERT OUTPUT Profile #TSMS100Yr Culv Group: Culvert #1

Q Culv Group (cfs)	950.00	Culv Full Len (ft)	78.00
# Barrels	4	Culv Vel US (ft/s)	9.90
Q Barrel (cfs)	237.50	Culv Vel DS (ft/s)	9.90
E.G. US. (ft)	2749.35	Culv Inv El Up (ft)	2744.00
W.S. US. (ft)	2748.77	Culv Inv El Dn (ft)	2744.00
E.G. DS (ft)	2748.08	Culv Frctn Ls (ft)	0.52
W.S. DS (ft)	2746.92	Culv Exit Loss (ft)	0.44
Delta EG (ft)	1.27	Culv Entr Loss (ft)	0.30
Delta WS (ft)	1.85	Q Weir (cfs)	
E.G. IC (ft)	2749.98	Weir Sta Lft (ft)	
E.G. OC (ft)	2749.35	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	

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Culv WS Inlet (ft)	2747.00	Weir Max Depth (ft)	
Culv WS Outlet (ft)	2747.00	Weir Avg Depth (ft)	
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	3.00	Min El Weir Flow (ft)	2750.92

Note: Culvert critical depth exceeds the height of the culvert.
Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations are not valid and the supercritical result has been discarded. The outlet answer will be used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 2155

INPUT
Description:
Station Elevation Data num= 50

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2750.8	.64	2750.8	.75	2751.2	4.18	2751.03	5.13	2750.65
9.2	2749.44	12.47	2748.39	13.91	2748.14	14.44	2748.09	14.9	2747.96
15.91	2747.85	16.9	2747.61	17.36	2747.57	18.15	2747.28	18.89	2747.22
22.02	2745.55	22.23	2745.53	23.07	2745	23.39	2744.77	23.53	2744.62
24.61	2744.74	33.73	2744.71	39.93	2744.43	41.72	2743.95	42.41	2743.77
53.85	2743.42	60.9	2743.88	61.31	2744.3	61.52	2745.61	61.72	2746.92
61.77	2746.91	63.99	2747.96	64.61	2747.91	68.81	2748.47	73.48	2748.36
79.11	2748.38	83.53	2748.47	84.55	2748.43	89.31	2748.35	95.69	2747.94
100.62	2747.97	105.59	2748.1	110.7	2748.15	120	2748.14	124.59	2748.06
140.83	2747.92	142.33	2747.86	145.71	2747.85	150.64	2747.72	157.32	2747.72

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	4.18	.035	68.81	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4.18	68.81	75	75	75	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	21.6	2750	F
62.2	157.32	2750	F

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2748.08	Element			
Vel Head (ft)	1.16	Wt. n-Val.		0.035	
W.S. Elev (ft)	2746.92	Reach Len. (ft)	75.00	75.00	75.00
Crit W.S. (ft)	2746.78	Flow Area (sq ft)		109.95	
E.G. Slope (ft/ft)	0.011874	Area (sq ft)		111.18	
Q Total (cfs)	950.00	Flow (cfs)		950.00	
Top Width (ft)	42.33	Top Width (ft)		42.33	
Vel Total (ft/s)	8.64	Avg. Vel. (ft/s)		8.64	
Max Chl Dpth (ft)	3.50	Hydr. Depth (ft)		2.74	
Conv. Total (cfs)	8718.1	Conv. (cfs)		8718.1	
Length Wtd. (ft)	75.00	Wetted Per. (ft)		43.08	
Min Ch El (ft)	2743.42	Shear (lb/sq ft)		1.89	
Alpha	1.00	Stream Power (lb/ft s)		16.35	
Frctn Loss (ft)	0.74	Cum Volume (acre-ft)	0.91	3.17	2.14
C & E Loss (ft)	0.10	Cum SA (acres)	1.06	1.68	2.76

Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 2080

INPUT
Description:
Station Elevation Data num= 51

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2755	0	2747.56	.39	2747.41	1.86	2746.96	6.04	2745.38
12	2743.2	16.93	2742.52	21.83	2741.1	23.41	2740.64	27.62	2741.81
30.25	2742.58	37.17	2744.71	39.57	2745.47	44.42	2745.39	50.37	2745.05
53.11	2745.05	54.87	2745.09	62.27	2745.71	64.59	2745.86	67.05	2745.89
67.85	2745.88	68.82	2745.89	73.39	2745.85	79.64	2745.92	83.72	2746.06
103.94	2746.3	106.89	2746.29	111.13	2746.38	115.62	2746.44	119.07	2746.44
125.93	2746.52	129.31	2746.59	139.96	2746.54	150.35	2746.53	157.36	2746.33

161.16	2746.2	165.01	2746.09	169.45	2745.9	172.76	2745.78	176.14	2745.75
184.37	2745.78	200.82	2745.45	207.92	2744.67	208.21	2744.72	211.65	2745.52
222.96	2746.26	225.87	2746.23	229.09	2746.16	231.69	2746.19	233.69	2746.19
236.06	2746.26								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	1.86	.035	39.57	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1.86	39.57	80	80	80	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
98.9	236.06	2747	F

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2747.25	Element			
Vel Head (ft)	0.97	Wt. n-Val.		0.035	0.080
W.S. Elev (ft)	2746.28	Reach Len. (ft)	80.00	80.00	80.00
Crit W.S. (ft)	2746.06	Flow Area (sq ft)		113.32	32.73
E.G. Slope (ft/ft)	0.008235	Area (sq ft)		113.32	71.45
Q Total (cfs)	950.00	Flow (cfs)		912.92	37.08
Top Width (ft)	175.72	Top Width (ft)		35.91	139.81
Vel Total (ft/s)	6.50	Avg. Vel. (ft/s)		8.06	1.13
Max Chl Dpth (ft)	5.64	Hydr. Depth (ft)		3.16	0.55
Conv. Total (cfs)	10468.6	Conv. (cfs)		10060.0	408.6
Length Wtd. (ft)	80.00	Wetted Per. (ft)		37.48	59.38
Min Ch El (ft)	2740.64	Shear (lb/sq ft)		1.55	0.28
Alpha	1.48	Stream Power (lb/ft s)		12.52	0.32
Frctn Loss (ft)	0.73	Cum Volume (acre-ft)	0.91	2.98	2.08
C & E Loss (ft)	0.08	Cum SA (acres)	1.06	1.61	2.64

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 2000

INPUT
Description:
Station Elevation Data num= 49

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2755	0	2745.79	4.21	2744.64	21.71	2742.82	28.81	2742.08
32.33	2741.76	40.08	2743.29	45.42	2744.31	52.11	2744.1	57.99	2744.02
60.72	2744.21	61.57	2744.23	64.27	2744.37	65.66	2744.37	67.25	2744.45
67.82	2744.48	69.56	2744.43	110.26	2745.02	117.55	2745.08	124.03	2745.15
125.44	2745.24	125.89	2745.25	126.39	2745.24	137.21	2745.37	138.95	2745.36
141.21	2745.3	144.02	2745.33	144.85	2745.33	145.25	2745.33	157.13	2744.98
158.72	2744.96	165.16	2744.63	171.39	2744.31	179.09	2744.71	183.11	2744.92
188.69	2743.95	189.97	2743.73	194.36	2744.52	195.1	2744.65	195.62	2744.75
195.9	2744.8	196.76	2744.96	197.48	2744.97	216.71	2745.23	219.01	2745.31
222.6	2745.37	223.39	2745.39	223.62	2745.39	228.94	2745.48		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	4.21	.035	45.42	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4.21	45.42	113	113	113	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
115.4	228.94	2746	F

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2746.44	Element			
Vel Head (ft)	0.80	Wt. n-Val.	0.040	0.035	0.080
W.S. Elev (ft)	2745.64	Reach Len. (ft)	113.00	113.00	113.00
Crit W.S. (ft)	2745.64	Flow Area (sq ft)	1.81	102.92	74.28
E.G. Slope (ft/ft)	0.010066	Area (sq ft)	1.81	102.92	148.99
Q Total (cfs)	950.00	Flow (cfs)	4.14	801.85	144.02
Top Width (ft)	228.37	Top Width (ft)	3.64	41.21	183.52
Vel Total (ft/s)	5.31	Avg. Vel. (ft/s)	2.28	7.79	1.94
Max Chl Dpth (ft)	3.87	Hydr. Depth (ft)	0.50	2.50	1.06
Conv. Total (cfs)	9468.9	Conv. (cfs)	41.2	7992.2	1435.4
Length Wtd. (ft)	113.00	Wetted Per. (ft)	3.78	41.60	70.00
Min Ch El (ft)	2741.76	Shear (lb/sq ft)	0.30	1.55	0.67

Alpha	1.84	Stream Power (lb/ft s)	0.69	12.11	1.29
Frctn Loss (ft)	1.21	Cum Volume (acre-ft)	0.90	2.78	1.87
C & E Loss (ft)	0:05	Cum SA (acres)	1.05	1.54	2.34

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 1890

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2749	0	2743	2	2743	5	2742	12	2740
23	2739.8	29	2740	39	2742.2	64	2742.2	69	2742
89	2741	102	2741.3	167	2742	437	2744	479	2746

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	2	.035	39	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
2	39	140	140	92	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
160	479	2744	F

CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2743.51	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.64	Wt. n-Val.		0.035	0.080
W.S. Elev (ft)	2742.87	Reach Len. (ft)	140.00	140.00	92.00
Crit W.S. (ft)	2742.87	Flow Area (sq ft)		82.29	142.91
E.G. Slope (ft/ft)	0.011419	Area (sq ft)		82.29	199.94
Q Total (cfs)	950.00	Flow (cfs)		633.13	316.87
Top Width (ft)	281.60	Top Width (ft)		36.60	245.00
Vel Total (ft/s)	4.22	Avg. Vel. (ft/s)		7.69	2.22
Max Chl Dpth (ft)	3.07	Hydr. Depth (ft)		2.25	1.18
Conv. Total (cfs)	8890.0	Conv. (cfs)		5924.8	2965.2
Length Wtd. (ft)	130.46	Wetted Per. (ft)		37.27	121.04
Min Ch El (ft)	2739.80	Shear (lb/sq ft)		1.57	0.84
Alpha	2.31	Stream Power (lb/ft s)		12.11	1.87
Frctn Loss (ft)	1.60	Cum Volume (acre-ft)	0.90	2.54	1.42
C & E Loss (ft)	0.02	Cum SA (acres)	1.05	1.44	1.79

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 1750

INPUT
Description:
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2746	0	2740	5	2740	20	2738	28	2737.2
40	2737	40	2737.5	50	2737.5	50	2737	68	2737
70	2738	120	2739.5	215	2739.5	240	2739	260	2740
315	2746	325	2746.5						

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Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	5	.035	70	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
5	70	100	140	155	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
195.3	325	2742	F

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2740.27	Element			
Vel Head (ft)	0.82	Wt. n-Val.		0.035	0.080
W.S. Elev (ft)	2739.45	Reach Len. (ft)	100.00	140.00	155.00
Crit W.S. (ft)	2739.45	Flow Area (sq ft)		118.49	35.12
E.G. Slope (ft/ft)	0.013255	Area (sq ft)		118.49	42.26
Q Total (cfs)	950.00	Flow (cfs)		889.36	60.64
Top Width (ft)	140.89	Top Width (ft)		60.89	80.00
Vel Total (ft/s)	6.18	Avg. Vel. (ft/s)		7.51	1.73
Max Chl Dpth (ft)	2.45	Hydr. Depth (ft)		1.95	0.73
Conv. Total (cfs)	8251.6	Conv. (cfs)		7724.9	526.7
Length Wtd. (ft)	138.30	Wetted Per. (ft)		62.26	48.41
Min Ch El (ft)	2737.00	Shear (lb/sq ft)		1.57	0.60
Alpha	1.38	Stream Power (lb/ft s)		11.82	1.04
Frctn Loss (ft)	2.29	Cum Volume (acre-ft)	0.90	2.22	1.17
C & E Loss (ft)	0.08	Cum SA (acres)	1.05	1.28	1.44

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 1610

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
15	2737	45	2736.5	52	2736.2	55	2736	63	2735
77	2735	116	2736	120	2736	143	2734	147	2734
150	2736	155	2736.3	177	2736	205	2735	220	2735
260	2736	300	2738	315	2738.4				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
15	.08	120	.035	155	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
120	155	125	130	115	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2737.14	Element			
Vel Head (ft)	0.54	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (ft)	2736.60	Reach Len. (ft)	125.00	130.00	115.00
Crit W.S. (ft)	2736.60	Flow Area (sq ft)	79.72	54.11	111.83
E.G. Slope (ft/ft)	0.021271	Area (sq ft)	79.72	54.11	111.83
Q Total (cfs)	950.00	Flow (cfs)	213.96	442.05	293.99
Top Width (ft)	232.68	Top Width (ft)	80.76	35.00	116.92
Vel Total (ft/s)	3.87	Avg. Vel. (ft/s)	2.68	8.17	2.63
Max Chl Dpth (ft)	2.60	Hydr. Depth (ft)	0.99	1.55	0.96
Conv. Total (cfs)	6513.7	Conv. (cfs)	1467.0	3030.9	2015.7
Length Wtd. (ft)	124.88	Wetted Per. (ft)	80.85	35.70	116.97
Min Ch El (ft)	2734.00	Shear (lb/sq ft)	1.31	2.01	1.27
Alpha	2.33	Stream Power (lb/ft s)	3.51	16.44	3.34
Frctn Loss (ft)	2.02	Cum Volume (acre-ft)	0.81	1.94	0.89
C & E Loss (ft)	0.01	Cum SA (acres)	0.96	1.13	1.09

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross

section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 1480

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
214.9	2733.68	244.9	2733.6	253.9	2732	264.9	2730.5	272.9	2730.3
276.9	2730.3	285.9	2732	294.9	2733	379.9	2732	394.9	2731
405.9	2732	429.9	2734						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
214.9	.08	244.9	.035	294.9	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
244.9	294.9	104.4	122	120.9	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2733.95	Element			
Vel Head (ft)	0.60	Wt. n-Val.		0.035	0.080
W.S. Elev (ft)	2733.35	Reach Len. (ft)	104.40	122.00	120.90
Crit W.S. (ft)	2733.35	Flow Area (sq ft)		91.67	131.79
E.G. Slope (ft/ft)	0.012764	Area (sq ft)		91.67	131.79
Q Total (cfs)	950.00	Flow (cfs)		667.09	282.91
Top Width (ft)	175.86	Top Width (ft)		48.62	127.25
Vel Total (ft/s)	4.25	Avg. Vel. (ft/s)		7.28	2.15
Max Chl Dpth (ft)	3.05	Hydr. Depth (ft)		1.89	1.04
Conv. Total (cfs)	8408.6	Conv. (cfs)		5904.5	2504.1
Length Wtd. (ft)	119.81	Wetted Per. (ft)		49.05	127.39
Min Ch El (ft)	2730.30	Shear (lb/sq ft)		1.49	0.82
Alpha	2.13	Stream Power (lb/ft s)		10.84	1.77
Frctn Loss (ft)	1.39	Cum Volume (acre-ft)	0.70	1.72	0.57
C & E Loss (ft)	0.00	Cum SA (acres)	0.84	1.00	0.77

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

LATERAL STRUCTURE

RIVER: Coronado Ridge
REACH: MAIN RS: 1421

INPUT
Description: LEFT BANK SPLIT FLOW
Lateral structure position = Left overbank
Distance from Upstream XS = 0
Deck/Roadway Width = 10
Weir Coefficient = 2.5
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 3

Sta	Elev	Sta	Elev	Sta	Elev
0	2733.68	54.5	2732	104.4	2730

Weir crest shape = Broad Crested

LATERAL STRUCTURE OUTPUT Profile #TSMS100Yr Lat Struct

E.G. US. (ft)	2733.95	Weir Sta US (ft)	47.65
W.S. US. (ft)	2733.35	Weir Sta DS (ft)	104.40
E.G. DS (ft)	2731.44	Weir Max Depth (ft)	0.85
W.S. DS (ft)	2730.85	Weir Avg Depth (ft)	0.40
Q US (cfs)	950.00	Weir Submerg	0.00
Q Leaving Total (cfs)	41.42	Min El Weir Flow (ft)	2730.00
Q DS (cfs)	908.64	Wr Top Wdth (ft)	56.75
Perc Q Leaving	4.35	Q Gate Group (cfs)	
Q Weir (cfs)	41.42	Gate Open Ht (ft)	

Q Gates (cfs)		Gate #Open	
Q Culv (cfs)		Gate Area (sq ft)	
Q Lat RC (cfs)		Gate Submerg	
Weir Flow Area (sq ft)	22.53	Gate Invert (ft)	

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 1358

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
146.03	2730	160.03	2730	164.06	2729.67	175.39	2729.83	184.61	2730.01
195.12	2730.1	197.3	2730	207.9	2729.75	227.1	2729.95	275.2	2730
294.4	2728	304.4	2728	322.8	2730	347.3	2731.46		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
146.03	.08	275.2	.035	322.8	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
275.2	322.8	67.2	109	126.6	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2731.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.59	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (ft)	2730.85	Reach Len. (ft)	67.20	109.00	126.60
Crit W.S. (ft)	2730.85	Flow Area (sq ft)	118.73	98.05	6.06
E.G. Slope (ft/ft)	0.010521	Area (sq ft)	118.73	98.05	6.06
Q Total (cfs)	908.64	Flow (cfs)	212.89	689.23	6.52
Top Width (ft)	191.03	Top Width (ft)	129.17	47.60	14.26
Vel Total (ft/s)	4.08	Avg. Vel. (ft/s)	1.79	7.03	1.08
Max Chl Dpth (ft)	2.85	Hydr. Depth (ft)	0.92	2.06	0.42
Conv. Total (cfs)	8858.5	Conv. (cfs)	2075.5	6719.5	63.5
Length Wtd. (ft)	103.16	Wetted Per. (ft)	130.04	47.81	14.29
Min Ch El (ft)	2728.00	Shear (lb/sq ft)	0.60	1.35	0.28
Alpha	2.30	Stream Power (lb/ft s)	1.08	9.47	0.30
Frctn Loss (ft)	1.15	Cum Volume (acre-ft)	0.55	1.46	0.38
C & E Loss (ft)	0.01	Cum SA (acres)	0.69	0.87	0.58

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

LATERAL STRUCTURE

RIVER: Coronado Ridge
REACH: MAIN RS: 1301

INPUT
Description: LEFT BANK SPLIT FLOW
Lateral structure position = Left overbank
Distance from Upstream XS = 0
Deck/Roadway Width = 10
Weir Coefficient = 2.5
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 3

Sta	Elev	Sta	Elev	Sta	Elev
0	2730	32.5	2729	67.2	2728.08

Weir crest shape = Broad Crested

LATERAL STRUCTURE OUTPUT Profile #TSMS100Yr Lat Struct

E.G. US. (ft)	2731.44	Weir Sta US (ft)	0.00
W.S. US. (ft)	2730.85	Weir Sta DS (ft)	67.20
E.G. DS (ft)	2729.13	Weir Max Depth (ft)	0.85
W.S. DS (ft)	2728.41	Weir Avg Depth (ft)	0.63
Q US (cfs)	908.64	Weir Submerg	0.00
Q Leaving Total (cfs)	84.99	Min El Weir Flow (ft)	2728.08
Q DS (cfs)	823.55	Wr Top Wdth (ft)	67.20
Perc Q Leaving	9.36	Q Gate Group (cfs)	
Q Weir (cfs)	84.99	Gate Open Ht (ft)	
Q Gates (cfs)		Gate #Open	
Q Culv (cfs)		Gate Area (sq ft)	
Q Lat RC (cfs)		Gate Submerg	
Weir Flow Area (sq ft)	42.03	Gate Invert (ft)	

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

LATERAL STRUCTURE

RIVER: Coronado Ridge
REACH: MAIN RS: 1300

INPUT
Description: Right Bank Split Flow
Lateral structure position = Right overbank
Distance from Upstream XS = 0
Deck/Roadway Width = 10
Weir Coefficient = 2.5
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 3

Sta	Elev	Sta	Elev	Sta	Elev
0	2731.46	78.5	2730	126.6	2728.56

Weir crest shape = Broad Crested

LATERAL STRUCTURE OUTPUT Profile #TSMS100Yr Lat Struct

E.G. US. (ft)	2731.44	Weir Sta US (ft)	
W.S. US. (ft)	2730.85	Weir Sta DS (ft)	
E.G. DS (ft)	2729.13	Weir Max Depth (ft)	
W.S. DS (ft)	2728.41	Weir Avg Depth (ft)	
Q US (cfs)	908.64	Weir Submerg	
Q Leaving Total (cfs)	0.00	Min El Weir Flow (ft)	2728.56
Q DS (cfs)	823.55	Wr Top Wdth (ft)	
Perc Q Leaving	0.00	Q Gate Group (cfs)	
Q Weir (cfs)		Gate Open Ht (ft)	
Q Gates (cfs)		Gate #Open	
Q Culv (cfs)		Gate Area (sq ft)	
Q Lat RC (cfs)		Gate Submerg	
Weir Flow Area (sq ft)		Gate Invert (ft)	

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 1248

INPUT
Description:
Station Elevation Data num= 13

PB PROJ No. 11515
Coronado Ridge Wash *(Main Branch)*
Existing Condition Analysis

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
197.68	2728.08	208.35	2728.08	212.64	2727.93	218.77	2727.53	228.89	2727.83
242.97	2728.04	248.5	2727.95	268.9	2726	271.8	2725.8	283.9	2726
293.3	2726.1	310.6	2727.9	329.2	2728.56				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
197.68	.08	248.5	.035	310.6	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
248.5	310.6	106.5	102	109.1	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2729.13	Element			
Vel Head (ft)	0.72	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (ft)	2728.41	Reach Len. (ft)	106.50	102.00	109.10
Crit W.S. (ft)	2728.41	Flow Area (sq ft)	25.78	113.48	3.66
E.G. Slope (ft/ft)	0.012005	Area (sq ft)	25.78	113.48	3.66
Q Total (cfs)	823.55	Flow (cfs)	33.21	787.34	2.99
Top Width (ft)	127.28	Top Width (ft)	50.82	62.10	14.36
Vel Total (ft/s)	5.76	Avg. Vel. (ft/s)	1.29	6.94	0.82
Max Chl Dpth (ft)	2.61	Hydr. Depth (ft)	0.51	1.83	0.25
Conv. Total (cfs)	7516.5	Conv. (cfs)	303.1	7186.0	27.3
Length Wtd. (ft)	102.60	Wetted Per. (ft)	51.17	62.30	14.37
Min Ch El (ft)	2725.80	Shear (lb/sq ft)	0.38	1.37	0.19
Alpha	1.39	Stream Power (lb/ft s)	0.49	9.47	0.16
Frctn Loss (ft)	1.26	Cum Volume (acre-ft)	0.44	1.19	0.36
C & E Loss (ft)	0.05	Cum SA (acres)	0.55	0.73	0.53

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

LATERAL STRUCTURE

RIVER: Coronado Ridge
REACH: MAIN RS: 1241

INPUT
Description: LEFT BANK SPLIT FLOW
Lateral structure position = Left overbank
Distance from Upstream XS = 0
Deck/Roadway Width = 10
Weir Coefficient = 2.5
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2728.08	2.9	2728	30.3	2727	54.3	2726	90.3	2725.3
106.5	2725.13								

Weir crest shape = Broad Crested

LATERAL STRUCTURE OUTPUT Profile #TSMS100Yr Lat Struct

E.G. US. (ft)	2729.13	Weir Sta US (ft)	0.00
W.S. US. (ft)	2728.41	Weir Sta DS (ft)	106.50
E.G. DS (ft)	2726.14	Weir Max Depth (ft)	0.97
W.S. DS (ft)	2725.58	Weir Avg Depth (ft)	0.68
Q US (cfs)	823.55	Weir Submerg	0.00
Q Leaving Total (cfs)	152.77	Min El Weir Flow (ft)	2725.13
Q DS (cfs)	566.07	Wr Top Wdth (ft)	106.50
Perc Q Leaving	18.39	Q Gate Group (cfs)	
Q Weir (cfs)	152.77	Gate Open Ht (ft)	
Q Gates (cfs)		Gate #Open	
Q Culv (cfs)		Gate Area (sq ft)	
Q Lat RC (cfs)		Gate Submerg	
Weir Flow Area (sq ft)	72.18	Gate Invert (ft)	

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

LATERAL STRUCTURE

RIVER: Coronado Ridge
REACH: MAIN RS: 1200

INPUT
Description: Right Bank Split Flow
Lateral structure position = Right overbank
Distance from Upstream XS = 0
Deck/Roadway Width = 10
Weir Coefficient = 2.5
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2728.56	31	2727.09	40.5	2726.68	61	2726.24	70.9	2725.84
79.2	2725.69	81.3	2725.68	106.9	2725.02	109.1	2725.01		

Weir crest shape = Broad Crested

LATERAL STRUCTURE OUTPUT Profile #TSMS100Yr Lat Struct

E.G. US. (ft)	2729.13	Weir Sta US (ft)	7.01
W.S. US. (ft)	2728.41	Weir Sta DS (ft)	109.10
E.G. DS (ft)	2726.14	Weir Max Depth (ft)	0.73
W.S. DS (ft)	2725.58	Weir Avg Depth (ft)	0.54
Q US (cfs)	823.55	Weir Submerg	0.00
Q Leaving Total (cfs)	107.29	Min El Weir Flow (ft)	2725.01
Q DS (cfs)	566.07	Wr Top Wdth (ft)	102.09
Perc Q Leaving	12.88	Q Gate Group (cfs)	
Q Weir (cfs)	107.29	Gate Open Ht (ft)	
Q Gates (cfs)		Gate #Open	
Q Culv (cfs)		Gate Area (sq ft)	
Q Lat RC (cfs)		Gate Submerg	
Weir Flow Area (sq ft)	55.59	Gate Invert (ft)	

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 1146

INPUT
Description:
Station Elevation Data num= 21

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
145.39	2725.13	146.28	2725.13	148.93	2724.8	153.91	2723.63	163.29	2723.6
163.3	2723.6	175.84	2723.59	177.65	2724.1	183.54	2724.01	188.41	2724.61
191.87	2725	196.7	2724.91	203.6	2724.67	206.7	2724.73	210.7	2724.61
216.5	2724.61	223.7	2724.73	224.6	2724.68	235.4	2724.83	254.9	2724.92
257.1	2725.01								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
145.39	.08	146.28	.035	191.87	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
146.28	191.87	85	96	88.4	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2726.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.56	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (ft)	2725.58	Reach Len. (ft)	85.00	96.00	88.40
Crit W.S. (ft)	2725.58	Flow Area (sq ft)	0.40	72.69	51.72
E.G. Slope (ft/ft)	0.012734	Area (sq ft)	0.40	72.69	51.72

Q Total (cfs)	566.07	Flow (cfs)	0.37	473.36	92.33
Top Width (ft)	111.71	Top Width (ft)	0.89	45.59	65.23
Vel Total (ft/s)	4.54	Avg. Vel. (ft/s)	0.94	6.51	1.79
Max Chl Dpth (ft)	1.99	Hydr. Depth (ft)	0.45	1.59	0.79
Conv. Total (cfs)	5016.3	Conv. (cfs)	3.3	4194.8	818.2
Length Wtd. (ft)	91.68	Wetted Per. (ft)	1.34	45.88	65.81
Min Ch El (ft)	2723.59	Shear (lb/sq ft)	0.24	1.26	0.62
Alpha	1.75	Stream Power (lb/ft s)	0.22	8.20	1.12
Frctn Loss (ft)	2.06	Cum Volume (acre-ft)	0.41	0.98	0.30
C & E Loss (ft)	0.06	Cum SA (acres)	0.48	0.61	0.43

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

LATERAL STRUCTURE

RIVER: Coronado Ridge
REACH: MAIN RS: 1100

INPUT
Description: Right Bank Split Flow
Lateral structure position = Right overbank
Distance from Upstream XS = 0
Deck/Roadway Width = 10
Weir Coefficient = 2.5
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2725.01	6.4	2725	10.9	2724.9	47.5	2723.41	52.1	2723.13
61.6	2722.79	70.5	2722.73	79.2	2722.46	81.5	2722.48	88.4	2722.49

Weir crest shape = Broad Crested

LATERAL STRUCTURE OUTPUT Profile #TSMS100Yr Lat Struct

E.G. US. (ft)	2726.14	Weir Sta US (ft)	0.00
W.S. US. (ft)	2725.58	Weir Sta DS (ft)	88.40
E.G. DS (ft)	2723.34	Weir Max Depth (ft)	0.97
W.S. DS (ft)	2722.98	Weir Avg Depth (ft)	0.66
Q US (cfs)	566.07	Weir Submerg	0.00
Q Leaving Total (cfs)	122.71	Min El Weir Flow (ft)	2722.46
Q DS (cfs)	723.64	Wr Top Wdth (ft)	88.40
Perc Q Leaving	21.26	Q Gate Group (cfs)	
Q Weir (cfs)	122.71	Gate Open Ht (ft)	
Q Gates (cfs)		Gate #Open	
Q Culv (cfs)		Gate Area (sq ft)	
Q Lat RC (cfs)		Gate Submerg	
Weir Flow Area (sq ft)	58.58	Gate Invert (ft)	

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 1050

INPUT
Description:
Station Elevation Data num= 38

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2723.81	5.56	2722.62	20.21	2721.65	30.69	2721.87	34.78	2721.84
41.05	2721.86	44.41	2721.03	46.72	2721.68	47.29	2721.97	70.77	2722.25
74.69	2722.31	81.71	2722.15	86.53	2722.2	90.42	2722.14	91.18	2722.17

91.84	2722.12	92.1	2722.07	94.55	2721.99	96.31	2722.06	100.26	2722.1
104.13	2723.1	108.23	2723.08	114.92	2723.01	120.65	2722.44	128.36	2721.88
136.37	2721.97	147.09	2721.99	158.1	2722.95	165.2	2723.31	173.1	2722.93
184.3	2722.64	186.5	2722.68	204.7	2722.44	207.4	2722.27	230.6	2721.79
233.3	2721.91	243.1	2721.8	253.7	2722.49				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	114.92	.035	158.1	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
114.92	158.1	95	110	100	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2723.34	Element			
Vel Head (ft)	0.37	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (ft)	2722.98	Reach Len. (ft)	95.00	110.00	100.00
Crit W.S. (ft)	2722.95	Flow Area (sq ft)	92.20	32.38	56.84
E.G. Slope (ft/ft)	0.040740	Area (sq ft)	92.20	32.38	56.84
Q Total (cfs)	723.64	Flow (cfs)	326.96	229.89	166.78
Top Width (ft)	224.62	Top Width (ft)	99.75	42.83	82.04
Vel Total (ft/s)	3.99	Avg. Vel. (ft/s)	3.55	7.10	2.93
Max Chl Dpth (ft)	1.95	Hydr. Depth (ft)	0.92	0.76	0.69
Conv. Total (cfs)	3585.2	Conv. (cfs)	1619.9	1139.0	826.3
Length Wtd. (ft)	105.30	Wetted Per. (ft)	100.21	42.92	82.57
Min Ch El (ft)	2721.88	Shear (lb/sq ft)	2.34	1.92	1.75
Alpha	1.49	Stream Power (lb/ft s)	8.30	13.62	5.14
Frctn Loss (ft)	2.29	Cum Volume (acre-ft)	0.32	0.86	0.19
C & E Loss (ft)	0.06	Cum SA (acres)	0.38	0.51	0.28

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 940

INPUT
Description:
Station Elevation Data num= 51

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2723.91	2.08	2723.23	4.43	2722.73	4.74	2722.66	6.51	2722.28
12.44	2721.02	13.38	2720.89	15.56	2720.53	20.01	2719.83	21.79	2719.53
28.48	2718.05	30.91	2717.45	33.17	2717.38	34.03	2717.36	36.68	2717.4
37.59	2717.51	37.6	2717.51	38.3	2717.59	39.66	2717.55	41.23	2717.48
45.02	2717.57	46.34	2717.59	49.11	2717.8	50.77	2717.94	52.66	2717.97
56.78	2717.96	57.21	2717.97	57.65	2718.03	58.11	2718.11	59.58	2718.35
62.99	2718.86	63.89	2719.12	67.43	2718.58	68.23	2718.47	68.82	2718.61
71.57	2719.17	73.58	2719.58	73.85	2719.61	74.13	2719.66	74.54	2719.68
79.17	2719.71	81.26	2719.82	82.7	2719.94	86.89	2720.08	89.33	2720.19
94.36	2720.29	95.84	2720.31	100.38	2720.39	117.19	2720.42	119.33	2720.36
126.53	2720.19								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	20.01	.035	63.89	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
20.01	63.89	115	110	100	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2721.00	Element			
Vel Head (ft)	0.93	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (ft)	2720.07	Reach Len. (ft)	115.00	110.00	100.00
Crit W.S. (ft)	2720.07	Flow Area (sq ft)	0.18	89.16	14.41
E.G. Slope (ft/ft)	0.013476	Area (sq ft)	0.18	89.16	14.41
Q Total (cfs)	723.64	Flow (cfs)	0.09	700.71	22.83
Top Width (ft)	68.10	Top Width (ft)	1.52	43.88	22.69
Vel Total (ft/s)	6.97	Avg. Vel. (ft/s)	0.52	7.86	1.58
Max Chl Dpth (ft)	2.71	Hydr. Depth (ft)	0.12	2.03	0.63
Conv. Total (cfs)	6233.7	Conv. (cfs)	0.8	6036.2	196.7
Length Wtd. (ft)	109.62	Wetted Per. (ft)	1.54	44.28	22.87
Min Ch El (ft)	2717.36	Shear (lb/sq ft)	0.10	1.69	0.53

Alpha	1.23	Stream Power (lb/ft s)	0.05	13.31	0.84
Frctn Loss (ft)	1.56	Cum Volume (acre-ft)	0.22	0.71	0.10
C & E Loss (ft)	0.04	Cum SA (acres)	0.27	0.40	0.16

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 830

INPUT
Description:
Station Elevation Data num= 50

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2720.66	.06	2720.68	.61	2720.89	3.61	2720.57	7.11	2720.89
9.68	2720.64	12.49	2720.11	20.41	2718.81	24.68	2718.37	27.07	2718.22
29.64	2717.96	33.29	2716.46	34.28	2716.03	36.45	2715.1	38.23	2715.11
47.9	2715.23	51.31	2715.22	55.28	2715.64	56.38	2715.75	56.53	2715.75
67.02	2715.71	73.46	2715.69	78.4	2715.76	80	2715.77	81.52	2716.07
88.82	2717.57	93.35	2717.73	94.07	2717.73	94.65	2717.75	101.21	2717.55
105.62	2717.48	109.59	2716.96	114.15	2716.31	117.54	2716.26	121.61	2716.24
127.33	2717.14	131.25	2717.74	138.22	2718.46	139.69	2718.37	142.04	2718.26
142.52	2718.32	144.6	2718.48	148.61	2718.11	151.13	2718.28	152.47	2718.4
154.3	2718.47	156.76	2718.71	158.3	2718.79	160.43	2718.92	163.92	2719.09

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	29.64	.035	88.82	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
29.64	88.82	130	130	120	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2718.19	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.79	Wt. n-Val.		0.035	0.080
W.S. Elev (ft)	2717.40	Reach Len. (ft)	130.00	130.00	120.00
Crit W.S. (ft)	2717.40	Flow Area (sq ft)		95.06	16.95
E.G. Slope (ft/ft)	0.015092	Area (sq ft)		95.06	16.95
Q Total (cfs)	723.64	Flow (cfs)		692.05	31.59
Top Width (ft)	79.77	Top Width (ft)		56.98	22.78
Vel Total (ft/s)	6.46	Avg. Vel. (ft/s)		7.28	1.86
Max Chl Dpth (ft)	2.30	Hydr. Depth (ft)		1.67	0.74
Conv. Total (cfs)	5890.5	Conv. (cfs)		5633.3	257.1
Length Wtd. (ft)	129.72	Wetted Per. (ft)		57.64	22.95
Min Ch El (ft)	2715.10	Shear (lb/sq ft)		1.55	0.70
Alpha	1.22	Stream Power (lb/ft s)		11.31	1.30
Frctn Loss (ft)	1.76	Cum Volume (acre-ft)	0.22	0.47	0.07
C & E Loss (ft)	0.06	Cum SA (acres)	0.27	0.27	0.11

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 700

INPUT
Description:
Station Elevation Data num= 50

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2716.46	5.92	2715.6	14.7	2715.61	15.49	2715.68	16.35	2715.72
17.55	2715.82	19.26	2715.93	19.81	2715.66	20.87	2716.07	23.75	2716.13
25.42	2716.2	30.06	2716.31	33.48	2716.33	37.2	2715.32	43.74	2713.6
44.54	2713.59	47.72	2713.59	58.84	2713.45	60.45	2713.44	65.55	2713.49
69.23	2713.55	75.28	2713.6	80.22	2713.57	81.77	2713.66	97.16	2713.79

98.48	2713.83	110.04	2714.06	116.63	2714.1	128.75	2713.84	130.18	2713.77
134.2	2713.41	140.27	2712.88	141.35	2712.75	143.79	2712.62	144.38	2712.6
150	2712.6	165.53	2712.6	173.14	2712.57	175.33	2713.79	180.78	2714.01
186.38	2714.3	188.78	2714.55	203.21	2715.85	207.29	2715.86	213.58	2715.91
215.2	2715.84	218.36	2715.77	229.25	2715.2	234.79	2715.42	238.97	2715.94

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	128.75	.035	175.33	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
128.75	175.33	105	100	100	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2715.21	Element			
Vel Head (ft)	0.59	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (ft)	2714.61	Reach Len. (ft)	105.00	100.00	100.00
Crit W.S. (ft)	2714.61	Flow Area (sq ft)	76.63	83.18	6.93
E.G. Slope (ft/ft)	0.012250	Area (sq ft)	76.63	83.18	6.93
Q Total (cfs)	723.64	Flow (cfs)	142.58	572.22	8.84
Top Width (ft)	149.60	Top Width (ft)	88.86	46.58	14.15
Vel Total (ft/s)	4.34	Avg. Vel. (ft/s)	1.86	6.88	1.28
Max Chl Dpth (ft)	2.04	Hydr. Depth (ft)	0.86	1.79	0.49
Conv. Total (cfs)	6538.1	Conv. (cfs)	1288.2	5170.1	79.9
Length Wtd. (ft)	100.53	Wetted Per. (ft)	89.01	46.95	14.18
Min Ch El (ft)	2712.57	Shear (lb/sq ft)	0.66	1.35	0.37
Alpha	2.02	Stream Power (lb/ft s)	1.23	9.32	0.48
Frctn Loss (ft)	1.24	Cum Volume (acre-ft)	0.10	0.21	0.03
C & E Loss (ft)	0.01	Cum SA (acres)	0.14	0.12	0.06

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 600

INPUT
Description:
Station Elevation Data num= 50

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2713.96	18.34	2714.23	24.34	2712.7	27.67	2712.21	31.59	2712.52
41.67	2713.41	50.77	2714.27	55.02	2714.54	66.81	2715.23	75.66	2713.86
82.33	2712.95	83.63	2712.81	92.09	2711.6	96.06	2711.67	103.06	2711.89
115.17	2711.8	115.53	2711.69	122.61	2710.39	124.36	2710.22	127.69	2710.71
128.15	2710.69	131.76	2710.32	137.66	2710.18	154.63	2709.79	157.34	2710.5
164.67	2710.5	170.25	2711.17	172.96	2711.29	174.8	2711.28	175.73	2711.32
179.17	2711.27	181.17	2711.41	181.58	2711.33	186.29	2711.48	192.75	2711.62
197.53	2711.76	201.98	2711.85	206.74	2712.01	210.67	2712.25	211.51	2712.26
218.07	2712.5	221.04	2712.57	230.77	2712.92	234.64	2713.12	239.25	2713.42
240.19	2713.46	243.45	2713.67	247.88	2713.78	250.38	2713.77	251.63	2713.72

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	115.17	.035	170.25	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
115.17	170.25	0	0	0	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2712.88	Element			
Vel Head (ft)	0.70	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (ft)	2712.18	Reach Len. (ft)			
Crit W.S. (ft)	2712.18	Flow Area (sq ft)	10.27	98.06	23.36
E.G. Slope (ft/ft)	0.012406	Area (sq ft)	10.27	98.06	23.36
Q Total (cfs)	723.64	Flow (cfs)	11.10	678.41	34.13
Top Width (ft)	121.55	Top Width (ft)	27.15	55.08	39.32
Vel Total (ft/s)	5.50	Avg. Vel. (ft/s)	1.08	6.92	1.46
Max Chl Dpth (ft)	2.39	Hydr. Depth (ft)	0.38	1.78	0.59
Conv. Total (cfs)	6496.9	Conv. (cfs)	99.6	6090.9	306.4
Length Wtd. (ft)		Wetted Per. (ft)	27.20	55.42	39.35
Min Ch El (ft)	2709.79	Shear (lb/sq ft)	0.29	1.37	0.46
Alpha	1.49	Stream Power (lb/ft s)	0.32	9.48	0.67
Frctn Loss (ft)		Cum Volume (acre-ft)			

C & E Loss (ft) Cum SA (acres)

Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth). Water surface set to critical depth.

SUMMARY OF MANNING'S N VALUES

River:Coronado Ridge

Reach	River Sta.	n1	n2	n3
MAIN	2250	.04	.02	.04
MAIN	2245	.04	.02	.04
MAIN	2240	Culvert		
MAIN	2155	.04	.035	.08
MAIN	2080	.04	.035	.08
MAIN	2000	.04	.035	.08
MAIN	1890	.08	.035	.08
MAIN	1750	.08	.035	.08
MAIN	1610	.08	.035	.08
MAIN	1480	.08	.035	.08
MAIN	1421	Lat Struct		
MAIN	1358	.08	.035	.08
MAIN	1301	Lat Struct		
MAIN	1300	Lat Struct		
MAIN	1248	.08	.035	.08
MAIN	1241	Lat Struct		
MAIN	1200	Lat Struct		
MAIN	1146	.08	.035	.08
MAIN	1100	Lat Struct		
MAIN	1050	.08	.035	.08
MAIN	940	.08	.035	.08
MAIN	830	.08	.035	.08
MAIN	700	.08	.035	.08
MAIN	600	.08	.035	.08

SUMMARY OF REACH LENGTHS

River: Coronado Ridge

Reach	River Sta.	Left	Channel	Right
MAIN	2250	5	5	5
MAIN	2245	90	90	90
MAIN	2240	Culvert		
MAIN	2155	75	75	75
MAIN	2080	80	80	80
MAIN	2000	113	113	113
MAIN	1890	140	140	92
MAIN	1750	100	140	155
MAIN	1610	125	130	115
MAIN	1480	104.4	122	120.9
MAIN	1421	Lat Struct		
MAIN	1358	67.2	109	126.6
MAIN	1301	Lat Struct		
MAIN	1300	Lat Struct		
MAIN	1248	106.5	102	109.1
MAIN	1241	Lat Struct		
MAIN	1200	Lat Struct		
MAIN	1146	85	96	88.4
MAIN	1100	Lat Struct		
MAIN	1050	95	110	100
MAIN	940	115	110	100
MAIN	830	130	130	120
MAIN	700	105	100	100
MAIN	600	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Coronado Ridge

Reach	River Sta.	Contr.	Expan.
MAIN	2250	.3	.5
MAIN	2245	.3	.5

PB PROJ No. 11515
Coronado Ridge Wash *(Main Branch)*
Existing Condition Analysis

MAIN	2240	Culvert		
MAIN	2155		.3	.5
MAIN	2080		.3	.5
MAIN	2000		.1	.3
MAIN	1890		.1	.3
MAIN	1750		.1	.3
MAIN	1610		.1	.3
MAIN	1480		.1	.3
MAIN	1421	Lat Struct		
MAIN	1358		.1	.3
MAIN	1301	Lat Struct		
MAIN	1300	Lat Struct		
MAIN	1248		.1	.3
MAIN	1241	Lat Struct		
MAIN	1200	Lat Struct		
MAIN	1146		.1	.3
MAIN	1100	Lat Struct		
MAIN	1050		.1	.3
MAIN	940		.1	.3
MAIN	830		.1	.3
MAIN	700		.1	.3
MAIN	600		.1	.3

PB PROJ No. 11515
Coronado Ridge Wash *(Main Branch)*
Existing Condition Analysis
Profile Output Table - Standard Table 1

Reach # Chl	River Sta		Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude
MAIN	2250		TSMS100Yr	950.00	2746.92	2749.18	2749.18	2750.23	0.004506	8.24	115.31	75.39	1.00
MAIN	2245		TSMS100Yr	950.00	2744.89	2748.77	2747.70	2749.34	0.001262	6.08	156.13	62.49	0.57
MAIN	2240	4-8'x3'x78' RCBC		Culvert									
MAIN	2155		TSMS100Yr	950.00	2743.42	2746.92	2746.78	2748.08	0.011874	8.64	109.95	42.33	0.92
MAIN	2080		TSMS100Yr	950.00	2740.64	2746.28	2746.06	2747.25	0.008235	8.06	146.05	175.72	0.80
MAIN	2000		TSMS100Yr	950.00	2741.76	2745.64	2745.64	2746.44	0.010066	7.79	179.01	228.37	0.87
MAIN	1890		TSMS100Yr	950.00	2739.80	2742.87	2742.87	2743.51	0.011419	7.69	225.20	281.60	0.90
MAIN	1750		TSMS100Yr	950.00	2737.00	2739.45	2739.45	2740.27	0.013255	7.51	153.61	140.89	0.95
MAIN	1610		TSMS100Yr	950.00	2734.00	2736.60	2736.60	2737.14	0.021271	8.17	245.66	232.68	1.16
MAIN	1480		TSMS100Yr	950.00	2730.30	2733.35	2733.35	2733.95	0.012764	7.28	223.46	175.86	0.93
MAIN	1421	LEFT SPLIT		Lat Struct									
MAIN	1358		TSMS100Yr	908.64	2728.00	2730.85	2730.85	2731.44	0.010521	7.03	222.84	191.03	0.86
MAIN	1301	LEFT SPLIT		Lat Struct									
MAIN	1300	RIGHT SPLIT		Lat Struct									
MAIN	1248		TSMS100Yr	823.55	2725.80	2728.41	2728.41	2729.13	0.012005	6.94	142.92	127.28	0.90
MAIN	1241	LEFT SPLIT		Lat Struct									
MAIN	1200	RIGHT SPLIT		Lat Struct									
MAIN	1146		TSMS100Yr	566.07	2723.59	2725.58	2725.58	2726.14	0.012734	6.51	124.82	111.71	0.91
MAIN	1100	RIGHT SPLIT		Lat Struct									
MAIN	1050		TSMS100Yr	723.64	2721.88	2722.98	2722.95	2723.34	0.040740	7.10	181.41	224.62	1.44
MAIN	940		TSMS100Yr	723.64	2717.36	2720.07	2720.07	2721.00	0.013476	7.86	103.75	68.10	0.97
MAIN	830		TSMS100Yr	723.64	2715.10	2717.40	2717.40	2718.19	0.015092	7.28	112.01	79.77	0.99
MAIN	700		TSMS100Yr	723.64	2712.57	2714.61	2714.61	2715.21	0.012250	6.88	166.74	149.60	0.91
MAIN	600		TSMS100Yr	723.64	2709.79	2712.18	2712.18	2712.88	0.012406	6.92	131.69	121.55	0.91

PB PROJ No. 11515
Coronado Ridge Wash *(Main Branch)*
Existing Condition Analysis
Profile Output Table - Standard Table 2

Reach	River Sta		Profile	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Leaving Total (cfs)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
MAIN	2250		TSMS100Yr	2750.23	2749.18	1.05	0.01	0.24			950.0		75.4
MAIN	2245		TSMS100Yr	2749.34	2748.77	0.57					950.0		62.5
MAIN	2240	4-8'x3'x78' RCBC		Culvert									
MAIN	2155		TSMS100Yr	2748.08	2746.92	1.16	0.74	0.10			950.0		42.3
MAIN	2080		TSMS100Yr	2747.25	2746.28	0.97	0.73	0.08			912.9	37.1	175.7
MAIN	2000		TSMS100Yr	2746.44	2745.64	0.80	1.21	0.05		4.1	801.8	144.0	228.4
MAIN	1890		TSMS100Yr	2743.51	2742.87	0.64	1.60	0.02			633.1	316.9	281.6
MAIN	1750		TSMS100Yr	2740.27	2739.45	0.82	2.29	0.08			889.4	60.6	140.9
MAIN	1610		TSMS100Yr	2737.14	2736.60	0.54	2.02	0.01		214.0	442.1	294.0	232.7
MAIN	1480		TSMS100Yr	2733.95	2733.35	0.60	1.39	0.00			667.1	282.9	175.9
MAIN	1421	LEFT SPLIT	TSMS100Yr						41.4				
MAIN	1358		TSMS100Yr	2731.44	2730.85	0.59	1.15	0.01		212.9	689.2	6.5	191.0
MAIN	1301	LEFT SPLIT	TSMS100Yr						85.0				
MAIN	1300	RIGHT SPLIT	TSMS100Yr						0.0				
MAIN	1248		TSMS100Yr	2729.13	2728.41	0.72	1.26	0.05		33.2	787.3	3.0	127.3
MAIN	1241	LEFT SPLIT	TSMS100Yr						152.8				
MAIN	1200	RIGHT SPLIT	TSMS100Yr						107.3				
MAIN	1146		TSMS100Yr	2726.14	2725.58	0.56	2.06	0.06		0.4	473.4	92.3	111.7
MAIN	1100	RIGHT SPLIT	TSMS100Yr						122.7				
MAIN	1050		TSMS100Yr	2723.34	2722.98	0.37	2.29	0.06		327.0	229.9	166.8	224.6
MAIN	940		TSMS100Yr	2721.00	2720.07	0.93	1.56	0.04		0.1	700.7	22.8	68.1
MAIN	830		TSMS100Yr	2718.19	2717.40	0.79	1.76	0.06			692.0	31.6	79.8
MAIN	700		TSMS100Yr	2715.21	2714.61	0.59	1.24	0.01		142.6	572.2	8.8	149.6
MAIN	600		TSMS100Yr	2712.88	2712.18	0.70				11.1	678.4	34.1	121.5

PB PROJ No. 11515
Coronado Ridge Wash *(Main Branch)*
Existing Condition Analysis
Profile Output Table - CUSTOM 1

Reach	River Sta		Profile	E.G. Elev	W.S. Elev	Vel Head	Froude # Chl	Froude # XS	Frctn Loss	C & E Loss	Q Total	Q Left	Q Channel	Q Right	Top Width	Q Weir
				(ft)	(ft)	(ft)			(ft)	(ft)	(cfs)	(cfs)	(cfs)	(cfs)	(ft)	(cfs)
MAIN	2250		TSMS100Yr	2750.23	2749.18	1.05	1.0	1.00	0.01	0.24	950.0		950.0		75.4	
MAIN	2245		TSMS100Yr	2749.34	2748.77	0.57	0.6	0.57			950.0		950.0		62.5	
MAIN	2240	4-8'x3'x78' RCBC		Culvert												
MAIN	2155		TSMS100Yr	2748.08	2746.92	1.16	0.9	0.92	0.74	0.10	950.0		950.0		42.3	
MAIN	2080		TSMS100Yr	2747.25	2746.28	0.97	0.8	0.93	0.73	0.08	950.0		912.9	37.1	175.7	
MAIN	2000		TSMS100Yr	2746.44	2745.64	0.80	0.9	0.75	1.21	0.05	950.0	4.1	801.8	144.0	228.4	
MAIN	1890		TSMS100Yr	2743.51	2742.87	0.64	0.9	0.62	1.60	0.02	950.0		633.1	316.9	281.6	
MAIN	1750		TSMS100Yr	2740.27	2739.45	0.82	0.9	0.92	2.29	0.08	950.0		889.4	60.6	140.9	
MAIN	1610		TSMS100Yr	2737.14	2736.60	0.54	1.2	0.66	2.02	0.01	950.0	214.0	442.1	294.0	232.7	
MAIN	1480		TSMS100Yr	2733.95	2733.35	0.60	0.9	0.66	1.39	0.00	950.0		667.1	282.9	175.9	
MAIN	1421	LEFT SPLIT	TSMS100Yr								950.0		41.4			
MAIN	1358		TSMS100Yr	2731.44	2730.85	0.59	0.9	0.67	1.15	0.01	908.6	212.9	689.2	6.5	191.0	
MAIN	1301	LEFT SPLIT	TSMS100Yr								908.6		85.0			
MAIN	1300	RIGHT SPLIT	TSMS100Yr								908.6					
MAIN	1248		TSMS100Yr	2729.13	2728.41	0.72	0.9	0.96	1.26	0.05	823.5	33.2	787.3	3.0	127.3	
MAIN	1241	LEFT SPLIT	TSMS100Yr								823.5		152.8			
MAIN	1200	RIGHT SPLIT	TSMS100Yr								823.5		107.3			
MAIN	1146		TSMS100Yr	2726.14	2725.58	0.56	0.9	0.76	2.06	0.06	566.1	0.4	473.4	92.3	111.7	
MAIN	1100	RIGHT SPLIT	TSMS100Yr								566.1		122.7			
MAIN	1050		TSMS100Yr	2723.34	2722.98	0.37	1.4	0.78	2.29	0.06	723.6	327.0	229.9	166.8	224.6	
MAIN	940		TSMS100Yr	2721.00	2720.07	0.93	1.0	1.00	1.56	0.04	723.6	0.1	700.7	22.8	68.1	
MAIN	830		TSMS100Yr	2718.19	2717.40	0.79	1.0	0.96	1.76	0.06	723.6		692.0	31.6	79.8	
MAIN	700		TSMS100Yr	2715.21	2714.61	0.59	0.9	0.72	1.24	0.01	723.6	142.6	572.2	8.8	149.6	
MAIN	600		TSMS100Yr	2712.88	2712.18	0.70	0.9	0.93			723.6	11.1	678.4	34.1	121.5	

PB PROJ No. 11515
Coronado Ridge Wash *(Main Branch)*
Existing Condition Analysis
ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : CRWEXSTMAIN

River: Coronado Ridge Reach: MAIN RS: 2250 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
River: Coronado Ridge Reach: MAIN RS: 2245 Profile: TSMS100Yr
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Coronado Ridge Reach: MAIN RS: 2240 Profile: TSMS100Yr Culv: Culvert #1
Note: Culvert critical depth exceeds the height of the culvert.
Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations are not valid and the supercritical result has been discarded. The outlet answer will be used.
River: Coronado Ridge Reach: MAIN RS: 2155 Profile: TSMS100Yr
Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Coronado Ridge Reach: MAIN RS: 2080 Profile: TSMS100Yr
Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
River: Coronado Ridge Reach: MAIN RS: 2000 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
River: Coronado Ridge Reach: MAIN RS: 1890 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
River: Coronado Ridge Reach: MAIN RS: 1750 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
River: Coronado Ridge Reach: MAIN RS: 1610 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Coronado Ridge Reach: MAIN RS: 1480 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Coronado Ridge Reach: MAIN RS: 1421 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

River: Coronado Ridge Reach: MAIN RS: 1358 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Coronado Ridge Reach: MAIN RS: 1301 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

River: Coronado Ridge Reach: MAIN RS: 1300 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

River: Coronado Ridge Reach: MAIN RS: 1248 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Coronado Ridge Reach: MAIN RS: 1241 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

River: Coronado Ridge Reach: MAIN RS: 1200 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

River: Coronado Ridge Reach: MAIN RS: 1146 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

River: Coronado Ridge Reach: MAIN RS: 1100 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

River: Coronado Ridge Reach: MAIN RS: 1050 Profile: TSMS100Yr
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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

River: Coronado Ridge Reach: MAIN RS: 940 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Coronado Ridge Reach: MAIN RS: 830 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

PB PROJ No. 11515
Coronado Ridge Wash *(Main Branch)*
Existing Condition Analysis

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Coronado Ridge Reach: MAIN RS: 700 Profile: TSMS100Yr

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Coronado Ridge Reach: MAIN RS: 600 Profile: TSMS100Yr

Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth). Water surface set to critical depth.

HEC-RAS Plan: CRWEXSTMAIN River: Coronado Ridge Reach: MAIN Profile: TSMS100Yr

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Froude # Chl	Froude # XS	Frctn Loss	C & E Loss	Q Total	Q Left	Q Channel	Q Right	Top Width	Q Weir
			(ft)	(ft)	(ft)			(ft)	(ft)	(cfs)	(cfs)	(cfs)	(cfs)	(ft)	(cfs)
MAIN	2250	TSMS100Yr	2750.23	2749.18	1.05	1.0	1.00	0.01	0.24	950.0		950.0		75.4	
MAIN	2245	TSMS100Yr	2749.34	2748.77	0.57	0.6	0.57			950.0		950.0		62.5	
MAIN	2240 4-8'x3'x78' RCBC		Culvert												
MAIN	2155	TSMS100Yr	2748.08	2746.92	1.16	0.9	0.92	0.74	0.10	950.0		950.0		42.3	
MAIN	2080	TSMS100Yr	2747.25	2746.28	0.97	0.8	0.93	0.73	0.08	950.0		912.9	37.1	175.7	
MAIN	2000	TSMS100Yr	2746.44	2745.64	0.80	0.9	0.75	1.21	0.05	950.0	4.1	801.8	144.0	228.4	
MAIN	1890	TSMS100Yr	2743.51	2742.87	0.64	0.9	0.62	1.60	0.02	950.0		633.1	316.9	281.6	
MAIN	1750	TSMS100Yr	2740.27	2739.45	0.82	0.9	0.92	2.29	0.08	950.0		889.4	60.6	140.9	
MAIN	1610	TSMS100Yr	2737.14	2736.60	0.54	1.2	0.66	2.02	0.01	950.0	214.0	442.1	294.0	232.7	
MAIN	1480	TSMS100Yr	2733.95	2733.35	0.60	0.9	0.66	1.39	0.00	950.0		667.1	282.9	175.9	
MAIN	1421 LEFT SPLIT	TSMS100Yr								950.0					41.4
MAIN	1358	TSMS100Yr	2731.44	2730.85	0.59	0.9	0.67	1.15	0.01	908.6	212.9	689.2	6.5	191.0	
MAIN	1301 LEFT SPLIT	TSMS100Yr								908.6					85.0
MAIN	1300 RIGHT SPLIT	TSMS100Yr								908.6					
MAIN	1248	TSMS100Yr	2729.13	2728.41	0.72	0.9	0.96	1.26	0.05	823.5	33.2	787.3	3.0	127.3	
MAIN	1241 LEFT SPLIT	TSMS100Yr								823.5					152.8
MAIN	1200 RIGHT SPLIT	TSMS100Yr								823.5					107.3
MAIN	1146	TSMS100Yr	2726.14	2725.58	0.56	0.9	0.76	2.06	0.06	566.1	0.4	473.4	92.3	111.7	
MAIN	1100 RIGHT SPLIT	TSMS100Yr								566.1					122.7
MAIN	1050	TSMS100Yr	2723.34	2722.98	0.37	1.4	0.78	2.29	0.06	723.6	327.0	229.9	166.8	224.6	
MAIN	940	TSMS100Yr	2721.00	2720.07	0.93	1.0	1.00	1.56	0.04	723.6	0.1	700.7	22.8	68.1	
MAIN	830	TSMS100Yr	2718.19	2717.40	0.79	1.0	0.96	1.76	0.06	723.6		692.0	31.6	79.8	
MAIN	700	TSMS100Yr	2715.21	2714.61	0.59	0.9	0.72	1.24	0.01	723.6	142.6	572.2	8.8	149.6	
MAIN	600	TSMS100Yr	2712.88	2712.18	0.70	0.9	0.93			723.6	11.1	678.4	34.1	121.5	

PB Proj No. 11515
Coronado Ridge Wash (*West Tributary*)
Existing Condition Analysis

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                    HEC-RAS Version 3.1.3 May 2005
                     U.S. Army Corp 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: CRW WEST TRIB EXIST
Project File : CRW_WESTTRIB.prj
Run Date and Time: 2/29/2008 11:11:55 AM

Project in English units

Project Description:
Coronado Ridge Wash
Limits of Study:

West Reach--
Conveys R/O Along
Houghton Road To Broadway and Then East to RCBC Under Broadway. Includes
Break-Out From Bashas' Stormdrain System

XSECs Developed from Project
Mapping & Supplimented with PAG 1998 Contours

PLAN DATA

Plan Title: CRW WEST TRIB EXIST
Plan File : 1:\11515\Drainage\HECRAS\Coronado Ridge Wash (ERZ) Restored\CRW_WESTTRIB.p02

Geometry Title: CRW WEST TRIB EXIST
Geometry File : 1:\11515\Drainage\HECRAS\Coronado Ridge Wash (ERZ) Restored\CRW_WESTTRIB.g02

Flow Title : CRW WEST TRIB FLOW
Flow File : 1:\11515\Drainage\HECRAS\Coronado Ridge Wash (ERZ) Restored\CRW_WESTTRIB.f01

Plan Description:
DS Starting Condition
Total Energy @ US Face XSEC of 4-8x3 CBC

Plan Summary Information:

Number of:	Cross Sections	=	8	Multiple Openings	=	0
	Culverts	=	2	Inline Structures	=	0
	Bridges	=	0	Lateral Structures	=	3

Computational Information

Water surface calculation tolerance	=	0.01
Critical depth calculation tolerance	=	0.01
Maximum number of iterations	=	40
Maximum difference tolerance	=	0.3
Flow tolerance factor	=	0.001

Computation Options
Critical depth computed at all cross sections

PB Proj No. 11515
Coronado Ridge Wash (*West Tributary*)
Existing Condition Analysis

Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: CRW WEST TRIB FLOW
Flow File : l:\11515\Drainage\HECRAS\Coronado Ridge Wash (ERZ) Restored\CRW_WESTTRIB.f01

Flow Data (cfs)

River	Reach	RS	TSMS100Yr
Coronado Ridge	WEST BRANCH	420	74

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Coronado Ridge	WEST BRANCH	TSMS100Yr	Critical	Known WS = 2750.23

GEOMETRY DATA

Geometry Title: CRW WEST TRIB EXIST
Geometry File : l:\11515\Drainage\HECRAS\Coronado Ridge Wash (ERZ) Restored\CRW_WESTTRIB.g02

CROSS SECTION

RIVER: Coronado Ridge
REACH: WEST BRANCH RS: 420

INPUT
Description:
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-28.9	2755.66	-4.5	2755.33	0	2755.47	.19	2755.47	.28	2755.47
.57	2755.48	6.66	2755.9	7.47	2755.99	10.02	2755.64	12.33	2755.36
16.95	2754.88	17.02	2754.87	17.14	2754.89	17.56	2754.93	22.24	2755.35
25.39	2756.1	27.33	2756.72	30.02	2757.11	33.92	2757.77	39.28	2758.84
43.64	2759.52	47.74	2759.54	49.48	2759.57	49.78	2759.56	52.51	2759.46
53.91	2759.43								

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-28.9	.016	.19	.018	7.47	.035	27.33	.022

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
7.47	27.33	60	60	60	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2756.08	Element			
Vel Head (ft)	0.23	Wt. n-Val.	0.016	0.035	
W.S. Elev (ft)	2755.85	Reach Len. (ft)	60.00	60.00	60.00
Crit W.S. (ft)	2755.85	Flow Area (sq ft)	11.78	8.72	
E.G. Slope (ft/ft)	0.008923	Area (sq ft)	11.78	8.72	
Q Total (cfs)	74.00	Flow (cfs)	50.63	23.37	
Top Width (ft)	50.60	Top Width (ft)	34.79	15.81	
Vel Total (ft/s)	3.61	Avg. Vel. (ft/s)	4.30	2.68	
Max Chl Dpth (ft)	0.98	Hydr. Depth (ft)	0.34	0.55	
Conv. Total (cfs)	783.4	Conv. (cfs)	536.0	247.4	
Length Wtd. (ft)	60.00	Wetted Per. (ft)	34.99	15.95	
Min Ch El (ft)	2754.87	Shear (lb/sq ft)	0.19	0.30	
Alpha	1.14	Stream Power (lb/ft s)	0.81	0.82	

Frctn Loss (ft)	0.10	Cum Volume (acre-ft)	0.04	0.18	0.00
C & E Loss (ft)	0.06	Cum SA (acres)	0.10	0.14	0.00

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

LATERAL STRUCTURE

RIVER: Coronado Ridge
REACH: WEST BRANCH RS: 400

INPUT
Description: LEFT WEIR ACROSS HOUGHTON
Lateral structure position = Left overbank
Distance from Upstream XS = 0
Deck/Roadway Width = 2
Weir Coefficient = 2.5
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 2

Sta	Elev	Sta	Elev
0	2755.66	60	2754.08

Weir crest shape = Broad Crested

LATERAL STRUCTURE OUTPUT Profile #TSMS100Yr Lat Struct

E.G. US. (ft)	2756.08	Weir Sta US (ft)	0.00
W.S. US. (ft)	2755.85	Weir Sta DS (ft)	60.00
E.G. DS (ft)	2754.50	Weir Max Depth (ft)	0.38
W.S. DS (ft)	2754.46	Weir Avg Depth (ft)	0.28
Q US (cfs)	74.00	Weir Submerg	0.00
Q Leaving Total (cfs)	22.67	Min El Weir Flow (ft)	2754.08
Q DS (cfs)	51.32	Wr Top Wdth (ft)	60.00
Perc Q Leaving	30.64	Q Gate Group (cfs)	
Q Weir (cfs)	22.67	Gate Open Ht (ft)	
Q Gates (cfs)		Gate #Open	
Q Culv (cfs)		Gate Area (sq ft)	
Q Lat RC (cfs)		Gate Submerg	
Weir Flow Area (sq ft)	16.87	Gate Invert (ft)	

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Coronado Ridge
REACH: WEST BRANCH RS: 360

PB Proj No. 11515
Coronado Ridge Wash (*West Tributary*)
Existing Condition Analysis

INPUT
Description: US XSEC SOUTH CULVERT ALONG HOUGHTON
Station Elevation Data num= 35

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-28.7	2754.08	-4.7	2753.79	0	2754.18	.37	2754.2	.69	2754.21
1.51	2754.25	5.23	2754.44	6.5	2754.5	7.17	2754.44	7.64	2754.36
8.22	2754.35	8.64	2754.12	13.12	2752.08	13.51	2752.04	17.44	2751.48
17.55	2751.46	17.64	2751.45	18.91	2751.72	21.47	2752.13	24.21	2753.13
28.74	2754.83	29.28	2754.96	30.73	2755.34	33.67	2756.12	35.28	2756.43
37.2	2756.56	37.76	2756.61	38.35	2756.63	39.24	2756.64	41.42	2756.6
42.35	2756.54	45.51	2756.63	46.22	2756.65	50.91	2756.62	53.91	2756.58

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-28.7	.016	.37	.018	8.22	.035	28.74	.022

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
8.22	28.74	25	25	25	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-28.7	11.6	2754.5	F
23.5	53.91	2754.7	F

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2754.50	Element			
Vel Head (ft)	0.05	Wt. n-Val.		0.035	
W.S. Elev (ft)	2754.46	Reach Len. (ft)	25.00	25.00	25.00
Crit W.S. (ft)	2752.82	Flow Area (sq ft)		29.30	
E.G. Slope (ft/ft)	0.000534	Area (sq ft)	15.57	35.76	
Q Total (cfs)	51.32	Flow (cfs)		51.32	
Top Width (ft)	55.01	Top Width (ft)	35.48	19.52	
Vel Total (ft/s)	1.75	Avg. Vel. (ft/s)		1.75	
Max Chl Dpth (ft)	3.01	Hydr. Depth (ft)		2.46	
Conv. Total (cfs)	2220.9	Conv. (cfs)		2220.9	
Length Wtd. (ft)	25.00	Wetted Per. (ft)		12.29	
Min Ch El (ft)	2751.45	Shear (lb/sq ft)		0.08	
Alpha	1.00	Stream Power (lb/ft s)		0.14	
Frctn Loss (ft)		Cum Volume (acre-ft)	0.02	0.15	0.00
C & E Loss (ft)		Cum SA (acres)	0.06	0.12	0.00

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CULVERT

RIVER: Coronado Ridge
REACH: WEST BRANCH RS: 357.5

INPUT
Description: Culvert Located West of Cheveron Along East Side of Houghton
Distance from Upstream XS = 8.9
Deck/Roadway Width = 5.5
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 4

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2753.99		4.2	2754.23		36	2755.49	
53.9	2755.78							

Upstream Bridge Cross Section Data
Station Elevation Data num= 35

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-28.7	2754.08	-4.7	2753.79	0	2754.18	.37	2754.2	.69	2754.21
1.51	2754.25	5.23	2754.44	6.5	2754.5	7.17	2754.44	7.64	2754.36
8.22	2754.35	8.64	2754.12	13.12	2752.08	13.51	2752.04	17.44	2751.48
17.55	2751.46	17.64	2751.45	18.91	2751.72	21.47	2752.13	24.21	2753.13
28.74	2754.83	29.28	2754.96	30.73	2755.34	33.67	2756.12	35.28	2756.43
37.2	2756.56	37.76	2756.61	38.35	2756.63	39.24	2756.64	41.42	2756.6

```
   42.35 2756.54   45.51 2756.63   46.22 2756.65   50.91 2756.62   53.91 2756.58

Manning's n Values          num=        4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
   -28.7    .016     .37    .018    8.22    .035   28.74    .022

Bank Sta: Left   Right    Coeff Contr.   Expan.
          8.22   28.74              .3       .5
Ineffective Flow     num=        2
   Sta L   Sta R    Elev  Permanent
   -28.7    11.6  2754.5       F
    23.5   53.91  2754.7       F

Downstream  Deck/Roadway Coordinates
    num=        4
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0 2753.87             6.5 2754.25            33.1 2755.44
    53.9 2755.81

Downstream Bridge Cross Section Data
Station Elevation Data    num=       30
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   -28.6 2753.47    -4.9 2753.14       0 2753.64    3.15 2753.83    5.56 2753.92
    6.41 2753.95    7.49 2753.87    7.97 2753.81    8.68 2753.86    9.44  2753.8
    9.86 2753.78   13.46 2752.22   14.99 2751.53   15.94 2751.48   16.08 2751.47
   17.56 2751.38   18.24 2751.34   22.08 2751.53   22.16 2751.53   22.52 2751.55
   22.97 2751.76   26.97 2753.95    27.9 2754.13   30.87 2754.55   32.94 2754.74
   33.83 2754.91   40.17 2756.04   42.61 2756.49   45.15 2756.42   53.91 2756.13

Manning's n Values          num=        4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
   -28.6    .016    3.15    .018    9.86    .035   26.97    .022

Bank Sta: Left   Right    Coeff Contr.   Expan.
          9.86   26.97              .3       .5
Ineffective Flow     num=        2
   Sta L   Sta R    Elev  Permanent
   -28.6    13.6  2753.5       F
    21.6   53.91    2754       F

Upstream Embankment side slope                =       0 horiz. to 1.0 vertical
Downstream Embankment side slope              =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins           =
Energy head used in spillway design           =
Spillway height used in design                =
Weir crest shape                              = Broad Crested

Number of Culverts =  1

Culvert Name      Shape      Rise    Span
Culvert #1       Circular     2.5
FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 1 - Square edge entrance with headwall
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss Coef
                 2.5    20.3     .013      .013          0                   .5                1
Number of Barrels =  2
Upstream   Elevation =  2751.65
Centerline Stations
    Sta.     Sta.
    15.4     19.7
Downstream Elevation =  2751.1
Centerline Stations
    Sta.     Sta.
    15.9     19.3

CULVERT OUTPUT  Profile #TSMS100Yr  Culv Group:  Culvert #1

  Q Culv Group (cfs)          50.26    Culv Full Len (ft)
  # Barrels                       2    Culv Vel US (ft/s)          7.03
```

PB Proj No. 11515
Coronado Ridge Wash (*West Tributary*)
Existing Condition Analysis

Q Barrel (cfs)	25.13	Culv Vel DS (ft/s)	9.91
E.G. US. (ft)	2754.51	Culv Inv El Up (ft)	2751.65
W.S. US. (ft)	2754.46	Culv Inv El Dn (ft)	2751.10
E.G. DS (ft)	2753.13	Culv Frctn Ls (ft)	0.22
W.S. DS (ft)	2752.59	Culv Exit Loss (ft)	0.78
Delta EG (ft)	1.38	Culv Entr Loss (ft)	0.38
Delta WS (ft)	1.87	Q Weir (cfs)	33.42
E.G. IC (ft)	2754.35	Weir Sta Lft (ft)	-28.70
E.G. OC (ft)	2754.51	Weir Sta Rgt (ft)	11.27
Culvert Control	Inlet	Weir Submerg	0.00
Culv WS Inlet (ft)	2753.36	Weir Max Depth (ft)	0.72
Culv WS Outlet (ft)	2752.38	Weir Avg Depth (ft)	0.44
Culv Nml Depth (ft)	1.06	Weir Flow Area (sq ft)	17.73
Culv Crt Depth (ft)	1.71	Min El Weir Flow (ft)	2754.51

Warning: During subcritical analysis, while trying to calculate culvert and weir flow, the program could not get a balance of energy within the specified tolerance and number of trials. The program used the solution with the minimum error.
Warning: During the culvert inlet computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.
Warning: During the culvert outlet computations, the program could not balance the culvert/weir flow. The reported outlet energy grade answer may not be valid.
Note: The flow in the culvert is entirely supercritical.

CROSS SECTION

RIVER: Coronado Ridge
REACH: WEST BRANCH RS: 335

INPUT
Description: DS XSEC SOUTH CULVERT ALONG HOUGHTON
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-28.6	2753.47	-4.9	2753.14	0	2753.64	3.15	2753.83	5.56	2753.92
6.41	2753.95	7.49	2753.87	7.97	2753.81	8.68	2753.86	9.44	2753.8
9.86	2753.78	13.46	2752.22	14.99	2751.53	15.94	2751.48	16.08	2751.47
17.56	2751.38	18.24	2751.34	22.08	2751.53	22.16	2751.53	22.52	2751.55
22.97	2751.76	26.97	2753.95	27.9	2754.13	30.87	2754.55	32.94	2754.74
33.83	2754.91	40.17	2756.04	42.61	2756.49	45.15	2756.42	53.91	2756.13

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-28.6	.016	3.15	.018	9.86	.035	26.97	.022

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9.86	26.97	45	45	45	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-28.6	13.6	2753.5	F
21.6	53.91	2754	F

CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2753.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.54	Wt. n-Val.		0.035	
W.S. Elev (ft)	2752.59	Reach Len. (ft)	45.00	45.00	45.00
Crit W.S. (ft)	2752.59	Flow Area (sq ft)		8.68	
E.G. Slope (ft/ft)	0.017838	Area (sq ft)		10.90	
Q Total (cfs)	51.32	Flow (cfs)		51.32	
Top Width (ft)	11.87	Top Width (ft)		11.87	
Vel Total (ft/s)	5.91	Avg. Vel. (ft/s)		5.91	
Max Chl Dpth (ft)	1.25	Hydr. Depth (ft)		1.08	
Conv. Total (cfs)	384.3	Conv. (cfs)		384.3	
Length Wtd. (ft)	45.00	Wetted Per. (ft)		8.14	
Min Ch El (ft)	2751.34	Shear (lb/sq ft)		1.19	
Alpha	1.00	Stream Power (lb/ft s)		7.02	
Frctn Loss (ft)	0.23	Cum Volume (acre-ft)	0.02	0.14	0.00
C & E Loss (ft)	0.24	Cum SA (acres)	0.05	0.11	0.00

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: WEST BRANCH RS: 290

INPUT
Description:
Station Elevation Data num= 37

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-28.5	2752.35	-7.2	2752	0	2752	.41	2751.96	.9	2751.92
1.56	2751.86	3.48	2751.7	6.35	2751.45	7.17	2751.43	7.32	2751.83
7.79	2751.89	7.96	2751.91	10.77	2751.88	11.06	2751.89	11.22	2751.89
11.32	2751.89	11.46	2751.89	13.65	2751.5	13.86	2751.39	14.05	2751.39
14.22	2751.39	14.37	2751.39	16.66	2751.31	16.9	2751.31	17.12	2751.31
17.56	2751.34	20.82	2751.54	20.92	2751.54	20.98	2751.54	21.17	2751.57
22.68	2751.99	24.29	2752.41	25.14	2752.52	27.12	2752.71	48.46	2754.74
52.45	2754.81	53.91	2754.9						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-28.5	.016	6.35	.018	11.46	.035	24.29	.022

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
11.46	24.29	55	50	45	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2752.46	Element			
Vel Head (ft)	0.07	Wt. n-Val.	0.016	0.035	
W.S. Elev (ft)	2752.39	Reach Len. (ft)	55.00	50.00	45.00
Crit W.S. (ft)	2752.19	Flow Area (sq ft)	14.42	10.15	
E.G. Slope (ft/ft)	0.002452	Area (sq ft)	14.42	10.15	
Q Total (cfs)	51.32	Flow (cfs)	33.17	18.16	
Top Width (ft)	52.70	Top Width (ft)	39.96	12.74	
Vel Total (ft/s)	2.09	Avg. Vel. (ft/s)	2.30	1.79	
Max Chl Dpth (ft)	1.08	Hydr. Depth (ft)	0.36	0.80	
Conv. Total (cfs)	1036.5	Conv. (cfs)	669.8	366.7	
Length Wtd. (ft)	51.32	Wetted Per. (ft)	40.31	12.92	
Min Ch El (ft)	2751.31	Shear (lb/sq ft)	0.05	0.12	
Alpha	1.04	Stream Power (lb/ft s)	0.13	0.22	
Frctn Loss (ft)	0.33	Cum Volume (acre-ft)	0.01	0.13	0.00
C & E Loss (ft)	0.04	Cum SA (acres)	0.03	0.10	0.00

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

RIVER: Coronado Ridge
REACH: WEST BRANCH RS: 240

INPUT
Description:
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

PB Proj No. 11515
Coronado Ridge Wash (*West Tributary*)
Existing Condition Analysis

13.2	2751.6	13.3	2751.57	16.98	2750.42	19.81	2750.36	20.67	2750.28
21.34	2750.23	21.88	2750.28	21.89	2750.28	23.79	2750.43	24.21	2750.47
25.52	2750.91	27.99	2751.73	28.1	2751.75	35.46	2752.23	38.44	2752.4
42.22	2752.68	54.93	2753.59	57.4	2753.64	65.45	2754.29		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
13.2	.025	13.3	.035	28.1	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
13.3	28.1	65.2	60	50	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2752.09	Element			
Vel Head (ft)	0.48	Wt. n-Val.	0.025	0.035	
W.S. Elev (ft)	2751.62	Reach Len. (ft)	65.20	60.00	50.00
Crit W.S. (ft)	2751.62	Flow Area (sq ft)	0.00	13.36	
E.G. Slope (ft/ft)	0.019380	Area (sq ft)	0.00	13.36	
Q Total (cfs)	74.00	Flow (cfs)	0.00	74.00	
Top Width (ft)	14.44	Top Width (ft)	0.10	14.34	
Vel Total (ft/s)	5.54	Avg. Vel. (ft/s)	0.70	5.54	
Max Chl Dpth (ft)	1.38	Hydr. Depth (ft)	0.03	0.93	
Conv. Total (cfs)	531.6	Conv. (cfs)	0.0	531.5	
Length Wtd. (ft)	59.98	Wetted Per. (ft)	0.12	14.72	
Min Ch El (ft)	2750.23	Shear (lb/sq ft)	0.03	1.10	
Alpha	1.00	Stream Power (lb/ft s)	0.02	6.08	
Frctn Loss (ft)	0.24	Cum Volume (acre-ft)	0.00	0.11	0.00
C & E Loss (ft)	0.12	Cum SA (acres)	0.00	0.08	0.00

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

LATERAL STRUCTURE

RIVER: Coronado Ridge
REACH: WEST BRANCH RS: 230

INPUT
Description: LEFT WEIR INTO INTERSECTION
Lateral structure position = Left overbank
Distance from Upstream XS = 0
Deck/Roadway Width = 2
Weir Coefficient = 2.5
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2751.6	17.4	2751.63	36.1	2751.43	41.5	2751.3	55.8	2751.25
60.5	2751.32	65.2	2751.3						

Weir crest shape = Broad Crested

LATERAL STRUCTURE OUTPUT Profile #TSMS100Yr Lat Struct

E.G. US. (ft)	2752.09	Weir Sta US (ft)	0.00
W.S. US. (ft)	2751.62	Weir Sta DS (ft)	65.20
E.G. DS (ft)	2751.58	Weir Max Depth (ft)	0.27
W.S. DS (ft)	2751.51	Weir Avg Depth (ft)	0.16
Q US (cfs)	74.00	Weir Submerg	0.00
Q Leaving Total (cfs)	8.78	Min El Weir Flow (ft)	2751.25
Q DS (cfs)	65.13	Wr Top Wdth (ft)	47.18

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Coronado Ridge Wash (*West Tributary*)
Existing Condition Analysis

Perc Q Leaving	11.99	Q Gate Group (cfs)	
Q Weir (cfs)	8.78	Gate Open Ht (ft)	
Q Gates (cfs)		Gate #Open	
Q Culv (cfs)		Gate Area (sq ft)	
Q Lat RC (cfs)		Gate Submerg	
Weir Flow Area (sq ft)	7.62	Gate Invert (ft)	

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Coronado Ridge
REACH: WEST BRANCH RS: 180

INPUT
Description:
Station Elevation Data num= 21

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
30.81	2751.31	31.26	2751.16	35.94	2749.69	39.57	2749.42	41.12	2749.32
42.07	2749.37	42.59	2749.39	45.85	2749.57	47.38	2750.17	49.76	2751.09
56.84	2752.52	56.96	2752.55	57	2752.55	57.15	2752.57	70.72	2754.25
73.77	2754.47	76.43	2754.67	93.5	2756.69	95.64	2756.96	97.02	2757.04
99.69	2757.13								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
30.81	.025	30.81	.035	49.76	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
30.81	49.76	77.9	60	35	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2751.58	Element			
Vel Head (ft)	0.07	Wt. n-Val.		0.035	0.030
W.S. Elev (ft)	2751.51	Reach Len. (ft)	77.90	60.00	35.00
Crit W.S. (ft)	2750.51	Flow Area (sq ft)		29.93	0.43
E.G. Slope (ft/ft)	0.001491	Area (sq ft)		29.93	0.43
Q Total (cfs)	65.13	Flow (cfs)		64.84	0.28
Top Width (ft)	21.01	Top Width (ft)		18.95	2.06
Vel Total (ft/s)	2.15	Avg. Vel. (ft/s)		2.17	0.66
Max Chl Dpth (ft)	2.19	Hydr. Depth (ft)		1.58	0.21
Conv. Total (cfs)	1686.4	Conv. (cfs)		1679.0	7.4
Length Wtd. (ft)	59.92	Wetted Per. (ft)		19.70	2.10
Min Ch El (ft)	2749.32	Shear (lb/sq ft)		0.14	0.02
Alpha	1.02	Stream Power (lb/ft s)		0.31	0.01
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)		0.08	0.00
C & E Loss (ft)	0.01	Cum SA (acres)		0.06	0.00

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.

LATERAL STRUCTURE

RIVER: Coronado Ridge
REACH: WEST BRANCH RS: 170

PB Proj No. 11515
Coronado Ridge Wash (*West Tributary*)
Existing Condition Analysis

INPUT
Description: LEFT WEIR ONTO BROADWAY
Lateral structure position = Left overbank
Distance from Upstream XS = 0
Deck/Roadway Width = 2
Weir Coefficient = 2.5
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2751.3	11.8	2750.93	24.4	2751.18	36.2	2751.14	40.9	2751.18
50.5	2751.05	58.6	2751.21	77.9	2751.35				

Weir crest shape = Broad Crested

LATERAL STRUCTURE OUTPUT Profile #TSMS100Yr Lat Struct

E.G. US. (ft)	2751.58	Weir Sta US (ft)	0.00
W.S. US. (ft)	2751.51	Weir Sta DS (ft)	77.90
E.G. DS (ft)	2751.50	Weir Max Depth (ft)	0.57
W.S. DS (ft)	2751.47	Weir Avg Depth (ft)	0.33
Q US (cfs)	65.13	Weir Submerg	0.00
Q Leaving Total (cfs)	38.16	Min El Weir Flow (ft)	2750.93
Q DS (cfs)	27.68	Wr Top Wdth (ft)	77.90
Perc Q Leaving	57.50	Q Gate Group (cfs)	
Q Weir (cfs)	38.16	Gate Open Ht (ft)	
Q Gates (cfs)		Gate #Open	
Q Culv (cfs)		Gate Area (sq ft)	
Q Lat RC (cfs)		Gate Submerg	
Weir Flow Area (sq ft)	25.62	Gate Invert (ft)	

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Coronado Ridge
REACH: WEST BRANCH RS: 120

INPUT
Description: US XSEC NORTH CULVERT WEST TRIB
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
54.69	2751.43	56.49	2750.72	58.5	2749.95	60.4	2749.67	62.74	2749.47
63.17	2749.51	65.15	2749.73	65.75	2749.78	66.76	2749.87	68.48	2750.76
71.68	2752.6	77.68	2754.1	81.99	2755.09	96.84	2756.68	101.03	2756.99
102.34	2757.03	104.89	2757.05	104.99	2756.65	106.34	2756.64		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
54.69	.025	54.69	.035	71.68	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
54.69	71.68	85	85	85	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
54.69	55.3	2751.5	F
71.2	106.34	2754	F

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Coronado Ridge Wash (*West Tributary*)
Existing Condition Analysis
CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2751.50	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.		0.035	
W.S. Elev (ft)	2751.47	Reach Len. (ft)	85.00	85.00	85.00
Crit W.S. (ft)	2750.38	Flow Area (sq ft)		20.07	
E.G. Slope (ft/ft)	0.000722	Area (sq ft)		20.17	
Q Total (cfs)	27.68	Flow (cfs)		27.68	
Top Width (ft)	15.02	Top Width (ft)		15.02	
Vel Total (ft/s)	1.38	Avg. Vel. (ft/s)		1.38	
Max Chl Dpth (ft)	2.00	Hydr. Depth (ft)		1.39	
Conv. Total (cfs)	1030.4	Conv. (cfs)		1030.4	
Length Wtd. (ft)	85.00	Wetted Per. (ft)		15.09	
Min Ch El (ft)	2749.47	Shear (lb/sq ft)		0.06	
Alpha	1.00	Stream Power (lb/ft s)		0.08	
Frctn Loss (ft)		Cum Volume (acre-ft)		0.05	
C & E Loss (ft)		Cum SA (acres)		0.04	

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CULVERT

RIVER: Coronado Ridge
REACH: WEST BRANCH RS: 115.2

INPUT
Description:
Distance from Upstream XS = 14.5
Deck/Roadway Width = 61.3
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2750.71		12.3	2750.58		26.7	2750.71	
26.8	2751.11		34.5	2751.26		94.3	2756.06	
104.9	2756.55							

Upstream Bridge Cross Section Data
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
54.69	2751.43	56.49	2750.72	58.5	2749.95	60.4	2749.67	62.74	2749.47
63.17	2749.51	65.15	2749.73	65.75	2749.78	66.76	2749.87	68.48	2750.76
71.68	2752.6	77.68	2754.1	81.99	2755.09	96.84	2756.68	101.03	2756.99
102.34	2757.03	104.89	2757.05	104.99	2756.65	106.34	2756.64		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
54.69	.025	54.69	.035	71.68	.03

Bank Sta: Left	Right	Coeff Contr.	Expan.
54.69	71.68	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
54.69	55.3	2751.5	F
71.2	106.34	2754	F

Downstream Deck/Roadway Coordinates
num= 8

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2750.96		28.4	2750.8		57.6	2752.16	
58.3	2752.59		85.5	2754.18		85.8	2753.76	
89	2753.72		106.3	2754.27				

Downstream Bridge Cross Section Data
Station Elevation Data num= 35

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2750.94	14.63	2750.84	16.02	2750.88	19.72	2751.09	21.85	2751.58
27.14	2751.42	29.67	2751.41	34.34	2749.58	36.19	2749	37.22	2748.89

39.36	2748.44	41.34	2748.27	42.88	2748.29	44.83	2748.44	46.49	2748.67
47.46	2748.66	49.22	2749	49.94	2749.23	51.34	2749.1	53.62	2749.71
54.95	2750.16	60.14	2751.65	62.08	2752.3	69.01	2753.24	71.26	2753.6
71.56	2751.85	71.63	2751.49	78.65	2751.53	78.76	2751.87	79.28	2753.7
83.85	2754.14	84.01	2753.74	87.37	2753.56	95.36	2753.87	98.44	2753.94

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	29.67	.035	62.08	.03

Bank Sta: Left	Right	Coeff Contr.	Expan.
29.67	62.08	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	44.5	2751.6	F
54	98.44	2753	F

Upstream Embankment side slope = 3 horiz. to 1.0 vertical
Downstream Embankment side slope = 3 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Circular	2.5	

FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 3 - Groove end entrance; pipe projecting from fill
Solution Criteria = Highest U.S. EG

Culvert Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
4.8	76.9	.013	.013	0	.9	1

Number of Barrels = 2
Upstream Elevation = 2749.31
Centerline Stations

Sta.	Sta.
61.3	65.1

Downstream Elevation = 2748.96
Centerline Stations

Sta.	Sta.
47.2	51.2

CULVERT OUTPUT Profile #TSMS100Yr Culv Group: Culvert #1

Q Culv Group (cfs)	27.68	Culv Full Len (ft)	
# Barrels	2	Culv Vel US (ft/s)	5.63
Q Barrel (cfs)	13.84	Culv Vel DS (ft/s)	5.64
E.G. US. (ft)	2751.50	Culv Inv El Up (ft)	2749.31
W.S. US. (ft)	2751.47	Culv Inv El Dn (ft)	2748.96
E.G. DS (ft)	2750.32	Culv Frctn Ls (ft)	0.35
W.S. DS (ft)	2750.23	Culv Exit Loss (ft)	0.39
Delta EG (ft)	1.18	Culv Entr Loss (ft)	0.44
Delta WS (ft)	1.24	Q Weir (cfs)	
E.G. IC (ft)	2751.08	Weir Sta Lft (ft)	
E.G. OC (ft)	2751.50	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	2750.56	Weir Max Depth (ft)	
Culv WS Outlet (ft)	2750.21	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	1.25	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	1.25	Min El Weir Flow (ft)	2752.89

Note: During the supercritical analysis, the water surface at the inlet was within 0.01 feet of normal depth. Therefore, the outlet will be at normal depth.
Note: The flow in the culvert is entirely supercritical.

CROSS SECTION

PB Proj No. 11515
Coronado Ridge Wash (*West Tributary*)
Existing Condition Analysis

RIVER: Coronado Ridge
REACH: WEST BRANCH RS: 35

INPUT
Description: DS XSEC NORTH CULVERT WEST TRIB
Station Elevation Data num= 35

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2750.94	14.63	2750.84	16.02	2750.88	19.72	2751.09	21.85	2751.58
27.14	2751.42	29.67	2751.41	34.34	2749.58	36.19	2749	37.22	2748.89
39.36	2748.44	41.34	2748.27	42.88	2748.29	44.83	2748.44	46.49	2748.67
47.46	2748.66	49.22	2749	49.94	2749.23	51.34	2749.1	53.62	2749.71
54.95	2750.16	60.14	2751.65	62.08	2752.3	69.01	2753.24	71.26	2753.6
71.56	2751.85	71.63	2751.49	78.65	2751.53	78.76	2751.87	79.28	2753.7
83.85	2754.14	84.01	2753.74	87.37	2753.56	95.36	2753.87	98.44	2753.94

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	29.67	.035	62.08	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
29.67	62.08	0	0	0	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	44.5	2751.6	F
54	98.44	2753	F

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2750.32	Element			
Vel Head (ft)	0.09	Wt. n-Val.		0.035	
W.S. Elev (ft)	2750.23	Reach Len. (ft)			
Crit W.S. (ft)	2749.61	Flow Area (sq ft)		11.71	
E.G. Slope (ft/ft)	0.002412	Area (sq ft)		28.64	
Q Total (cfs)	27.68	Flow (cfs)		27.68	
Top Width (ft)	22.51	Top Width (ft)		22.51	
Vel Total (ft/s)	2.36	Avg. Vel. (ft/s)		2.36	
Max Chl Dpth (ft)	1.96	Hydr. Depth (ft)		1.23	
Conv. Total (cfs)	563.6	Conv. (cfs)		563.6	
Length Wtd. (ft)		Wetted Per. (ft)		9.69	
Min Ch El (ft)	2748.27	Shear (lb/sq ft)		0.18	
Alpha	1.00	Stream Power (lb/ft s)		0.43	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

PB Proj No. 11515
Coronado Ridge Wash (*West Tributary*)
Existing Condition Analysis

SUMMARY OF MANNING'S N VALUES

River:Coronado Ridge

Reach	River Sta.	n1	n2	n3	n4
WEST BRANCH	420	.016	.018	.035	.022
WEST BRANCH	400	Lat Struct			
WEST BRANCH	360	.016	.018	.035	.022
WEST BRANCH	357.5	Culvert			
WEST BRANCH	335	.016	.018	.035	.022
WEST BRANCH	290	.016	.018	.035	.022
WEST BRANCH	240	.025	.035	.03	
WEST BRANCH	230	Lat Struct			
WEST BRANCH	180	.025	.035	.03	
WEST BRANCH	170	Lat Struct			
WEST BRANCH	120	.025	.035	.03	
WEST BRANCH	115.2	Culvert			
WEST BRANCH	35	.025	.035	.03	

SUMMARY OF REACH LENGTHS

River: Coronado Ridge

Reach	River Sta.	Left	Channel	Right
WEST BRANCH	420	60	60	60
WEST BRANCH	400	Lat Struct		
WEST BRANCH	360	25	25	25
WEST BRANCH	357.5	Culvert		
WEST BRANCH	335	45	45	45
WEST BRANCH	290	55	50	45
WEST BRANCH	240	65.2	60	50
WEST BRANCH	230	Lat Struct		
WEST BRANCH	180	77.9	60	35
WEST BRANCH	170	Lat Struct		
WEST BRANCH	120	85	85	85
WEST BRANCH	115.2	Culvert		
WEST BRANCH	35	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Coronado Ridge

Reach	River Sta.	Contr.	Expan.
WEST BRANCH	420	.1	.3
WEST BRANCH	400	Lat Struct	
WEST BRANCH	360	.3	.5
WEST BRANCH	357.5	Culvert	
WEST BRANCH	335	.3	.5
WEST BRANCH	290	.1	.3
WEST BRANCH	240	.1	.3
WEST BRANCH	230	Lat Struct	
WEST BRANCH	180	.1	.3
WEST BRANCH	170	Lat Struct	
WEST BRANCH	120	.3	.5
WEST BRANCH	115.2	Culvert	
WEST BRANCH	35	.3	.5

PB Proj No. 11515
Coronado Ridge Wash (*West Tributary*)
Existing Condition Analysis

Profile Output Table - Standard Table 1

Reach	River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
WEST BRANCH	420	74.00	2754.87	2755.85	2755.85	2756.08	0.008923	2.68	20.50	50.60	0.64
WEST BRANCH	400	Lat Struct									
WEST BRANCH	360	51.32	2751.45	2754.46	2752.82	2754.50	0.000534	1.75	29.30	55.01	0.20
WEST BRANCH	357.5	Culvert									
WEST BRANCH	335	51.32	2751.34	2752.59	2752.59	2753.13	0.017838	5.91	8.68	11.87	1.00
WEST BRANCH	290	51.32	2751.31	2752.39	2752.19	2752.46	0.002452	1.79	24.56	52.70	0.35
WEST BRANCH	240	74.00	2750.23	2751.62	2751.62	2752.09	0.019380	5.54	13.36	14.44	1.01
WEST BRANCH	230	Lat Struct									
WEST BRANCH	180	65.13	2749.32	2751.51	2750.51	2751.58	0.001491	2.17	30.36	21.01	0.30
WEST BRANCH	170	Lat Struct									
WEST BRANCH	120	27.68	2749.47	2751.47	2750.38	2751.50	0.000722	1.38	20.07	15.02	0.21
WEST BRANCH	115.2	Culvert									
WEST BRANCH	35	27.68	2748.27	2750.23	2749.61	2750.32	0.002412	2.36	11.71	22.51	0.38

Profile Output Table - Standard Table 2

Reach	River Sta	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
WEST BRANCH	420	2756.08	2755.85	0.23	0.10	0.06	50.6	23.4		50.6
WEST BRANCH	400	Lat Struct								
WEST BRANCH	360	2754.50	2754.46	0.05				51.3		55.0
WEST BRANCH	357.5	Culvert								
WEST BRANCH	335	2753.13	2752.59	0.54	0.23	0.24		51.3		11.9
WEST BRANCH	290	2752.46	2752.39	0.07	0.33	0.04	33.2	18.2		52.7
WEST BRANCH	240	2752.09	2751.62	0.48	0.24	0.12	0.0	74.0		14.4
WEST BRANCH	230	Lat Struct								
WEST BRANCH	180	2751.58	2751.51	0.07	0.07	0.01		64.8	0.3	21.0
WEST BRANCH	170	Lat Struct								
WEST BRANCH	120	2751.50	2751.47	0.03				27.7		15.0
WEST BRANCH	115.2	Culvert								
WEST BRANCH	35	2750.32	2750.23	0.09				27.7		22.5

PB Proj No. 11515
Coronado Ridge Wash (*West Tributary*)
Existing Condition Analysis
Profile Output Table - Lateral Structures

Reach	River Sta	Q US	Q Leaving Total	Q DS	Q Weir	Q Gates	Wr Top Wdth	Weir Max Depth	Weir Avg Depth	Min El Weir Flow	E.G. US.	W.S. US.	E.G. DS	W.S. DS
		(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
WEST BRANCH	400	74.00	22.67	51.32	22.67		60.00	0.38	0.28	2754.08	2756.08	2755.85	2754.50	2754.46
WEST BRANCH	230	74.00	8.78	65.13	8.78		47.18	0.27	0.16	2751.25	2752.09	2751.62	2751.58	2751.51
WEST BRANCH	170	65.13	38.16	27.68	38.16		77.90	0.57	0.33	2750.93	2751.58	2751.51	2751.50	2751.47

PB Proj No. 11515
Coronado Ridge Wash (*West Tributary*)
Existing Condition Analysis
ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : CRW_WSTTRBEX

River: Coronado Ridge Reach: WEST BRANCH RS: 420 Profile: TSMS100Yr
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: Coronado Ridge Reach: WEST BRANCH RS: 400 Profile: TSMS100Yr
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: Coronado Ridge Reach: WEST BRANCH RS: 360 Profile: TSMS100Yr
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Coronado Ridge Reach: WEST BRANCH RS: 357.5 Profile: TSMS100Yr
Warning:During subcritical analysis, while trying to calculate culvert and weir flow, the program could not get a balance of energy within the specified tolerance and number of trials. The program used the solution with the minimum error.
River: Coronado Ridge Reach: WEST BRANCH RS: 357.5 Profile: TSMS100Yr Culv: Culvert #1
Warning:During the culvert inlet computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.
Warning:During the culvert outlet computations, the program could not balance the culvert/weir flow. The reported outlet energy grade answer may not be valid.
Note: The flow in the culvert is entirely supercritical.
River: Coronado Ridge Reach: WEST BRANCH RS: 335 Profile: TSMS100Yr
Warning:The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
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.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Coronado Ridge Reach: WEST BRANCH RS: 290 Profile: TSMS100Yr
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.
River: Coronado Ridge Reach: WEST BRANCH RS: 240 Profile: TSMS100Yr
Warning:The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.

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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Coronado Ridge Reach: WEST BRANCH RS: 230 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Coronado Ridge Reach: WEST BRANCH RS: 180 Profile: TSMS100Yr
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.

River: Coronado Ridge Reach: WEST BRANCH RS: 170 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Coronado Ridge Reach: WEST BRANCH RS: 120 Profile: TSMS100Yr
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

River: Coronado Ridge Reach: WEST BRANCH RS: 115.2 Profile: TSMS100Yr Culv: Culvert #1
Note: During the supercritical analysis, the water surface at the inlet was within 0.01 feet of normal depth. Therefore, the outlet will be at normal depth.
Note: The flow in the culvert is entirely supercritical.

River: Coronado Ridge Reach: WEST BRANCH RS: 35 Profile: TSMS100Yr
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

HEC-RAS Plan: CRW_EXSPLT River: Coronado Ridge Reach: WEST BRANCH Profile: TSMS100Yr

Reach	River Sta	E.G. Elev	W.S. Elev	Vel Head	Froude # Chl	Froude # XS	Frctn Loss	C & E Loss	Q Total	Q Left	Q Channel	Q Right	Top Width	Q Weir
		(ft)	(ft)	(ft)			(ft)	(ft)	(cfs)	(cfs)	(cfs)	(cfs)	(ft)	(cfs)
WEST BRANCH	420	2756.08	2755.85	0.23	0.6	1.00	0.10	0.06	74.0	50.6	23.4		50.6	
WEST BRANCH	400								74.0					22.7
WEST BRANCH	360	2754.50	2754.46	0.05	0.2	0.20			51.3		51.3		55.0	
WEST BRANCH	357.5	Culvert												
WEST BRANCH	335	2753.13	2752.59	0.54	1.0	1.00	0.23	0.24	51.3		51.3		11.9	
WEST BRANCH	290	2752.46	2752.39	0.07	0.4	0.54	0.33	0.04	51.3	33.2	18.2		52.7	
WEST BRANCH	240	2752.09	2751.62	0.48	1.0	1.01	0.24	0.12	74.0	0.0	74.0		14.4	
WEST BRANCH	230								74.0					8.8
WEST BRANCH	180	2751.58	2751.51	0.07	0.3	0.31	0.07	0.01	65.1		64.8	0.3	21.0	
WEST BRANCH	170								65.1					38.2
WEST BRANCH	120	2751.50	2751.47	0.03	0.2	0.21			27.7		27.7		15.0	
WEST BRANCH	115.2	Culvert												
WEST BRANCH	35	2750.32	2750.23	0.09	0.4	0.38			27.7		27.7		22.5	

PB Proj No. 11515
Coronado Ridge Wash (*East Tributary*)
Existing Condition Analysis

HEC-RAS Version 3.1.3 May 2005
U.S. Army Corp 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: CRW (ERZ) RCBC To East Trib
Project File : CRW_EASTTRIB.prj
Run Date and Time: 3/3/2008 9:06:56 AM

Project in English units

Project Description:
Coronado Ridge Wash
Limits of Study:
East Trinbutary--
Conveys R/O from
Eastern Segemnt of Barrio Rincon Along Broadway West to RCBC Under Broadway.

XSECs Developed from Project Mapping & Supplimented with PAG 1998
Contours

Starting Condition Established from CRW Main Segment Analysis

PLAN DATA

Plan Title: CRW EAST TRIB EXST
Plan File : 1:\11515\Drainage\HECRAS\Coronado Ridge Wash (ERZ) Restored\CRW_EASTTRIB.p02

Geometry Title: CRW EAST TRIB EXST GEOMETRY
Geometry File : 1:\11515\Drainage\HECRAS\Coronado Ridge Wash (ERZ) Restored\CRW_EASTTRIB.g02

Flow Title : CRW EAST TRIB FLOW EXST
Flow File : 1:\11515\Drainage\HECRAS\Coronado Ridge Wash (ERZ) Restored\CRW_EASTTRIB.f02

Plan Description:
Starting condition Total energy Grade @ US XSEC of 4-8x3 CBC

Plan Summary Information:

Number of:	Cross Sections =	11	Multiple Openings =	0
	Culverts =	2	Inline Structures =	0
	Bridges =	0	Lateral Structures =	2

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
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: Subcritical Flow

FLOW DATA

Flow Title: CRW EAST TRIB FLOW EXST
Flow File : l:\11515\Drainage\HECRAS\Coronado Ridge Wash (ERZ) Restored\CRW_EASTTRIB.f02

Flow Data (cfs)

River	Reach	RS	TSMS100Yr
Coronado Ridge	EAST BRANCH	1000	171

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Coronado Ridge	EAST BRANCH	TSMS100Yr	Critical	Known WS = 2750.23

GEOMETRY DATA

Geometry Title: CRW EAST TRIB EXST GEOMETRY
Geometry File : l:\11515\Drainage\HECRAS\Coronado Ridge Wash (ERZ) Restored\CRW_EASTTRIB.g02

CROSS SECTION

RIVER: Coronado Ridge
REACH: EAST BRANCH RS: 1000

INPUT
Description: Cut from 2' Topo
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2778	0	2768.2	7	2768	58	2770	85	2771.2
85	2781								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	0	.05	85	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	85	190	190	190	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2769.79	Element			
Vel Head (ft)	0.38	Wt. n-Val.		0.050	
W.S. Elev (ft)	2769.41	Reach Len. (ft)	190.00	190.00	190.00
Crit W.S. (ft)	2769.38	Flow Area (sq ft)		34.36	
E.G. Slope (ft/ft)	0.039120	Area (sq ft)		34.36	
Q Total (cfs)	171.00	Flow (cfs)		171.00	
Top Width (ft)	42.86	Top Width (ft)		42.86	
Vel Total (ft/s)	4.98	Avg. Vel. (ft/s)		4.98	
Max Chl Dpth (ft)	1.41	Hydr. Depth (ft)		0.80	
Conv. Total (cfs)	864.6	Conv. (cfs)		864.6	
Length Wtd. (ft)	190.00	Wetted Per. (ft)		44.10	
Min Ch El (ft)	2768.00	Shear (lb/sq ft)		1.90	
Alpha	1.00	Stream Power (lb/ft s)		9.47	
Frctn Loss (ft)	5.48	Cum Volume (acre-ft)	0.18	0.93	0.06
C & E Loss (ft)	0.02	Cum SA (acres)	0.26	0.95	0.12

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

PB Proj No. 11515
Coronado Ridge Wash (*East Tributary*)
Existing Condition Analysis
RIVER: Coronado Ridge
REACH: EAST BRANCH RS: 810

INPUT
Description: Cut From 2' Topo
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2773.8	0	2763.8	34	2763	40	2762.5	47	2763
66	2764	102	2766	108	2766.2	108	2776.2		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	34	.045	47	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
34	47	160	170	180	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2764.28	Element			
Vel Head (ft)	0.32	Wt. n-Val.	0.050	0.045	0.050
W.S. Elev (ft)	2763.97	Reach Len. (ft)	160.00	170.00	180.00
Crit W.S. (ft)	2763.97	Flow Area (sq ft)	19.29	15.82	8.89
E.G. Slope (ft/ft)	0.022165	Area (sq ft)	19.29	15.82	8.89
Q Total (cfs)	171.00	Flow (cfs)	58.27	88.52	24.21
Top Width (ft)	65.38	Top Width (ft)	34.00	13.00	18.38
Vel Total (ft/s)	3.89	Avg. Vel. (ft/s)	3.02	5.59	2.72
Max Chl Dpth (ft)	1.47	Hydr. Depth (ft)	0.57	1.22	0.48
Conv. Total (cfs)	1148.6	Conv. (cfs)	391.4	594.5	162.6
Length Wtd. (ft)	169.00	Wetted Per. (ft)	34.18	13.04	18.40
Min Ch El (ft)	2762.50	Shear (lb/sq ft)	0.78	1.68	0.67
Alpha	1.35	Stream Power (lb/ft s)	2.36	9.39	1.82
Frctn Loss (ft)	3.12	Cum Volume (acre-ft)	0.14	0.82	0.04
C & E Loss (ft)	0.06	Cum SA (acres)	0.18	0.83	0.08

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Coronado Ridge
REACH: EAST BRANCH RS: 640

INPUT
Description:
Station Elevation Data num= 41

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2768	0	2758.92	8	2758.82	14.33	2758.47	15.54	2758.45
15.79	2758.4	21.64	2758.59	38.02	2759.3	47.36	2759.6	49.75	2759.74
64.69	2759.35	70.41	2759.16	82.81	2758.95	94.08	2758.77	94.34	2758.73
96.61	2758.63	104.36	2758.86	113.32	2759.01	117.36	2759.2	124.11	2758.73
125.24	2758.85	126.77	2759.24	129.95	2759.2	135.57	2759.49	140.53	2759.66
141.32	2759.72	143.55	2759.77	144.39	2759.84	146.87	2759.9	150.76	2759.93
156.96	2759.88	157.23	2759.9	158.37	2759.88	159.73	2760.53	160.46	2760.95
163.45	2761.97	167.69	2763.96	169.76	2764.97	172.42	2766.17	175.3	2767.04
176.84	2767.04								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	0	.045	176.84	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	176.84	55	90	115	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2759.61	Element			

PB Proj No. 11515
Coronado Ridge Wash (*East Tributary*)
Existing Condition Analysis

Vel Head (ft)	0.11	Wt. n-Val.		0.045	
W.S. Elev (ft)	2759.50	Reach Len. (ft)	55.00	90.00	115.00
Crit W.S. (ft)	2759.34	Flow Area (sq ft)		63.90	
E.G. Slope (ft/ft)	0.015582	Area (sq ft)		63.90	
Q Total (cfs)	171.00	Flow (cfs)		171.00	
Top Width (ft)	121.43	Top Width (ft)		121.43	
Vel Total (ft/s)	2.68	Avg. Vel. (ft/s)		2.68	
Max Chl Dpth (ft)	1.10	Hydr. Depth (ft)		0.53	
Conv. Total (cfs)	1369.9	Conv. (cfs)		1369.9	
Length Wtd. (ft)	90.00	Wetted Per. (ft)		122.15	
Min Ch El (ft)	2758.40	Shear (lb/sq ft)		0.51	
Alpha	1.00	Stream Power (lb/ft s)		1.36	
Frctn Loss (ft)	2.15	Cum Volume (acre-ft)	0.10	0.67	0.02
C & E Loss (ft)	0.02	Cum SA (acres)	0.12	0.57	0.04

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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Coronado Ridge
REACH: EAST BRANCH RS: 550

INPUT
Description:
Station Elevation Data num= 42

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2768	0	2758.96	.74	2759.01	9.01	2758.33	9.43	2758.33
13.1	2757.94	16.48	2757.64	27.96	2757.63	34.08	2757.52	35.44	2757.46
36.42	2757.5	43.4	2757.47	49.53	2757.28	52.38	2757.02	103.62	2756.45
104.89	2756.83	110.27	2755.82	113.22	2756.53	113.76	2756.55	117.04	2756.72
122.42	2757.17	123.91	2756.65	124.78	2756.31	128.61	2756.63	137.53	2757.25
141.77	2757.46	146.46	2757.64	150.49	2757.54	155.09	2757.58	158.29	2757.74
166.89	2758.31	169.7	2758.42	171.6	2758.55	189.12	2760.73	191.79	2761.1
196.47	2761.27	198.1	2761.22	200.36	2761.25	201.34	2761.32	202.35	2761.3
203.65	2761.36	203.65	2771						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	0	.045	203.65	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	203.65	55	90	110	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2757.46	Element			
Vel Head (ft)	0.26	Wt. n-Val.		0.045	
W.S. Elev (ft)	2757.19	Reach Len. (ft)	55.00	90.00	110.00
Crit W.S. (ft)	2757.19	Flow Area (sq ft)		41.63	
E.G. Slope (ft/ft)	0.041156	Area (sq ft)		41.63	
Q Total (cfs)	171.00	Flow (cfs)		171.00	
Top Width (ft)	86.23	Top Width (ft)		86.23	
Vel Total (ft/s)	4.11	Avg. Vel. (ft/s)		4.11	
Max Chl Dpth (ft)	1.37	Hydr. Depth (ft)		0.48	
Conv. Total (cfs)	842.9	Conv. (cfs)		842.9	
Length Wtd. (ft)	85.00	Wetted Per. (ft)		86.68	
Min Ch El (ft)	2755.82	Shear (lb/sq ft)		1.23	
Alpha	1.00	Stream Power (lb/ft s)		5.07	
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)	0.10	0.56	0.02
C & E Loss (ft)	0.07	Cum SA (acres)	0.12	0.36	0.04

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

PB Proj No. 11515
Coronado Ridge Wash (*East Tributary*)
Existing Condition Analysis

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Coronado Ridge
REACH: EAST BRANCH RS: 460

INPUT
Description:
Station Elevation Data num= 40

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2759.22	1.28	2759.21	1.84	2759.15	9.13	2758.72	12.1	2758.7
15.97	2758.49	16.87	2758.51	21.9	2758.4	25.73	2758	26.56	2757.88
27.45	2757.85	33.8	2757.35	36.89	2757.2	39.78	2756.88	42.18	2756.66
49.35	2756.11	51.42	2755.99	62.64	2755.6	64.37	2755.49	74.4	2755.37
79.89	2755.26	84.15	2755.22	87.26	2755.26	100.45	2754.9	109.67	2755.01
114.48	2754.99	117.73	2754.93	122.78	2754.19	126.48	2754.43	130.47	2754.61
140.3	2754.67	155.67	2754.7	164.37	2756.77	166.37	2757.28	169.04	2757.45
171.03	2757.61	177.79	2757.95	182.41	2758.08	186.88	2758.25	191.41	2758.35

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	117.73	.035	166.37	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
117.73	166.37		60	75	85	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	80	2757	F

CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2756.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.050	0.035	
W.S. Elev (ft)	2756.27	Reach Len. (ft)	60.00	75.00	85.00
Crit W.S. (ft)	2755.42	Flow Area (sq ft)	45.73	68.51	
E.G. Slope (ft/ft)	0.001001	Area (sq ft)	66.77	68.51	
Q Total (cfs)	171.00	Flow (cfs)	48.87	122.13	
Top Width (ft)	115.03	Top Width (ft)	70.49	44.55	
Vel Total (ft/s)	1.50	Avg. Vel. (ft/s)	1.07	1.78	
Max Chl Dpth (ft)	2.08	Hydr. Depth (ft)	1.21	1.54	
Conv. Total (cfs)	5406.0	Conv. (cfs)	1544.9	3861.2	
Length Wtd. (ft)	72.86	Wetted Per. (ft)	37.74	44.80	
Min Ch El (ft)	2754.19	Shear (lb/sq ft)	0.08	0.10	
Alpha	1.16	Stream Power (lb/ft s)	0.08	0.17	
Frctn Loss (ft)	0.06	Cum Volume (acre-ft)	0.06	0.45	0.02
C & E Loss (ft)	0.02	Cum SA (acres)	0.08	0.22	0.04

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: EAST BRANCH RS: 385

INPUT
Description: US FACE OF EAST CULVERT ALONG BROADWAY
AS-BUILT PLANS -> RIPRAP
LINING
Station Elevation Data num= 40

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2756.68	1.26	2756.53	2.4	2756.48	8.81	2756.11	10.11	2756.07
11.5	2756.05	13.09	2755.97	17.3	2755.78	19.85	2755.73	22.11	2755.45
24.32	2755.41	26.8	2755.17	28.77	2755.15	31.17	2754.81	33.29	2754.64
35.33	2754.24	37.45	2753.69	39.6	2753.27	42.01	2752.43	49.05	2752.42
54.88	2752.42	56.22	2753.04	59.95	2754.87	60.55	2755.16	62.64	2756.24
63.81	2756.34	65.14	2756.44	68.38	2756.58	68.55	2756.5	71.52	2756.46
73.23	2756.37	73.96	2756.36	75.05	2756.24	75.17	2755.84	76.23	2755.74

79.08	2755.51	79.17	2755.51	84.06	2755.5	88.89	2755.64	95.56	2755.81

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	28.77	.035	62.64	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
28.77	62.64	60	60	60	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	39.9	2756.5	F
57.9	95.56	2756.5	F

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2756.23	Element			
Vel Head (ft)	0.11	Wt. n-Val.		0.035	
W.S. Elev (ft)	2756.11	Reach Len. (ft)	60.00	60.00	60.00
Crit W.S. (ft)	2753.99	Flow Area (sq ft)		63.51	
E.G. Slope (ft/ft)	0.000774	Area (sq ft)	8.81	88.80	10.00
Q Total (cfs)	171.00	Flow (cfs)		171.00	
Top Width (ft)	74.13	Top Width (ft)	20.03	33.63	20.47
Vel Total (ft/s)	2.69	Avg. Vel. (ft/s)		2.69	
Max Chl Dpth (ft)	3.69	Hydr. Depth (ft)		3.53	
Conv. Total (cfs)	6146.8	Conv. (cfs)		6146.8	
Length Wtd. (ft)	60.00	Wetted Per. (ft)		18.45	
Min Ch El (ft)	2752.42	Shear (lb/sq ft)		0.17	
Alpha	1.00	Stream Power (lb/ft s)		0.45	
Frctn Loss (ft)		Cum Volume (acre-ft)	0.01	0.31	0.01
C & E Loss (ft)		Cum SA (acres)	0.01	0.15	0.02

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CULVERT

RIVER: Coronado Ridge
REACH: EAST BRANCH RS: 380

INPUT
Description:
Distance from Upstream XS = 11.5
Deck/Roadway Width = 32.3
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 11

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2757.58		42.6	2756.76		42.7	2756.81	
51.6	2756.78		52	2756.55		63.8	2756.32	
65.1	2756.46		66.5	2755.9		79.7	2755.31	
82.6	2755.3		93.9	2755.6				

Upstream Bridge Cross Section Data
Station Elevation Data num= 40

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2756.68	1.26	2756.53	2.4	2756.48	8.81	2756.11	10.11	2756.07
11.5	2756.05	13.09	2755.97	17.3	2755.78	19.85	2755.73	22.11	2755.45
24.32	2755.41	26.8	2755.17	28.77	2755.15	31.17	2754.81	33.29	2754.64
35.33	2754.24	37.45	2753.69	39.6	2753.27	42.01	2752.43	49.05	2752.42
54.88	2752.42	56.22	2753.04	59.95	2754.87	60.55	2755.16	62.64	2756.24
63.81	2756.34	65.14	2756.44	68.38	2756.58	68.55	2756.5	71.52	2756.46
73.23	2756.37	73.96	2756.36	75.05	2756.24	75.17	2755.84	76.23	2755.74
79.08	2755.51	79.17	2755.51	84.06	2755.5	88.89	2755.64	95.56	2755.81

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	28.77	.035	62.64	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
28.77	62.64	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent

0	39.9	2756.5	F
57.9	95.56	2756.5	F

Downstream Deck/Roadway Coordinates

num= 12

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2757.28		5.5	2757.28		18.2	2756.63	
18.3	2756.72		27.2	2756.77		27.6	2756.34	
39.5	2756.21		47.2	2755.84		49.6	2755.64	
50	2755.25		61.5	2754.16		77.4	2754.66	

Downstream Bridge Cross Section Data

Station Elevation Data num= 40

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2756.82	7.62	2754.99	8.39	2754.76	8.87	2754.59	9.21	2754.45
9.58	2754.27	10.99	2753.51	11.19	2753.41	11.87	2753.23	12.16	2753.06
12.71	2752.84	13.21	2752.67	13.88	2752.48	13.92	2752.44	15.04	2752.09
15.57	2751.95	16.1	2751.82	17.14	2751.62	18.02	2751.47	23.62	2751.61
26.87	2751.68	28.25	2751.73	28.47	2751.82	29.37	2752.23	32.71	2754.22
33.73	2754.51	34.32	2754.67	34.83	2754.77	37.23	2754.97	38.89	2755.08
40.26	2755.13	42.61	2755.33	46.01	2754.96	46.53	2754.94	48.19	2754.83
51.71	2754.62	51.81	2754.23	53.12	2754.04	55.2	2754.04	69.29	2754.38

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	9.21	.035	32.71	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
9.21	32.71	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	14.1	2754.6	F
32.1	69.29	2754.6	F

Right Levee Station= 42.6 Elevation= 2760

Upstream Embankment side slope = 3 horiz. to 1.0 vertical
Downstream Embankment side slope = 3 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Conspan Arch	4.33	8

FHWA Chart # 60- Span/Rise ratio approximate 2:1
FHWA Scale # 2 - 45 degree wing wall angle
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	5.3	45	.013	.018	1.3	.3	1

Upstream Elevation = 2750.44
Centerline Station = 48.9
Downstream Elevation = 2750.31
Centerline Station = 23.1

CULVERT OUTPUT Profile #TSMS100Yr Culv Group: Culvert #1

Q Culv Group (cfs)	171.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	8.26
Q Barrel (cfs)	171.00	Culv Vel DS (ft/s)	9.37
E.G. US. (ft)	2756.23	Culv Inv El Up (ft)	2750.44
W.S. US. (ft)	2756.11	Culv Inv El Dn (ft)	2750.31
E.G. DS (ft)	2754.07	Culv Frctn Ls (ft)	0.24
W.S. DS (ft)	2753.58	Culv Exit Loss (ft)	1.25
Delta EG (ft)	2.15	Culv Entr Loss (ft)	0.67
Delta WS (ft)	2.53	Q Weir (cfs)	
E.G. IC (ft)	2756.23	Weir Sta Lft (ft)	
E.G. OC (ft)	2755.88	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	2754.50	Weir Max Depth (ft)	
Culv WS Outlet (ft)	2753.96	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	4.33	Weir Flow Area (sq ft)	

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Coronado Ridge Wash (*East Tributary*)
Existing Condition Analysis

Culv Crt Depth (ft) 3.65 Min El Weir Flow (ft) 2756.45

Note: The normal depth exceeds the height of the culvert. The program assumes that the normal depth is equal to the height of the culvert.

CROSS SECTION

RIVER: Coronado Ridge
REACH: EAST BRANCH RS: 325

INPUT
Description: DS XSEC EAST CULVERT ALONG BROADWAY
Station Elevation Data num= 40

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2756.82	7.62	2754.99	8.39	2754.76	8.87	2754.59	9.21	2754.45
9.58	2754.27	10.99	2753.51	11.19	2753.41	11.87	2753.23	12.16	2753.06
12.71	2752.84	13.21	2752.67	13.88	2752.48	13.92	2752.44	15.04	2752.09
15.57	2751.95	16.1	2751.82	17.14	2751.62	18.02	2751.47	23.62	2751.61
26.87	2751.68	28.25	2751.73	28.47	2751.82	29.37	2752.23	32.71	2754.22
33.73	2754.51	34.32	2754.67	34.83	2754.77	37.23	2754.97	38.89	2755.08
40.26	2755.13	42.61	2755.33	46.01	2754.96	46.53	2754.94	48.19	2754.83
51.71	2754.62	51.81	2754.23	53.12	2754.04	55.2	2754.04	69.29	2754.38

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	9.21	.035	32.71	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9.21	32.71	35.5	35.5	35.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	14.1	2754.6	F
32.1	69.29	2754.6	F

Right Levee Station= 42.6 Elevation= 2760

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2754.07	Element			
Vel Head (ft)	0.49	Wt. n-Val.		0.035	
W.S. Elev (ft)	2753.58	Reach Len. (ft)	35.50	35.50	35.50
Crit W.S. (ft)	2753.28	Flow Area (sq ft)		30.36	
E.G. Slope (ft/ft)	0.008854	Area (sq ft)		32.38	
Q Total (cfs)	171.00	Flow (cfs)		171.00	
Top Width (ft)	20.78	Top Width (ft)		20.78	
Vel Total (ft/s)	5.63	Avg. Vel. (ft/s)		5.63	
Max Chl Dpth (ft)	2.11	Hydr. Depth (ft)		1.73	
Conv. Total (cfs)	1817.3	Conv. (cfs)		1817.3	
Length Wtd. (ft)	35.50	Wetted Per. (ft)		18.13	
Min Ch El (ft)	2751.47	Shear (lb/sq ft)		0.93	
Alpha	1.00	Stream Power (lb/ft s)		5.21	
Frctn Loss (ft)	0.32	Cum Volume (acre-ft)		0.23	0.00
C & E Loss (ft)	0.04	Cum SA (acres)		0.12	0.01

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: EAST BRANCH RS: 289

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2756.91	1.5	2756.91	1.65	2756.87	2.24	2756.68	2.47	2756.61
17.81	2751.59	18.55	2751.46	19.66	2751.25	24	2751.22	27.69	2751.19
28.49	2751.18	32.18	2752.4	35.88	2753.63	37.41	2753.72	42.64	2754.28

Manning's n Values num= 3

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Coronado Ridge Wash (*East Tributary*)
Existing Condition Analysis

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	1.5	.035	35.88	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1.5	35.88	129.4	129.4	129.4	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2753.72	Element			
Vel Head (ft)	0.41	Wt. n-Val.		0.035	
W.S. Elev (ft)	2753.31	Reach Len. (ft)	129.40	129.40	129.40
Crit W.S. (ft)		Flow Area (sq ft)		33.24	
E.G. Slope (ft/ft)	0.008981	Area (sq ft)		33.24	
Q Total (cfs)	171.00	Flow (cfs)		171.00	
Top Width (ft)	22.34	Top Width (ft)		22.34	
Vel Total (ft/s)	5.14	Avg. Vel. (ft/s)		5.14	
Max Chl Dpth (ft)	2.13	Hydr. Depth (ft)		1.49	
Conv. Total (cfs)	1804.4	Conv. (cfs)		1804.4	
Length Wtd. (ft)	129.40	Wetted Per. (ft)		22.98	
Min Ch El (ft)	2751.18	Shear (lb/sq ft)		0.81	
Alpha	1.00	Stream Power (lb/ft s)		4.17	
Frctn Loss (ft)	0.34	Cum Volume (acre-ft)		0.20	0.00
C & E Loss (ft)	0.09	Cum SA (acres)		0.10	0.01

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.

LATERAL STRUCTURE

RIVER: Coronado Ridge
REACH: EAST BRANCH RS: 280

INPUT
Description: Right Overbank Split Flow
Lateral structure position = Right overbank
Distance from Upstream XS = 0
Deck/Roadway Width = 2
Weir Coefficient = 2.6
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 2

Sta	Elev	Sta	Elev
0	2754.28	129.4	2752.74

Weir crest shape = Broad Crested

LATERAL STRUCTURE OUTPUT Profile #TSMS100Yr Lat Struct

E.G. US. (ft)	2753.72	Weir Sta US (ft)	89.23
W.S. US. (ft)	2753.31	Weir Sta DS (ft)	129.40
E.G. DS (ft)	2753.28	Weir Max Depth (ft)	0.44
W.S. DS (ft)	2753.18	Weir Avg Depth (ft)	0.22
Q US (cfs)	171.00	Weir Submerg	0.00
Q Leaving Total (cfs)	12.14	Min El Weir Flow (ft)	2752.74
Q DS (cfs)	158.97	Wr Top Wdth (ft)	40.17
Perc Q Leaving	7.04	Q Gate Group (cfs)	
Q Weir (cfs)	12.14	Gate Open Ht (ft)	
Q Gates (cfs)		Gate #Open	
Q Culv (cfs)		Gate Area (sq ft)	
Q Lat RC (cfs)		Gate Submerg	
Weir Flow Area (sq ft)	8.81	Gate Invert (ft)	

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Coronado Ridge
REACH: EAST BRANCH RS: 160

PB Proj No. 11515
Coronado Ridge Wash (*East Tributary*)
Existing Condition Analysis
INPUT
Description:
Station Elevation Data num= 21

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2756.92	.05	2756.91	1.13	2756.78	13.15	2752.88	19.97	2750.69
20.5	2750.52	20.52	2750.52	20.55	2750.5	20.57	2750.49	20.86	2750.35
21.04	2750.27	22.55	2749.59	25.61	2749.6	30.1	2749.69	30.94	2750.01
31.36	2750.15	38.3	2752.33	38.84	2752.43	39.58	2752.55	40.03	2752.56
42.72	2752.74								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	1.13	.035	38.3	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1.13	38.3	25	25	25	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2753.28	Element			
Vel Head (ft)	0.10	Wt. n-Val.		0.035	0.050
W.S. Elev (ft)	2753.18	Reach Len. (ft)	25.00	25.00	25.00
Crit W.S. (ft)		Flow Area (sq ft)		61.80	2.64
E.G. Slope (ft/ft)	0.001196	Area (sq ft)		61.80	2.64
Q Total (cfs)	158.97	Flow (cfs)		157.16	1.80
Top Width (ft)	30.49	Top Width (ft)		26.07	4.42
Vel Total (ft/s)	2.47	Avg. Vel. (ft/s)		2.54	0.68
Max Chl Dpth (ft)	3.59	Hydr. Depth (ft)		2.37	0.60
Conv. Total (cfs)	4597.0	Conv. (cfs)		4544.8	52.2
Length Wtd. (ft)	25.00	Wetted Per. (ft)		27.11	4.88
Min Ch El (ft)	2749.59	Shear (lb/sq ft)		0.17	0.04
Alpha	1.05	Stream Power (lb/ft s)		0.43	0.03
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)		0.06	0.00
C & E Loss (ft)	0.03	Cum SA (acres)		0.03	0.00

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.

LATERAL STRUCTURE

RIVER: Coronado Ridge
REACH: EAST BRANCH RS: 150

INPUT
Description: ROB SPLIT FLOW
Lateral structure position = Right overbank
Distance from Upstream XS = 0
Deck/Roadway Width = 2
Weir Coefficient = 2.6
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 2

Sta	Elev	Sta	Elev
0	2752.74	25	2753.54

Weir crest shape = Broad Crested

LATERAL STRUCTURE OUTPUT Profile #TSMS100Yr Lat Struct

E.G. US. (ft)	2753.28	Weir Sta US (ft)	0.00
W.S. US. (ft)	2753.18	Weir Sta DS (ft)	9.15
E.G. DS (ft)	2753.19	Weir Max Depth (ft)	0.44
W.S. DS (ft)	2752.78	Weir Avg Depth (ft)	0.22
Q US (cfs)	158.97	Weir Submerg	0.00
Q Leaving Total (cfs)	2.77	Min El Weir Flow (ft)	2752.74
Q DS (cfs)	156.23	Wr Top Wdth (ft)	9.15
Perc Q Leaving	1.72	Q Gate Group (cfs)	
Q Weir (cfs)	2.77	Gate Open Ht (ft)	
Q Gates (cfs)		Gate #Open	
Q Culv (cfs)		Gate Area (sq ft)	
Q Lat RC (cfs)		Gate Submerg	

Weir Flow Area (sq ft) 2.01 Gate Invert (ft)

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Coronado Ridge
REACH: EAST BRANCH RS: 135

INPUT
Description: US FACE OF WEST CULVERT ALONG BROADWAY
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2756.45	3.34	2756.03	3.99	2755.91	6.14	2755.39	7.26	2755.25		
10.19	2754.81	11.74	2754.67	12.17	2754.62	13.15	2754.49	14.68	2754.26		
16.48	2753.97	17.54	2753.79	17.98	2753.61	18.45	2753.51	19.93	2752.36		
23.24	2749.37	25.7	2749.37	29.35	2749.38	30.01	2749.41	30.26	2749.52		
30.29	2749.66	30.75	2753.47	31.52	2753.54	32.55	2753.54				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	18.45	.035	30.75	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
18.45	30.75	53	53	53	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	20.7	2753.9	F
30.7	32.55	2754	F

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2753.19	Element			
Vel Head (ft)	0.41	Wt. n-Val.		0.035	
W.S. Elev (ft)	2752.78	Reach Len. (ft)	53.00	53.00	53.00
Crit W.S. (ft)	2751.70	Flow Area (sq ft)		30.31	
E.G. Slope (ft/ft)	0.005138	Area (sq ft)		31.02	
Q Total (cfs)	156.23	Flow (cfs)		156.23	
Top Width (ft)	11.28	Top Width (ft)		11.28	
Vel Total (ft/s)	5.15	Avg. Vel. (ft/s)		5.15	
Max Chl Dpth (ft)	3.41	Hydr. Depth (ft)		3.04	
Conv. Total (cfs)	2179.6	Conv. (cfs)		2179.6	
Length Wtd. (ft)	53.00	Wetted Per. (ft)		13.75	
Min Ch El (ft)	2749.37	Shear (lb/sq ft)		0.71	
Alpha	1.00	Stream Power (lb/ft s)		3.64	
Frctn Loss (ft)		Cum Volume (acre-ft)		0.03	
C & E Loss (ft)		Cum SA (acres)		0.02	

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CULVERT

RIVER: Coronado Ridge
REACH: EAST BRANCH RS: 134

INPUT
Description:
Distance from Upstream XS = 6
Deck/Roadway Width = 36.7
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 12

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2755.6		4.5	2755.4		7.9	2754.95	
18.1	2754.29		19.8	2753.93		21.4	2754.47	
29.9	2754.38		31.8	2753.61		37.4	2753.29	
37.6	2752.88		55.7	2751.93		68	2751.96	

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Coronado Ridge Wash (*East Tributary*)
Existing Condition Analysis

Upstream Bridge Cross Section Data
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2756.45	3.34	2756.03	3.99	2755.91	6.14	2755.39	7.26	2755.25
10.19	2754.81	11.74	2754.67	12.17	2754.62	13.15	2754.49	14.68	2754.26
16.48	2753.97	17.54	2753.79	17.98	2753.61	18.45	2753.51	19.93	2752.36
23.24	2749.37	25.7	2749.37	29.35	2749.38	30.01	2749.41	30.26	2749.52
30.29	2749.66	30.75	2753.47	31.52	2753.54	32.55	2753.54		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	18.45	.035	30.75	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
18.45	30.75	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	20.7	2753.9	F
30.7	32.55	2754	F

Downstream Deck/Roadway Coordinates
num= 13

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2756.69		39.8	2754.28		40.1	2754.58	
48.9	2754.37		49.5	2753.72		52.8	2753.4	
56.6	2753.36		60.1	2752.98		60.2	2752.57	
71.6	2752.07		74.9	2752.02		80.2	2751.77	
86.2	2751.72							

Downstream Bridge Cross Section Data
Station Elevation Data num= 33

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2756.63	.06	2756.89	4.63	2756.57	7.41	2756.26	8.31	2756.24
14.92	2755.37	19.88	2754.9	26.58	2754.2	29.26	2753.89	30.99	2753.41
32.23	2752.87	35.79	2751.65	37.02	2751.25	37.42	2749.33	37.71	2749.19
38.7	2749.05	51	2749.1	51.52	2750.67	52.43	2751.3	53.18	2751.46
55.18	2752.14	56.6	2752.42	56.99	2752.64	57.26	2752.6	57.81	2752.85
65.44	2752.41	66.88	2752.37	70.15	2752.16	70.26	2751.76	73.59	2751.68
75.04	2751.67	76.58	2751.69	86.61	2751.64				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	29.26	.035	57.81	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
29.26	57.81	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	36	2752.72	F
53.5	86.61	2752.72	F

Upstream Embankment side slope = 3 horiz. to 1.0 vertical
Downstream Embankment side slope = 3 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Conspan Arch	4.3	8

FHWA Chart # 60- Span/Rise ratio approximate 2:1
FHWA Scale # 2 - 45 degree wing wall angle
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	1	43	.013	.018	.8	.3	1

Upstream Elevation = 2748.51
Centerline Station = 25.7
Downstream Elevation = 2748.39
Centerline Station = 45

CULVERT OUTPUT Profile #TSMS100Yr Culv Group: Culvert #1

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Q Culv Group (cfs)	156.23	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	7.65
Q Barrel (cfs)	156.23	Culv Vel DS (ft/s)	8.70
E.G. US. (ft)	2753.19	Culv Inv El Up (ft)	2748.51
W.S. US. (ft)	2752.78	Culv Inv El Dn (ft)	2748.39
E.G. DS (ft)	2751.44	Culv Frctn Ls (ft)	0.19
W.S. DS (ft)	2750.65	Culv Exit Loss (ft)	1.18
Delta EG (ft)	1.75	Culv Entr Loss (ft)	0.39
Delta WS (ft)	2.13	Q Weir (cfs)	
E.G. IC (ft)	2753.19	Weir Sta Lft (ft)	
E.G. OC (ft)	2753.08	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	2751.90	Weir Max Depth (ft)	
Culv WS Outlet (ft)	2751.45	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	3.81	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	3.06	Min El Weir Flow (ft)	2753.94

CROSS SECTION

RIVER: Coronado Ridge
REACH: EAST BRANCH RS: 82

INPUT
Description: DS XSEC WEST CULVERT ALONG BROADWAY
LAS XSEC FOR EAST BRANCH -->
JUNCTION WITH SOUTH, WEST AND MAIN
Station Elevation Data num= 33

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2756.63	.06	2756.89	4.63	2756.57	7.41	2756.26	8.31	2756.24
14.92	2755.37	19.88	2754.9	26.58	2754.2	29.26	2753.89	30.99	2753.41
32.23	2752.87	35.79	2751.65	37.02	2751.25	37.42	2749.33	37.71	2749.19
38.7	2749.05	51	2749.1	51.52	2750.67	52.43	2751.3	53.18	2751.46
55.18	2752.14	56.6	2752.42	56.99	2752.64	57.26	2752.6	57.81	2752.85
65.44	2752.41	66.88	2752.37	70.15	2752.16	70.26	2751.76	73.59	2751.68
75.04	2751.67	76.58	2751.69	86.61	2751.64				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	29.26	.035	57.81	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
29.26	57.81	0	0	0	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	36	2752.72	F
53.5	86.61	2752.72	F

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2751.44	Element			
Vel Head (ft)	0.80	Wt. n-Val.		0.035	
W.S. Elev (ft)	2750.65	Reach Len. (ft)			
Crit W.S. (ft)	2750.65	Flow Area (sq ft)		21.83	
E.G. Slope (ft/ft)	0.019732	Area (sq ft)		21.83	
Q Total (cfs)	156.23	Flow (cfs)		156.23	
Top Width (ft)	14.37	Top Width (ft)		14.37	
Vel Total (ft/s)	7.16	Avg. Vel. (ft/s)		7.16	
Max Chl Dpth (ft)	1.60	Hydr. Depth (ft)		1.52	
Conv. Total (cfs)	1112.2	Conv. (cfs)		1112.2	
Length Wtd. (ft)		Wetted Per. (ft)		16.60	
Min Ch El (ft)	2749.05	Shear (lb/sq ft)		1.62	
Alpha	1.00	Stream Power (lb/ft s)		11.60	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Warning: User specified water surface is not possible for the specified flow regime. The program used critical depth as the starting water surface.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

PB Proj No. 11515
Coronado Ridge Wash (*East Tributary*)
Existing Condition Analysis

SUMMARY OF MANNING'S N VALUES

River:Coronado Ridge

Reach	River Sta.	n1	n2	n3
EAST BRANCH	1000	.05	.05	.05
EAST BRANCH	810	.05	.045	.05
EAST BRANCH	640	.05	.045	.05
EAST BRANCH	550	.05	.045	.05
EAST BRANCH	460	.05	.035	.05
EAST BRANCH	385	.05	.035	.05
EAST BRANCH	380	Culvert		
EAST BRANCH	325	.05	.035	.05
EAST BRANCH	289	.05	.035	.05
EAST BRANCH	280	Lat Struct		
EAST BRANCH	160	.05	.035	.05
EAST BRANCH	150	Lat Struct		
EAST BRANCH	135	.05	.035	.05
EAST BRANCH	134	Culvert		
EAST BRANCH	82	.05	.035	.05

SUMMARY OF REACH LENGTHS

River: Coronado Ridge

Reach	River Sta.	Left	Channel	Right
EAST BRANCH	1000	190	190	190
EAST BRANCH	810	160	170	180
EAST BRANCH	640	55	90	115
EAST BRANCH	550	55	90	110
EAST BRANCH	460	60	75	85
EAST BRANCH	385	60	60	60
EAST BRANCH	380	Culvert		
EAST BRANCH	325	35.5	35.5	35.5
EAST BRANCH	289	129.4	129.4	129.4
EAST BRANCH	280	Lat Struct		
EAST BRANCH	160	25	25	25
EAST BRANCH	150	Lat Struct		
EAST BRANCH	135	53	53	53
EAST BRANCH	134	Culvert		
EAST BRANCH	82	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Coronado Ridge

Reach	River Sta.	Contr.	Expan.
EAST BRANCH	1000	.1	.3
EAST BRANCH	810	.1	.3
EAST BRANCH	640	.1	.3
EAST BRANCH	550	.1	.3
EAST BRANCH	460	.3	.5
EAST BRANCH	385	.3	.5
EAST BRANCH	380	Culvert	
EAST BRANCH	325	.3	.5
EAST BRANCH	289	.1	.3
EAST BRANCH	280	Lat Struct	
EAST BRANCH	160	.1	.3
EAST BRANCH	150	Lat Struct	
EAST BRANCH	135	.3	.5
EAST BRANCH	134	Culvert	
EAST BRANCH	82	.3	.5

PB Proj No. 11515
Coronado Ridge Wash (*East Tributary*)
Existing Condition Analysis
Profile Output Table - Standard Table 1

Reach	River Sta		Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
EAST BRANCH	1000		171.00	2768.00	2769.41	2769.38	2769.79	0.039120	4.98	34.36	42.86	0.98
EAST BRANCH	810		171.00	2762.50	2763.97	2763.97	2764.28	0.022165	5.59	44.00	65.38	0.89
EAST BRANCH	640		171.00	2758.40	2759.50	2759.34	2759.61	0.015582	2.68	63.90	121.43	0.65
EAST BRANCH	550		171.00	2755.82	2757.19	2757.19	2757.46	0.041156	4.11	41.63	86.23	1.04
EAST BRANCH	460		171.00	2754.19	2756.27	2755.42	2756.31	0.001001	1.78	114.25	115.03	0.25
EAST BRANCH	385		171.00	2752.42	2756.11	2753.99	2756.23	0.000774	2.69	63.51	74.13	0.25
EAST BRANCH	380	EAST CONARCH 8'x	Culvert									
EAST BRANCH	325		171.00	2751.47	2753.58	2753.28	2754.07	0.008854	5.63	30.36	20.78	0.75
EAST BRANCH	289		171.00	2751.18	2753.31		2753.72	0.008981	5.14	33.24	22.34	0.74
EAST BRANCH	280		Lat Struct									
EAST BRANCH	160		158.97	2749.59	2753.18		2753.28	0.001196	2.54	64.44	30.49	0.29
EAST BRANCH	150		Lat Struct									
EAST BRANCH	135		156.23	2749.37	2752.78	2751.70	2753.19	0.005138	5.15	30.31	11.28	0.52
EAST BRANCH	134	WEST CONARCH 8'x	Culvert									
EAST BRANCH	82		156.23	2749.05	2750.65	2750.65	2751.44	0.019732	7.16	21.83	14.37	1.02

Profile Output Table - Standard Table 2

Reach	River Sta		E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
EAST BRANCH	1000		2769.79	2769.41	0.38	5.48	0.02		171.0		42.9
EAST BRANCH	810		2764.28	2763.97	0.32	3.12	0.06	58.3	88.5	24.2	65.4
EAST BRANCH	640		2759.61	2759.50	0.11	2.15	0.02		171.0		121.4
EAST BRANCH	550		2757.46	2757.19	0.26	0.25	0.07		171.0		86.2
EAST BRANCH	460		2756.31	2756.27	0.04	0.06	0.02	48.9	122.1		115.0
EAST BRANCH	385		2756.23	2756.11	0.11				171.0		74.1
EAST BRANCH	380	EAST CONARCH 8'x	Culvert								
EAST BRANCH	325		2754.07	2753.58	0.49	0.32	0.04		171.0		20.8
EAST BRANCH	289		2753.72	2753.31	0.41	0.34	0.09		171.0		22.3
EAST BRANCH	280		Lat Struct								
EAST BRANCH	160		2753.28	2753.18	0.10	0.05	0.03		157.2	1.8	30.5
EAST BRANCH	150		Lat Struct								
EAST BRANCH	135		2753.19	2752.78	0.41				156.2		11.3
EAST BRANCH	134	WEST CONARCH 8'x	Culvert								

EAST BRANCH	82			2751.44	2750.65	0.80				156.2	14.4

Profile Output Table - Lateral Structures

Reach	River Sta	Q US	Q Leaving Total	Q DS	Q Weir	Q Gates	Wr Top Wdth	Weir Max Depth	Weir Avg Depth	Min El Weir Flow	E.G. US.	W.S. US.	E.G. DS	W.S. DS
		(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
EAST BRANCH	280	171.00	12.14	158.97	12.14		40.17	0.44	0.22	2752.74	2753.72	2753.31	2753.28	2753.18
EAST BRANCH	150	158.97	2.77	156.23	2.77		9.15	0.44	0.22	2752.74	2753.28	2753.18	2753.19	2752.78

PB Proj No. 11515
Coronado Ridge Wash (*East Tributary*)
Existing Condition Analysis
ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : CRW ETRIB EX

River: Coronado Ridge Reach: EAST BRANCH RS: 1000 Profile: TSMS100Yr
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Coronado Ridge Reach: EAST BRANCH RS: 810 Profile: TSMS100Yr
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: Coronado Ridge Reach: EAST BRANCH RS: 640 Profile: TSMS100Yr
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Coronado Ridge Reach: EAST BRANCH RS: 550 Profile: TSMS100Yr
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: Coronado Ridge Reach: EAST BRANCH RS: 460 Profile: TSMS100Yr
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
River: Coronado Ridge Reach: EAST BRANCH RS: 385 Profile: TSMS100Yr
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Coronado Ridge Reach: EAST BRANCH RS: 380 Profile: TSMS100Yr Culv: Culvert #1
Note: The normal depth exceeds the height of the culvert. The program assumes that the normal depth is equal to the height of the culvert.
River: Coronado Ridge Reach: EAST BRANCH RS: 325 Profile: TSMS100Yr
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Coronado Ridge Reach: EAST BRANCH RS: 289 Profile: TSMS100Yr
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.
River: Coronado Ridge Reach: EAST BRANCH RS: 280 Profile: TSMS100Yr
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Coronado Ridge Reach: EAST BRANCH RS: 160 Profile: TSMS100Yr
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.
River: Coronado Ridge Reach: EAST BRANCH RS: 150 Profile: TSMS100Yr
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Coronado Ridge Reach: EAST BRANCH RS: 135 Profile: TSMS100Yr

PB Proj No. 11515
Coronado Ridge Wash (*East Tributary*)
Existing Condition Analysis

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

River: Coronado Ridge Reach: EAST BRANCH RS: 82 Profile: TSMS100Yr

Warning: User specified water surface is not possible for the specified flow regime. The program used critical depth as the starting water surface.

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

HEC-RAS Plan: CRW ETRIB EX River: Coronado Ridge Reach: EAST BRANCH Profile: TSMS100Yr

Reach	River Sta	E.G. Elev	W.S. Elev	Vel Head	Froude # Chl	Froude # XS	Frctn Loss	C & E Loss	Q Total	Q Left	Q Channel	Q Right	Top Width	Q Weir
		(ft)	(ft)	(ft)			(ft)	(ft)	(cfs)	(cfs)	(cfs)	(cfs)	(ft)	(cfs)
EAST BRANCH	1000	2769.79	2769.41	0.38	1.0	0.98	5.48	0.02	171.0		171.0		42.9	
EAST BRANCH	810	2764.28	2763.97	0.32	0.9	0.83	3.12	0.06	171.0	58.3	88.5	24.2	65.4	
EAST BRANCH	640	2759.61	2759.50	0.11	0.7	0.65	2.15	0.02	171.0		171.0		121.4	
EAST BRANCH	550	2757.46	2757.19	0.26	1.0	1.04	0.25	0.07	171.0		171.0		86.2	
EAST BRANCH	460	2756.31	2756.27	0.04	0.3	0.22	0.06	0.02	171.0	48.9	122.1		115.0	
EAST BRANCH	385	2756.23	2756.11	0.11	0.3	0.25			171.0		171.0		74.1	
EAST BRANCH	380 EAST CONARCH 8'x	Culvert												
EAST BRANCH	325	2754.07	2753.58	0.49	0.8	0.75	0.32	0.04	171.0		171.0		20.8	
EAST BRANCH	289	2753.72	2753.31	0.41	0.7	0.74	0.34	0.09	171.0		171.0		22.3	
EAST BRANCH	280								171.0					12.1
EAST BRANCH	160	2753.28	2753.18	0.10	0.3	0.30	0.05	0.03	159.0		157.2	1.8	30.5	
EAST BRANCH	150								159.0					2.8
EAST BRANCH	135	2753.19	2752.78	0.41	0.5	0.52			156.2		156.2		11.3	
EAST BRANCH	134 WEST CONARCH 8'x	Culvert												
EAST BRANCH	82	2751.44	2750.65	0.80	1.0	1.02			156.2		156.2		14.4	

CRW SPLT XSEC - 1 (Exist Cond)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04200	ft/ft
Discharge	230.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	21.76
0+26	21.07
0+91	16.29
1+25	20.92
1+44	22.05

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 21.76)	(1+44, 22.05)	0.045

Results

Normal Depth	1.85	ft
Elevation Range	16.29 to 22.05 ft	
Flow Area	35.87	ft²
Wetted Perimeter	38.90	ft
Top Width	38.70	ft
Normal Depth	1.85	ft
Critical Depth	1.98	ft
Critical Slope	0.02982	ft/ft
Velocity	6.41	ft/s
Velocity Head	0.64	ft
Specific Energy	2.49	ft
Froude Number	1.17	
Flow Type	Supercritical	

CRW SPLT XSEC - 1 (Exist Cond)

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.85	ft
Critical Depth	1.98	ft
Channel Slope	0.04200	ft/ft
Critical Slope	0.02982	ft/ft

CRW SPLT XSEC - 2 (Exist Cond)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.02330	ft/ft
Discharge	230.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	16.93
0+42	16.09
0+81	12.52
1+37	17.43

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 16.93)	(1+37, 17.43)	0.045

Results

Normal Depth	2.02	ft
Elevation Range	12.52 to 17.43 ft	
Flow Area	45.48	ft²
Wetted Perimeter	45.25	ft
Top Width	45.07	ft
Normal Depth	2.02	ft
Critical Depth	1.92	ft
Critical Slope	0.03005	ft/ft
Velocity	5.06	ft/s
Velocity Head	0.40	ft
Specific Energy	2.42	ft
Froude Number	0.89	
Flow Type	Subcritical	

CRW SPLT XSEC - 2 (Exist Cond)

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.02	ft
Critical Depth	1.92	ft
Channel Slope	0.02330	ft/ft
Critical Slope	0.03005	ft/ft

CRW SPLT XSEC - 3 (Exist Cond)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.02440	ft/ft
Discharge	230.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	11.49
0+15	11.38
0+39	10.46
0+56	8.55
0+73	8.42
0+85	8.91
0+95	10.11
1+05	10.64

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 11.49)	(1+05, 10.64)	0.045

Results

Normal Depth	1.37	ft
Elevation Range	8.42 to 11.49 ft	
Flow Area	45.73	ft²
Wetted Perimeter	47.49	ft
Top Width	47.36	ft
Normal Depth	1.37	ft
Critical Depth	1.30	ft
Critical Slope	0.03047	ft/ft
Velocity	5.03	ft/s
Velocity Head	0.39	ft

CRW SPLT XSEC - 3 (Exist Cond)

Results

Specific Energy	1.76	ft
Froude Number	0.90	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.37	ft
Critical Depth	1.30	ft
Channel Slope	0.02440	ft/ft
Critical Slope	0.03047	ft/ft

B-2

BASHAS' SHOPPING CENTER

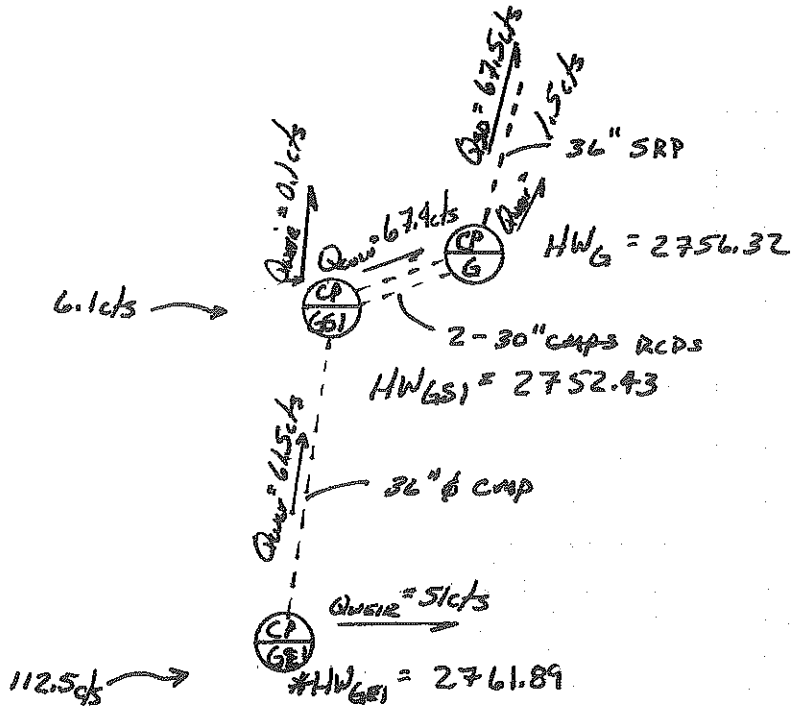
PB Americas, Inc.
COMPUTATION SHEET

Subject: Houghton Road Speedway – Old Spanish Trail
Hydraulic Analysis Exist Condition

Page 1 of 1
Made by Bambauer
Date 30 OCT 07 / 11 FEB 08
Checked by D. Ruvalcaba
Date 25 FEB 08

CP G, CP GS1 & CP GE1

Summary of Results – Final Iteration For Headwater & Split Flow Configuration



* HW_{GE1} is Starting Condition For HECRAS Analysis Upstream of this Point

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Exisitng Condition)
CP G

OUTPUT FROM CULVERT MASTER
Culvert Diameter = 3

Total Discharge (cfs)	Weir Discharge (cfs)	Discharge (cfs)	HW Elev. (ft)	TW Elev. (ft)	(I) Hwi	(O) Hwo	(D) Dn. V	(D) Dn. depth
65.0	0.0	65.0	2,755.94	2,736.78	2,755.94	2,755.28	22.4	1.3
66.0	0.0	66.0	2,756.09	2,736.79	2,756.09	2,755.36	22.5	1.3
67.2	0.2	67.0	2,756.24	2,736.80	2,756.24	2,755.43	22.6	1.3
70.6	2.6	68.0	2,756.39	2,736.82	2,756.39	2,755.51	22.6	1.3
78.4	9.4	69.0	2,756.54	2,736.83	2,756.54	2,755.60	22.7	1.3
94.1	24.1	70.0	2,756.69	2,736.84	2,756.69	2,755.68	22.7	1.4
119.0	48.0	71.0	2,756.85	2,736.85	2,756.85	2,755.76	22.8	1.4
154.4	82.4	72.0	2,757.01	2,736.86	2,757.01	2,755.84	22.9	1.4
202.8	129.8	73.0	2,757.17	2,736.87	2,757.17	2,755.93	22.9	1.4
260.6	186.6	74.0	2,757.33	2,736.88	2,757.33	2,756.01	23.0	1.4
326.8	251.8	75.0	2,757.49	2,736.89	2,757.49	2,756.10	23.0	1.4
405.6	329.6	76.0	2,757.66	2,736.90	2,757.66	2,756.19	23.1	1.4

Q_{100} =	1.6	*Peak 100-Year Flow (Local Runoff) Reaching CP G*
Q_{100} =	67.4	*Peak 100-Year Flow Reaching CP G From CP GS1 (2-30" Dia RCPs)*
Q_{100} =	69.0	*Combined Peak 100-Year Flow Reaching CP G*

By Linear Interpolation:

Q_{SD} =	67.5	*Flow Entering Basha's Stormdrain (36" Dia SRP)*
Q_{weir} =	1.5	*Flow Breaking onto Basha's Parking Lot*
Total Q_{100} =	69.0	
WSE_{100} =	2756.32	

Note: Combined Local Runoff with Flow From CP GS1 (2-30" Dia RCPs)

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Exisitng Condition)
CP G

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Irregular Weir Cross-Section:

	STA (ft)	ELEV (ft)	SEGMENT
1	0	2758.02	
2	14	2757.29	A
3	15.4	2757.14	B
4	16.9	2757.13	C
5	25.9	2756.92	D
6	32	2756.97	E
7	89.7	2756.45	F
8	93.3	2756.51	G
9	124.7	2756.15	H
10	129.8	2756.55	I
11	139.1	2757.92	J
12	145.7	2758.17	K
13	155.1	2758.34	L

Rating Table

WSE	Qweir
55.94	0.0
56.09	0.0
56.24	0.2
56.39	2.6
56.54	9.4
56.69	24.1
56.85	48.0
57.01	82.4
57.17	129.8
57.33	186.6
57.49	251.8
57.66	329.6

Base Elevation *2700 feet*

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 55.94 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 56.09 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 56.24 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	58.02														
	14.0	57.29	14.0	-0.0521	0.00			0.0	0.00			0.0	0.00			0.0
B	14.0	57.29														
	15.4	57.14	1.4	-0.1071	0.00			0.0	0.00			0.0	0.00			0.0
C	15.4	57.14														
	16.9	57.13	1.5	-0.0067	0.00			0.0	0.00			0.0	0.00			0.0
D	16.9	57.13														
	25.9	56.92	9.0	-0.0233	0.00			0.0	0.00			0.0	0.00			0.0
E	25.9	56.92														
	32.0	56.97	6.1	0.0082	0.00			0.0	0.00			0.0	0.00			0.0
F	32.0	56.97														
	89.7	56.45	57.7	-0.0090	0.00			0.0	0.00			0.0	0.00			0.0
G	89.7	56.45														
	93.3	56.51	3.6	0.0167	0.00			0.0	0.00			0.0	0.00			0.0
H	93.3	56.51														
	124.7	56.15	31.4	-0.0115	0.00			0.0	0.00			0.0	7.85	0.09	0.04	0.2
I	124.7	56.15												0.09		
	129.8	56.55	5.1	0.0784	0.00			0.0	0.00			0.0	1.15		0.04	0.0
J	129.8	56.55														
	139.1	57.92	9.3	0.1473	0.00			0.0	0.00			0.0	0.00			0.0
K	139.1	57.92														
	145.7	58.17	6.6	0.0379	0.00			0.0	0.00			0.0	0.00			0.0
L	145.7	58.17														
	155.1	58.34	9.4	0.0181	0.00			0.0	0.00			0.0	0.00			0.0
								0.0				0.0				0.2

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Exisitng Condition)
CP G

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation *2700 feet*

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 56.39 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 56.54 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 56.69 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	58.02														
	14.0	57.29	14.0	-0.0521	0.00			0.0	0.00			0.0	0.00			0.0
B	14.0	57.29														
	15.4	57.14	1.4	-0.1071	0.00			0.0	0.00			0.0	0.00			0.0
C	15.4	57.14														
	16.9	57.13	1.5	-0.0067	0.00			0.0	0.00			0.0	0.00			0.0
D	16.9	57.13														
	25.9	56.92	9.0	-0.0233	0.00			0.0	0.00			0.0	0.00			0.0
E	25.9	56.92														
	32.0	56.97	6.1	0.0082	0.00			0.0	0.00			0.0	0.00			0.0
F	32.0	56.97														
	89.7	56.45	57.7	-0.0090	0.00			0.0	9.99	0.09	0.05	0.2	26.63	0.24	0.12	2.9
G	89.7	56.45								0.09				0.24		
	93.3	56.51	3.6	0.0167	0.00			0.0	3.60	0.03	0.06	0.1	3.60	0.18	0.21	0.9
H	93.3	56.51								0.03				0.18		
	124.7	56.15	31.4	-0.0115	20.93	0.24	0.12	2.3	31.40	0.39	0.21	7.9	31.40	0.54	0.36	17.6
I	124.7	56.15				0.24				0.39				0.54		
	129.8	56.55	5.1	0.0784	3.06		0.12	0.3	4.97		0.19	1.1	5.10	0.14	0.34	2.6
J	129.8	56.55												0.14		
	139.1	57.92	9.3	0.1473	0.00			0.0	0.00			0.0	0.95		0.07	0.0
K	139.1	57.92														
	145.7	58.17	6.6	0.0379	0.00			0.0	0.00			0.0	0.00			0.0
L	145.7	58.17														
	155.1	58.34	9.4	0.0181	0.00			0.0	0.00			0.0	0.00			0.0
								2.6				9.4				24.1

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Exisitng Condition)
CP G

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation *2700 feet*

Irregular Weir Analysis					WSE = 56.85				WSE = 57.01				WSE = 57.17			
Segmt	STA	ELEV	DL	So	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	58.02														
	14.0	57.29	14.0	-0.0521	0.00			0.0	0.00			0.0	0.00			0.0
B	14.0	57.29														
	15.4	57.14	1.4	-0.1071	0.00			0.0	0.00			0.0	0.28	0.03	0.02	0.0
C	15.4	57.14												0.03		
	16.9	57.13	1.5	-0.0067	0.00			0.0	0.00			0.0	1.50	0.04	0.04	0.0
D	16.9	57.13												0.04		
	25.9	56.92	9.0	-0.0233	0.00			0.0	3.86	0.09	0.05	0.1	9.00	0.25	0.14	1.3
E	25.9	56.92								0.09				0.25		
	32.0	56.97	6.1	0.0082	0.00			0.0	6.10	0.04	0.07	0.3	6.10	0.20	0.23	1.7
F	32.0	56.97								0.04				0.20		
	89.7	56.45	57.7	-0.0090	44.38	0.40	0.20	10.3	57.70	0.56	0.30	24.7	57.70	0.72	0.46	46.8
G	89.7	56.45				0.40				0.56				0.72		
	93.3	56.51	3.6	0.0167	3.60	0.34	0.37	2.1	3.60	0.50	0.53	3.6	3.60	0.66	0.69	5.4
H	93.3	56.51				0.34				0.50				0.66		
	124.7	56.15	31.4	-0.0115	31.40	0.70	0.52	30.6	31.40	0.86	0.68	45.8	31.40	1.02	0.84	62.9
I	124.7	56.15				0.70				0.86				1.02		
	129.8	56.55	5.1	0.0784	5.10	0.30	0.50	4.7	5.10	0.46	0.66	7.1	5.10	0.62	0.82	9.8
J	129.8	56.55				0.30				0.46				0.62		
	139.1	57.92	9.3	0.1473	2.04		0.15	0.3	3.12		0.23	0.9	4.21		0.31	1.9
K	139.1	57.92														
	145.7	58.17	6.6	0.0379	0.00			0.0	0.00			0.0	0.00			0.0
L	145.7	58.17														
	155.1	58.34	9.4	0.0181	0.00			0.0	0.00			0.0	0.00			0.0
								48.0				82.4				129.8

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Exisitng Condition)
CP G

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation *2700 feet*

Irregular Weir Analysis					WSE = 57.33				WSE = 57.49				WSE = 57.66			
Segmt	STA	ELEV	DL	So	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	58.02														
	14.0	57.29	14.0	-0.0521	0.77	0.04	0.02	0.0	3.84	0.20	0.10	0.3	7.10	0.37	0.18	1.5
B	14.0	57.29				0.04				0.20				0.37		
	15.4	57.14	1.4	-0.1071	1.40	0.19	0.12	0.1	1.40	0.35	0.27	0.5	1.40	0.52	0.44	1.1
C	15.4	57.14				0.19				0.35				0.52		
	16.9	57.13	1.5	-0.0067	1.50	0.20	0.19	0.3	1.50	0.36	0.35	0.8	1.50	0.53	0.52	1.5
D	16.9	57.13				0.20				0.36				0.53		
	25.9	56.92	9.0	-0.0233	9.00	0.41	0.30	3.9	9.00	0.57	0.46	7.4	9.00	0.74	0.63	11.8
E	25.9	56.92				0.41				0.57				0.74		
	32.0	56.97	6.1	0.0082	6.10	0.36	0.38	3.8	6.10	0.52	0.54	6.4	6.10	0.69	0.71	9.6
F	32.0	56.97				0.36				0.52				0.69		
	89.7	56.45	57.7	-0.0090	57.70	0.88	0.62	73.2	57.70	1.04	0.78	103.3	57.70	1.21	0.95	138.9
G	89.7	56.45				0.88				1.04				1.21		
	93.3	56.51	3.6	0.0167	3.60	0.82	0.85	7.3	3.60	0.98	1.01	9.5	3.60	1.15	1.18	12.0
H	93.3	56.51				0.82				0.98				1.15		
	124.7	56.15	31.4	-0.0115	31.40	1.18	1.00	81.6	31.40	1.34	1.16	102.0	31.40	1.51	1.33	125.2
I	124.7	56.15				1.18				1.34				1.51		
	129.8	56.55	5.1	0.0784	5.10	0.78	0.98	12.9	5.10	0.94	1.14	16.1	5.10	1.11	1.31	19.9
J	129.8	56.55				0.78				0.94				1.11		
	139.1	57.92	9.3	0.1473	5.29		0.39	3.4	6.38		0.47	5.3	7.54		0.55	8.1
K	139.1	57.92														
	145.7	58.17	6.6	0.0379	0.00			0.0	0.00			0.0	0.00			0.0
L	145.7	58.17														
	155.1	58.34	9.4	0.0181	0.00			0.0	0.00			0.0	0.00			0.0
								186.6				251.8				329.6

Culvert Designer/Analyzer Report
G EXST COND

Comments: CP G3
EXST INLET TO BASHA'S STORMDRAIN
1-36" SRP
ESTIMATE TAILWATER W/ RECTANGLE CHANNEL
@ SAME SLOPE OF STORMDRAIN

Analysis Component			
Storm Event	Design	Discharge	68.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	68.00 cfs	Check Discharge	0.00 cfs

Tailwater properties: Rectangular Channel

Tailwater conditions for Design Storm.			
Discharge	68.00 cfs	Bottom Elevation	2,735.76 ft
Depth	1.06 ft	Velocity	21.47 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-36 inch Circular	68.00 cfs	2,756.39 ft	22.62 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
G EXST COND

Component:Culvert-1

Culvert Summary					
Computed Headwater Elev	2,756.39	ft	Discharge	68.00	cfs
Inlet Control HW Elev.	2,756.39	ft	Tailwater Elevation	2,736.82	ft
Outlet Control HW Elev.	2,755.51	ft	Control Type	Inlet Control	
Headwater Depth/Height	2.22				

Grades					
Upstream Invert	2,749.72	ft	Downstream Invert	2,735.76	ft
Length	292.00	ft	Constructed Slope	0.047808	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	1.32	ft
Slope Type	Steep		Normal Depth	1.31	ft
Flow Regime	Supercritical		Critical Depth	2.63	ft
Velocity Downstream	22.62	ft/s	Critical Slope	0.006726	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.011	
Section Material	CMP		Span	3.00	ft
Section Size	36 inch		Rise	3.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	2,755.51	ft	Upstream Velocity Head	1.67	ft
Ke	0.90		Entrance Loss	1.50	ft

Inlet Control Properties					
Inlet Control HW Elev.	2,756.39	ft	Flow Control	Submerged	
Inlet Type	Projecting		Area Full	7.1	ft2
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Rating Table Report
G EXST COND

Range Data:

	Minimum	Maximum	Increment	
Discharge	0.00	60.00	5.00	cfs

Discharge (cfs)	HW Elev. (ft)	TW Elev. (ft)	(I) Hwi	(O) Hwo	(D) Dn. V	(D) Dn. depth
0.00	2,749.72	2,735.76	2,749.72	2,749.72	0.00	0.00
5.00	2,750.89	2,735.95	2,750.62	2,750.89	10.80	0.35
10.00	2,751.41	2,736.05	2,751.09	2,751.41	13.28	0.49
15.00	2,751.84	2,736.14	2,751.49	2,751.84	14.97	0.60
20.00	2,752.21	2,736.22	2,751.85	2,752.21	16.28	0.69
25.00	2,752.56	2,736.29	2,752.21	2,752.56	17.37	0.77
30.00	2,752.90	2,736.36	2,752.55	2,752.90	18.30	0.85
35.00	2,753.22	2,736.42	2,752.90	2,753.22	19.12	0.92
40.00	2,753.54	2,736.49	2,753.24	2,753.54	19.85	0.98
45.00	2,753.87	2,736.55	2,753.61	2,753.87	20.51	1.05
50.00	2,754.20	2,736.61	2,754.04	2,754.20	21.12	1.11
55.00	2,754.62	2,736.67	2,754.62	2,754.54	21.67	1.16
60.00	2,755.25	2,736.73	2,755.25	2,754.90	22.07	1.23

Rating Table Report
G EXST COND

Range Data:				
	Minimum	Maximum	Increment	
Discharge	65.00	76.00	1.00	cfs

Discharge (cfs)	HW Elev. (ft)	TW Elev. (ft)	(I) Hwi	(O) Hwo	(D) Dn. V	(D) Dn. depth
65.00	2,755.94	2,736.78	2,755.94	2,755.28	22.42	1.29
66.00	2,756.09	2,736.79	2,756.09	2,755.36	22.49	1.30
67.00	2,756.24	2,736.80	2,756.24	2,755.43	22.55	1.31
68.00	2,756.39	2,736.82	2,756.39	2,755.51	22.62	1.32
69.00	2,756.54	2,736.83	2,756.54	2,755.60	22.68	1.34
70.00	2,756.69	2,736.84	2,756.69	2,755.68	22.74	1.35
71.00	2,756.85	2,736.85	2,756.85	2,755.76	22.80	1.36
72.00	2,757.01	2,736.86	2,757.01	2,755.84	22.86	1.37
73.00	2,757.17	2,736.87	2,757.17	2,755.93	22.92	1.38
74.00	2,757.33	2,736.88	2,757.33	2,756.01	22.98	1.40
75.00	2,757.49	2,736.89	2,757.49	2,756.10	23.04	1.41
76.00	2,757.66	2,736.90	2,757.66	2,756.19	23.10	1.42

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Exisitng Condition)
CP GS1

OUTPUT FROM CULVERT MASTER
Culvert Diameter = 2.5

Total Discharge (cfs)	Weir Discharge (cfs)	Discharge (cfs)	HW Elev. (ft)	TW Elev. (ft)	(I) Hwi	(O) Hwo	(D) Dn. V	(D) Dn. depth
65.0	0.0	65	2757.34	2755.94	2756.56	2757.34	6.62	2.5
67.0	0.0	67	2757.70	2756.22	2756.67	2757.70	6.82	2.5
69.5	0.5	69	2757.90	2756.32	2756.78	2757.90	7.03	2.5
73.5	2.5	71	2758.07	2756.40	2756.90	2758.07	7.23	2.5
78.9	5.9	73	2758.20	2756.44	2757.01	2758.20	7.44	2.5
88.4	13.4	75	2758.34	2756.47	2757.14	2758.34	7.64	2.5
103.2	26.2	77	2758.48	2756.51	2757.26	2758.48	7.84	2.5
123.9	44.9	79	2758.61	2756.55	2757.39	2758.61	8.05	2.5
150.8	69.8	81	2758.74	2756.56	2757.52	2758.74	8.25	2.5
180.0	97.0	83	2758.86	2756.58	2757.66	2758.86	8.45	2.5
215.5	130.5	85	2758.99	2756.60	2757.80	2758.99	8.66	2.5
258.2	171.2	87	2759.13	2756.62	2757.94	2759.13	8.86	2.5

Q_{100} =	6.1	*Peak 100-Year Flow (Runoff) Reaching CP GS1*
Q_{100} =	61.5	*Peak 100-Year Flow Reaching CP GS1 From CP GE1 (36" Dia CMP)*
Q_{100} =	67.6	*Combined Peak 100-Year Flow Reaching CP GS1*

By Linear Interpolation:

Q_{culv} =	67.4	*Flow under Driveway (2-30" Dia. RCPs) to CP G*
Q_{weir} =	0.1	*Flow Breaking onto Basha's Parking Lot*
Total Q_{100} =	67.6	
WSE_{100} =	2752.43	

Note: Combined Local Runoff with Flow From CP GE1 (36" Dia CMP)

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Exisitng Condition)
CP GS1

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge 2.5
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Irregular Roadway Cross-Section:

	STA (ft)	ELEV (ft)	SEGMENT
1	0	2758.66	
2	12.7	2757.70	A
3	20.3	2758.09	B
4	74.9	2758.53	C
5	99.7	2759.32	D
6	112.2	2759.97	E
7			F
8			G
9			H
10			I
11			J
12			K
13			L

Rating Table

WSE	Qweir
57.34	0.0
57.70	0.0
57.90	0.5
58.07	2.5
58.20	5.9
58.34	13.4
58.48	26.2
58.61	44.9
58.74	69.8
58.86	97.0
58.99	130.5
59.13	171.2

Base Elevation 2700 feet

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 57.34 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 57.70 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 57.90 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	58.66														
	12.7	57.70	12.7	-0.0756	0.00			0.0	0.00			0.0	2.65	0.20	0.10	0.2
B	12.7	57.70												0.20		
	20.3	58.09	7.6	0.0513	0.00			0.0	0.00			0.0	3.90		0.10	0.3
C	20.3	58.09														
	74.9	58.53	54.6	0.0081	0.00			0.0	0.00			0.0	0.00			0.0
D	74.9	58.53														
	99.7	59.32	24.8	0.0319	0.00			0.0	0.00			0.0	0.00			0.0
E	99.7	59.32														
	112.2	59.97	12.5	0.0520	0.00			0.0	0.00			0.0	0.00			0.0
F	112.2	59.97														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00				#REF!				#REF!				#REF!		
K	#REF!	#REF!														
	0.0	0.00	0.0	#REF!	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								0.0				0.0				0.5

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Exisitng Condition)
CP GS1

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge 2.5
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation 2700 feet

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 58.07 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 58.20 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 58.34 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	58.66														
	12.7	57.70	12.7	-0.0756	4.89	0.37	0.19	1.0	6.61	0.50	0.25	2.1	8.47	0.64	0.32	4.0
B	12.7	57.70				0.37				0.50				0.64		
	20.3	58.09	7.6	0.0513	7.21		0.19	1.5	7.60	0.11	0.30	3.3	7.60	0.25	0.45	5.9
C	20.3	58.09								0.11				0.25		
	74.9	58.53	54.6	0.0081	0.00			0.0	13.65		0.05	0.5	31.02		0.13	3.6
D	74.9	58.53														
	99.7	59.32	24.8	0.0319	0.00			0.0	0.00			0.0	0.00			0.0
E	99.7	59.32														
	112.2	59.97	12.5	0.0520	0.00			0.0	0.00			0.0	0.00			0.0
F	112.2	59.97														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00				#REF!				#REF!				#REF!		
K	#REF!	#REF!														
	0.0	0.00	0.0	#REF!	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								2.5				5.9				13.4

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Exisitng Condition)
CP GS1

Qw = Cw x DL x d$^{3/2}$ Cw = 2.6
Qw : Weir Discharge 2.5
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation 2700 feet

Irregular Weir Analysis					WSE = 58.48				WSE = 58.61				WSE = 58.74			
Segmt	STA	ELEV	DL	So	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	58.66												0.08		
	12.7	57.70	12.7	-0.0756	10.32	0.78	0.39	6.5	12.04	0.91	0.46	9.6	12.70	1.04	0.56	13.8
B	12.7	57.70				0.78				0.91				1.04		
	20.3	58.09	7.6	0.0513	7.60	0.39	0.59	8.8	7.60	0.52	0.72	11.9	7.60	0.65	0.84	15.3
C	20.3	58.09				0.39				0.52				0.65		
	74.9	58.53	54.6	0.0081	48.40		0.19	10.8	54.60	0.08	0.30	23.3	54.60	0.21	0.43	40.0
D	74.9	58.53								0.08				0.21		
	99.7	59.32	24.8	0.0319	0.00			0.0	2.51		0.04	0.1	6.59		0.10	0.6
E	99.7	59.32														
	112.2	59.97	12.5	0.0520	0.00			0.0	0.00			0.0	0.00			0.0
F	112.2	59.97														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00				#REF!				#REF!				#REF!		
K	#REF!	#REF!														
	0.0	0.00	0.0	#REF!	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								26.2				44.9				69.8

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Exisitng Condition)
CP GS1

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge 2.5
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation *2700 feet*

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 58.86 Adj'd DL	Yi / Yii	Yave	Qweir (ft³/sec)	WSE = 58.99 Adj'd DL	Yi / Yii	Yave	Qweir (ft³/sec)	WSE = 59.13 Adj'd DL	Yi / Yii	Yave	Qweir (ft³/sec)
A	0.0	58.66				0.20				0.33				0.47		
	12.7	57.70	12.7	-0.0756	12.70	1.16	0.68	18.5	12.70	1.29	0.81	24.1	12.70	1.43	0.95	30.6
B	12.7	57.70				1.16				1.29				1.43		
	20.3	58.09	7.6	0.0513	7.60	0.77	0.97	18.7	7.60	0.90	1.09	22.6	7.60	1.04	1.24	27.1
C	20.3	58.09				0.77				0.90				1.04		
	74.9	58.53	54.6	0.0081	54.60	0.33	0.55	57.9	54.60	0.46	0.68	79.6	54.60	0.60	0.82	105.4
D	74.9	58.53				0.33				0.46				0.60		
	99.7	59.32	24.8	0.0319	10.36		0.16	1.8	14.44		0.23	4.1	18.84		0.30	8.0
E	99.7	59.32														
	112.2	59.97	12.5	0.0520	0.00			0.0	0.00			0.0	0.00			0.0
F	112.2	59.97														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00				#REF!				#REF!				#REF!		
K	#REF!	#REF!														
	0.0	0.00	0.0	#REF!	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								97.0				130.5				171.2

Culvert Designer/Analyzer Report
GS1 EXST COND

Comments: CP GS1
CP G3 HEADWATER IS TAILWATER FOR THIS STRUCTURE
2-30"x 58' RCPs
Results Represent Manual
Adjustments to Account for Increased
Flow from CP GS1 & GS2
6.1 cfs Added to Qculv(GS3)

Analysis Component			
Storm Event	Design	Discharge	67.60 cfs

Peak Discharge Method: User-Specified			
Design Discharge	67.60 cfs	Check Discharge	0.00 cfs

Tailwater Conditions: Tailwater Rating

Discharge (cfs)	TW Elev. (ft)
10.00	2,751.41
15.00	2,751.84
20.00	2,752.21
25.00	2,752.56
30.00	2,752.90
35.00	2,753.22
40.00	2,753.54
45.00	2,753.87
50.00	2,754.20
55.00	2,754.62
60.00	2,755.25
65.00	2,755.94
66.00	2,756.09
67.20	2,756.24
70.60	2,756.39
78.40	2,756.54
94.10	2,756.69

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	2-30 inch Circular	67.60 cfs	2,757.77 ft	6.89 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
GS1 EXST COND

Component:Culvert-1

Culvert Summary					
Computed Headwater Elev	2,757.77	ft	Discharge	67.60	cfs
Inlet Control HW Elev.	2,756.70	ft	Tailwater Elevation	2,756.26	ft
Outlet Control HW Elev.	2,757.77	ft	Control Type	Outlet Control	
Headwater Depth/Height	1.84				

Grades					
Upstream Invert	2,753.18	ft	Downstream Invert	2,751.20	ft
Length	60.00	ft	Constructed Slope	0.033000	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	5.06	ft
Slope Type	N/A		Normal Depth	1.18	ft
Flow Regime	N/A		Critical Depth	1.98	ft
Velocity Downstream	6.89	ft/s	Critical Slope	0.007272	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.50	ft
Section Size	30 inch		Rise	2.50	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	2,757.77	ft	Upstream Velocity Head	0.74	ft
Ke	0.50		Entrance Loss	0.37	ft

Inlet Control Properties					
Inlet Control HW Elev.	2,756.70	ft	Flow Control	Submerged	
Inlet Type	Square edge w/headwall		Area Full	9.8	ft2
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Rating Table Report
GS1 EXST COND

Range Data:

	Minimum	Maximum	Increment	
Discharge	0.00	60.00	5.00	cfs

Discharge (cfs)	HW Elev. (ft)	TW Elev. (ft)	(I) Hwi	(O) Hwo	(D) Dn. V	(D) Dn. depth
0.00	2,753.18	0.00	2,753.18	2,753.18	0.00	0.00
5.00	2,753.97	0.00	2,753.84	2,753.97	7.02	0.31
10.00	2,754.32	2,751.41	2,754.15	2,754.32	8.63	0.44
15.00	2,754.59	2,751.84	2,754.41	2,754.59	9.49	0.55
20.00	2,754.84	2,752.21	2,754.64	2,754.84	10.10	0.64
25.00	2,755.06	2,752.56	2,754.85	2,755.06	4.58	1.36
30.00	2,755.27	2,752.90	2,755.06	2,755.27	4.22	1.70
35.00	2,755.46	2,753.22	2,755.26	2,755.46	4.12	2.02
40.00	2,755.66	2,753.54	2,755.46	2,755.66	4.19	2.34
45.00	2,755.84	2,753.87	2,755.66	2,755.84	4.58	2.50
50.00	2,756.03	2,754.20	2,755.86	2,756.03	5.09	2.50
55.00	2,756.22	2,754.62	2,756.07	2,756.22	5.60	2.50
60.00	2,756.45	2,755.25	2,756.31	2,756.45	6.11	2.50

Rating Table Report
GS1 EXST COND

Range Data:

	Minimum	Maximum	Increment	
Discharge	65.00	87.00	2.00	cfs

Discharge (cfs)	HW Elev. (ft)	TW Elev. (ft)	(I) Hwi	(O) Hwo	(D) Dn. V	(D) Dn. depth
65.00	2,757.34	2,755.94	2,756.56	2,757.34	6.62	2.50
67.00	2,757.70	2,756.22	2,756.67	2,757.70	6.82	2.50
69.00	2,757.90	2,756.32	2,756.78	2,757.90	7.03	2.50
71.00	2,758.07	2,756.40	2,756.90	2,758.07	7.23	2.50
73.00	2,758.20	2,756.44	2,757.01	2,758.20	7.44	2.50
75.00	2,758.34	2,756.47	2,757.14	2,758.34	7.64	2.50
77.00	2,758.48	2,756.51	2,757.26	2,758.48	7.84	2.50
79.00	2,758.61	2,756.55	2,757.39	2,758.61	8.05	2.50
81.00	2,758.74	2,756.56	2,757.52	2,758.74	8.25	2.50
83.00	2,758.86	2,756.58	2,757.66	2,758.86	8.45	2.50
85.00	2,758.99	2,756.60	2,757.80	2,758.99	8.66	2.50
87.00	2,759.13	2,756.62	2,757.94	2,759.13	8.86	2.50

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Exisitng Condition)
CP GE1

OUTPUT FROM CULVERT MASTER
Culvert Diameter = 3

Total Discharge (cfs)	Weir Discharge (cfs)	Discharge (cfs)	HW Elev. (ft)	TW Elev. (ft)	(I) Hwi	(O) Hwo	(D) Dn. V	(D) Dn. depth
51.0	0.0	51	2,761.13	2,756.07	2,761.04	2,761.13	9.75	2.08
52.1	0.1	52	2,761.20	2,756.11	2,761.15	2,761.20	9.78	2.11
53.4	0.4	53	2,761.27	2,756.14	2,761.27	2,761.27	9.81	2.14
55.3	1.3	54	2,761.38	2,756.18	2,761.38	2,761.33	9.84	2.18
57.8	2.8	55	2,761.50	2,756.22	2,761.50	2,761.40	9.86	2.21
61.0	5.0	56	2,761.63	2,756.27	2,761.63	2,761.47	9.88	2.24
65.0	8.0	57	2,761.75	2,756.31	2,761.75	2,761.54	9.90	2.28
70.9	12.9	58	2,761.88	2,756.36	2,761.88	2,761.62	9.92	2.31
79.1	20.1	59	2,762.01	2,756.40	2,762.01	2,761.69	9.93	2.35
89.8	29.8	60	2,762.14	2,756.45	2,762.14	2,761.76	9.94	2.39
103.6	42.6	61	2,762.27	2,756.63	2,762.27	2,761.84	9.94	2.43
122.8	60.8	62	2,762.41	2,756.81	2,762.41	2,761.91	9.94	2.47

Q_{100} =	112.5	*Peak 100-Year Flow Reaching CP GE1*

By Linear Interpolation:

Q_{culv} =	61.5	*Flow under Houghton Road (36" Dia. CMP) to CP GS1*
Q_{weir} =	51.0	*Flow north towards Houghton Road & Broadway Blvd. Intersection.*
Total Q_{100} =	112.5	
WSE_{100} =	2761.89	

Note: Hydrologic analysis shows a higher flow rate @ CP GE2 (112.5cfs) than at CP GE1 (110.6cfs). Use CP GE2 flow rate for analysis.

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Exisitng Condition)
CP GE1

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Irregular Roadway Cross-Section:

	STA (ft)	ELEV (ft)	SEGMENT
1	0	2763.25	A
2	5.2	2762.95	B
3	10.5	2762.85	C
4	19.5	2762.24	D
5	48.7	2761.65	E
6	49.3	2761.69	F
7	50.8	2761.61	G
8	51.9	2761.27	H
9	54.8	2761.12	I
10	55.3	2761.12	J
11	56.0	2761.13	K
12	67.2	2762.37	L
13	86.8	2763.04	

Rating Table

WSE	Qweir
61.13	0.0
61.20	0.1
61.27	0.4
61.38	1.3
61.50	2.8
61.63	5.0
61.75	8.0
61.88	12.9
62.01	20.1
62.14	29.8
62.27	42.6
62.41	60.8

Base Elevation 2700 feet

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 61.13 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 61.20 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 61.27 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	63.25														
	5.2	62.95	5.2	-0.0577	0.00			0.0	0.00			0.0	0.00			0.0
B	5.2	62.95														
	10.5	62.85	5.3	-0.0189	0.00			0.0	0.00			0.0	0.00			0.0
C	10.5	62.85														
	19.5	62.24	9.0	-0.0678	0.00			0.0	0.00			0.0	0.00			0.0
D	19.5	62.24														
	48.7	61.65	29.2	-0.0202	0.00			0.0	0.00			0.0	0.00			0.0
E	48.7	61.65														
	49.3	61.69	0.6	0.0667	0.00			0.0	0.00			0.0	0.00			0.0
F	49.3	61.69														
	50.8	61.61	1.5	-0.0533	0.00			0.0	0.00			0.0	0.00			0.0
G	50.8	61.61														
	51.9	61.27	1.1	-0.3091	0.00			0.0	0.00			0.0	0.00			0.0
H	51.9	61.27														
	54.8	61.12	2.9	-0.0517	0.19	0.01	0.01	0.0	1.55	0.08	0.04	0.0	2.90	0.15	0.08	0.2
I	54.8	61.12				0.01				0.08				0.15		
	55.3	61.12	0.5	0.0000	0.50	0.01	0.01	0.0	0.50	0.08	0.08	0.0	0.50	0.15	0.15	0.1
J	55.3	61.12				0.01				0.08				0.15		
	56.0	61.13	0.7	0.0143	0.70		0.01	0.0	0.70	0.07	0.07	0.0	0.70	0.14	0.14	0.1
K	56.0	61.13								0.07				0.14		
	67.2	62.37	11.2	0.1107	0.00			0.0	0.63		0.03	0.0	1.26		0.07	0.1
L	67.2	62.37														
	86.8	63.04	19.6	0.0342	0.00			0.0	0.00			0.0	0.00			0.0
								0.0				0.1				0.4

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Exisitng Condition)
CP GE1

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation *2700 feet*

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 61.38 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 61.50 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 61.63 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	63.25														
	5.2	62.95	5.2	-0.0577	0.00			0.0	0.00			0.0	0.00			0.0
B	5.2	62.95														
	10.5	62.85	5.3	-0.0189	0.00			0.0	0.00			0.0	0.00			0.0
C	10.5	62.85														
	19.5	62.24	9.0	-0.0678	0.00			0.0	0.00			0.0	0.00			0.0
D	19.5	62.24														
	48.7	61.65	29.2	-0.0202	0.00			0.0	0.00			0.0	0.00			0.0
E	48.7	61.65														
	49.3	61.69	0.6	0.0667	0.00			0.0	0.00			0.0	0.00			0.0
F	49.3	61.69														
	50.8	61.61	1.5	-0.0533	0.00			0.0	0.00			0.0	0.38	0.02	0.01	0.0
G	50.8	61.61												0.02		
	51.9	61.27	1.1	-0.3091	0.36	0.11	0.06	0.0	0.74	0.23	0.12	0.1	1.10	0.36	0.19	0.2
H	51.9	61.27				0.11				0.23				0.36		
	54.8	61.12	2.9	-0.0517	2.90	0.26	0.19	0.6	2.90	0.38	0.31	1.3	2.90	0.51	0.44	2.2
I	54.8	61.12				0.26				0.38				0.51		
	55.3	61.12	0.5	0.0000	0.50	0.26	0.26	0.2	0.50	0.38	0.38	0.3	0.50	0.51	0.51	0.5
J	55.3	61.12				0.26				0.38				0.51		
	56.0	61.13	0.7	0.0143	0.70	0.25	0.26	0.2	0.70	0.37	0.38	0.4	0.70	0.50	0.51	0.7
K	56.0	61.13				0.25				0.37				0.50		
	67.2	62.37	11.2	0.1107	2.26		0.13	0.3	3.34		0.18	0.7	4.52		0.25	1.5
L	67.2	62.37														
	86.8	63.04	19.6	0.0342	0.00			0.0	0.00			0.0	0.00			0.0
								1.3				2.8				5.0

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Exisitng Condition)
CP GE1

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation *2700 feet*

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 61.75 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 61.88 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 62.01 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	63.25														
	5.2	62.95	5.2	-0.0577	0.00			0.0	0.00			0.0	0.00			0.0
B	5.2	62.95														
	10.5	62.85	5.3	-0.0189	0.00			0.0	0.00			0.0	0.00			0.0
C	10.5	62.85														
	19.5	62.24	9.0	-0.0678	0.00			0.0	0.00			0.0	0.00			0.0
D	19.5	62.24														
	48.7	61.65	29.2	-0.0202	4.95	0.10	0.05	0.1	11.38	0.23	0.12	1.2	17.82	0.36	0.18	3.5
E	48.7	61.65				0.10				0.23				0.36		
	49.3	61.69	0.6	0.0667	0.60	0.06	0.08	0.0	0.60	0.19	0.21	0.2	0.60	0.32	0.34	0.3
F	49.3	61.69				0.06				0.19				0.32		
	50.8	61.61	1.5	-0.0533	1.50	0.14	0.10	0.1	1.50	0.27	0.23	0.4	1.50	0.40	0.36	0.8
G	50.8	61.61				0.14				0.27				0.40		
	51.9	61.27	1.1	-0.3091	1.10	0.48	0.31	0.5	1.10	0.61	0.44	0.8	1.10	0.74	0.57	1.2
H	51.9	61.27				0.48				0.61				0.74		
	54.8	61.12	2.9	-0.0517	2.90	0.63	0.56	3.1	2.90	0.76	0.69	4.3	2.90	0.89	0.82	5.5
I	54.8	61.12				0.63				0.76				0.89		
	55.3	61.12	0.5	0.0000	0.50	0.63	0.63	0.7	0.50	0.76	0.76	0.9	0.50	0.89	0.89	1.1
J	55.3	61.12				0.63				0.76				0.89		
	56.0	61.13	0.7	0.0143	0.70	0.62	0.63	0.9	0.70	0.75	0.76	1.2	0.70	0.88	0.89	1.5
K	56.0	61.13				0.62				0.75				0.88		
	67.2	62.37	11.2	0.1107	5.60		0.31	2.5	6.77		0.38	4.0	7.95		0.44	6.0
L	67.2	62.37														
	86.8	63.04	19.6	0.0342	0.00			0.0	0.00			0.0	0.00			0.0
								8.0				12.9				20.1

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Exisitng Condition)
CP GE1

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation *2700 feet*

Irregular Weir Analysis					WSE =			62.14	WSE =			62.27	WSE =			62.41
Segmt	STA	ELEV	DL	So	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	63.25														
	5.2	62.95	5.2	-0.0577	0.00			0.0	0.00			0.0	0.00			0.0
B	5.2	62.95														
	10.5	62.85	5.3	-0.0189	0.00			0.0	0.00			0.0	0.00			0.0
C	10.5	62.85														
	19.5	62.24	9.0	-0.0678	0.00			0.0	0.44	0.03	0.02	0.0	2.51	0.17	0.09	0.2
D	19.5	62.24								0.03				0.17		
	48.7	61.65	29.2	-0.0202	24.25	0.49	0.24	7.6	29.20	0.62	0.33	14.1	29.20	0.76	0.46	24.1
E	48.7	61.65				0.49				0.62				0.76		
	49.3	61.69	0.6	0.0667	0.60	0.45	0.47	0.5	0.60	0.58	0.60	0.7	0.60	0.72	0.74	1.0
F	49.3	61.69				0.45				0.58				0.72		
	50.8	61.61	1.5	-0.0533	1.50	0.53	0.49	1.3	1.50	0.66	0.62	1.9	1.50	0.80	0.76	2.6
G	50.8	61.61				0.53				0.66				0.80		
	51.9	61.27	1.1	-0.3091	1.10	0.87	0.70	1.7	1.10	1.00	0.83	2.2	1.10	1.14	0.97	2.7
H	51.9	61.27				0.87				1.00				1.14		
	54.8	61.12	2.9	-0.0517	2.90	1.02	0.94	6.9	2.90	1.15	1.08	8.4	2.90	1.29	1.21	10.1
I	54.8	61.12				1.02				1.15				1.29		
	55.3	61.12	0.5	0.0000	0.50	1.02	1.02	1.3	0.50	1.15	1.15	1.6	0.50	1.29	1.29	1.9
J	55.3	61.12				1.02				1.15				1.29		
	56.0	61.13	0.7	0.0143	0.70	1.01	1.01	1.9	0.70	1.14	1.14	2.2	0.70	1.28	1.28	2.7
K	56.0	61.13				1.01				1.14				1.28		
	67.2	62.37	11.2	0.1107	9.12		0.50	8.5	10.30		0.57	11.5	11.20	0.04	0.66	15.6
L	67.2	62.37												0.04		
	86.8	63.04	19.6	0.0342	0.00			0.0	0.00			0.0	1.17		0.02	0.0
								29.8				42.6				60.8

Culvert Designer/Analyzer Report
GE1 EXST COND

Comments: CP GS3
East Side of Houghton Road
1-36"x92' CMP

Analysis Component			
Storm Event	Design	Discharge	62.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	62.00 cfs	Check Discharge	0.00 cfs

Tailwater Conditions: Tailwater Rating

Discharge (cfs)	TW Elev. (ft)
10.00	2,754.32
15.00	2,754.59
20.00	2,754.84
25.00	2,755.06
30.00	2,755.27
35.00	2,755.46
40.00	2,755.66
45.00	2,755.84
50.00	2,756.03
55.00	2,756.22
60.00	2,756.45
65.00	2,757.34
67.00	2,757.70
69.00	2,757.90
71.00	2,758.07
73.00	2,758.20
75.00	2,758.34
77.00	2,758.48
79.00	2,758.61
81.00	2,758.74
83.00	2,758.86
85.00	2,758.99
87.00	2,759.13

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-36 inch Circular	62.00 cfs	2,762.41 ft	9.94 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
GE1 EXST COND

Component:Culvert-1

Culvert Summary					
Computed Headwater Elev:	2,762.41	ft	Discharge	62.00	cfs
Inlet Control HW Elev.	2,762.41	ft	Tailwater Elevation	2,756.81	ft
Outlet Control HW Elev.	2,761.91	ft	Control Type	Inlet Control	
Headwater Depth/Height	1.94				

Grades					
Upstream Invert	2,756.58	ft	Downstream Invert	2,753.90	ft
Length	92.00	ft	Constructed Slope	0.029130	ft/ft

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	2.47	ft
Slope Type	Steep		Normal Depth	2.47	ft
Flow Regime	N/A		Critical Depth	2.54	ft
Velocity Downstream	9.94	ft/s	Critical Slope	0.027960	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	3.00	ft
Section Size	36 inch		Rise	3.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	2,761.91	ft	Upstream Velocity Head	1.47	ft
Ke	0.90		Entrance Loss	1.32	ft

Inlet Control Properties					
Inlet Control HW Elev.	2,762.41	ft	Flow Control	Submerged	
Inlet Type	Projecting		Area Full	7.1	ft2
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Rating Table Report
GE1 EXST COND

Range Data:

	Minimum	Maximum	Increment	
Discharge	0.00	50.00	5.00	cfs

Discharge (cfs)	HW Elev. (ft)	TW Elev. (ft)	(I) Hwi	(O) Hwo	(D) Dn. V	(D) Dn. depth
0.00	2,756.58	0.00	2,756.58	2,756.58	0.00	0.00
5.00	2,757.75	0.00	2,757.51	2,757.75	5.25	0.58
10.00	2,758.27	2,754.32	2,757.98	2,758.27	6.42	0.82
15.00	2,758.70	2,754.59	2,758.37	2,758.70	7.20	1.01
20.00	2,759.07	2,754.84	2,758.74	2,759.07	7.79	1.18
25.00	2,759.42	2,755.06	2,759.09	2,759.42	8.27	1.33
30.00	2,759.76	2,755.27	2,759.44	2,759.76	8.66	1.48
35.00	2,760.08	2,755.46	2,759.78	2,760.08	9.00	1.62
40.00	2,760.40	2,755.66	2,760.13	2,760.40	9.28	1.76
45.00	2,760.73	2,755.84	2,760.50	2,760.73	9.52	1.90
50.00	2,761.06	2,756.03	2,760.92	2,761.06	9.71	2.05

Rating Table Report
GE1 EXST COND

Range Data:				
	Minimum	Maximum	Increment	
Discharge	51.00	62.00	1.00	cfs

Discharge (cfs)	HW Elev. (ft)	TW Elev. (ft)	(I) Hwi	(O) Hwo	(D) Dn. V	(D) Dn. depth
51.00	2,761.13	2,756.07	2,761.04	2,761.13	9.75	2.08
52.00	2,761.20	2,756.11	2,761.15	2,761.20	9.78	2.11
53.00	2,761.27	2,756.14	2,761.27	2,761.27	9.81	2.14
54.00	2,761.38	2,756.18	2,761.38	2,761.33	9.84	2.18
55.00	2,761.50	2,756.22	2,761.50	2,761.40	9.86	2.21
56.00	2,761.63	2,756.27	2,761.63	2,761.47	9.88	2.24
57.00	2,761.75	2,756.31	2,761.75	2,761.54	9.90	2.28
58.00	2,761.88	2,756.36	2,761.88	2,761.62	9.92	2.31
59.00	2,762.01	2,756.40	2,762.01	2,761.69	9.93	2.35
60.00	2,762.14	2,756.45	2,762.14	2,761.76	9.94	2.39
61.00	2,762.27	2,756.63	2,762.27	2,761.84	9.94	2.43
62.00	2,762.41	2,756.81	2,762.41	2,761.91	9.94	2.47

11515 HOUGHTON ROAD
CP GE1-CP GE4
EXIST HYDRAULIC ANALYSIS

```
                    HEC-RAS Version 3.1.3 May 2005
                     U.S. Army Corp 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: Bashas Stormdrain GE1-GE4
Project File : EXSTCOND.prj
Run Date and Time: 2/7/2008 1:34:31 PM

Project in English units

Project Description:
Existing Condition Analysis
CP GE1o CP GE4
External Analysis Determined
Starting Condition For CP GE3 Headwater
Starting WSE-100 = 2761.89

PROPOSED
CONDITION --
PRELIMINARY ANALYSIS
CP GE1- CP GE4
EXTERNAL ANALYSIS FOR CP
GE1 HEADWATER
STARTING WSE-100 = 2760.17

PLAN DATA

Plan Title: EXST Bashas Stormdrain GE1-GE4
Plan File : l:\11515\Drainage\HECRAS\Bashas SD GS1-GS6\EXSTCOND.p01

Geometry Title: EXST Bashas Stormdrain GE1-GE4
Geometry File : l:\11515\Drainage\HECRAS\Bashas SD GS1-GS6\EXSTCOND.g01

Flow Title : EXST Bashas Stormdrain GE1-GE4
Flow File : l:\11515\Drainage\HECRAS\Bashas SD GS1-GS6\EXSTCOND.f01

Plan Description:
Existing Condition
Tailwater Established from Rating Curve Computed

Externally from HECRAS.

Plan Summary Information:

Number of:	Cross Sections =	10	Multiple Openings =	0
	Culverts =	2	Inline Structures =	0
	Bridges =	0	Lateral Structures =	0

Computational Information

Water surface calculation tolerance	=	0.01
Critical depth calculation tolerance	=	0.01
Maximum number of iterations	=	40
Maximum difference tolerance	=	0.3
Flow tolerance factor	=	0.001

Computation Options

11515 HOUGHTON ROAD
CP GE1-CP GE4
EXIST HYDRAULIC ANALYSIS

Critical depth computed at all cross sections
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: EXST Bashas Stormdrain GE1-GE4
Flow File : 1:\11515\Drainage\HECRAS\Bashas SD GS1-GS6\EXSTCOND.f01

Flow Data (cfs)

River	Reach	RS	100-Year
Bashas SD	GS1-GS6	1695	84
Bashas SD	GS1-GS6	1275	113

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Bashas SD	GS1-GS6	100-Year	Critical	Known WS = 2761.89

GEOMETRY DATA

Geometry Title: EXST Bashas Stormdrain GE1-GE4
Geometry File : 1:\11515\Drainage\HECRAS\Bashas SD GS1-GS6\EXSTCOND.g01

CROSS SECTION

RIVER: Bashas SD
REACH: GS1-GS6 RS: 1695

INPUT
Description:
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2781.52	16.82	2781.31	26.84	2780.93	29.56	2780.71	35.44	2780.42
58.11	2779.05	66.09	2778.66	68.25	2778.41	77.16	2777.91	81.5	2777.47
88.35	2777.03	91.03	2776.75	95.78	2776.55	106.69	2775.9	113.82	2775.65
123.84	2774.78	132.61	2774.29	139.03	2773.54	145.14	2772.92	148.57	2772.43
154.94	2771.4	157.72	2772.02	159.58	2772.34	161.04	2772.4	174.72	2773.72
177.43	2774.11	181.44	2774.43	185.62	2774.88	192.1	2775.48	208.52	2776.07

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	113.82	.04	192.1	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
113.82	192.1	65	60	55	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	2773.42	Element			
Vel Head (ft)	0.37	Wt. n-Val.		0.040	
W.S. Elev (ft)	2773.06	Reach Len. (ft)	65.00	60.00	55.00
Crit W.S. (ft)	2773.06	Flow Area (sq ft)		17.26	
E.G. Slope (ft/ft)	0.027051	Area (sq ft)		17.26	
Q Total (cfs)	84.00	Flow (cfs)		84.00	
Top Width (ft)	24.03	Top Width (ft)		24.03	
Vel Total (ft/s)	4.87	Avg. Vel. (ft/s)		4.87	
Max Chl Dpth (ft)	1.66	Hydr. Depth (ft)		0.72	
Conv. Total (cfs)	510.7	Conv. (cfs)		510.7	
Length Wtd. (ft)	60.00	Wetted Per. (ft)		24.29	
Min Ch El (ft)	2771.40	Shear (lb/sq ft)		1.20	
Alpha	1.00	Stream Power (lb/ft s)		5.84	
Frctn Loss (ft)	1.49	Cum Volume (acre-ft)		0.76	0.00
C & E Loss (ft)	0.01	Cum SA (acres)		0.60	0.02

11515 HOUGHTON ROAD
CP GE1-CP GE4
EXIST HYDRAULIC ANALYSIS

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Bashas SD
REACH: GS1-GS6 RS: 1635

INPUT
Description:
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2777.06	6.56	2776.99	10.72	2776.61	13.23	2776.08	17.06	2775.66
23.65	2775.32	26.85	2775.23	29.04	2775.24	33.96	2774.99	39.57	2774.94
43.87	2774.61	45.86	2774.56	47.14	2774.68	49.24	2774.57	52.04	2774.5
52.82	2774.41	55.88	2774.24	59.66	2773.69	60.62	2773.61	64.22	2773.45
67.51	2773.25	78.85	2771.76	80.12	2771.53	88.49	2770.69	98	2770.04
98.74	2769.99	104.31	2770.62	110.05	2772.92	111.39	2773.8	115.2	2775.96

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	67.51	.04	115.2	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
67.51	115.2	140	135	130	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	2771.65	Element			
Vel Head (ft)	0.34	Wt. n-Val.		0.040	
W.S. Elev (ft)	2771.31	Reach Len. (ft)	140.00	135.00	130.00
Crit W.S. (ft)	2771.27	Flow Area (sq ft)		18.01	
E.G. Slope (ft/ft)	0.023025	Area (sq ft)		18.01	
Q Total (cfs)	84.00	Flow (cfs)		84.00	
Top Width (ft)	23.70	Top Width (ft)		23.70	
Vel Total (ft/s)	4.66	Avg. Vel. (ft/s)		4.66	
Max Chl Dpth (ft)	1.32	Hydr. Depth (ft)		0.76	
Conv. Total (cfs)	553.6	Conv. (cfs)		553.6	
Length Wtd. (ft)	135.00	Wetted Per. (ft)		23.92	
Min Ch El (ft)	2769.99	Shear (lb/sq ft)		1.08	
Alpha	1.00	Stream Power (lb/ft s)		5.05	
Frctn Loss (ft)	3.43	Cum Volume (acre-ft)		0.73	0.00
C & E Loss (ft)	0.00	Cum SA (acres)		0.57	0.02

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Bashas SD
REACH: GS1-GS6 RS: 1500

INPUT
Description:
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2771.97	12.13	2771.78	14.02	2771.71	16.84	2771.54	18.91	2771.39
22.43	2771.15	27.28	2770.72	30.22	2770.48	33.8	2770.25	34.9	2770.19
35.46	2770.14	39.48	2769.87	40.21	2769.84	43.72	2769.41	44.49	2769.34
48.04	2769.12	49.01	2769.04	52.32	2768.78	57.76	2768.05	58.97	2767.93
68.73	2767.37	70.22	2767.28	70.62	2767.27	79.9	2766.41	85.16	2767.64
87.88	2767.84	99.81	2768.76	103.82	2770.6	112.68	2774.73	112.78	2774.73

Manning's n Values num= 3

11515 HOUGHTON ROAD
CP GE1-CP GE4
EXIST HYDRAULIC ANALYSIS

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	12.13	.04	112.78	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
12.13	112.78	105	100	95	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	2768.22	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.32	Wt. n-Val.		0.040	
W.S. Elev (ft)	2767.90	Reach Len. (ft)	105.00	100.00	95.00
Crit W.S. (ft)	2767.90	Flow Area (sq ft)		18.39	
E.G. Slope (ft/ft)	0.028161	Area (sq ft)		18.39	
Q Total (cfs)	84.00	Flow (cfs)		84.00	
Top Width (ft)	29.10	Top Width (ft)		29.10	
Vel Total (ft/s)	4.57	Avg. Vel. (ft/s)		4.57	
Max Chl Dpth (ft)	1.49	Hydr. Depth (ft)		0.63	
Conv. Total (cfs)	500.6	Conv. (cfs)		500.6	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		29.30	
Min Ch El (ft)	2766.41	Shear (lb/sq ft)		1.10	
Alpha	1.00	Stream Power (lb/ft s)		5.04	
Frctn Loss (ft)	0.51	Cum Volume (acre-ft)		0.67	0.00
C & E Loss (ft)	0.09	Cum SA (acres)		0.48	0.02

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Bashas SD
REACH: GS1-GS6 RS: 1400

INPUT
Description:
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2769.67	9.51	2769.17	11.34	2769.08	12.7	2768.79	17.82	2767.68
18.37	2767.69	27.32	2767.02	30.92	2766.82	32.66	2766.68	34.54	2766.58
38.02	2766.49	41.58	2766.15	45.78	2765.79	48.19	2765.56	50.02	2765.39
53.32	2765.02	56.36	2764.65	61.19	2764.92	61.72	2764.95	62.55	2764.94
67.74	2764.9	68.53	2764.92	73.57	2765.5	75.39	2765.84	82.15	2766.37
82.75	2766.31	85.23	2766.41	100.22	2766.83	101.53	2767.32	115.5	2772.47

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	18.37	.04	115.5	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
18.37	115.5	55	55	55	.3	.5

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	2766.65	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.		0.040	
W.S. Elev (ft)	2766.61	Reach Len. (ft)	55.00	55.00	55.00
Crit W.S. (ft)	2765.73	Flow Area (sq ft)		53.31	
E.G. Slope (ft/ft)	0.002044	Area (sq ft)		53.31	
Q Total (cfs)	84.00	Flow (cfs)		84.00	
Top Width (ft)	58.46	Top Width (ft)		58.46	
Vel Total (ft/s)	1.58	Avg. Vel. (ft/s)		1.58	
Max Chl Dpth (ft)	1.96	Hydr. Depth (ft)		0.91	
Conv. Total (cfs)	1857.8	Conv. (cfs)		1857.8	
Length Wtd. (ft)	55.00	Wetted Per. (ft)		58.66	
Min Ch El (ft)	2764.65	Shear (lb/sq ft)		0.12	
Alpha	1.00	Stream Power (lb/ft s)		0.18	
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)		0.59	0.00

C & E Loss (ft)	0.00	Cum SA (acres)	0.38	0.02

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: Bashas SD
REACH: GS1-GS6 RS: 1345

INPUT
Description:
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2768.35	.08	2768.38	12.03	2767.84	12.15	2767.8	13.27	2767.93
14.15	2767.91	23.14	2767.34	26.43	2767.23	29.79	2767.05	36	2766.42
38.11	2766.36	40.14	2765.94	42.6	2765.56	44.88	2765.36	51.01	2764.51
55.32	2763.5	59.39	2763.5	61.07	2763.47	71.55	2763.82	84.16	2764.59
88.06	2765.34	92.14	2766.03	92.89	2766.11	96.45	2766.84	99.31	2767.58
104.51	2768.77	109.57	2769.23	112.18	2769.14	112.3	2771.35	112.4	2772.18

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	13.27	.04	104.51	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
13.27	104.51	70	70	70	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	48.8	2767	F
67.4	112.4	2767	F

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	2766.60	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.		0.040	
W.S. Elev (ft)	2766.56	Reach Len. (ft)	70.00	70.00	70.00
Crit W.S. (ft)	2764.61	Flow Area (sq ft)		51.70	
E.G. Slope (ft/ft)	0.000494	Area (sq ft)		115.24	
Q Total (cfs)	84.00	Flow (cfs)		84.00	
Top Width (ft)	60.45	Top Width (ft)		60.45	
Vel Total (ft/s)	1.62	Avg. Vel. (ft/s)		1.62	
Max Chl Dpth (ft)	3.09	Hydr. Depth (ft)		2.78	
Conv. Total (cfs)	3777.9	Conv. (cfs)		3777.9	
Length Wtd. (ft)	70.00	Wetted Per. (ft)		18.74	
Min Ch El (ft)	2763.47	Shear (lb/sq ft)		0.09	
Alpha	1.00	Stream Power (lb/ft s)		0.14	
Frctn Loss (ft)		Cum Volume (acre-ft)		0.49	0.00
C & E Loss (ft)		Cum SA (acres)		0.31	0.02

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid,
energy was used.

CULVERT

RIVER: Bashas SD
REACH: GS1-GS6 RS: 1340.5

INPUT
Description: COWHEAD SADDLE LANE
Distance from Upstream XS = 8
Deck/Roadway Width = 40
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 2

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2767		200	2767	

Upstream Bridge Cross Section Data
Station Elevation Data num= 30

11515 HOUGHTON ROAD
CP GE1-CP GE4
EXIST HYDRAULIC ANALYSIS

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2768.35	.08	2768.38	12.03	2767.84	12.15	2767.8	13.27	2767.93
14.15	2767.91	23.14	2767.34	26.43	2767.23	29.79	2767.05	36	2766.42
38.11	2766.36	40.14	2765.94	42.6	2765.56	44.88	2765.36	51.01	2764.51
55.32	2763.5	59.39	2763.5	61.07	2763.47	71.55	2763.82	84.16	2764.59
88.06	2765.34	92.14	2766.03	92.89	2766.11	96.45	2766.84	99.31	2767.58
104.51	2768.77	109.57	2769.23	112.18	2769.14	112.3	2771.35	112.4	2772.18

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	13.27	.04	104.51	.05

Bank Sta: Left Right Coeff Contr. Expan.
13.27 104.51 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	48.8	2767	F
67.4	112.4	2767	F

Downstream Deck/Roadway Coordinates
num= 2

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2766.4		200	2766.4	

Downstream Bridge Cross Section Data
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2765.18	12.78	2764.85	13.6	2764.73	14.62	2765.14	15.33	2765.26
22.6	2765.27	24.86	2764.86	26.13	2764.81	28.49	2765.13	33.09	2765.04
36.15	2764.14	36.45	2764.12	38.03	2764.61	39.79	2764.6	40.93	2764.5
48.27	2761.24	49.11	2760.92	50.08	2760.64	51.29	2760.56	55.28	2760.44
60.24	2760.24	61.08	2760.25	66.04	2760.06	72.9	2760.22	75.57	2761.5
83.25	2765.95	84.46	2766.7	88.64	2766.83	100.48	2767.27	106.56	2767.57

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	40.93	.04	84.46	.05

Bank Sta: Left Right Coeff Contr. Expan.
40.93 84.46 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	49.65	2766.9	F
61.05	106.56	2766.9	F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
0	200	2761.76

Upstream Embankment side slope = 3 horiz. to 1.0 vertical
Downstream Embankment side slope = 3 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Circular	2	

FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 3 - Groove end entrance; pipe projecting from fill
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	4.5	65	.013	.013	0	.5	1

Number of Barrels = 4
Upstream Elevation = 2763.61
Centerline Stations

Sta.	Sta.	Sta.	Sta.
54.3	57.5	60.3	63.4

Downstream Elevation = 2761.76
Centerline Stations

Sta.	Sta.	Sta.	Sta.
50.9	53.7	56.8	59.8

11515 HOUGHTON ROAD
CP GE1-CP GE4
EXIST HYDRAULIC ANALYSIS

CULVERT OUTPUT Profile #100-Year Culv Group: Culvert #1

Q Culv Group (cfs)	84.00	Culv Full Len (ft)	
# Barrels	4	Culv Vel US (ft/s)	7.61
Q Barrel (cfs)	21.00	Culv Vel DS (ft/s)	11.55
E.G. US. (ft)	2766.60	Culv Inv El Up (ft)	2763.61
W.S. US. (ft)	2766.56	Culv Inv El Dn (ft)	2761.76
E.G. DS (ft)	2763.94	Culv Frctn Ls (ft)	1.19
W.S. DS (ft)	2763.21	Culv Exit Loss (ft)	1.02
Delta EG (ft)	2.67	Culv Entr Loss (ft)	0.45
Delta WS (ft)	3.35	Q Weir (cfs)	
E.G. IC (ft)	2766.38	Weir Sta Lft (ft)	
E.G. OC (ft)	2766.60	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	2765.25	Weir Max Depth (ft)	
Culv WS Outlet (ft)	2762.88	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	1.06	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	1.64	Min El Weir Flow (ft)	2767.01

Note: The flow in the culvert is entirely supercritical.

CROSS SECTION

RIVER: Bashas SD
REACH: GS1-GS6 RS: 1275

INPUT
Description:
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2765.18	12.78	2764.85	13.6	2764.73	14.62	2765.14	15.33	2765.26
22.6	2765.27	24.86	2764.86	26.13	2764.81	28.49	2765.13	33.09	2765.04
36.15	2764.14	36.45	2764.12	38.03	2764.61	39.79	2764.6	40.93	2764.5
48.27	2761.24	49.11	2760.92	50.08	2760.64	51.29	2760.56	55.28	2760.44
60.24	2760.24	61.08	2760.25	66.04	2760.06	72.9	2760.22	75.57	2761.5
83.25	2765.95	84.46	2766.7	88.64	2766.83	100.48	2767.27	106.56	2767.57

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	40.93	.04	84.46	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
40.93	84.46	75	75	75	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	49.65	2766.9	F
61.05	106.56	2766.9	F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
0	200	2761.76

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	2763.94	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.72	Wt. n-Val.		0.040	
W.S. Elev (ft)	2763.21	Reach Len. (ft)	75.00	75.00	75.00
Crit W.S. (ft)	2763.21	Flow Area (sq ft)		16.55	
E.G. Slope (ft/ft)	0.020532	Area (sq ft)		46.19	
Q Total (cfs)	113.00	Flow (cfs)		113.00	
Top Width (ft)	34.70	Top Width (ft)		34.70	
Vel Total (ft/s)	6.83	Avg. Vel. (ft/s)		6.83	
Max Chl Dpth (ft)	1.45	Hydr. Depth (ft)		1.45	
Conv. Total (cfs)	788.6	Conv. (cfs)		788.6	
Length Wtd. (ft)	75.00	Wetted Per. (ft)		11.40	
Min Ch El (ft)	2761.76	Shear (lb/sq ft)		1.86	
Alpha	1.00	Stream Power (lb/ft s)		12.71	
Frctn Loss (ft)	0.16	Cum Volume (acre-ft)		0.36	0.00
C & E Loss (ft)	0.35	Cum SA (acres)		0.23	0.02

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for

additional cross sections.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid,
energy was used.

CROSS SECTION

RIVER: Bashas SD
REACH: GS1-GS6 RS: 1200

INPUT
Description:
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2763.68	.1	2763.67	9.67	2763.26	12.14	2763.15	15.7	2762.6
16.4	2762.49	17.35	2762.33	18.06	2762.21	25.76	2761.02	35.01	2760.98
35.6	2760.98	35.83	2760.97	46.49	2760.58	46.73	2760.58	51.45	2760.85
54.08	2761	54.72	2761.04	55.85	2761.1	57.77	2761.11	60.8	2761.13
60.92	2761.13	60.95	2761.13	61.02	2761.13	61.09	2761.13	70.31	2761.17
72.08	2761.25	74.96	2761.33	93.26	2761.96	107.28	2766.2	112.7	2767.83

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	12.14	.04	112.7	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
12.14	112.7	58	58	58	.3	.5

CROSS SECTION OUTPUT Profile #100-Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	2762.51	Element			
Vel Head (ft)	0.02	Wt. n-Val.		0.040	
W.S. Elev (ft)	2762.49	Reach Len. (ft)	58.00	58.00	58.00
Crit W.S. (ft)	2761.53	Flow Area (sq ft)		96.71	
E.G. Slope (ft/ft)	0.000753	Area (sq ft)		96.71	
Q Total (cfs)	113.00	Flow (cfs)		113.00	
Top Width (ft)	78.58	Top Width (ft)		78.58	
Vel Total (ft/s)	1.17	Avg. Vel. (ft/s)		1.17	
Max Chl Dpth (ft)	1.91	Hydr. Depth (ft)		1.23	
Conv. Total (cfs)	4117.9	Conv. (cfs)		4117.9	
Length Wtd. (ft)	58.00	Wetted Per. (ft)		78.81	
Min Ch El (ft)	2760.58	Shear (lb/sq ft)		0.06	
Alpha	1.00	Stream Power (lb/ft s)		0.07	
Frctn Loss (ft)	0.06	Cum Volume (acre-ft)		0.23	0.00
C & E Loss (ft)	0.03	Cum SA (acres)		0.13	0.02

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: Bashas SD
REACH: GS1-GS6 RS: 1142

INPUT
Description:
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2763.01	5.23	2762.71	6.59	2762.68	10.74	2762.54	24.05	2762.68
25.43	2762.78	28.1	2762.88	31.1	2762.96	38.08	2762.22	43.24	2761.72
46.48	2761.17	47.8	2760.97	48.72	2760.93	53.5	2759.95	54.9	2759.29
56.34	2758.58	57.11	2758.58	58.85	2758.58	62.48	2758.52	63.23	2760.66
67.09	2761.88	67.64	2762.03	68.43	2761.98	75.99	2762.07	80.29	2762.26
81.67	2762.38	83.4	2762.48	87.69	2763.17	87.79	2762.77	88.08	2762.77

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CP GE1-CP GE4
EXIST HYDRAULIC ANALYSIS

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	31.1	.04	67.64	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
31.1	67.64	65	65	65	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	51.1	2764	F
63.1	88.08	2764	F

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	2762.41	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.		0.040	
W.S. Elev (ft)	2762.28	Reach Len. (ft)	65.00	65.00	65.00
Crit W.S. (ft)	2760.51	Flow Area (sq ft)		38.09	
E.G. Slope (ft/ft)	0.001619	Area (sq ft)		53.24	2.57
Q Total (cfs)	113.00	Flow (cfs)		113.00	
Top Width (ft)	42.89	Top Width (ft)		30.08	12.82
Vel Total (ft/s)	2.97	Avg. Vel. (ft/s)		2.97	
Max Chl Dpth (ft)	3.75	Hydr. Depth (ft)		3.17	
Conv. Total (cfs)	2808.6	Conv. (cfs)		2808.6	
Length Wtd. (ft)	65.00	Wetted Per. (ft)		13.62	
Min Ch El (ft)	2758.52	Shear (lb/sq ft)		0.28	
Alpha	1.00	Stream Power (lb/ft s)		0.84	
Frctn Loss (ft)		Cum Volume (acre-ft)		0.13	0.00
C & E Loss (ft)		Cum SA (acres)		0.06	0.01

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid,
energy was used.

CULVERT

RIVER: Bashas SD
REACH: GS1-GS6 RS: 1134.9

INPUT
Description: Southern enterance to Smiths Commercial Site
Distance from Upstream XS = 8
Deck/Roadway Width = 30
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2763		30	2763.7		100	2763.4	

Upstream Bridge Cross Section Data
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2763.01	5.23	2762.71	6.59	2762.68	10.74	2762.54	24.05	2762.68
25.43	2762.78	28.1	2762.88	31.1	2762.96	38.08	2762.22	43.24	2761.72
46.48	2761.17	47.8	2760.97	48.72	2760.93	53.5	2759.95	54.9	2759.29
56.34	2758.58	57.11	2758.58	58.85	2758.58	62.48	2758.52	63.23	2760.66
67.09	2761.88	67.64	2762.03	68.43	2761.98	75.99	2762.07	80.29	2762.26
81.67	2762.38	83.4	2762.48	87.69	2763.17	87.79	2762.77	88.08	2762.77

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	31.1	.04	67.64	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
31.1	67.64	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	51.1	2764	F
63.1	88.08	2764	F

Downstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2763		30	2763.7		100	2763.4	

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CP GE1-CP GE4
EXIST HYDRAULIC ANALYSIS

Downstream Bridge Cross Section Data
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2763.34	2.16	2763.22	2.56	2763.18	3.92	2763.1	4.5	2763.05
4.97	2763.03	5.32	2762.99	5.67	2762.97	6.17	2762.93	7.27	2762.84
7.48	2762.83	8.39	2762.75	10.21	2762.31	13.49	2761.13	15.92	2760.36
16.71	2760.04	16.79	2759.61	21.87	2757.77	22.94	2757.71	23.96	2757.75
27.03	2757.86	30.68	2759.13	36.47	2760.59	37.66	2760.98	38.79	2761.49
42.68	2763.26	47.24	2763.14	55.36	2763.06	57.16	2763.03	58.06	2763.03

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	8.39	.035	42.68	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
8.39	42.68	.3	.5

Upstream Embankment side slope = 3 horiz. to 1.0 vertical
Downstream Embankment side slope = 3 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Conspan Arch	4.3	6

FHWA Chart # 60- Span/Rise ratio approximate 2:1
FHWA Scale # 2 - 45 degree wing wall angle
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	3	43	.013	.025	0	.3	1

Upstream Elevation = 2757.88
Centerline Station = 57.1
Downstream Elevation = 2757.72
Centerline Station = 23.9

CULVERT OUTPUT Profile #100-Year Culv Group: Culvert #1

Q Culv Group (cfs)	113.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	4.76
Q Barrel (cfs)	113.00	Culv Vel DS (ft/s)	4.68
E.G. US. (ft)	2762.42	Culv Inv El Up (ft)	2757.88
W.S. US. (ft)	2762.28	Culv Inv El Dn (ft)	2757.72
E.G. DS (ft)	2761.97	Culv Frctn Ls (ft)	0.04
W.S. DS (ft)	2761.93	Culv Exit Loss (ft)	0.30
Delta EG (ft)	0.45	Culv Entr Loss (ft)	0.11
Delta WS (ft)	0.35	Q Weir (cfs)	
E.G. IC (ft)	2761.57	Weir Sta Lft (ft)	
E.G. OC (ft)	2762.42	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	2761.96	Weir Max Depth (ft)	
Culv WS Outlet (ft)	2761.93	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.28	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	2.23	Min El Weir Flow (ft)	2763.62

CROSS SECTION

RIVER: Bashas SD
REACH: GS1-GS6 RS: 1077

INPUT
Description:
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2763.34	2.16	2763.22	2.56	2763.18	3.92	2763.1	4.5	2763.05
4.97	2763.03	5.32	2762.99	5.67	2762.97	6.17	2762.93	7.27	2762.84
7.48	2762.83	8.39	2762.75	10.21	2762.31	13.49	2761.13	15.92	2760.36
16.71	2760.04	16.79	2759.61	21.87	2757.77	22.94	2757.71	23.96	2757.75
27.03	2757.86	30.68	2759.13	36.47	2760.59	37.66	2760.98	38.79	2761.49

42.68	2763.26	47.24	2763.14	55.36	2763.06	57.16	2763.03	58.06	2763.03

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	8.39	.035	42.68	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
8.39	42.68	20	28	35	.3	.5

CROSS SECTION OUTPUT Profile #100-Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	2761.97	Element			
Vel Head (ft)	0.04	Wt. n-Val.		0.035	
W.S. Elev (ft)	2761.93	Reach Len. (ft)	20.00	28.00	35.00
Crit W.S. (ft)	2759.59	Flow Area (sq ft)		69.95	
E.G. Slope (ft/ft)	0.000471	Area (sq ft)		69.95	
Q Total (cfs)	113.00	Flow (cfs)		113.00	
Top Width (ft)	28.47	Top Width (ft)		28.47	
Vel Total (ft/s)	1.62	Avg. Vel. (ft/s)		1.62	
Max Chl Dpth (ft)	4.22	Hydr. Depth (ft)		2.46	
Conv. Total (cfs)	5206.3	Conv. (cfs)		5206.3	
Length Wtd. (ft)	28.00	Wetted Per. (ft)		30.14	
Min Ch El (ft)	2757.71	Shear (lb/sq ft)		0.07	
Alpha	1.00	Stream Power (lb/ft s)		0.11	
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)		0.04	
C & E Loss (ft)	0.00	Cum SA (acres)		0.02	

CROSS SECTION

RIVER: Bashas SD
REACH: GS1-GS6 RS: 1048

INPUT
Description:
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2762.27	.55	2762.28	3.28	2762.31	6.66	2762.43	9.67	2762.35
9.79	2762.36	9.97	2762.35	10.16	2762.32	11.42	2762.13	11.79	2762.08
12.45	2761.88	13.65	2761.54	14.13	2761.41	14.76	2761.25	15.94	2760.95
19.76	2759.67	21.06	2759.11	21.73	2758.83	23.99	2758	25.32	2757.36
26.14	2757.5	29.26	2758.06	32.02	2759.33	32.95	2759.92	34.76	2760.47
35.14	2760.6	35.95	2760.87	36.89	2761.2	39.87	2762.26	40.8	2762.27

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	9.97	.035	39.87	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9.97	39.87	0	0	0	.3	.5

CROSS SECTION OUTPUT Profile #100-Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	2761.95	Element			
Vel Head (ft)	0.06	Wt. n-Val.		0.035	
W.S. Elev (ft)	2761.89	Reach Len. (ft)			
Crit W.S. (ft)	2759.69	Flow Area (sq ft)		59.79	
E.G. Slope (ft/ft)	0.000722	Area (sq ft)		59.79	
Q Total (cfs)	113.00	Flow (cfs)		113.00	
Top Width (ft)	26.41	Top Width (ft)		26.41	
Vel Total (ft/s)	1.89	Avg. Vel. (ft/s)		1.89	
Max Chl Dpth (ft)	4.53	Hydr. Depth (ft)		2.26	
Conv. Total (cfs)	4204.7	Conv. (cfs)		4204.7	
Length Wtd. (ft)		Wetted Per. (ft)		28.04	
Min Ch El (ft)	2757.36	Shear (lb/sq ft)		0.10	
Alpha	1.00	Stream Power (lb/ft s)		0.18	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

SUMMARY OF MANNING'S N VALUES

11515 HOUGHTON ROAD
CP GE1-CP GE4
EXIST HYDRAULIC ANALYSIS

River:Bashas SD

Reach	River Sta.	n1	n2	n3
GS1-GS6	1695	.05	.04	.05
GS1-GS6	1635	.05	.04	.05
GS1-GS6	1500	.05	.04	.05
GS1-GS6	1400	.05	.04	.05
GS1-GS6	1345	.05	.04	.05
GS1-GS6	1340.5	Culvert		
GS1-GS6	1275	.05	.04	.05
GS1-GS6	1200	.05	.04	.05
GS1-GS6	1142	.05	.04	.05
GS1-GS6	1134.9	Culvert		
GS1-GS6	1077	.05	.035	.05
GS1-GS6	1048	.05	.035	.05

SUMMARY OF REACH LENGTHS

River: Bashas SD

Reach	River Sta.	Left	Channel	Right
GS1-GS6	1695	65	60	55
GS1-GS6	1635	140	135	130
GS1-GS6	1500	105	100	95
GS1-GS6	1400	55	55	55
GS1-GS6	1345	70	70	70
GS1-GS6	1340.5	Culvert		
GS1-GS6	1275	75	75	75
GS1-GS6	1200	58	58	58
GS1-GS6	1142	65	65	65
GS1-GS6	1134.9	Culvert		
GS1-GS6	1077	20	28	35
GS1-GS6	1048	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Bashas SD

Reach	River Sta.	Contr.	Expan.
GS1-GS6	1695	.1	.3
GS1-GS6	1635	.1	.3
GS1-GS6	1500	.1	.3
GS1-GS6	1400	.3	.5
GS1-GS6	1345	.3	.5
GS1-GS6	1340.5	Culvert	
GS1-GS6	1275	.3	.5
GS1-GS6	1200	.3	.5
GS1-GS6	1142	.3	.5
GS1-GS6	1134.9	Culvert	
GS1-GS6	1077	.3	.5
GS1-GS6	1048	.3	.5

11515 HOUGHTON ROAD
CP GE1-CP GE4
EXIST HYDRAULIC ANALYSIS

Profile Output Table - Standard Table 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
GS1-GS6	1695	100-Year	84.00	2771.40	2773.06	2773.06	2773.42	0.027051	4.87	17.26	24.03	1.01
GS1-GS6	1635	100-Year	84.00	2769.99	2771.31	2771.27	2771.65	0.023025	4.66	18.01	23.70	0.94
GS1-GS6	1500	100-Year	84.00	2766.41	2767.90	2767.90	2768.22	0.028161	4.57	18.39	29.10	1.01
GS1-GS6	1400	100-Year	84.00	2764.65	2766.61	2765.73	2766.65	0.002044	1.58	53.31	58.46	0.29
GS1-GS6	1345	100-Year	84.00	2763.47	2766.56	2764.61	2766.60	0.000494	1.62	51.70	60.45	0.17
GS1-GS6	1340.5		Culvert									
GS1-GS6	1275	100-Year	113.00	2761.76	2763.21	2763.21	2763.94	0.020532	6.83	16.55	34.70	1.00
GS1-GS6	1200	100-Year	113.00	2760.58	2762.49	2761.53	2762.51	0.000753	1.17	96.71	78.58	0.19
GS1-GS6	1142	100-Year	113.00	2758.52	2762.28	2760.51	2762.41	0.001619	2.97	38.09	42.89	0.29
GS1-GS6	1134.9		Culvert									
GS1-GS6	1077	100-Year	113.00	2757.71	2761.93	2759.59	2761.97	0.000471	1.62	69.95	28.47	0.18
GS1-GS6	1048	100-Year	113.00	2757.36	2761.89	2759.69	2761.95	0.000722	1.89	59.79	26.41	0.22

Profile Output Table - Standard Table 2

Reach	River Sta	Profile	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
GS1-GS6	1695	100-Year	2773.42	2773.06	0.37	1.49	0.01		84.00		24.03
GS1-GS6	1635	100-Year	2771.65	2771.31	0.34	3.43	0.00		84.00		23.70
GS1-GS6	1500	100-Year	2768.22	2767.90	0.32	0.51	0.09		84.00		29.10
GS1-GS6	1400	100-Year	2766.65	2766.61	0.04	0.05	0.00		84.00		58.46
GS1-GS6	1345	100-Year	2766.60	2766.56	0.04				84.00		60.45
GS1-GS6	1340.5		Culvert								
GS1-GS6	1275	100-Year	2763.94	2763.21	0.72	0.16	0.35		113.00		34.70
GS1-GS6	1200	100-Year	2762.51	2762.49	0.02	0.06	0.03		113.00		78.58
GS1-GS6	1142	100-Year	2762.41	2762.28	0.14				113.00		42.89
GS1-GS6	1134.9		Culvert								
GS1-GS6	1077	100-Year	2761.97	2761.93	0.04	0.02	0.00		113.00		28.47
GS1-GS6	1048	100-Year	2761.95	2761.89	0.06				113.00		26.41

11515 HOUGHTON ROAD
CP GE1-CP GE4
EXIST HYDRAULIC ANALYSIS

Profile Output Table - Culvert Only

Reach	River Sta		Profile	E.G. US.	W.S. US.	E.G. IC	E.G. OC	Min El Weir Flow	Q Culv Group	Q Weir	Delta WS	Culv Vel US	Culv Vel DS
				(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(ft)	(ft/s)	(ft/s)
GS1-GS6	1340.5	Culvert #1	100-Year	2766.60	2766.56	2766.38	2766.60	2767.01	84.00		3.35	7.61	11.55
GS1-GS6	1134.9	Culvert #1	100-Year	2762.42	2762.28	2761.57	2762.42	2763.62	113.00		0.35	4.76	4.68

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : GE1-GE4EXST

River: Bashas SD Reach: GS1-GS6 RS: 1695 Profile: 100-Year
Warning:The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: Bashas SD Reach: GS1-GS6 RS: 1635 Profile: 100-Year
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Bashas SD Reach: GS1-GS6 RS: 1500 Profile: 100-Year
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: Bashas SD Reach: GS1-GS6 RS: 1400 Profile: 100-Year
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.
River: Bashas SD Reach: GS1-GS6 RS: 1345 Profile: 100-Year
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Bashas SD Reach: GS1-GS6 RS: 1340.5 Profile: 100-Year Culv: Culvert #1
Note: The flow in the culvert is entirely supercritical.
River: Bashas SD Reach: GS1-GS6 RS: 1275 Profile: 100-Year
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
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.
    Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
        the need for additional cross sections.
    Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
        water surface came back below critical depth.  This indicates that there is not a valid subcritical answer.  The
        program defaulted to critical depth.
    Note:   Multiple critical depths were found at this location.  The critical depth with the lowest, valid, energy was used.
River: Bashas SD  Reach: GS1-GS6     RS: 1200     Profile: 100-Year
    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.
River: Bashas SD  Reach: GS1-GS6     RS: 1142     Profile: 100-Year
    Note:   Multiple critical depths were found at this location.  The critical depth with the lowest, valid, energy was used.
```

HEC-RAS Plan: GE1-GE4EXST River: Bashas SD Reach: GS1-GS6 Profile: 100-Year

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
GS1-GS6	1695	100-Year	84.00	2771.40	2773.06	2773.06	2773.42	0.027051	4.87	17.26	24.03	1.01
GS1-GS6	1635	100-Year	84.00	2769.99	2771.31	2771.27	2771.65	0.023025	4.66	18.01	23.70	0.94
GS1-GS6	1500	100-Year	84.00	2766.41	2767.90	2767.90	2768.22	0.028161	4.57	18.39	29.10	1.01
GS1-GS6	1400	100-Year	84.00	2764.65	2766.61	2765.73	2766.65	0.002044	1.58	53.31	58.46	0.29
GS1-GS6	1345	100-Year	84.00	2763.47	2766.56	2764.61	2766.60	0.000494	1.62	51.70	60.45	0.17
GS1-GS6	1340.5		Culvert									
GS1-GS6	1275	100-Year	113.00	2761.76	2763.21	2763.21	2763.94	0.020532	6.83	16.55	34.70	1.00
GS1-GS6	1200	100-Year	113.00	2760.58	2762.49	2761.53	2762.51	0.000753	1.17	96.71	78.58	0.19
GS1-GS6	1142	100-Year	113.00	2758.52	2762.28	2760.51	2762.41	0.001619	2.97	38.09	42.89	0.29
GS1-GS6	1134.9		Culvert									
GS1-GS6	1077	100-Year	113.00	2757.71	2761.93	2759.59	2761.97	0.000471	1.62	69.95	28.47	0.18
GS1-GS6	1048	100-Year	113.00	2757.36	2761.89	2759.69	2761.95	0.000722	1.89	59.79	26.41	0.22

HEC-RAS Plan: GE1-GE4EXST River: Bashas SD Reach: GS1-GS6 Profile: 100-Year

Reach	River Sta	Profile	E.G. US.	W.S. US.	E.G. IC	E.G. OC	Min El Weir Flow	Q Culv Group	Q Weir	Delta WS	Culv Vel US	Culv Vel DS
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(ft)	(ft/s)	(ft/s)
GS1-GS6	1340.5 Culvert #1	100-Year	2766.60	2766.56	2766.38	2766.60	2767.01	84.00		3.35	7.61	11.55
GS1-GS6	1134.9 Culvert #1	100-Year	2762.42	2762.28	2761.57	2762.42	2763.62	113.00		0.35	4.76	4.68

B-3

KENSINGTON WASH

PB PROJ NO. 11515
CP H5 & H6
EXISTING CONDITION

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                    HEC-RAS Version 3.1.3 May 2005
                     U.S. Army Corp 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: exst condition swale east side swale
Project File : cph6exst.prj
Run Date and Time: 2/27/2008 11:11:58 AM

Project in English units

Project Description:
EXISTING CONDITION --
ROADSIDE SWALE ALONG EAST SIDE OF HOUGHTON ROAD
CP H5
TO CP H6
DETERMINE THE CAPACITY OF THIS EXISTING SWALE

PLAN DATA

Plan Title: exst condition east swale capacity
Plan File : l:\11515\Drainage\HECRAS\CPH6 STA17750-18300\cph6exst.p01

Geometry Title: cp h5 eastside swale exst cond
Geometry File : l:\11515\Drainage\HECRAS\CPH6 STA17750-18300\cph6exst.g01

Flow Title : cp h5 & h6 Combined
Flow File : l:\11515\Drainage\HECRAS\CPH6 STA17750-18300\cph6exst.f01

Plan Description:
CP H5 & H6
Exist Condition
Split Flow Analysis

Plan Summary Information:

Number of:	Cross Sections	= 21	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 0	Lateral Structures	=	6

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed at all cross sections
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

PB PROJ NO. 11515
CP H5 & H6
EXISTING CONDITION

FLOW DATA

Flow Title: cp h5 & h6 Combined
Flow File : 1:\11515\Drainage\HECRAS\CPH6 STA17750-18300\cph6exst.f01

Flow Data (cfs)

River	Reach	RS	PF 1
EAST SWALE	CP H6-H5	18600	42
EAST SWALE	CP H6-H5	18250	106

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
EAST SWALE	CP H6-H5	PF 1	Critical	Normal S = 0.02

GEOMETRY DATA

Geometry Title: cp h5 eastside swale exst cond
Geometry File : 1:\11515\Drainage\HECRAS\CPH6 STA17750-18300\cph6exst.g01

CROSS SECTION

RIVER: EAST SWALE
REACH: CP H6-H5 RS: 18600

INPUT
Description:
Station Elevation Data num= 86

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2812.3	.59	2812.3	3.65	2812.26	11.9	2812.27	18.97	2811.77
23.15	2811.45	26.93	2811.52	28.62	2811.53	40.45	2811.33	40.5	2811.33
40.58	2811.33	51.88	2810.9	56.97	2810.49	59.11	2810.34	61.88	2810.15
62.08	2810.14	69.38	2809.73	73.48	2809.41	76.05	2809.2	76.88	2809.18
77.92	2809.12	82.84	2808.9	83.9	2808.71	85.85	2808.4	86.49	2808.57
87.59	2808.71	88.88	2808.88	89.77	2808.87	91.73	2808.62	93.35	2808.63
94.65	2808.55	95.99	2808.53	97.61	2808.52	100.33	2808.47	101.68	2808.32
104.48	2808.24	106.28	2808.21	107.76	2808.06	108.3	2808.03	108.47	2808.02
108.68	2808.01	124.81	2807.29	125.26	2807.27	125.55	2807.27	126.31	2807.19
128.04	2807.06	132.2	2806.87	136.1	2806.59	136.82	2806.57	139.24	2806.53
141.64	2806.49	145.68	2806.48	146.63	2806.47	151.12	2806.27	151.22	2806.27
151.27	2806.27	151.76	2806.26	154.9	2806.16	157.65	2806.08	158.26	2806.05
158.53	2806.06	164.17	2806.03	164.96	2806.02	180.99	2806.12	183.81	2806.13
184.8	2806.15	201.13	2806.17	206.33	2806.18	207.49	2806.27	207.73	2806.29
208.58	2806.33	211.96	2806.52	217.5	2806.87	219.99	2807.53	221.97	2807.82
223.84	2808.11	227.32	2808.71	227.68	2808.71	227.72	2808.71	231.39	2808.74
234.13	2808.77	236.33	2808.85	240.09	2808.94	243.76	2808.97	246.47	2809.23
250	2809.52								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.022	88.88	.035	227.68	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
88.88	227.68	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2806.52	Element			
Vel Head (ft)	0.08	Wt. n-Val.		0.035	
W.S. Elev (ft)	2806.44	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2806.38	Flow Area (sq ft)		18.51	
E.G. Slope (ft/ft)	0.014701	Area (sq ft)		18.51	
Q Total (cfs)	42.00	Flow (cfs)		42.00	
Top Width (ft)	63.24	Top Width (ft)		63.24	
Vel Total (ft/s)	2.27	Avg. Vel. (ft/s)		2.27	
Max Chl Dpth (ft)	0.42	Hydr. Depth (ft)		0.29	

PB PROJ NO. 11515
CP H5 & H6
EXISTING CONDITION

Conv. Total (cfs)	346.4	Conv. (cfs)		346.4	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		63.26	
Min Ch El (ft)	2806.02	Shear (lb/sq ft)		0.27	
Alpha	1.00	Stream Power (lb/ft s)		0.61	
Frctn Loss (ft)	0.99	Cum Volume (acre-ft)	0.10	0.32	0.07
C & E Loss (ft)	0.01	Cum SA (acres)	0.35	0.65	0.19

CROSS SECTION

RIVER: EAST SWALE
REACH: CP H6-H5 RS: 18550

INPUT
Description:
Station Elevation Data num= 99

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2810.5	.63	2810.51	6.69	2810.38	11.71	2810.37	13.97	2810.15
14.65	2810.09	15.5	2810.03	16.54	2809.96	17.83	2809.87	18.58	2809.82
19.8	2809.74	20.09	2809.71	24.02	2809.37	24.64	2809.34	29.03	2809.27
35.35	2809.23	39.66	2809.21	50.84	2808.83	51.51	2808.81	51.56	2808.8
51.86	2808.77	52.79	2808.69	59.43	2808.15	61.63	2808.03	65.85	2807.87
67.22	2807.81	67.58	2807.8	68.07	2807.79	69.89	2808.06	70.98	2808.23
71.53	2808.19	74.92	2807.96	76.63	2807.84	78.84	2807.54	83.48	2806.84
86.08	2807.07	86.95	2807.1	90.09	2806.81	90.74	2806.77	94.41	2806.54
94.64	2806.53	98.24	2806.32	98.68	2806.31	102.18	2806.2	103.76	2806.11
107.33	2805.96	107.86	2805.88	109.49	2805.8	116.82	2805.38	118.04	2805.33
120.78	2805.29	122.34	2805.28	123.62	2805.26	126.26	2805.27	130.72	2805.26
131.31	2805.27	131.69	2805.26	142.94	2805.05	143.21	2805.05	144.67	2804.99
149.33	2804.8	150.17	2804.77	151.03	2804.76	152.44	2804.75	154.1	2804.78
159.98	2804.9	161.76	2805.21	166.34	2806.09	167.07	2806.12	168.69	2806.15
170.94	2806.16	171.24	2806.18	174.08	2806.23	177.37	2806.24	179.03	2806.26
181.78	2806.26	182.56	2806.25	184.2	2806.22	186.14	2806.23	196.01	2806.77
198.1	2806.89	198.57	2806.92	205	2807.03	207.36	2807.12	209.41	2807.18
211.61	2807.27	215.53	2807.45	215.76	2807.46	219.72	2807.52	221.55	2807.52
224.15	2807.53	228.61	2807.59	229.59	2807.62	233.45	2807.83	234.21	2807.88
240.63	2808.32	242.03	2808.41	243.82	2808.47	250	2809.06		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.022	86.95	.035	166.34	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
86.95	166.34	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2805.53	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.		0.035	
W.S. Elev (ft)	2805.38	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2805.38	Flow Area (sq ft)		13.39	
E.G. Slope (ft/ft)	0.028103	Area (sq ft)		13.39	
Q Total (cfs)	42.00	Flow (cfs)		42.00	
Top Width (ft)	45.69	Top Width (ft)		45.69	
Vel Total (ft/s)	3.14	Avg. Vel. (ft/s)		3.14	
Max Chl Dpth (ft)	0.63	Hydr. Depth (ft)		0.29	
Conv. Total (cfs)	250.5	Conv. (cfs)		250.5	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		45.74	
Min Ch El (ft)	2804.75	Shear (lb/sq ft)		0.51	
Alpha	1.00	Stream Power (lb/ft s)		1.61	
Frctn Loss (ft)	1.31	Cum Volume (acre-ft)	0.10	0.31	0.07
C & E Loss (ft)	0.01	Cum SA (acres)	0.35	0.58	0.19

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

PB PROJ NO. 11515
CP H5 & H6
EXISTING CONDITION
CROSS SECTION

RIVER: EAST SWALE
REACH: CP H6-H5 RS: 18500

INPUT
Description:
Station Elevation Data num= 94

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2808.57	.36	2808.57	5.29	2808.64	11.99	2808.61	16.67	2808.41
16.76	2808.4	16.89	2808.38	17.44	2808.27	20.22	2807.73	22.52	2807.36
24.78	2806.98	25.22	2807.02	26.16	2807.08	27.82	2807.2	35.75	2807.06
39.27	2807.06	43.03	2806.95	51.26	2806.68	58.26	2806	58.37	2805.99
60.92	2806.41	61.16	2806.44	61.74	2806.42	73.57	2805.95	73.58	2805.95
73.64	2805.95	78.2	2806.02	79.29	2806.04	85.71	2806.3	86.18	2806.3
93.58	2806.24	94.33	2806.06	96.65	2805.54	103.81	2803.85	108.97	2803.61
112.83	2803.42	115.82	2803.4	116.56	2803.38	118.73	2803.35	120.35	2803.36
124.22	2803.24	125.49	2803.2	128.98	2803.37	129.66	2803.4	130.07	2803.43
135.29	2804.42	136.69	2804.69	140.31	2804.74	141.51	2804.79	142.77	2804.81
146.08	2804.92	148.48	2804.87	151.21	2804.9	153.55	2804.86	156.81	2804.74
161.57	2804.39	162.39	2804.32	163.83	2804.19	164.52	2804.19	167.09	2804.17
167.9	2804.16	168.55	2804.16	168.82	2804.16	178.14	2804.04	179.28	2804.05
182.61	2804.02	183.68	2804.01	189.4	2804.46	193.19	2804.74	195.12	2805.2
199.9	2806.34	204.89	2807.95	207.94	2808.97	209.4	2809.11	211.34	2809.78
213.52	2810.03	216.42	2810.45	218.08	2810.57	218.87	2810.52	222.06	2809.83
222.72	2809.63	223.07	2809.58	224.41	2809.52	226.23	2809.45	227.48	2809.45
228.66	2809.51	230.38	2809.47	231.68	2809.47	232.86	2809.47	234.36	2809.57
240.42	2809.73	240.63	2809.73	244.19	2809.62	246.74	2809.5		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.022	93.58	.035	136.69	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
93.58	136.69	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2804.07	Element			
Vel Head (ft)	0.21	Wt. n-Val.		0.035	
W.S. Elev (ft)	2803.86	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2803.86	Flow Area (sq ft)		11.54	
E.G. Slope (ft/ft)	0.024654	Area (sq ft)		11.54	
Q Total (cfs)	42.00	Flow (cfs)		42.00	
Top Width (ft)	28.56	Top Width (ft)		28.56	
Vel Total (ft/s)	3.64	Avg. Vel. (ft/s)		3.64	
Max Chl Dpth (ft)	0.66	Hydr. Depth (ft)		0.40	
Conv. Total (cfs)	267.5	Conv. (cfs)		267.5	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		28.62	
Min Ch El (ft)	2803.20	Shear (lb/sq ft)		0.62	
Alpha	1.00	Stream Power (lb/ft s)		2.26	
Frctn Loss (ft)	1.25	Cum Volume (acre-ft)	0.10	0.29	0.07
C & E Loss (ft)	0.00	Cum SA (acres)	0.35	0.54	0.19

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: EAST SWALE
REACH: CP H6-H5 RS: 18450

INPUT
Description:
Station Elevation Data num= 99

PB PROJ NO. 11515
CP H5 & H6
EXISTING CONDITION

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2806.5	11.95	2806.73	16.78	2806.49	20.98	2805.6	25.54	2804.93
27.97	2805.09	39.36	2805.08	51.31	2804.7	52.03	2804.62	52.32	2804.61
55.37	2804.33	59.6	2803.96	59.9	2803.95	60.54	2803.95	60.74	2803.94
61.18	2803.94	61.57	2803.93	62.54	2803.93	64.2	2803.95	65.01	2803.94
66.35	2803.96	68.28	2803.94	72.28	2803.84	73.04	2803.8	75.26	2803.75
76.04	2803.75	77.17	2803.69	78.72	2803.7	79.5	2803.69	80.9	2803.64
81.43	2803.61	81.95	2803.55	83.01	2803.43	83.38	2803.42	84.18	2803.34
84.51	2803.33	84.91	2803.3	85.36	2803.29	88.77	2803.1	89.63	2803.07
91.8	2802.92	92.11	2802.91	96.24	2802.63	98.85	2802.48	101.95	2802.35
102.13	2802.33	103	2802.3	103.23	2802.28	104.98	2802.22	108.17	2802.1
112.71	2801.91	113.67	2801.88	114.56	2801.87	115.8	2801.9	121.5	2801.94
121.96	2801.96	128.9	2802.44	130.58	2802.53	131.55	2802.55	133.33	2802.62
134.56	2802.7	136.85	2802.77	143.66	2802.93	146.13	2802.98	148.34	2803.07
150.6	2803.07	160.3	2803.22	161.75	2803.22	163.08	2803.24	163.43	2803.25
163.74	2803.25	164.36	2803.29	165.76	2803.34	168.82	2803.42	169.78	2803.46
173.63	2803.63	175.12	2803.68	176.71	2803.71	178.09	2803.77	179	2803.83
179.69	2803.9	180.46	2803.93	190.79	2804.23	192.15	2804.3	195.2	2804.6
199.96	2805.16	202.33	2805.45	204.94	2805.68	206.77	2805.81	208.59	2805.94
211.82	2805.99	215.66	2805.97	217.46	2805.99	220.18	2806.1	224.64	2806.22
229.92	2807.21	233.69	2807.84	239.3	2808.88	248.67	2809.51		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.022	80.9	.035	136.85	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
80.9	136.85	50	50	50	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
153	248.67	2805

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2802.70	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.19	Wt. n-Val.		0.035	
W.S. Elev (ft)	2802.50	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2802.50	Flow Area (sq ft)		11.92	
E.G. Slope (ft/ft)	0.025314	Area (sq ft)		11.92	
Q Total (cfs)	42.00	Flow (cfs)		42.00	
Top Width (ft)	31.60	Top Width (ft)		31.60	
Vel Total (ft/s)	3.52	Avg. Vel. (ft/s)		3.52	
Max Chl Dpth (ft)	0.63	Hydr. Depth (ft)		0.38	
Conv. Total (cfs)	264.0	Conv. (cfs)		264.0	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		31.63	
Min Ch El (ft)	2801.87	Shear (lb/sq ft)		0.60	
Alpha	1.00	Stream Power (lb/ft s)		2.10	
Frctn Loss (ft)	0.71	Cum Volume (acre-ft)	0.10	0.28	0.07
C & E Loss (ft)	0.02	Cum SA (acres)	0.35	0.51	0.19

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: EAST SWALE
REACH: CP H6-H5 RS: 18400

INPUT
Description:
Station Elevation Data num= 85

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2804.69	.22	2804.69	.92	2804.7	11.95	2804.75	14.82	2804.58
16.47	2804.49	16.53	2804.49	16.62	2804.47	16.65	2804.47	16.69	2804.47
16.79	2804.45	17.23	2804.4	20.36	2804.04	22.93	2803.64	25.37	2803.22

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CP H5 & H6
EXISTING CONDITION

25.69	2803.28	27.82	2803.31	35.73	2803.16	38.95	2803.1	39.2	2803.1
45.54	2802.92	51.38	2802.77	52.64	2802.54	52.96	2802.46	53.43	2802.41
54.3	2802.3	55.79	2802.01	57.52	2801.68	58.83	2801.44	60.26	2801.57
62.54	2801.72	65.36	2801.58	67.67	2801.45	69.08	2801.28	69.97	2801.19
70.5	2801.22	72.92	2801.42	75.89	2801.45	77.24	2801.48	83.97	2800.99
84.35	2800.96	84.95	2801.06	89.3	2801.86	91.8	2801.18	97.49	2800.04
102.68	2799.99	103.69	2799.99	104.08	2799.99	107.98	2799.91	109.99	2800.08
112.62	2800.22	112.86	2800.22	113.38	2800.24	113.74	2800.14	115.71	2800.1
115.82	2800.21	115.96	2800.23	116.39	2800.31	117.32	2800.35	118.77	2800.42
119.35	2800.45	120.1	2800.5	120.43	2800.53	120.64	2800.55	121.03	2800.58
123.74	2800.9	125.18	2801.05	125.64	2801.1	125.85	2801.12	126.21	2801.16
127.08	2801.24	127.26	2801.26	128.25	2801.36	128.31	2801.37	128.33	2801.37
129.22	2801.47	130.16	2801.75	130.58	2801.88	130.69	2801.92	131.05	2802.05
142.39	2802.87	144.01	2802.97	145.08	2802.98	145.64	2802.98	150	2803

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.022	89.3	.035	131.05	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
89.3	131.05	50	50	50	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
135	150	2805

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2800.84	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.		0.035	
W.S. Elev (ft)	2800.73	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2800.57	Flow Area (sq ft)		15.57	
E.G. Slope (ft/ft)	0.009005	Area (sq ft)		15.57	
Q Total (cfs)	42.00	Flow (cfs)		42.00	
Top Width (ft)	28.24	Top Width (ft)		28.24	
Vel Total (ft/s)	2.70	Avg. Vel. (ft/s)		2.70	
Max Chl Dpth (ft)	0.82	Hydr. Depth (ft)		0.55	
Conv. Total (cfs)	442.6	Conv. (cfs)		442.6	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		28.41	
Min Ch El (ft)	2799.91	Shear (lb/sq ft)		0.31	
Alpha	1.00	Stream Power (lb/ft s)		0.83	
Frctn Loss (ft)	0.63	Cum Volume (acre-ft)	0.10	0.26	0.07
C & E Loss (ft)	0.01	Cum SA (acres)	0.35	0.47	0.19

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: EAST SWALE
REACH: CP H6-H5 RS: 18350

INPUT
Description:
Station Elevation Data num= 69

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2802.86	.25	2802.86	3.59	2802.94	12.03	2803.05	15.28	2802.81
16.71	2802.69	18.81	2802.52	19.37	2802.47	20.38	2802.32	20.67	2802.3
23.25	2802	25.57	2801.72	26.62	2801.63	27.14	2801.61	27.42	2801.58
28.19	2801.61	32.21	2801.55	39.66	2801.43	45.28	2801.24	51.41	2801.05
54.51	2800.58	55.78	2800.38	56.06	2800.36	58.13	2800.2	61.18	2800.3
61.86	2800.32	65.49	2800.18	71.56	2799.94	72.48	2800.12	76.79	2801.1
81.64	2799.76	82.31	2799.58	82.86	2799.53	86.74	2799.28	88.67	2799.15
89	2799.13	89.62	2799.15	93.09	2799.25	94.54	2799.25	95.39	2799.23
96.25	2799.44	98.1	2799.93	99.62	2800.13	99.71	2800.14	107.22	2800.05
107.27	2800.05	107.29	2800.05	107.35	2800.05	107.38	2800.05	107.48	2800.04
114.57	2799.73	115.38	2799.65	116.17	2799.68	116.85	2799.71	118.14	2799.84
120.44	2800	123	2800.22	124.08	2800.26	125.3	2801.09	125.76	2801.46
128.35	2802.02	129.87	2802.36	130.2	2802.36	130.58	2802.37	133.53	2802.43
144.73	2802.64	146.23	2802.65	148.5	2802.57	150.01	2802.58		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val

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CP H5 & H6
EXISTING CONDITION

0	.022	51.41	.035	99.71	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
51.41	99.71	50	50	50	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
133	150.01	2805

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2800.20	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	Wt. n-Val.		0.035	0.080
W.S. Elev (ft)	2799.96	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2799.96	Flow Area (sq ft)		10.21	1.59
E.G. Slope (ft/ft)	0.019216	Area (sq ft)		10.21	1.59
Q Total (cfs)	42.00	Flow (cfs)		40.85	1.15
Top Width (ft)	28.65	Top Width (ft)		18.06	10.59
Vel Total (ft/s)	3.56	Avg. Vel. (ft/s)		4.00	0.73
Max Chl Dpth (ft)	0.83	Hydr. Depth (ft)		0.57	0.15
Conv. Total (cfs)	303.0	Conv. (cfs)		294.7	8.3
Length Wtd. (ft)	50.00	Wetted Per. (ft)		18.22	10.61
Min Ch El (ft)	2799.13	Shear (lb/sq ft)		0.67	0.18
Alpha	1.23	Stream Power (lb/ft s)		2.69	0.13
Frctn Loss (ft)	1.02	Cum Volume (acre-ft)	0.10	0.25	0.07
C & E Loss (ft)	0.00	Cum SA (acres)	0.35	0.45	0.18

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: EAST SWALE
REACH: CP H6-H5 RS: 18300

INPUT
Description:
Station Elevation Data num= 68

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2801.12	.31	2801.12	6.43	2801.16	12.02	2801.26	14.06	2801.11
16.89	2801.07	20.61	2800.5	20.63	2800.49	20.76	2800.47	24.81	2799.94
26.11	2799.93	26.88	2799.96	27.22	2799.98	28.07	2800.04	31.76	2800.02
39.44	2799.98	45.92	2799.76	51.68	2799.56	53.62	2799.36	57.55	2798.98
57.77	2799.01	57.89	2799.02	59.43	2798.87	63.51	2798.73	71.41	2797.86
72.61	2797.73	74.18	2798.09	74.9	2798.3	76.94	2798.17	77.04	2798.17
77.07	2798.19	78.69	2799.28	84.34	2799.67	90.06	2799.97	92.07	2801.53
93.83	2802.15	95.03	2801.99	97.56	2801.75	98.23	2802.03	99.76	2802.45
102.37	2802.99	103.36	2803.06	106.77	2803.28	107.43	2803.18	107.75	2803.11
110.43	2802.42	111.84	2801.84	113.99	2800.76	116.35	2800.87	121.73	2801.05
121.8	2801.06	121.93	2801.06	127.26	2801.53	128.72	2801.78	128.84	2801.78
130.27	2801.86	132.59	2802.14	134.06	2802.28	135.34	2802.51	135.95	2802.53
136.85	2802.5	138.48	2802.39	140.84	2802.23	140.97	2802.22	141.05	2802.22
144.06	2802.32	147.76	2802.42	150	2802.46				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.022	51.68	.035	92.07	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
51.68	92.07	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2799.15	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.26	Wt. n-Val.		0.035	
W.S. Elev (ft)	2798.89	Reach Len. (ft)	50.00	50.00	50.00

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CP H5 & H6
EXISTING CONDITION

Crit W.S. (ft)	2798.89	Flow Area (sq ft)		10.26	
E.G. Slope (ft/ft)	0.021511	Area (sq ft)		10.26	
Q Total (cfs)	42.00	Flow (cfs)		42.00	
Top Width (ft)	18.91	Top Width (ft)		18.91	
Vel Total (ft/s)	4.09	Avg. Vel. (ft/s)		4.09	
Max Chl Dpth (ft)	1.16	Hydr. Depth (ft)		0.54	
Conv. Total (cfs)	286.4	Conv. (cfs)		286.4	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		19.27	
Min Ch El (ft)	2797.73	Shear (lb/sq ft)		0.72	
Alpha	1.00	Stream Power (lb/ft s)		2.93	
Frctn Loss (ft)	0.91	Cum Volume (acre-ft)	0.10	0.24	0.07
C & E Loss (ft)	0.01	Cum SA (acres)	0.35	0.42	0.17

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: EAST SWALE
REACH: CP H6-H5 RS: 18250

INPUT
Description:
Station Elevation Data num= 51

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2799.39	11.96	2799.48	16.85	2799.37	17.81	2799.28	18.14	2799.28
18.82	2799.22	20.31	2799.13	21.87	2798.94	25.73	2798.42	25.99	2798.47
27.95	2798.5	35.92	2798.44	40.18	2798.39	48.89	2798.14	51	2798.069
51.86	2798.04	53.85	2797.81	57.92	2797.57	62.43	2797.55	63.74	2797.45
65.16	2797.4	67.61	2797.18	73.76	2796.55	77.44	2796.31	79.03	2796.61
80.27	2796.81	82.92	2796.84	87.99	2796.84	94.07	2796.5	102.59	2796.44
103.13	2796.47	108.76	2796.67	109.58	2796.78	110.89	2796.89	113.75	2796.69
116.2	2796.71	119.3	2796.84	120.55	2796.94	122.1	2796.99	124.54	2797.17
127.06	2797.26	129.17	2797.4	132.97	2797.6	134.65	2797.7	136.97	2797.72
138.59	2797.76	140.88	2797.79	144.98	2798.08	146.4	2798.14	149.22	2798.36
150.01	2798.45								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.018	51	.035	110.89	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
51	110.89	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2797.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.22	Wt. n-Val.		0.035	0.080
W.S. Elev (ft)	2797.24	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2797.20	Flow Area (sq ft)		25.65	5.42
E.G. Slope (ft/ft)	0.017204	Area (sq ft)		25.65	5.42
Q Total (cfs)	106.00	Flow (cfs)		99.50	6.50
Top Width (ft)	59.68	Top Width (ft)		43.98	15.70
Vel Total (ft/s)	3.41	Avg. Vel. (ft/s)		3.88	1.20
Max Chl Dpth (ft)	0.93	Hydr. Depth (ft)		0.58	0.35
Conv. Total (cfs)	808.2	Conv. (cfs)		758.6	49.6
Length Wtd. (ft)	50.00	Wetted Per. (ft)		44.10	15.72
Min Ch El (ft)	2796.31	Shear (lb/sq ft)		0.62	0.37
Alpha	1.22	Stream Power (lb/ft s)		2.42	0.44
Frctn Loss (ft)	0.96	Cum Volume (acre-ft)	0.10	0.22	0.07
C & E Loss (ft)	0.00	Cum SA (acres)	0.35	0.39	0.16

CROSS SECTION

PB PROJ NO. 11515
CP H5 & H6
EXISTING CONDITION

RIVER: EAST SWALE
REACH: CP H6-H5 RS: 18200

INPUT
Description:
Station Elevation Data num= 51

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2797.93	3.69	2797.93	11.96	2797.88	15.68	2797.71	16.59	2797.69
18.39	2797.6	19.05	2797.59	20.22	2797.51	25.78	2796.72	26.89	2796.8
27.19	2796.85	27.35	2796.79	27.8	2796.85	39.99	2796.78	40.86	2796.74
51	2796.443	52.12	2796.41	57.28	2795.97	58.24	2795.89	59.15	2796
60.46	2796.13	65.2	2795.9	65.86	2795.86	69.83	2795.76	74.37	2795.55
77.56	2795.26	79.33	2795.53	80	2795.62	80.79	2795.6	87.7	2795.52
89.3	2795.51	90.07	2795.49	91.31	2795.48	94.84	2795.3	101.61	2796.08
103.19	2796.09	106.56	2796.14	110.14	2796.16	111.47	2796.21	121.34	2796.72
122.27	2796.76	124.72	2796.85	127.13	2796.92	129.2	2797.02	135.01	2797.43
137.78	2797.66	142.27	2797.97	144.42	2798.11	146.5	2798.28	148.08	2798.29
150	2798.44								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.018	51	.035	101.61	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
51	101.61	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2796.49	Element			
Vel Head (ft)	0.26	Wt. n-Val.		0.035	0.080
W.S. Elev (ft)	2796.23	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2796.23	Flow Area (sq ft)		25.55	0.95
E.G. Slope (ft/ft)	0.021614	Area (sq ft)		25.55	0.95
Q Total (cfs)	106.00	Flow (cfs)		105.46	0.54
Top Width (ft)	57.59	Top Width (ft)		47.37	10.22
Vel Total (ft/s)	4.00	Avg. Vel. (ft/s)		4.13	0.56
Max Chl Dpth (ft)	0.97	Hydr. Depth (ft)		0.54	0.09
Conv. Total (cfs)	721.0	Conv. (cfs)		717.4	3.6
Length Wtd. (ft)	50.00	Wetted Per. (ft)		47.50	10.23
Min Ch El (ft)	2795.26	Shear (lb/sq ft)		0.73	0.13
Alpha	1.06	Stream Power (lb/ft s)		3.00	0.07
Frctn Loss (ft)	1.09	Cum Volume (acre-ft)	0.10	0.19	0.06
C & E Loss (ft)	0.00	Cum SA (acres)	0.35	0.34	0.15

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: EAST SWALE
REACH: CP H6-H5 RS: 18150

INPUT
Description:
Station Elevation Data num= 51

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2796.41	.33	2796.41	3.99	2796.39	11.99	2796.28	14.13	2796.23
16.38	2796.15	20.1	2795.97	20.59	2795.93	24.71	2795.16	25.25	2795.17
26.06	2795.17	27.57	2795.26	31.32	2795.25	39.94	2795.14	51	2794.711
52.59	2794.65	52.83	2794.63	57.51	2794.36	61.21	2794.61	62.28	2794.6
65.41	2794.46	68.21	2794.27	69.96	2794.19	77.33	2794.26	79.6	2793.97
82.61	2793.62	84.41	2793.71	88.11	2794.01	90.07	2794.13	92.89	2794.35
93.5	2794.37	98.68	2794.46	100.47	2794.54	101.35	2794.74	104.17	2794.82
108.16	2794.87	111.48	2794.97	113.57	2795.05	116.99	2795.22	118.96	2795.24
121	2795.34	123.96	2795.59	128.81	2795.82	131.11	2796.08	134.18	2796.34
137.14	2796.5	138.22	2796.54	141.88	2796.72	144.61	2796.8	146.56	2796.92

PB PROJ NO. 11515
CP H5 & H6
EXISTING CONDITION
150.01 2797.04

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.018	51	.035	92.89	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
51	92.89	50	50	50	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
121	150.01	2795

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2795.09	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.28	Wt. n-Val.	0.018	0.035	0.080
W.S. Elev (ft)	2794.81	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2794.81	Flow Area (sq ft)	0.12	23.79	3.09
E.G. Slope (ft/ft)	0.021813	Area (sq ft)	0.12	23.79	3.09
Q Total (cfs)	106.00	Flow (cfs)	0.20	102.14	3.67
Top Width (ft)	55.27	Top Width (ft)	2.51	41.89	10.87
Vel Total (ft/s)	3.93	Avg. Vel. (ft/s)	1.63	4.29	1.19
Max Chl Dpth (ft)	1.19	Hydr. Depth (ft)	0.05	0.57	0.28
Conv. Total (cfs)	717.7	Conv. (cfs)	1.3	691.5	24.8
Length Wtd. (ft)	50.00	Wetted Per. (ft)	2.51	41.99	10.89
Min Ch El (ft)	2793.62	Shear (lb/sq ft)	0.07	0.77	0.39
Alpha	1.16	Stream Power (lb/ft s)	0.11	3.31	0.46
Frctn Loss (ft)	1.10	Cum Volume (acre-ft)	0.10	0.16	0.06
C & E Loss (ft)	0.02	Cum SA (acres)	0.35	0.28	0.14

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: EAST SWALE
REACH: CP H6-H5 RS: 18100

INPUT
Description:
Station Elevation Data num= 51

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2794.89	.16	2794.89	1.61	2794.88	12.04	2794.73	14.74	2794.58
17.18	2794.46	17.24	2794.45	17.49	2794.45	20.63	2794.18	24.71	2794.06
25.21	2793.95	26.6	2793.9	28.02	2793.89	35.76	2793.78	40.02	2793.79
43.12	2793.65	51	2793.422	51.75	2793.4	53.47	2793.39	53.96	2793.36
55.21	2793.28	56.55	2793.2	58.5	2793.33	59.49	2793.4	61.71	2793.32
68.64	2793.01	70.97	2792.96	73	2792.94	74.43	2793	77.46	2793.18
84.38	2793.17	89.24	2793.19	94.32	2793.11	96.48	2793.06	100.63	2792.84
103.14	2792.76	103.94	2792.82	109.4	2793.31	111.64	2793.5	115.14	2793.33
115.46	2793.32	115.95	2793.42	118.6	2793.92	119.75	2794.02	120.34	2794.06
120.7	2794.09	121.15	2794.12	121.41	2794.82	121.43	2794.83	144.3	2794.96
150	2794.98								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.018	51	.035	111.64	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
51	111.64	50	50	50	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
121	150	2795

CROSS SECTION OUTPUT Profile #PF 1

PB PROJ NO. 11515
CP H5 & H6
EXISTING CONDITION

E.G. Elev (ft)	2793.81	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.22	Wt. n-Val.	0.018	0.035	0.080
W.S. Elev (ft)	2793.59	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2793.59	Flow Area (sq ft)	0.50	27.66	0.89
E.G. Slope (ft/ft)	0.022387	Area (sq ft)	0.50	27.66	0.89
Q Total (cfs)	106.00	Flow (cfs)	1.19	104.05	0.76
Top Width (ft)	71.73	Top Width (ft)	5.87	60.64	5.22
Vel Total (ft/s)	3.65	Avg. Vel. (ft/s)	2.38	3.76	0.85
Max Chl Dpth (ft)	0.83	Hydr. Depth (ft)	0.08	0.46	0.17
Conv. Total (cfs)	708.5	Conv. (cfs)	7.9	695.4	5.1
Length Wtd. (ft)	50.00	Wetted Per. (ft)	5.87	60.71	5.25
Min Ch El (ft)	2792.76	Shear (lb/sq ft)	0.12	0.64	0.24
Alpha	1.05	Stream Power (lb/ft s)	0.28	2.40	0.20
Frctn Loss (ft)	0.71	Cum Volume (acre-ft)	0.10	0.13	0.06
C & E Loss (ft)	0.03	Cum SA (acres)	0.34	0.23	0.13

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: EAST SWALE
REACH: CP H6-H5 RS: 18050

INPUT
Description:
Station Elevation Data num= 51

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2793.68	.35	2793.69	9.15	2793.65	11.97	2793.66	12.81	2793.65
17.43	2793.48	18.62	2793.32	19.03	2793.31	20.48	2793.29	23.14	2792.98
25.24	2792.81	26.09	2792.81	26.89	2792.88	27.22	2792.92	27.83	2792.88
28.22	2792.91	32.98	2792.88	39.58	2792.89	43.29	2792.81	51	2792.595
51.54	2792.58	55.24	2792.46	56.67	2792.42	57.49	2792.39	59.08	2792.7
59.54	2792.78	68.84	2792.03	70.66	2792.01	73.41	2791.95	75.5	2792.08
78.68	2792.34	81.17	2792.31	93.48	2792.32	95.27	2792.33	105.77	2792.37
107.76	2792.47	110.11	2792.46	110.99	2792.48	114.28	2792.46	117.02	2792.46
123.49	2792.54	127.68	2792.48	131.61	2792.5	132.56	2792.51	141.88	2792.53
142.7	2792.57	143.06	2792.58	146.06	2792.75	147.95	2792.75	149.92	2792.72
150.01	2792.72								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.018	51	.035	107.76	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
51	107.76	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2792.99	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.	0.018	0.035	0.080
W.S. Elev (ft)	2792.88	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2792.78	Flow Area (sq ft)	1.65	31.48	14.79
E.G. Slope (ft/ft)	0.009777	Area (sq ft)	1.65	31.48	14.79
Q Total (cfs)	106.00	Flow (cfs)	3.42	89.13	13.45
Top Width (ft)	115.38	Top Width (ft)	16.37	56.76	42.25
Vel Total (ft/s)	2.21	Avg. Vel. (ft/s)	2.08	2.83	0.91
Max Chl Dpth (ft)	0.93	Hydr. Depth (ft)	0.10	0.55	0.35
Conv. Total (cfs)	1072.0	Conv. (cfs)	34.6	901.4	136.1
Length Wtd. (ft)	50.00	Wetted Per. (ft)	16.38	56.85	42.42
Min Ch El (ft)	2791.95	Shear (lb/sq ft)	0.06	0.34	0.21
Alpha	1.43	Stream Power (lb/ft s)	0.13	0.96	0.19
Frctn Loss (ft)	0.22	Cum Volume (acre-ft)	0.10	0.09	0.05
C & E Loss (ft)	0.02	Cum SA (acres)	0.33	0.16	0.10

PB PROJ NO. 11515
CP H5 & H6
EXISTING CONDITION

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: EAST SWALE
REACH: CP H6-H5 RS: 18000

INPUT
Description:
Station Elevation Data num= 50

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
11.86	2792.89	14.96	2792.73	19.65	2792.63	19.99	2792.68	25.18	2792.54
27.32	2792.36	27.76	2792.5	30.62	2792.51	38.82	2792.42	50.67	2792.21
51	2792.199	52.56	2792.15	53.56	2792.15	55.11	2792.1	57.6	2792.06
63.76	2791.53	66.1	2791.38	69.78	2790.97	70.73	2790.88	73.46	2791.1
74.01	2791.24	76.54	2791.43	82.12	2791.59	88.8	2791.62	90.11	2791.62
94.34	2791.72	96.89	2791.72	99.04	2791.78	103.46	2791.83	106.61	2792.05
107.8	2792.06	109.73	2792.19	113.49	2792.54	113.86	2792.59	121.42	2792.84
125.57	2793.03	126.39	2793.34	126.66	2793.41	128.02	2793.69	130.91	2794.13
133.59	2794.48	134.3	2794.52	135.18	2794.68	137.58	2794.87	141.07	2795.45
143.13	2795.89	144.29	2795.96	147.46	2796.08	148.13	2796.12	150	2796.18

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
11.86	.018	51	.035	76.54	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
51	76.54	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2792.76	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.06	Wt. n-Val.	0.018	0.035	0.080
W.S. Elev (ft)	2792.70	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2792.20	Flow Area (sq ft)	8.59	28.65	34.13
E.G. Slope (ft/ft)	0.002427	Area (sq ft)	8.59	28.65	34.13
Q Total (cfs)	106.00	Flow (cfs)	13.73	64.53	27.74
Top Width (ft)	101.10	Top Width (ft)	34.80	25.54	40.75
Vel Total (ft/s)	1.49	Avg. Vel. (ft/s)	1.60	2.25	0.81
Max Chl Dpth (ft)	1.82	Hydr. Depth (ft)	0.25	1.12	0.84
Conv. Total (cfs)	2151.5	Conv. (cfs)	278.7	1309.9	563.0
Length Wtd. (ft)	50.00	Wetted Per. (ft)	34.84	25.63	40.79
Min Ch El (ft)	2790.88	Shear (lb/sq ft)	0.04	0.17	0.13
Alpha	1.63	Stream Power (lb/ft s)	0.06	0.38	0.10
Frctn Loss (ft)	0.17	Cum Volume (acre-ft)	0.09	0.06	0.02
C & E Loss (ft)	0.01	Cum SA (acres)	0.30	0.11	0.05

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.

LATERAL STRUCTURE

RIVER: EAST SWALE
REACH: CP H6-H5 RS: 17975

INPUT
Description: STA 180+00 TO STA 179+50
WEIR FLOW OVER HOUGHTON ROAD
PROFILE
WEIR COEFFICIENT - 2.6
Lateral structure position = Left overbank
Distance from Upstream XS = 0
Deck/Roadway Width = 10
Weir Coefficient = 2.6
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 2

Sta	Elev	Sta	Elev
0	2792.89	50	2792.46

PB PROJ NO. 11515
CP H5 & H6
EXISTING CONDITION

Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Circular	2.5	

FHWA Chart # 2 - Corrugated Metal Pipe Culvert
FHWA Scale # 3 - Pipe projecting from fill
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
		118	.024	.024	0	.9	1

Upstream Elevation = 2789.39
Centerline Station = 9
Downstream Elevation = 2786.88
Centerline Station = 72

LATERAL STRUCTURE OUTPUT Profile #PF 1 Culv Group: Culvert #1

E.G. US. (ft)	2792.76	Weir Sta US (ft)	47.81
W.S. US. (ft)	2792.70	Weir Sta DS (ft)	50.00
E.G. DS (ft)	2792.58	Weir Max Depth (ft)	0.01
W.S. DS (ft)	2792.47	Weir Avg Depth (ft)	0.00
Q US (cfs)	106.00	Weir Submerg	0.00
Q Leaving Total (cfs)	26.41	Min El Weir Flow (ft)	2792.46
Q DS (cfs)	79.59	Wr Top Wdth (ft)	2.19
Perc Q Leaving	24.91	Q Culv Group (cfs)	26.41
Q Weir (cfs)	0.00	# Barrels	1
Q Gates (cfs)		Culv Length (ft)	118.00
Q Culv (cfs)	26.41	Culv Depth Blocked (ft)	
Q Lat RC (cfs)		Culv Inv El Up (ft)	2789.39
Weir Flow Area (sq ft)	0.01	Culv Inv El Dn (ft)	2786.88

CROSS SECTION

RIVER: EAST SWALE
REACH: CP H6-H5 RS: 17950

INPUT
Description:
Station Elevation Data num= 48

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
11.76	2792.46	17.05	2792.31	17.17	2792.32	19.46	2792.34	20.1	2792.29
25.35	2791.97	25.7	2791.99	27.69	2792.08	39.08	2792.14	47.47	2791.93
51	2791.858	51.89	2791.84	53.8	2791.78	54.53	2791.75	56.18	2791.71
58.02	2791.64	62.35	2791.8	63.71	2791.81	67.4	2791.83	69.25	2791.86
71.61	2792	74.68	2792.07	75.71	2792.14	78.83	2792.23	78.9	2792.23
80.25	2792.27	93.8	2792.59	97.08	2792.75	98.6	2792.81	99.03	2792.88
105.29	2793.24	111.6	2793.49	111.99	2793.5	113.59	2793.56	114.75	2793.55
115.17	2793.55	116.37	2793.59	119.31	2793.76	122.84	2793.91	126	2794.06
126.38	2794.09	126.58	2794.09	129.46	2794.22	133.24	2794.52	138.21	2794.78
145.08	2795.21	145.58	2795.25	150	2795.69				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
11.76	.018	51	.035	78.83	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
51	78.83	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2792.58	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.	0.018	0.035	0.080
W.S. Elev (ft)	2792.47	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2792.37	Flow Area (sq ft)	13.44	16.55	1.15
E.G. Slope (ft/ft)	0.005808	Area (sq ft)	13.44	16.55	1.15
Q Total (cfs)	79.59	Flow (cfs)	41.35	37.86	0.39
Top Width (ft)	76.89	Top Width (ft)	39.24	27.83	9.82
Vel Total (ft/s)	2.56	Avg. Vel. (ft/s)	3.08	2.29	0.34
Max Chl Dpth (ft)	0.83	Hydr. Depth (ft)	0.34	0.59	0.12

PB PROJ NO. 11515
CP H5 & H6
EXISTING CONDITION

Conv. Total (cfs)	1044.4	Conv. (cfs)	542.6	496.8	5.1
Length Wtd. (ft)	50.00	Wetted Per. (ft)	39.27	27.85	9.83
Min Ch El (ft)	2791.64	Shear (lb/sq ft)	0.12	0.22	0.04
Alpha	1.13	Stream Power (lb/ft s)	0.38	0.49	0.01
Frctn Loss (ft)	0.23	Cum Volume (acre-ft)	0.08	0.03	0.00
C & E Loss (ft)	0.00	Cum SA (acres)	0.26	0.08	0.02

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

LATERAL STRUCTURE

RIVER: EAST SWALE
REACH: CP H6-H5 RS: 17925

INPUT
Description: STA 179+50 TO STA 179+00
WEIR FLOW OVER HOUGHTON ROAD EAST TO
WEST
WEIR COEFFICIENT - 2.6
Lateral structure position = Left overbank
Distance from Upstream XS = 0
Deck/Roadway Width = 10
Weir Coefficient = 2.6
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 2

Sta	Elev	Sta	Elev
0	2792.46	50	2791.89

Weir crest shape = Broad Crested

LATERAL STRUCTURE OUTPUT Profile #PF 1 Lat Struct

E.G. US. (ft)	2792.58	Weir Sta US (ft)	0.00
W.S. US. (ft)	2792.47	Weir Sta DS (ft)	50.00
E.G. DS (ft)	2792.35	Weir Max Depth (ft)	0.31
W.S. DS (ft)	2792.20	Weir Avg Depth (ft)	0.16
Q US (cfs)	79.59	Weir Submerg	0.00
Q Leaving Total (cfs)	9.37	Min El Weir Flow (ft)	2791.89
Q DS (cfs)	70.19	Wr Top Wdth (ft)	50.00
Perc Q Leaving	11.81	Q Gate Group (cfs)	
Q Weir (cfs)	9.37	Gate Open Ht (ft)	
Q Gates (cfs)		Gate #Open	
Q Culv (cfs)		Gate Area (sq ft)	
Q Lat RC (cfs)		Gate Submerg	
Weir Flow Area (sq ft)	8.04	Gate Invert (ft)	

CROSS SECTION

RIVER: EAST SWALE
REACH: CP H6-H5 RS: 17900

INPUT
Description:
Station Elevation Data num= 48

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
11.84	2791.89	17.17	2791.72	18.99	2791.61	19.95	2791.44	23.03	2791.64
24.17	2791.72	24.66	2791.71	25.79	2791.65	26.79	2791.69	27.9	2791.77
39.68	2791.72	46.31	2791.63	51	2791.588	51.83	2791.58	53.38	2791.61
54.54	2791.58	57.95	2791.91	59.3	2791.93	60.29	2791.93	61.75	2792.03
71.53	2792.17	72.25	2792.16	72.29	2792.18	73.92	2792.2	78.13	2792.27
82.75	2792.66	89.69	2793.04	93.62	2792.96	95.04	2792.95	96.71	2792.96
102.47	2793.09	103.54	2793.14	104.06	2793.15	104.53	2793.17	104.99	2793.18
112.23	2793.51	114.6	2793.66	117.28	2793.77	126.93	2794.35	128.99	2794.44
129.48	2794.44	130.74	2794.47	131.15	2794.51	138.45	2795.27	139.37	2795.39
140.67	2795.68	142.07	2795.77	149.99	2797.26				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
11.84	.018	51	.035	57.95	.08

PB PROJ NO. 11515
CP H5 & H6
EXISTING CONDITION

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
51	57.95	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2792.35	Element			
Vel Head (ft)	0.14	Wt. n-Val.	0.018	0.035	0.080
W.S. Elev (ft)	2792.20	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2792.11	Flow Area (sq ft)	19.97	3.72	2.04
E.G. Slope (ft/ft)	0.003666	Area (sq ft)	19.97	3.72	2.04
Q Total (cfs)	70.19	Flow (cfs)	63.31	6.30	0.58
Top Width (ft)	62.27	Top Width (ft)	39.16	6.95	16.16
Vel Total (ft/s)	2.73	Avg. Vel. (ft/s)	3.17	1.69	0.28
Max Chl Dpth (ft)	0.76	Hydr. Depth (ft)	0.51	0.54	0.13
Conv. Total (cfs)	1159.4	Conv. (cfs)	1045.7	104.1	9.5
Length Wtd. (ft)	50.00	Wetted Per. (ft)	39.51	6.97	16.17
Min Ch El (ft)	2791.58	Shear (lb/sq ft)	0.12	0.12	0.03
Alpha	1.25	Stream Power (lb/ft s)	0.37	0.21	0.01
Frctn Loss (ft)	0.26	Cum Volume (acre-ft)	0.06	0.02	0.00
C & E Loss (ft)	0.01	Cum SA (acres)	0.21	0.06	0.01

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.

LATERAL STRUCTURE

RIVER: EAST SWALE
REACH: CP H6-H5 RS: 17875

INPUT
Description: STA 179+00 TO STA 178+50
WEIR FLOW OVER HOUGHTON ROAD EAST TO
WEST
WEIR COEFFICIENT - 2.6
Lateral structure position = Left overbank
Distance from Upstream XS = 0
Deck/Roadway Width = 10
Weir Coefficient = 2.6
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 2

Sta	Elev	Sta	Elev
0	2791.89	50	2791.62

Weir crest shape = Broad Crested

LATERAL STRUCTURE OUTPUT Profile #PF 1 Lat Struct

E.G. US. (ft)	2792.35	Weir Sta US (ft)	0.00
W.S. US. (ft)	2792.20	Weir Sta DS (ft)	50.00
E.G. DS (ft)	2792.08	Weir Max Depth (ft)	0.31
W.S. DS (ft)	2791.84	Weir Avg Depth (ft)	0.27
Q US (cfs)	70.19	Weir Submerg	0.00
Q Leaving Total (cfs)	18.18	Min El Weir Flow (ft)	2791.62
Q DS (cfs)	52.17	Wr Top Wdth (ft)	50.00
Perc Q Leaving	25.68	Q Gate Group (cfs)	
Q Weir (cfs)	18.18	Gate Open Ht (ft)	
Q Gates (cfs)		Gate #Open	
Q Culv (cfs)		Gate Area (sq ft)	
Q Lat RC (cfs)		Gate Submerg	
Weir Flow Area (sq ft)	13.44	Gate Invert (ft)	

CROSS SECTION

RIVER: EAST SWALE
REACH: CP H6-H5 RS: 17850

INPUT

PB PROJ NO. 11515
CP H5 & H6
EXISTING CONDITION
Description:

Station Elevation Data num= 39

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
27.74	2791.62	29.73	2791.58	40.2	2791.44	51	2791.305	51.41	2791.3
52.41	2791.22	54.08	2791.21	55.99	2791.05	60.96	2791.91	66.75	2792.58
69.22	2792.67	73.16	2792.79	74.14	2792.78	78.95	2792.79	83.27	2792.76
84.67	2792.81	90.77	2792.99	93.78	2793.08	95.12	2793.14	99.61	2793.26
99.73	2793.26	102.99	2793.34	106.71	2793.46	108.21	2793.4	111.28	2793.32
119.74	2793.54	121.28	2793.56	127.26	2793.86	128.98	2793.87	137.38	2794.59
139.13	2794.84	144.9	2795.35	145.14	2795.38	146.1	2795.59	146.26	2795.61
147.04	2795.76	147.14	2795.78	147.96	2795.92	150	2796.26		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
27.74	.018	51	.035	66.75	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
51	66.75	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2792.08	Element			
Vel Head (ft)	0.24	Wt. n-Val.	0.018	0.035	
W.S. Elev (ft)	2791.84	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2791.84	Flow Area (sq ft)	9.09	5.05	
E.G. Slope (ft/ft)	0.009429	Area (sq ft)	9.09	5.05	
Q Total (cfs)	52.17	Flow (cfs)	38.67	13.49	
Top Width (ft)	32.84	Top Width (ft)	23.26	9.58	
Vel Total (ft/s)	3.69	Avg. Vel. (ft/s)	4.26	2.67	
Max Chl Dpth (ft)	0.79	Hydr. Depth (ft)	0.39	0.53	
Conv. Total (cfs)	537.2	Conv. (cfs)	398.3	139.0	
Length Wtd. (ft)	50.00	Wetted Per. (ft)	23.49	9.66	
Min Ch El (ft)	2791.05	Shear (lb/sq ft)	0.23	0.31	
Alpha	1.12	Stream Power (lb/ft s)	0.97	0.82	
Frctn Loss (ft)	0.49	Cum Volume (acre-ft)	0.04	0.02	
C & E Loss (ft)	0.01	Cum SA (acres)	0.18	0.05	

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

LATERAL STRUCTURE

RIVER: EAST SWALE
REACH: CP H6-H5 RS: 17825

INPUT
Description: STA 178+50 TO STA 178+00
WEIR FLOW OVER HOUGHTON FROM EAST TO WEST
WEIR COEFFICIENT - 2.6
Lateral structure position = Left overbank
Distance from Upstream XS = 0
Deck/Roadway Width = 10
Weir Coefficient = 2.6
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 2

Sta	Elev	Sta	Elev
0	2791.62	50	2791.09

Weir crest shape = Broad Crested

LATERAL STRUCTURE OUTPUT Profile #PF 1 Lat Struct

E.G. US. (ft)	2792.08	Weir Sta US (ft)	0.00
W.S. US. (ft)	2791.84	Weir Sta DS (ft)	50.00
E.G. DS (ft)	2791.48	Weir Max Depth (ft)	0.22

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EXISTING CONDITION

W.S. DS (ft)	2791.28	Weir Avg Depth (ft)	0.21
Q US (cfs)	52.17	Weir Submerg	0.00
Q Leaving Total (cfs)	12.31	Min El Weir Flow (ft)	2791.09
Q DS (cfs)	39.94	Wr Top Wdth (ft)	50.00
Perc Q Leaving	23.44	Q Gate Group (cfs)	
Q Weir (cfs)	12.31	Gate Open Ht (ft)	
Q Gates (cfs)		Gate #Open	
Q Culv (cfs)		Gate Area (sq ft)	
Q Lat RC (cfs)		Gate Submerg	
Weir Flow Area (sq ft)	10.38	Gate Invert (ft)	

CROSS SECTION

RIVER: EAST SWALE
REACH: CP H6-H5 RS: 17800

INPUT
Description:
Station Elevation Data num= 40

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
27.37	2791.09	33.46	2791.09	40.29	2791	49.63	2790.72	51	2790.7
51.71	2790.69	52.18	2790.64	52.67	2790.67	53.62	2790.64	55.22	2790.57
56.6	2790.83	60.22	2791.56	67.23	2792.9	78.47	2793.31	81.38	2793.45
82.28	2793.48	93.11	2793.98	99.1	2794.46	100.89	2794.61	101.91	2794.61
103.46	2794.65	106.47	2794.69	108.4	2794.73	109.8	2794.75	110.9	2794.78
113.5	2795.1	114.34	2795.09	115.74	2795.16	119.73	2795.27	123.68	2795.42
125.95	2795.4	129.31	2795.39	130.53	2795.43	134.37	2795.46	138.91	2795.54
139.17	2795.55	144.75	2795.53	145.8	2795.5	147.09	2795.56	150	2795.7

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
27.37	.018	51	.035	67.23	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
51	67.23	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2791.48	Element			
Vel Head (ft)	0.20	Wt. n-Val.	0.018	0.035	
W.S. Elev (ft)	2791.28	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2791.28	Flow Area (sq ft)	7.49	3.99	
E.G. Slope (ft/ft)	0.010309	Area (sq ft)	7.49	3.99	
Q Total (cfs)	39.94	Flow (cfs)	29.02	10.92	
Top Width (ft)	31.47	Top Width (ft)	23.63	7.84	
Vel Total (ft/s)	3.48	Avg. Vel. (ft/s)	3.87	2.73	
Max Chl Dpth (ft)	0.71	Hydr. Depth (ft)	0.32	0.51	
Conv. Total (cfs)	393.3	Conv. (cfs)	285.8	107.5	
Length Wtd. (ft)	50.00	Wetted Per. (ft)	23.83	7.91	
Min Ch El (ft)	2790.57	Shear (lb/sq ft)	0.20	0.32	
Alpha	1.07	Stream Power (lb/ft s)	0.78	0.89	
Frctn Loss (ft)	0.45	Cum Volume (acre-ft)	0.03	0.01	
C & E Loss (ft)	0.01	Cum SA (acres)	0.15	0.04	

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

LATERAL STRUCTURE

RIVER: EAST SWALE
REACH: CP H6-H5 RS: 17775

INPUT
Description: STA 178+00 TO STA 177+50
WEIR FLOW OVER HOUGHTON ROAD EAST TO

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CP H5 & H6
EXISTING CONDITION
WEST

WEIR COEFFICIENT - 2.6
Lateral structure position = Left overbank
Distance from Upstream XS = 0
Deck/Roadway Width = 10
Weir Coefficient = 2.6
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 2

Sta	Elev	Sta	Elev
0	2791.09	50	2790.62

Weir crest shape = Broad Crested

LATERAL STRUCTURE OUTPUT Profile #PF 1 Lat Struct

E.G. US. (ft)	2791.48	Weir Sta US (ft)	0.00
W.S. US. (ft)	2791.28	Weir Sta DS (ft)	50.00
E.G. DS (ft)	2790.86	Weir Max Depth (ft)	0.19
W.S. DS (ft)	2790.69	Weir Avg Depth (ft)	0.13
Q US (cfs)	39.94	Weir Submerg	0.00
Q Leaving Total (cfs)	6.37	Min El Weir Flow (ft)	2790.62
Q DS (cfs)	33.63	Wr Top Wdth (ft)	50.00
Perc Q Leaving	15.79	Q Gate Group (cfs)	
Q Weir (cfs)	6.37	Gate Open Ht (ft)	
Q Gates (cfs)		Gate #Open	
Q Culv (cfs)		Gate Area (sq ft)	
Q Lat RC (cfs)		Gate Submerg	
Weir Flow Area (sq ft)	6.59	Gate Invert (ft)	

CROSS SECTION

RIVER: EAST SWALE
REACH: CP H6-H5 RS: 17750

INPUT
Description:
Station Elevation Data num= 44

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
27.21	2790.62	32.88	2790.46	39.58	2790.3	44.28	2790.24	51	2790.213
51.79	2790.21	55.89	2790.34	58.35	2790.5	65.85	2791.01	67.56	2791.03
71.12	2790.97	72.53	2790.97	74.21	2790.97	77.28	2791.53	80.45	2792.16
82.08	2792.35	84.6	2792.72	86.98	2793.01	88.66	2793.32	91.86	2793.54
92.96	2793.68	93.84	2793.77	97.06	2793.92	97.96	2793.98	99.72	2794.06
102.86	2794.23	105.89	2794.43	108.33	2794.43	111.38	2794.5	114.22	2794.53
115.65	2794.56	118.34	2794.65	119.95	2794.73	122.12	2794.74	124.3	2794.76
126.75	2794.7	128.62	2794.74	131.8	2794.72	132.88	2794.73	137.29	2794.58
139.67	2794.57	145.67	2794.78	147.06	2794.84	150	2794.92		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
27.21	.018	51	.035	65.85	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
51	65.85	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2790.86	Element			
Vel Head (ft)	0.17	Wt. n-Val.	0.018	0.035	
W.S. Elev (ft)	2790.69	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2790.69	Flow Area (sq ft)	8.08	3.04	
E.G. Slope (ft/ft)	0.007777	Area (sq ft)	8.08	3.04	
Q Total (cfs)	33.63	Flow (cfs)	28.56	5.07	
Top Width (ft)	33.97	Top Width (ft)	23.79	10.18	
Vel Total (ft/s)	3.03	Avg. Vel. (ft/s)	3.54	1.67	
Max Chl Dpth (ft)	0.48	Hydr. Depth (ft)	0.34	0.30	
Conv. Total (cfs)	381.4	Conv. (cfs)	323.9	57.5	
Length Wtd. (ft)	50.00	Wetted Per. (ft)	23.87	10.20	
Min Ch El (ft)	2790.21	Shear (lb/sq ft)	0.16	0.14	
Alpha	1.21	Stream Power (lb/ft s)	0.58	0.24	
Frctn Loss (ft)	0.37	Cum Volume (acre-ft)	0.03	0.01	

C & E Loss (ft)	0.02	Cum SA (acres)	0.12	0.03

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

LATERAL STRUCTURE

RIVER: EAST SWALE
REACH: CP H6-H5 RS: 17725

INPUT
Description: STA 177+50 TO STA 177+00
WEIR FLOW EVER HOUGHTON ROAD EAST TO WEST
WEIR COEFFICIENT - 2.6

Lateral structure position = Left overbank
Distance from Upstream XS = 0
Deck/Roadway Width = 10
Weir Coefficient = 2.6
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 2

Sta	Elev	Sta	Elev
0	2790.62	50	2789.47

Weir crest shape = Broad Crested

LATERAL STRUCTURE OUTPUT Profile #PF 1 Lat Struct

E.G. US. (ft)	2790.86	Weir Sta US (ft)	0.00
W.S. US. (ft)	2790.69	Weir Sta DS (ft)	50.00
E.G. DS (ft)	2789.83	Weir Max Depth (ft)	0.25
W.S. DS (ft)	2789.72	Weir Avg Depth (ft)	0.16
Q US (cfs)	33.63	Weir Submerg	0.00
Q Leaving Total (cfs)	8.93	Min El Weir Flow (ft)	2789.47
Q DS (cfs)	24.73	Wr Top Wdth (ft)	50.00
Perc Q Leaving	26.46	Q Gate Group (cfs)	
Q Weir (cfs)	8.93	Gate Open Ht (ft)	
Q Gates (cfs)		Gate #Open	
Q Culv (cfs)		Gate Area (sq ft)	
Q Lat RC (cfs)		Gate Submerg	
Weir Flow Area (sq ft)	8.17	Gate Invert (ft)	

CROSS SECTION

RIVER: EAST SWALE
REACH: CP H6-H5 RS: 17700

INPUT
Description:
Station Elevation Data num= 50

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1.07	2789.47	10.71	2789.45	13.15	2789.41	15.82	2789.36	18.74	2789.26
23.82	2789.56	27.49	2789.75	39.1	2789.69	39.98	2789.67	41.67	2789.65
51	2789.502	51.78	2789.49	52.42	2789.47	59.85	2789.72	60.61	2789.73
61.04	2789.75	61.66	2789.79	64.23	2789.95	69.51	2790.16	71.99	2790.3
73.23	2790.46	73.55	2790.5	77.64	2790.92	78.77	2791.06	81.89	2791.4
86.16	2791.82	89.71	2792.19	90.45	2792.26	92.91	2792.47	94.6	2792.53
95.12	2792.54	98.99	2792.66	103.23	2792.79	105.64	2792.85	107.44	2792.91
110.37	2793.03	111.36	2793.05	111.95	2793.07	114.23	2793.11	117.69	2793.23
119.06	2793.23	121.69	2793.26	124.88	2793.41	129.55	2793.56	130.47	2793.59
133.81	2793.71	134.97	2793.73	143.73	2793.74	147.71	2793.77	150	2793.82

PB PROJ NO. 11515
CP H5 & H6
EXISTING CONDITION

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1.07	.018	51	.035	71.99	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
51	71.99	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2789.83	Element			
Vel Head (ft)	0.10	Wt. n-Val.	0.018	0.035	
W.S. Elev (ft)	2789.72	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2789.72	Flow Area (sq ft)	8.89	1.30	
E.G. Slope (ft/ft)	0.006999	Area (sq ft)	8.89	1.30	
Q Total (cfs)	24.73	Flow (cfs)	23.48	1.25	
Top Width (ft)	53.66	Top Width (ft)	44.48	9.18	
Vel Total (ft/s)	2.43	Avg. Vel. (ft/s)	2.64	0.96	
Max Chl Dpth (ft)	0.46	Hydr. Depth (ft)	0.20	0.14	
Conv. Total (cfs)	295.6	Conv. (cfs)	280.7	14.9	
Length Wtd. (ft)	50.00	Wetted Per. (ft)	44.75	9.19	
Min Ch El (ft)	2789.47	Shear (lb/sq ft)	0.09	0.06	
Alpha	1.13	Stream Power (lb/ft s)	0.23	0.06	
Frctn Loss (ft)	0.42	Cum Volume (acre-ft)	0.02	0.01	
C & E Loss (ft)	0.00	Cum SA (acres)	0.08	0.02	

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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 energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: EAST SWALE
REACH: CP H6-H5 RS: 17650

INPUT
Description:
Station Elevation Data num= 51

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2788.7	1.35	2788.74	9.06	2788.69	12.79	2788.63	15.14	2788.57
17.41	2788.49	20.26	2788.3	20.55	2788.29	21.09	2788.25	23.67	2788.29
25.09	2788.36	27.77	2788.47	28.99	2788.47	39.48	2788.35	45.02	2788.41
51	2788.401	51.48	2788.4	52.43	2788.37	53.34	2788.33	54.07	2788.26
56	2788.15	56.84	2788.1	58.15	2788.7	58.61	2788.91	59.01	2789.01
63.39	2790.1	65.09	2790.36	66.24	2790.49	67.82	2790.51	78.26	2790.45
79.09	2790.48	80.17	2790.5	90.75	2790.71	93.9	2790.79	95.19	2790.83
100.71	2791.02	103.53	2791.09	107.13	2791.16	108.29	2791.21	112.43	2791.24
119.15	2791.38	121.54	2791.42	127.32	2791.58	130.34	2791.65	131.83	2791.66
136.13	2791.79	137.13	2791.81	142.25	2791.84	143.11	2791.87	145.34	2791.91
150	2792.01								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.018	51	.035	66.24	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
51	66.24	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2788.71	Element			
Vel Head (ft)	0.11	Wt. n-Val.	0.018	0.035	
W.S. Elev (ft)	2788.60	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2788.60	Flow Area (sq ft)	7.31	2.19	
E.G. Slope (ft/ft)	0.010022	Area (sq ft)	7.31	2.19	
Q Total (cfs)	24.73	Flow (cfs)	20.47	4.26	
Top Width (ft)	43.98	Top Width (ft)	37.05	6.93	

PB PROJ NO. 11515
CP H5 & H6
EXISTING CONDITION

Vel Total (ft/s)	2.60	Avg. Vel. (ft/s)	2.80	1.95
Max Chl Dpth (ft)	0.50	Hydr. Depth (ft)	0.20	0.32
Conv. Total (cfs)	247.1	Conv. (cfs)	204.5	42.5
Length Wtd. (ft)	50.00	Wetted Per. (ft)	37.06	7.05
Min Ch El (ft)	2788.10	Shear (lb/sq ft)	0.12	0.19
Alpha	1.05	Stream Power (lb/ft s)	0.35	0.38
Frctn Loss (ft)	0.61	Cum Volume (acre-ft)	0.01	0.00
C & E Loss (ft)	0.00	Cum SA (acres)	0.04	0.01

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: EAST SWALE
REACH: CP H6-H5 RS: 17600

INPUT
Description:
Station Elevation Data num= 51

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2787.8	1.47	2787.82	13.45	2787.79	18.51	2787.68	21.57	2787.25
24.38	2787.01	25.03	2786.97	25.41	2786.93	28.22	2787.07	35.44	2787.02
39.96	2787.07	51	2786.999	52.33	2786.99	57.59	2786.6	58.73	2786.53
60.76	2786.98	61.38	2787.02	62.51	2787.24	63.99	2787.51	65.68	2787.64
69.09	2787.45	70.18	2787.65	71.92	2788.01	73.43	2788.33	74.41	2788.32
76.95	2788.3	82.26	2788.24	84.72	2788.35	86.71	2788.54	88.65	2788.67
93.15	2788.73	95.58	2788.8	96.62	2788.86	98.16	2788.9	101.39	2788.95
102.83	2789.02	105.72	2789.06	111.72	2789.28	114.47	2789.43	119.51	2789.59
120.03	2789.62	126.38	2790.17	129.1	2790.44	130.52	2790.56	131.87	2790.7
136.48	2791.02	138.06	2791.13	139.72	2791.19	142.89	2791.28	146.98	2791.44
150	2791.53								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.018	51	.035	73.43	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
51	73.43	0	0	0	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2787.32	Element			
Vel Head (ft)	0.13	Wt. n-Val.	0.018	0.035	
W.S. Elev (ft)	2787.20	Reach Len. (ft)			
Crit W.S. (ft)	2787.20	Flow Area (sq ft)	4.54	4.19	
E.G. Slope (ft/ft)	0.015178	Area (sq ft)	4.54	4.19	
Q Total (cfs)	24.73	Flow (cfs)	13.45	11.28	
Top Width (ft)	40.08	Top Width (ft)	28.80	11.28	
Vel Total (ft/s)	2.83	Avg. Vel. (ft/s)	2.97	2.69	
Max Chl Dpth (ft)	0.67	Hydr. Depth (ft)	0.16	0.37	
Conv. Total (cfs)	200.8	Conv. (cfs)	109.2	91.6	
Length Wtd. (ft)		Wetted Per. (ft)	28.81	11.37	
Min Ch El (ft)	2786.53	Shear (lb/sq ft)	0.15	0.35	
Alpha	1.01	Stream Power (lb/ft s)	0.44	0.94	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth). Water surface set to critical depth.

PB PROJ NO. 11515
CP H5 & H6
EXISTING CONDITION
SUMMARY OF MANNING'S N VALUES

River:EAST SWALE

Reach	River Sta.	n1	n2	n3
CP H6-H5	18600	.022	.035	.08
CP H6-H5	18550	.022	.035	.08
CP H6-H5	18500	.022	.035	.08
CP H6-H5	18450	.022	.035	.08
CP H6-H5	18400	.022	.035	.08
CP H6-H5	18350	.022	.035	.08
CP H6-H5	18300	.022	.035	.08
CP H6-H5	18250	.018	.035	.08
CP H6-H5	18200	.018	.035	.08
CP H6-H5	18150	.018	.035	.08
CP H6-H5	18100	.018	.035	.08
CP H6-H5	18050	.018	.035	.08
CP H6-H5	18000	.018	.035	.08
CP H6-H5	17975	Lat Struct		
CP H6-H5	17950	.018	.035	.08
CP H6-H5	17925	Lat Struct		
CP H6-H5	17900	.018	.035	.08
CP H6-H5	17875	Lat Struct		
CP H6-H5	17850	.018	.035	.08
CP H6-H5	17825	Lat Struct		
CP H6-H5	17800	.018	.035	.08
CP H6-H5	17775	Lat Struct		
CP H6-H5	17750	.018	.035	.08
CP H6-H5	17725	Lat Struct		
CP H6-H5	17700	.018	.035	.08
CP H6-H5	17650	.018	.035	.08
CP H6-H5	17600	.018	.035	.08

SUMMARY OF REACH LENGTHS

River: EAST SWALE

Reach	River Sta.	Left	Channel	Right
CP H6-H5	18600	50	50	50
CP H6-H5	18550	50	50	50
CP H6-H5	18500	50	50	50
CP H6-H5	18450	50	50	50
CP H6-H5	18400	50	50	50
CP H6-H5	18350	50	50	50
CP H6-H5	18300	50	50	50
CP H6-H5	18250	50	50	50
CP H6-H5	18200	50	50	50
CP H6-H5	18150	50	50	50
CP H6-H5	18100	50	50	50
CP H6-H5	18050	50	50	50
CP H6-H5	18000	50	50	50
CP H6-H5	17975	Lat Struct		
CP H6-H5	17950	50	50	50
CP H6-H5	17925	Lat Struct		
CP H6-H5	17900	50	50	50
CP H6-H5	17875	Lat Struct		
CP H6-H5	17850	50	50	50
CP H6-H5	17825	Lat Struct		
CP H6-H5	17800	50	50	50
CP H6-H5	17775	Lat Struct		
CP H6-H5	17750	50	50	50
CP H6-H5	17725	Lat Struct		
CP H6-H5	17700	50	50	50
CP H6-H5	17650	50	50	50
CP H6-H5	17600	0	0	0

PB PROJ NO. 11515
CP H5 & H6
EXISTING CONDITION
SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: EAST SWALE

Reach	River Sta.	Contr.	Expan.
CP H6-H5	18600	.1	.3
CP H6-H5	18550	.1	.3
CP H6-H5	18500	.1	.3
CP H6-H5	18450	.1	.3
CP H6-H5	18400	.1	.3
CP H6-H5	18350	.1	.3
CP H6-H5	18300	.1	.3
CP H6-H5	18250	.1	.3
CP H6-H5	18200	.1	.3
CP H6-H5	18150	.1	.3
CP H6-H5	18100	.1	.3
CP H6-H5	18050	.1	.3
CP H6-H5	18000	.1	.3
CP H6-H5	17975	Lat Struct	
CP H6-H5	17950	.1	.3
CP H6-H5	17925	Lat Struct	
CP H6-H5	17900	.1	.3
CP H6-H5	17875	Lat Struct	
CP H6-H5	17850	.1	.3
CP H6-H5	17825	Lat Struct	
CP H6-H5	17800	.1	.3
CP H6-H5	17775	Lat Struct	
CP H6-H5	17750	.1	.3
CP H6-H5	17725	Lat Struct	
CP H6-H5	17700	.1	.3
CP H6-H5	17650	.1	.3
CP H6-H5	17600	.1	.3

PB PROJ NO. 11515
CP H5 & H6
EXISTING CONDITION
Profile Output Table - Standard Table 1

Reach	River Sta		Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
CP H6-H5	18600		42.00	2806.02	2806.44	2806.38	2806.52	0.014701	2.27	18.51	63.24	0.74
CP H6-H5	18550		42.00	2804.75	2805.38	2805.38	2805.53	0.028103	3.14	13.39	45.69	1.02
CP H6-H5	18500		42.00	2803.20	2803.86	2803.86	2804.07	0.024654	3.64	11.54	28.56	1.01
CP H6-H5	18450		42.00	2801.87	2802.50	2802.50	2802.70	0.025314	3.52	11.92	31.60	1.01
CP H6-H5	18400		42.00	2799.91	2800.73	2800.57	2800.84	0.009005	2.70	15.57	28.24	0.64
CP H6-H5	18350		42.00	2799.13	2799.96	2799.96	2800.20	0.019216	4.00	11.80	28.65	0.94
CP H6-H5	18300		42.00	2797.73	2798.89	2798.89	2799.15	0.021511	4.09	10.26	18.91	0.98
CP H6-H5	18250		106.00	2796.31	2797.24	2797.20	2797.46	0.017204	3.88	31.07	59.68	0.90
CP H6-H5	18200		106.00	2795.26	2796.23	2796.23	2796.49	0.021614	4.13	26.50	57.59	0.99
CP H6-H5	18150		106.00	2793.62	2794.81	2794.81	2795.09	0.021813	4.29	27.00	55.27	1.00
CP H6-H5	18100		106.00	2792.76	2793.59	2793.59	2793.81	0.022387	3.76	29.05	71.73	0.98
CP H6-H5	18050		106.00	2791.95	2792.88	2792.78	2792.99	0.009777	2.83	47.92	115.38	0.67
CP H6-H5	18000		106.00	2790.88	2792.70	2792.20	2792.76	0.002427	2.25	71.37	101.10	0.37
CP H6-H5	17975	30" Culvert & HR	Lat Struct									
CP H6-H5	17950		79.59	2791.64	2792.47	2792.37	2792.58	0.005808	2.29	31.13	76.89	0.52
CP H6-H5	17925	HR Weir	Lat Struct									
CP H6-H5	17900		70.19	2791.58	2792.20	2792.11	2792.35	0.003666	1.69	25.73	62.27	0.41
CP H6-H5	17875	HR Weir	Lat Struct									
CP H6-H5	17850		52.17	2791.05	2791.84	2791.84	2792.08	0.009429	2.67	14.13	32.84	0.65
CP H6-H5	17825	HR Weir	Lat Struct									
CP H6-H5	17800		39.94	2790.57	2791.28	2791.28	2791.48	0.010309	2.73	11.48	31.47	0.67
CP H6-H5	17775	HR Weir	Lat Struct									
CP H6-H5	17750		33.63	2790.21	2790.69	2790.69	2790.86	0.007777	1.67	11.11	33.97	0.54
CP H6-H5	17725	HR Weir	Lat Struct									
CP H6-H5	17700		24.73	2789.47	2789.72	2789.72	2789.83	0.006999	0.96	10.18	53.66	0.45
CP H6-H5	17650		24.73	2788.10	2788.60	2788.60	2788.71	0.010022	1.95	9.50	43.98	0.61

PB PROJ NO. 11515
CP H5 & H6
EXISTING CONDITION

CP H6-H5	17600	24.73	2786.53	2787.20	2787.20	2787.32	0.015178	2.69	8.73	40.08
	0.78									

Profile Output Table - Standard Table 2

Reach	River Sta		E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
CP H6-H5	18600		2806.52	2806.44	0.08	0.99	0.01		42.0		63.2
CP H6-H5	18550		2805.53	2805.38	0.15	1.31	0.01		42.0		45.7
CP H6-H5	18500		2804.07	2803.86	0.21	1.25	0.00		42.0		28.6
CP H6-H5	18450		2802.70	2802.50	0.19	0.71	0.02		42.0		31.6
CP H6-H5	18400		2800.84	2800.73	0.11	0.63	0.01		42.0		28.2
CP H6-H5	18350		2800.20	2799.96	0.24	1.02	0.00		40.8	1.2	28.7
CP H6-H5	18300		2799.15	2798.89	0.26	0.91	0.01		42.0		18.9
CP H6-H5	18250		2797.46	2797.24	0.22	0.96	0.00		99.5	6.5	59.7
CP H6-H5	18200		2796.49	2796.23	0.26	1.09	0.00		105.5	0.5	57.6
CP H6-H5	18150		2795.09	2794.81	0.28	1.10	0.02	0.2	102.1	3.7	55.3
CP H6-H5	18100		2793.81	2793.59	0.22	0.71	0.03	1.2	104.1	0.8	71.7
CP H6-H5	18050		2792.99	2792.88	0.11	0.22	0.02	3.4	89.1	13.5	115.4
CP H6-H5	18000		2792.76	2792.70	0.06	0.17	0.01	13.7	64.5	27.7	101.1
CP H6-H5	17975	30" Culvert & HR	Lat Struct								
CP H6-H5	17950		2792.58	2792.47	0.12	0.23	0.00	41.3	37.9	0.4	76.9
CP H6-H5	17925	HR Weir	Lat Struct								
CP H6-H5	17900		2792.35	2792.20	0.14	0.26	0.01	63.3	6.3	0.6	62.3
CP H6-H5	17875	HR Weir	Lat Struct								
CP H6-H5	17850		2792.08	2791.84	0.24	0.49	0.01	38.7	13.5		32.8
CP H6-H5	17825	HR Weir	Lat Struct								
CP H6-H5	17800		2791.48	2791.28	0.20	0.45	0.01	29.0	10.9		31.5
CP H6-H5	17775	HR Weir	Lat Struct								
CP H6-H5	17750		2790.86	2790.69	0.17	0.37	0.02	28.6	5.1		34.0
CP H6-H5	17725	HR Weir	Lat Struct								
CP H6-H5	17700		2789.83	2789.72	0.10	0.42	0.00	23.5	1.2		53.7
CP H6-H5	17650		2788.71	2788.60	0.11	0.61	0.00	20.5	4.3		44.0
CP H6-H5	17600		2787.32	2787.20	0.13			13.5	11.3		40.1

PB PROJ NO. 11515
CP H5 & H6
EXISTING CONDITION
Profile Output Table - Lateral Structures

Reach	River Sta		Q US	Q Leaving Total	Q DS	Q Weir	Q Gates	Wr Top Wdth	Weir Max Depth	Weir Avg Depth	Min El Weir Flow	E.G. US.	W.S. US.	E.G. DS	W.S. DS
			(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
CP H6-H5	17975	30" Culvert & HR	106.00	26.41	79.59	0.00		2.19	0.01	0.00	2792.46	2792.76	2792.70	2792.58	2792.47
CP H6-H5	17925	HR Weir	79.59	9.37	70.19	9.37		50.00	0.31	0.16	2791.89	2792.58	2792.47	2792.35	2792.20
CP H6-H5	17875	HR Weir	70.19	18.18	52.17	18.18		50.00	0.31	0.27	2791.62	2792.35	2792.20	2792.08	2791.84
CP H6-H5	17825	HR Weir	52.17	12.31	39.94	12.31		50.00	0.22	0.21	2791.09	2792.08	2791.84	2791.48	2791.28
CP H6-H5	17775	HR Weir	39.94	6.37	33.63	6.37		50.00	0.19	0.13	2790.62	2791.48	2791.28	2790.86	2790.69
CP H6-H5	17725	HR Weir	33.63	8.93	24.73	8.93		50.00	0.25	0.16	2789.47	2790.86	2790.69	2789.83	2789.72

PB PROJ NO. 11515
CP H5 & H6
EXISTING CONDITION
ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : cph5&6_exst

River: EAST SWALE Reach: CP H6-H5 RS: 18550 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: EAST SWALE Reach: CP H6-H5 RS: 18500 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: EAST SWALE Reach: CP H6-H5 RS: 18450 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: EAST SWALE Reach: CP H6-H5 RS: 18400 Profile: PF 1
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.
River: EAST SWALE Reach: CP H6-H5 RS: 18350 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning:Divided flow computed for this cross-section.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: EAST SWALE Reach: CP H6-H5 RS: 18300 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: EAST SWALE Reach: CP H6-H5 RS: 18200 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

PB PROJ NO. 11515
CP H5 & H6
EXISTING CONDITION

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: EAST SWALE Reach: CP H6-H5 RS: 18150 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: EAST SWALE Reach: CP H6-H5 RS: 18100 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
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.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: EAST SWALE Reach: CP H6-H5 RS: 18050 Profile: PF 1
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.

River: EAST SWALE Reach: CP H6-H5 RS: 18000 Profile: PF 1
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.

River: EAST SWALE Reach: CP H6-H5 RS: 17950 Profile: PF 1
Warning:The cross-section end points had to be extended vertically for the computed water surface.

River: EAST SWALE Reach: CP H6-H5 RS: 17900 Profile: PF 1
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.

River: EAST SWALE Reach: CP H6-H5 RS: 17850 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning:The cross-section end points had to be extended vertically for the computed water surface.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: EAST SWALE Reach: CP H6-H5 RS: 17800 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning:The cross-section end points had to be extended vertically for the computed water surface.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: EAST SWALE Reach: CP H6-H5 RS: 17750 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The cross-section end points had to be extended vertically for the computed water surface.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate

the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: EAST SWALE Reach: CP H6-H5 RS: 17700 Profile: PF 1

Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

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 energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: EAST SWALE Reach: CP H6-H5 RS: 17650 Profile: PF 1

Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: EAST SWALE Reach: CP H6-H5 RS: 17600 Profile: PF 1

Warning:Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth). Water surface set to critical depth.

HEC-RAS Plan: cph5&6_exst River: EAST SWALE Reach: CP H6-H5 Profile: PF 1

Reach	River Sta	Q US	Q Leaving Total	Q DS	Q Weir	Q Gates	Wr Top Wdth	Weir Max Depth	Weir Avg Depth	Min El Weir Flow	E.G. US.	W.S. US.	E.G. DS	W.S. DS
		(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
CP H6-H5	17975 30" Culvert & HR	106.00	26.41	79.59	0.00		2.19	0.01	0.00	2792.46	2792.76	2792.70	2792.58	2792.47
CP H6-H5	17925 HR Weir	79.59	9.37	70.19	9.37		50.00	0.31	0.16	2791.89	2792.58	2792.47	2792.35	2792.20
CP H6-H5	17875 HR Weir	70.19	18.18	52.17	18.18		50.00	0.31	0.27	2791.62	2792.35	2792.20	2792.08	2791.84
CP H6-H5	17825 HR Weir	52.17	12.31	39.94	12.31		50.00	0.22	0.21	2791.09	2792.08	2791.84	2791.46	2791.28
CP H6-H5	17775 HR Weir	39.94	6.37	33.63	6.37		50.00	0.19	0.13	2790.62	2791.48	2791.28	2790.86	2790.69
CP H6-H5	17725 HR Weir	33.63	8.93	24.73	8.93		50.00	0.25	0.16	2789.47	2790.86	2790.69	2789.83	2789.72

HEC-RAS Plan: cph5&6_exst River: EAST SWALE Reach: CP H6-H5 Profile: PF 1

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
CP H6-H5	18600	42.00	2806.02	2806.44	2806.38	2806.52	0.014701	2.27	18.51	63.24	0.74
CP H6-H5	18550	42.00	2804.75	2805.38	2805.38	2805.53	0.028103	3.14	13.39	45.69	1.02
CP H6-H5	18500	42.00	2803.20	2803.86	2803.86	2804.07	0.024654	3.64	11.54	28.56	1.01
CP H6-H5	18450	42.00	2801.87	2802.50	2802.50	2802.70	0.025314	3.52	11.92	31.60	1.01
CP H6-H5	18400	42.00	2799.91	2800.73	2800.57	2800.84	0.009005	2.70	15.57	28.24	0.64
CP H6-H5	18350	42.00	2799.13	2799.96	2799.96	2800.20	0.019216	4.00	11.80	28.65	0.94
CP H6-H5	18300	42.00	2797.73	2798.89	2798.89	2799.15	0.021511	4.09	10.26	18.91	0.98
CP H6-H5	18250	106.00	2796.31	2797.24	2797.20	2797.46	0.017204	3.88	31.07	59.68	0.90
CP H6-H5	18200	106.00	2795.26	2796.23	2796.23	2796.49	0.021614	4.13	26.50	57.59	0.99
CP H6-H5	18150	106.00	2793.62	2794.81	2794.81	2795.09	0.021813	4.29	27.00	55.27	1.00
CP H6-H5	18100	106.00	2792.76	2793.59	2793.59	2793.81	0.022387	3.76	29.05	71.73	0.98
CP H6-H5	18050	106.00	2791.95	2792.88	2792.78	2792.99	0.009777	2.83	47.92	115.38	0.67
CP H6-H5	18000	106.00	2790.88	2792.70	2792.20	2792.76	0.002427	2.25	71.37	101.10	0.37
CP H6-H5	17975 30" Culvert & HR	Lat Struct									
CP H6-H5	17950	79.59	2791.64	2792.47	2792.37	2792.58	0.005808	2.29	31.13	76.89	0.52
CP H6-H5	17925 HR Weir	Lat Struct									
CP H6-H5	17900	70.19	2791.58	2792.20	2792.11	2792.35	0.003666	1.69	25.73	62.27	0.41
CP H6-H5	17875 HR Weir	Lat Struct									
CP H6-H5	17850	52.17	2791.05	2791.84	2791.84	2792.08	0.009429	2.67	14.13	32.84	0.65
CP H6-H5	17825 HR Weir	Lat Struct									
CP H6-H5	17800	39.94	2790.57	2791.28	2791.28	2791.48	0.010309	2.73	11.48	31.47	0.67
CP H6-H5	17775 HR Weir	Lat Struct									
CP H6-H5	17750	33.63	2790.21	2790.69	2790.69	2790.86	0.007777	1.67	11.11	33.97	0.54
CP H6-H5	17725 HR Weir	Lat Struct									
CP H6-H5	17700	24.73	2789.47	2789.72	2789.72	2789.83	0.006999	0.96	10.18	53.66	0.45
CP H6-H5	17650	24.73	2788.10	2788.60	2788.60	2788.71	0.010022	1.95	9.50	43.98	0.61
CP H6-H5	17600	24.73	2786.53	2787.20	2787.20	2787.32	0.015178	2.69	8.73	40.08	0.78

HEC-RAS Plan: cph5&6_exst River: EAST SWALE Reach: CP H6-H5 Profile: PF 1

Reach	River Sta	E.G. Elev	W.S. Elev	Vel Head	Froude # Chl	Froude # XS	Frctn Loss	C & E Loss	Q Total	Q Left	Q Channel	Q Right	Top Width	Q Weir
		(ft)	(ft)	(ft)			(ft)	(ft)	(cfs)	(cfs)	(cfs)	(cfs)	(ft)	(cfs)
CP H6-H5	18600	2806.52	2806.44	0.08	0.7	0.74	0.99	0.01	42.0		42.0		63.2	
CP H6-H5	18550	2805.53	2805.38	0.15	1.0	1.02	1.31	0.01	42.0		42.0		45.7	
CP H6-H5	18500	2804.07	2803.86	0.21	1.0	1.01	1.25	0.00	42.0		42.0		28.6	
CP H6-H5	18450	2802.70	2802.50	0.19	1.0	1.01	0.71	0.02	42.0		42.0		31.6	
CP H6-H5	18400	2800.84	2800.73	0.11	0.6	0.64	0.63	0.01	42.0		42.0		28.2	
CP H6-H5	18350	2800.20	2799.96	0.24	0.9	0.98	1.02	0.00	42.0		40.8	1.2	28.7	
CP H6-H5	18300	2799.15	2798.89	0.26	1.0	0.98	0.91	0.01	42.0		42.0		18.9	
CP H6-H5	18250	2797.46	2797.24	0.22	0.9	0.83	0.96	0.00	106.0		99.5	6.5	59.7	
CP H6-H5	18200	2796.49	2796.23	0.26	1.0	1.04	1.09	0.00	106.0		105.5	0.5	57.6	
CP H6-H5	18150	2795.09	2794.81	0.28	1.0	0.99	1.10	0.02	106.0	0.2	102.1	3.7	55.3	
CP H6-H5	18100	2793.81	2793.59	0.22	1.0	1.01	0.71	0.03	106.0	1.2	104.1	0.8	71.7	
CP H6-H5	18050	2792.99	2792.88	0.11	0.7	0.60	0.22	0.02	106.0	3.4	89.1	13.5	115.4	
CP H6-H5	18000	2792.76	2792.70	0.06	0.4	0.31	0.17	0.01	106.0	13.7	64.5	27.7	101.1	
CP H6-H5	17975 30" Culvert & HR								106.0					0.0
CP H6-H5	17950	2792.58	2792.47	0.12	0.5	0.71	0.23	0.00	79.6	41.3	37.9	0.4	76.9	
CP H6-H5	17925 HR Weir								79.6					9.4
CP H6-H5	17900	2792.35	2792.20	0.14	0.4	0.75	0.26	0.01	70.2	63.3	6.3	0.6	62.3	
CP H6-H5	17875 HR Weir								70.2					18.2
CP H6-H5	17850	2792.08	2791.84	0.24	0.6	0.99	0.49	0.01	52.2	38.7	13.5		32.8	
CP H6-H5	17825 HR Weir								52.2					12.3
CP H6-H5	17800	2791.48	2791.28	0.20	0.7	1.01	0.45	0.01	39.9	29.0	10.9		31.5	
CP H6-H5	17775 HR Weir								39.9					6.4
CP H6-H5	17750	2790.86	2790.69	0.17	0.5	0.93	0.37	0.02	33.6	28.6	5.1		34.0	
CP H6-H5	17725 HR Weir								33.6					8.9
CP H6-H5	17700	2789.83	2789.72	0.10	0.5	0.98	0.42	0.00	24.7	23.5	1.2		53.7	
CP H6-H5	17650	2788.71	2788.60	0.11	0.6	0.99	0.61	0.00	24.7	20.5	4.3		44.0	
CP H6-H5	17600	2787.32	2787.20	0.13	0.8	1.07			24.7	13.5	11.3		40.1	

PB Proj No. 11515
TSMS Node MG-N0080
Existing Condition

```
                    HEC-RAS Version 3.1.3 May 2005
                     U.S. Army Corp 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: TSMS MG_N0080
Project File : MGN0080.prj
Run Date and Time: 1/14/2008 9:50:52 AM

Project in English units

Project Description:
Kensington Wash
Located southside of Kensington Drive

PLAN DATA

Plan Title: TSMS MG_N0080 EXISTING
Plan File : 1:\11515\Drainage\HECRAS\TSMS MG_N0080\MGN0080.p01

Geometry Title: TSMS MG_N0080 EXISTING
Geometry File : 1:\11515\Drainage\HECRAS\TSMS MG_N0080\MGN0080.g01

Flow Title : TSMS MG_N0080
Flow File : 1:\11515\Drainage\HECRAS\TSMS MG_N0080\MGN0080.f01

Plan Description:
Existing Condition Analysis

Plan Summary Information:

Number of:	Cross Sections	=	10	Multiple Openings	=	0
	Culverts	=	1	Inline Structures	=	0
	Bridges	=	0	Lateral Structures	=	0

Computational Information

Water surface calculation tolerance	=	0.01
Critical depth calculation tolerance	=	0.01
Maximum number of iterations	=	20
Maximum difference tolerance	=	0.3
Flow tolerance factor	=	0.001

Computation Options

Critical depth computed at all cross sections	
Conveyance Calculation Method:	At breaks in n values only
Friction Slope Method:	Average Conveyance
Computational Flow Regime:	Subcritical Flow

FLOW DATA

Flow Title: TSMS MG_N0080
Flow File : 1:\11515\Drainage\HECRAS\TSMS MG_N0080\MGN0080.f01

Flow Data (cfs)

PB Proj No. 11515
TSMS Node MG-N0080
Existing Condition

River	Reach	RS	TSMS 100YR	TSMS 10YR
MGN0080	Kennsington	1440	465	184

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
MGN0080	Kennsington	TSMS 100YR	Critical	Rating Curve #1
MGN0080	Kennsington	TSMS 10YR	Critical	Known WS = 2778.45

Rating Curve #1

Flow (cfs)	Elev (ft)
0	2772.68
50	2774.05
100	2774.86
150	2775.59
200	2776.26
250	2776.92
300	2777.6
350	2778.32
400	2779.11
450	2779.97
465	2780.06

GEOMETRY DATA

Geometry Title: TSMS MG_N0080 EXISTING
Geometry File : l:\11515\Drainage\HECRAS\TSMS MG_N0080\MGN0080.g01

PB Proj No. 11515
TSMS Node MG-N0080
Existing Condition

CROSS SECTION

RIVER: MGN0080
REACH: Kennsington RS: 1440

INPUT
Description: uppermost xsec
Dense over bank brush
Main Channel Dense brush &
Braided condition
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2804	0	2794	17	2794	46	2792	60	2791.2
100	2791.8	142	2791.5	165	2792	188	2794	220	2794
220	2804								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	46	.06	165	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
46	165	120	150	165	.1	.3

CROSS SECTION OUTPUT Profile #TSMS 100YR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2793.01	Element			
Vel Head (ft)	0.14	Wt. n-Val.	0.080	0.060	0.080
W.S. Elev (ft)	2792.87	Reach Len. (ft)	120.00	150.00	165.00
Crit W.S. (ft)	2792.40	Flow Area (sq ft)	5.50	149.65	4.36
E.G. Slope (ft/ft)	0.011057	Area (sq ft)	5.50	149.65	4.36
Q Total (cfs)	465.00	Flow (cfs)	6.15	453.97	4.88
Top Width (ft)	141.64	Top Width (ft)	12.62	119.00	10.01
Vel Total (ft/s)	2.92	Avg. Vel. (ft/s)	1.12	3.03	1.12
Max Chl Dpth (ft)	1.67	Hydr. Depth (ft)	0.44	1.26	0.44
Conv. Total (cfs)	4422.1	Conv. (cfs)	58.5	4317.2	46.4
Length Wtd. (ft)	149.86	Wetted Per. (ft)	12.65	119.03	10.05
Min Ch El (ft)	2791.20	Shear (lb/sq ft)	0.30	0.87	0.30
Alpha	1.06	Stream Power (lb/ft s)	0.34	2.63	0.33
Frctn Loss (ft)	2.36	Cum Volume (acre-ft)	0.20	5.73	0.67
C & E Loss (ft)	0.01	Cum SA (acres)	0.21	2.31	0.48

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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: MGN0080
REACH: Kennsington RS: 1290

INPUT
Description: Dense Overbank Brush
Dense Main Channel Brush & Braided Condition
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2802	0	2792	8	2792	35	2790	62	2789.2
85	2789.5	160	2789.8	168	2789.2	183	2790	212	2792
234	2794	250	2794	250	2804				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	35	.06	183	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
35	183	75	125	140	.1	.3

CROSS SECTION OUTPUT Profile #TSMS 100YR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2790.66	Element			
Vel Head (ft)	0.19	Wt. n-Val.	0.080	0.060	0.080
W.S. Elev (ft)	2790.46	Reach Len. (ft)	75.00	125.00	140.00

PB Proj No. 11515
TSMS Node MG-N0080
Existing Condition

Crit W.S. (ft)	2790.25	Flow Area (sq ft)	1.45	130.62	1.56
E.G. Slope (ft/ft)	0.024081	Area (sq ft)	1.45	130.62	1.56
Q Total (cfs)	465.00	Flow (cfs)	1.58	461.73	1.69
Top Width (ft)	160.98	Top Width (ft)	6.26	148.00	6.72
Vel Total (ft/s)	3.48	Avg. Vel. (ft/s)	1.09	3.54	1.09
Max Chl Dpth (ft)	1.26	Hydr. Depth (ft)	0.23	0.88	0.23
Conv. Total (cfs)	2996.5	Conv. (cfs)	10.2	2975.4	10.9
Length Wtd. (ft)	124.87	Wetted Per. (ft)	6.28	148.06	6.74
Min Ch El (ft)	2789.20	Shear (lb/sq ft)	0.35	1.33	0.35
Alpha	1.03	Stream Power (lb/ft s)	0.38	4.69	0.38
Frctn Loss (ft)	2.04	Cum Volume (acre-ft)	0.19	5.25	0.66
C & E Loss (ft)	0.02	Cum SA (acres)	0.18	1.85	0.45

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: MGN0080
REACH: Kennsington RS: 1165

INPUT
Description:
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2802	0	2792	29	2791	33	2789	55	2788
86	2787	130	2787.6	150	2787.8	174	2787	176	2786.9
178	2787	202	2787.5	216	2788	238	2790	260	2791
280	2791.5	280	2801.5						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	55	.06	216	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
55	216	24	34	39	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
42	50	2790

CROSS SECTION OUTPUT Profile #TSMS 100YR

E.G. Elev (ft)	2788.58	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.	0.080	0.060	0.080
W.S. Elev (ft)	2788.47	Reach Len. (ft)	24.00	34.00	39.00
Crit W.S. (ft)	2788.06	Flow Area (sq ft)	1.76	167.24	1.19
E.G. Slope (ft/ft)	0.011853	Area (sq ft)	1.76	167.24	1.19
Q Total (cfs)	465.00	Flow (cfs)	1.71	462.38	0.91
Top Width (ft)	171.11	Top Width (ft)	5.00	161.00	5.11
Vel Total (ft/s)	2.73	Avg. Vel. (ft/s)	0.98	2.76	0.76
Max Chl Dpth (ft)	1.56	Hydr. Depth (ft)	0.35	1.04	0.23
Conv. Total (cfs)	4271.0	Conv. (cfs)	15.7	4247.0	8.3
Length Wtd. (ft)	33.95	Wetted Per. (ft)	5.24	161.05	5.13
Min Ch El (ft)	2786.90	Shear (lb/sq ft)	0.25	0.77	0.17
Alpha	1.02	Stream Power (lb/ft s)	0.24	2.12	0.13
Frctn Loss (ft)	0.77	Cum Volume (acre-ft)	0.18	4.82	0.66
C & E Loss (ft)	0.02	Cum SA (acres)	0.17	1.41	0.43

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: MGN0080
REACH: Kennsington RS: 1131

INPUT
Description:
Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2790.9	20.6	2789.88	30.1	2788.66	70	2787.029	84.9	2786.42

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Existing Condition

106.7	2786.78	111.6	2786.78	114.6	2786.65	131.8	2786.83	137.6	2786.68
141.6	2786.69	148.6	2786.77	157.4	2786.66	165.7	2786.94	168.9	2786.82
177.4	2786.94	195.9	2786.79	201.7	2786.6	220	2787.85	229.8	2788.52
258.5	2789.85	277.6	2790.39						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	70	.06	220	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
70	220	56	56	56	.1	.3

CROSS SECTION OUTPUT Profile #TSMS 100YR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2787.79	Element			
Vel Head (ft)	0.34	Wt. n-Val.	0.080	0.060	
W.S. Elev (ft)	2787.45	Reach Len. (ft)	56.00	56.00	56.00
Crit W.S. (ft)	2787.45	Flow Area (sq ft)	2.17	98.29	
E.G. Slope (ft/ft)	0.059925	Area (sq ft)	2.17	98.29	
Q Total (cfs)	465.00	Flow (cfs)	3.50	461.50	
Top Width (ft)	154.47	Top Width (ft)	10.32	144.15	
Vel Total (ft/s)	4.63	Avg. Vel. (ft/s)	1.61	4.70	
Max Chl Dpth (ft)	1.03	Hydr. Depth (ft)	0.21	0.68	
Conv. Total (cfs)	1899.5	Conv. (cfs)	14.3	1885.2	
Length Wtd. (ft)	56.00	Wetted Per. (ft)	10.32	144.22	
Min Ch El (ft)	2786.42	Shear (lb/sq ft)	0.79	2.55	
Alpha	1.02	Stream Power (lb/ft s)	1.27	11.97	
Frctn Loss (ft)	0.12	Cum Volume (acre-ft)	0.18	4.72	0.66
C & E Loss (ft)	0.07	Cum SA (acres)	0.17	1.29	0.43

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: MGN0080
REACH: Kennsington RS: 1075

INPUT
Description: East ROW
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2791	153	2785	224	2784	230	2784	264	2785
302	2788	370	2788.5						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	153	.025	264	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
153	264	45	45	45	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	180	2788	F

CROSS SECTION OUTPUT Profile #TSMS 100YR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2786.62	Element			
Vel Head (ft)	0.10	Wt. n-Val.		0.025	0.080
W.S. Elev (ft)	2786.52	Reach Len. (ft)	45.00	45.00	45.00
Crit W.S. (ft)	2785.36	Flow Area (sq ft)		181.07	14.64
E.G. Slope (ft/ft)	0.000654	Area (sq ft)	29.47	227.25	14.64
Q Total (cfs)	465.00	Flow (cfs)		459.22	5.78
Top Width (ft)	169.02	Top Width (ft)	38.77	111.00	19.26
Vel Total (ft/s)	2.38	Avg. Vel. (ft/s)		2.54	0.39
Max Chl Dpth (ft)	2.52	Hydr. Depth (ft)		2.16	0.76

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Conv. Total (cfs)	18182.2	Conv. (cfs)		17956.2	226.0
Length Wtd. (ft)	45.00	Wetted Per. (ft)		84.02	19.32
Min Ch El (ft)	2784.00	Shear (lb/sq ft)		0.09	0.03
Alpha	1.13	Stream Power (lb/ft s)		0.22	0.01
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	0.16	4.51	0.65
C & E Loss (ft)	0.03	Cum SA (acres)	0.14	1.13	0.42

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: MGN0080
REACH: Kennsington RS: 1030

INPUT
Description: US Face of Culvert
Code Rating Curve to Account for Angle point in Culverts, See External Computation

Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2788.8	180	2784	233	2783.8	280	2784	352	2785
392	2785.4								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.016	180	.016	280	.016

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
180	280	57	85	110	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	223.75	2786.3	F
256.25	392	2786.3	F

Internal Rating Curve

Flow (cfs)	Elev (ft)
0	2781.49
120	2784.61
133.5	2786.19
169	2786.41
267.7	2786.68
409.4	2786.92
594.4	2767.18
814.3	2787.43

CROSS SECTION OUTPUT Profile #TSMS 100YR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2786.59	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.016	0.016	0.016
W.S. Elev (ft)	2786.58	Reach Len. (ft)	57.00	85.00	110.00
Crit W.S. (ft)	2785.70	Flow Area (sq ft)	124.67	267.86	204.81
E.G. Slope (ft/ft)	0.000027	Area (sq ft)	124.67	267.86	204.81
Q Total (cfs)	465.00	Flow (cfs)	70.90	248.07	146.03
Top Width (ft)	308.70	Top Width (ft)	96.70	100.00	112.00
Vel Total (ft/s)	0.78	Avg. Vel. (ft/s)	0.57	0.93	0.71
Max Chl Dpth (ft)	2.78	Hydr. Depth (ft)	1.29	2.68	1.83
Conv. Total (cfs)	89934.5	Conv. (cfs)	13712.4	47978.8	28243.3
Length Wtd. (ft)	85.00	Wetted Per. (ft)	96.73	100.00	113.19
Min Ch El (ft)	2783.80	Shear (lb/sq ft)	0.00	0.00	0.00
Alpha	1.10	Stream Power (lb/ft s)	0.00	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	0.08	4.25	0.54
C & E Loss (ft)		Cum SA (acres)	0.07	1.02	0.35

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TSMS Node MG-N0080
Existing Condition

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid,
energy was used.

CULVERT

RIVER: MGN0080
REACH: Kennsington RS: 1020

INPUT
Description:
Distance from Upstream XS = 10
Deck/Roadway Width = 70
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 6

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2787.6		84	2786.5		192	2786.3	
268	2786		325	2785.8		475	2785	

Upstream Bridge Cross Section Data
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2788.8	180	2784	233	2783.8	280	2784	352	2785
392	2785.4								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.016	180	.016	280	.016

Bank Sta: Left	Right	Coeff Contr.	Expan.
180	280	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	223.75	2786.3	F
256.25	392	2786.3	F

Internal Rating Curve

Flow (cfs)	Elev (ft)
0	2781.49
120	2784.61
133.5	2786.19
169	2786.41
267.7	2786.68
409.4	2786.92
594.4	2767.18
814.3	2787.43

Downstream Deck/Roadway Coordinates
num= 6

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2787.6		84	2786.5		192	2786.3	
268	2786		325	2785.8		475	2785	

Downstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2787.2	17	2787	100	2786	145	2785.5	155	2785
183	2781	197	2783	212	2783.5	248	2783	260	2782.6
260	2783.1	273	2782.5	273	2790				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	155	.04	197	.02

Bank Sta: Left	Right	Coeff Contr.	Expan.
155	197	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	175.25	2786	F

PB Proj No. 11515
TSMS Node MG-N0080
Existing Condition

192.75	273	2786	F

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Circular	3.5	

FHWA Chart # 2 - Corrugated Metal Pipe Culvert
FHWA Scale # 1 - Headwall
Solution Criteria = Highest U.S. EG

Culvert Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
10	75	.024	.024	0	.5	1

Number of Barrels = 3
Upstream Elevation = 2781.49
Centerline Stations

Sta.	Sta.	Sta.
235.5	240	244.5

Downstream Elevation = 2780.79
Centerline Stations

Sta.	Sta.	Sta.
179.5	184	188.5

CULVERT OUTPUT Profile #TSMS 100YR Culv Group: Culvert #1

Q Culv Group (cfs)	141.70	Culv Full Len (ft)	75.00
# Barrels	3	Culv Vel US (ft/s)	4.91
Q Barrel (cfs)	47.23	Culv Vel DS (ft/s)	4.91
E.G. US. (ft)	2786.58	Culv Inv El Up (ft)	2781.49
W.S. US. (ft)	2786.58	Culv Inv El Dn (ft)	2780.79
E.G. DS (ft)	2785.83	Culv Frctn Ls (ft)	0.56
W.S. DS (ft)	2784.44	Culv Exit Loss (ft)	
Delta EG (ft)	0.75	Culv Entr Loss (ft)	0.19
Delta WS (ft)	2.14	Q Weir (cfs)	323.30
E.G. IC (ft)	2786.44	Weir Sta Lft (ft)	83.29
E.G. OC (ft)	2786.58	Weir Sta Rgt (ft)	392.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	2784.99	Weir Max Depth (ft)	1.14
Culv WS Outlet (ft)	2784.29	Weir Avg Depth (ft)	0.50
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	154.86
Culv Crt Depth (ft)	2.15	Min El Weir Flow (ft)	2786.06

CROSS SECTION

RIVER: MGN0080
REACH: Kennsington RS: 945

INPUT
Description: DS XSEC Culv
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2787.2	17	2787	100	2786	145	2785.5	155	2785
183	2781	197	2783	212	2783.5	248	2783	260	2782.6
260	2783.1	273	2782.5	273	2790				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	155	.04	197	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
155	197	55	85	105	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	175.25	2786	F
192.75	273	2786	F

CROSS SECTION OUTPUT Profile #TSMS 100YR

PB Proj No. 11515
TSMS Node MG-N0080
Existing Condition

E.G. Elev (ft)	2785.83	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.39	Wt. n-Val.		0.040	
W.S. Elev (ft)	2784.44	Reach Len. (ft)	55.00	85.00	105.00
Crit W.S. (ft)	2784.44	Flow Area (sq ft)		49.18	
E.G. Slope (ft/ft)	0.016558	Area (sq ft)		75.71	101.94
Q Total (cfs)	465.00	Flow (cfs)		465.00	
Top Width (ft)	114.10	Top Width (ft)		38.10	76.00
Vel Total (ft/s)	9.46	Avg. Vel. (ft/s)		9.46	
Max Chl Dpth (ft)	3.44	Hydr. Depth (ft)		2.81	
Conv. Total (cfs)	3613.6	Conv. (cfs)		3613.6	
Length Wtd. (ft)	85.00	Wetted Per. (ft)		17.68	
Min Ch El (ft)	2781.00	Shear (lb/sq ft)		2.88	
Alpha	1.00	Stream Power (lb/ft s)		27.19	
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	0.00	3.92	0.15
C & E Loss (ft)	0.68	Cum SA (acres)	0.00	0.88	0.11

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: MGN0080
REACH: Kennsington RS: 865

INPUT
Description:
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2787	91	2783	100	2782	138	2776	156	2775.2
188	2775.3	199	2775.4	203	2776	223	2780	230	2780.2

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	100	.04	223	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
100	223	140	120	100	.3	.5

CROSS SECTION OUTPUT Profile #TSMS 100YR

E.G. Elev (ft)	2780.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.		0.040	0.020
W.S. Elev (ft)	2780.06	Reach Len. (ft)	140.00	120.00	100.00
Crit W.S. (ft)	2776.56	Flow Area (sq ft)		396.88	0.06
E.G. Slope (ft/ft)	0.000183	Area (sq ft)		396.88	0.06
Q Total (cfs)	465.00	Flow (cfs)		464.99	0.01
Top Width (ft)	112.83	Top Width (ft)		110.72	2.11
Vel Total (ft/s)	1.17	Avg. Vel. (ft/s)		1.17	0.10
Max Chl Dpth (ft)	4.86	Hydr. Depth (ft)		3.58	0.03
Conv. Total (cfs)	34372.6	Conv. (cfs)		34372.1	0.5
Length Wtd. (ft)	119.96	Wetted Per. (ft)		111.49	2.11
Min Ch El (ft)	2775.20	Shear (lb/sq ft)		0.04	0.00
Alpha	1.00	Stream Power (lb/ft s)		0.05	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	0.00	3.46	0.03
C & E Loss (ft)	0.01	Cum SA (acres)	0.00	0.74	0.02

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.

PB Proj No. 11515
TSMS Node MG-N0080
Existing Condition

CROSS SECTION

RIVER: MGN0080
REACH: Kennsington RS: 745

INPUT
Description: DS XSEC for Reach
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2782	25	2780	46	2775	80	2774.8	103	2774.6
140	2774.4	170	2774.3	180	2775	195	2778	202	2779

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	25	.03	195	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
25	195	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #TSMS 100YR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2780.07	Element			
Vel Head (ft)	0.00	Wt. n-Val.	0.040	0.030	0.040
W.S. Elev (ft)	2780.06	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	2775.33	Flow Area (sq ft)	0.03	837.71	10.95
E.G. Slope (ft/ft)	0.000015	Area (sq ft)	0.03	837.71	10.95
Q Total (cfs)	465.00	Flow (cfs)	0.00	463.08	1.92
Top Width (ft)	177.80	Top Width (ft)	0.80	170.00	7.00
Vel Total (ft/s)	0.55	Avg. Vel. (ft/s)	0.01	0.55	0.18
Max Chl Dpth (ft)	5.76	Hydr. Depth (ft)	0.03	4.93	1.56
Conv. Total (cfs)	120221.5	Conv. (cfs)	0.1	119725.6	495.8
Length Wtd. (ft)	100.00	Wetted Per. (ft)	0.81	170.91	8.14
Min Ch El (ft)	2774.30	Shear (lb/sq ft)	0.00	0.00	0.00
Alpha	1.01	Stream Power (lb/ft s)	0.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	0.00	1.76	0.01
C & E Loss (ft)	0.00	Cum SA (acres)	0.00	0.35	0.01

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

CROSS SECTION

RIVER: MGN0080
REACH: Kennsington RS: 640

INPUT
Description:
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2782	27	2780	42	2776	65	2773.2	118	2774
146	2776	162	2777.5						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	27	.03	162	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
27	162	0	0	0	.1	.3

CROSS SECTION OUTPUT Profile #TSMS 100YR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2780.07	Element			
Vel Head (ft)	0.01	Wt. n-Val.	0.040	0.030	
W.S. Elev (ft)	2780.06	Reach Len. (ft)			
Crit W.S. (ft)	2774.82	Flow Area (sq ft)	0.02	693.51	
E.G. Slope (ft/ft)	0.000021	Area (sq ft)	0.02	693.51	
Q Total (cfs)	465.00	Flow (cfs)	0.00	465.00	
Top Width (ft)	135.81	Top Width (ft)	0.81	135.00	
Vel Total (ft/s)	0.67	Avg. Vel. (ft/s)	0.02	0.67	
Max Chl Dpth (ft)	6.86	Hydr. Depth (ft)	0.03	5.14	
Conv. Total (cfs)	100585.3	Conv. (cfs)	0.1	100585.2	
Length Wtd. (ft)		Wetted Per. (ft)	0.81	138.40	
Min Ch El (ft)	2773.20	Shear (lb/sq ft)	0.00	0.01	

PB Proj No. 11515
TSMS Node MG-N0080
Existing Condition

Alpha	1.00	Stream Power (lb/ft s)	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)		
C & E Loss (ft)		Cum SA (acres)		

SUMMARY OF MANNING'S N VALUES

River:MGN0080

Reach	River Sta.	n1	n2	n3
Kennsington	1440	.08	.06	.08
Kennsington	1290	.08	.06	.08
Kennsington	1165	.08	.06	.08
Kennsington	1131	.08	.06	.08
Kennsington	1075	.08	.025	.08
Kennsington	1030	.016	.016	.016
Kennsington	1020	Culvert		
Kennsington	945	.03	.04	.02
Kennsington	865	.03	.04	.02
Kennsington	745	.04	.03	.04
Kennsington	640	.04	.03	.04

SUMMARY OF REACH LENGTHS

River: MGN0080

Reach	River Sta.	Left	Channel	Right
Kennsington	1440	120	150	165
Kennsington	1290	75	125	140
Kennsington	1165	24	34	39
Kennsington	1131	56	56	56
Kennsington	1075	45	45	45
Kennsington	1030	57	85	110
Kennsington	1020	Culvert		
Kennsington	945	55	85	105
Kennsington	865	140	120	100
Kennsington	745	100	100	100
Kennsington	640	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: MGN0080

Reach	River Sta.	Contr.	Expan.
Kennsington	1440	.1	.3
Kennsington	1290	.1	.3
Kennsington	1165	.1	.3
Kennsington	1131	.1	.3
Kennsington	1075	.1	.3
Kennsington	1030	.3	.5
Kennsington	1020	Culvert	
Kennsington	945	.3	.5
Kennsington	865	.3	.5
Kennsington	745	.1	.3
Kennsington	640	.1	.3

PB Proj No. 11515
TSMS Node MG-N0080
Existing Condition

Profile Output Table - Standard Table 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Kennsington	1440	TSMS 100YR	465.00	2791.20	2792.87	2792.40	2793.01	0.011057	3.03	159.50	141.64	0.48
Kennsington	1290	TSMS 100YR	465.00	2789.20	2790.46	2790.25	2790.66	0.024081	3.54	133.63	160.98	0.66
Kennsington	1165	TSMS 100YR	465.00	2786.90	2788.47	2788.06	2788.58	0.011853	2.76	170.18	171.11	0.48
Kennsington	1131	TSMS 100YR	465.00	2786.42	2787.45	2787.45	2787.79	0.059925	4.70	100.47	154.47	1.00
Kennsington	1075	TSMS 100YR	465.00	2784.00	2786.52	2785.36	2786.62	0.000654	2.54	195.71	169.02	0.30
Kennsington	1030	TSMS 100YR	465.00	2783.80	2786.58	2785.70	2786.59	0.000027	0.93	597.34	308.70	0.10
Kennsington	1020		Culvert									
Kennsington	945	TSMS 100YR	465.00	2781.00	2784.44	2784.44	2785.83	0.016558	9.46	49.18	114.10	0.99
Kennsington	865	TSMS 100YR	465.00	2775.20	2780.06	2776.56	2780.08	0.000183	1.17	396.95	112.83	0.11
Kennsington	745	TSMS 100YR	465.00	2774.30	2780.06	2775.33	2780.07	0.000015	0.55	848.69	177.80	0.04
Kennsington	640	TSMS 100YR	465.00	2773.20	2780.06	2774.82	2780.07	0.000021	0.67	693.53	135.81	0.05

Profile Output Table - Standard Table 2

Reach	River Sta	Profile	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
Kennsington	1440	TSMS 100YR	2793.01	2792.87	0.14	2.36	0.01	6.15	453.97	4.88	141.64
Kennsington	1290	TSMS 100YR	2790.66	2790.46	0.19	2.04	0.02	1.58	461.73	1.69	160.98
Kennsington	1165	TSMS 100YR	2788.58	2788.47	0.12	0.77	0.02	1.71	462.38	0.91	171.11
Kennsington	1131	TSMS 100YR	2787.79	2787.45	0.34	0.12	0.07	3.50	461.50		154.47
Kennsington	1075	TSMS 100YR	2786.62	2786.52	0.10	0.00	0.03		459.22	5.78	169.02
Kennsington	1030	TSMS 100YR	2786.59	2786.58	0.01			70.90	248.07	146.03	308.70
Kennsington	1020		Culvert								
Kennsington	945	TSMS 100YR	2785.83	2784.44	1.39	0.05	0.68		465.00		114.10
Kennsington	865	TSMS 100YR	2780.08	2780.06	0.02	0.00	0.01		464.99	0.01	112.83
Kennsington	745	TSMS 100YR	2780.07	2780.06	0.00	0.00	0.00	0.00	463.08	1.92	177.80
Kennsington	640	TSMS 100YR	2780.07	2780.06	0.01			0.00	465.00		135.81

PB Proj No. 11515
TSMS Node MG-N0080
Existing Condition

Profile Output Table - Culvert Only

Reach	River Sta		Profile	E.G. US.	W.S. US.	E.G. IC	E.G. OC	Min El Weir Flow	Q Culv Group	Q Weir	Delta WS	Culv Vel US	Culv Vel DS
				(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(ft)	(ft/s)	(ft/s)
Kennsington	1020	Culvert #1	TSMS 100YR	2786.58	2786.58	2786.44	2786.58	2786.06	141.70	323.30	2.14	4.91	4.91

PB Proj No. 11515
TSMS Node MG-N0080
Existing Condition

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : N0080_EXST

River: MGN0080 Reach: Kennsington RS: 1440 Profile: TSMS 100YR
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: MGN0080 Reach: Kennsington RS: 1290 Profile: TSMS 100YR
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: MGN0080 Reach: Kennsington RS: 1165 Profile: TSMS 100YR
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.
River: MGN0080 Reach: Kennsington RS: 1131 Profile: TSMS 100YR
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: MGN0080 Reach: Kennsington RS: 1075 Profile: TSMS 100YR
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
River: MGN0080 Reach: Kennsington RS: 1030 Profile: TSMS 100YR
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: MGN0080 Reach: Kennsington RS: 945 Profile: TSMS 100YR
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: MGN0080 Reach: Kennsington RS: 865 Profile: TSMS 100YR
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.
River: MGN0080 Reach: Kennsington RS: 745 Profile: TSMS 100YR
Warning:The cross-section end points had to be extended vertically for the computed water surface.

HEC-RAS Plan: N0080_EXST River: MGN0080 Reach: Kennsington Profile: TSMS 100YR

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Kennsington	1440	465.00	2791.20	2792.87	2792.40	2793.01	0.011057	3.03	159.50	141.64	0.48
Kennsington	1290	465.00	2789.20	2790.46	2790.25	2790.66	0.024081	3.54	133.63	160.98	0.66
Kennsington	1165	465.00	2786.90	2788.47	2788.06	2788.58	0.011853	2.76	170.18	171.11	0.48
Kennsington	1131	465.00	2786.42	2787.45	2787.45	2787.79	0.059925	4.70	100.47	154.47	1.00
Kennsington	1075	465.00	2784.00	2786.52	2785.36	2786.62	0.000654	2.54	195.71	169.02	0.30
Kennsington	1030	465.00	2783.80	2786.58	2785.70	2786.59	0.000027	0.93	597.34	308.70	0.10
Kennsington	1020	Culvert									
Kennsington	945	465.00	2781.00	2784.44	2784.44	2785.83	0.016558	9.46	49.18	114.10	0.99
Kennsington	865	465.00	2775.20	2780.06	2776.56	2780.08	0.000183	1.17	396.95	112.83	0.11
Kennsington	745	465.00	2774.30	2780.06	2775.33	2780.07	0.000015	0.55	848.69	177.80	0.04
Kennsington	640	465.00	2773.20	2780.06	2774.82	2780.07	0.000021	0.67	693.53	135.81	0.05

HEC-RAS River: MGN0080 Reach: Kennsington Profile: TSMS 100YR

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Kennsington	1440	TSMS 100YR	MGN0080NEW	465.00	2791.20	2792.90	2792.40	2793.04	0.010162	2.96	163.94	142.45	0.46
Kennsington	1440	TSMS 100YR	N0080_EXST	465.00	2791.20	2792.87	2792.40	2793.01	0.011057	3.03	159.50	141.64	0.48
Kennsington	1290	TSMS 100YR	MGN0080NEW	465.00	2789.20	2790.42	2790.26	2790.63	0.028646	3.73	126.54	159.74	0.72
Kennsington	1290	TSMS 100YR	N0080_EXST	465.00	2789.20	2790.46	2790.25	2790.66	0.024081	3.54	133.63	160.98	0.66
Kennsington	1165	TSMS 100YR	MGN0080NEW	465.00	2786.90	2788.52	2788.06	2788.62	0.010075	2.63	178.97	171.68	0.44
Kennsington	1165	TSMS 100YR	N0080_EXST	465.00	2786.90	2788.47	2788.06	2788.58	0.011853	2.76	170.18	171.11	0.48
Kennsington	1131	TSMS 100YR	MGN0080NEW	465.00	2786.42	2787.53	2787.53	2787.92	0.056354	5.01	92.76	157.45	1.00
Kennsington	1131	TSMS 100YR	N0080_EXST	465.00	2786.42	2787.45	2787.45	2787.79	0.059925	4.70	100.47	154.47	1.00
Kennsington	1106	TSMS 100YR	MGN0080NEW	465.00	2778.05	2784.80	2781.03	2784.96	0.000546	3.22	144.46	49.34	0.23
Kennsington	1102	TSMS 100YR	MGN0080NEW	465.00	2777.97	2784.55	2781.12	2784.90	0.001028	4.74	98.07	67.22	0.33
Kennsington	1100			Culvert									
Kennsington	1075	TSMS 100YR	N0080_EXST	465.00	2784.00	2786.52	2785.36	2786.62	0.000654	2.54	195.71	169.02	0.30
Kennsington	1030	TSMS 100YR	N0080_EXST	465.00	2783.80	2786.58	2785.70	2786.59	0.000027	0.93	597.34	308.70	0.10
Kennsington	945	TSMS 100YR	N0080_EXST	465.00	2781.00	2784.44	2784.44	2785.83	0.016558	9.46	49.18	114.10	0.99
Kennsington	865	TSMS 100YR	MGN0080NEW	465.00	2775.20	2780.00	2777.62	2780.15	0.001196	3.10	150.09	108.54	0.27
Kennsington	865	TSMS 100YR	N0080_EXST	465.00	2775.20	2780.06	2776.56	2780.08	0.000183	1.17	396.95	112.83	0.11
Kennsington	745	TSMS 100YR	MGN0080NEW	465.00	2774.30	2780.06	2775.33	2780.07	0.000015	0.55	848.69	177.80	0.04
Kennsington	745	TSMS 100YR	N0080_EXST	465.00	2774.30	2780.06	2775.33	2780.07	0.000015	0.55	848.69	177.80	0.04
Kennsington	640	TSMS 100YR	MGN0080NEW	465.00	2773.20	2780.06	2774.82	2780.07	0.000021	0.67	693.53	135.81	0.05
Kennsington	640	TSMS 100YR	N0080_EXST	465.00	2773.20	2780.06	2774.82	2780.07	0.000021	0.67	693.53	135.81	0.05

B-4

CP-I

PARSONS BRINCKERHOFF COMPUTATION SHEET

Page 1 of 7

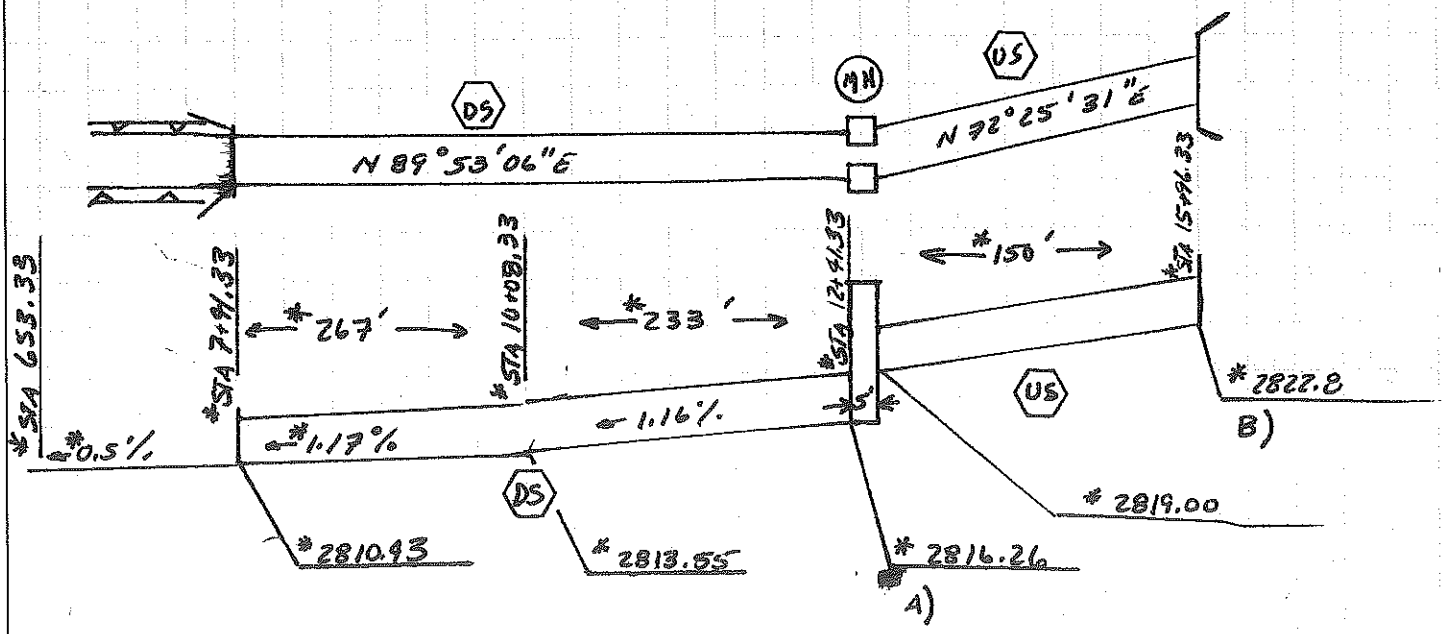
Made by GB

Date 05 NOV 07

Checked by

Date

Subject Houghton Road
East Hydraulic Analysis
CP I 2



- Data Compiled From As-Built Plans & Survey
- * Denotes As-Built Data

A) Denotes Survey Data

US 2 - 45" x 29" x 150' HERCP

DS 2 - 42" x 29" x 500' CMPA

A) North → Rim 2825.79
BOT 2817.75

South → Rim 2825.84
BOT 2817.72

Average → Rim 25.82 (+ 1.42')
BOT 17.74 (+ 1.48')

B) North → 2824.01

South → 2823.85

Average → 23.93 (+ 1.13')

Subject Houghton Road
Exist Hydraulic Analysis
CP I 2

BASED ON AS-BUILT & SURVEY DATA

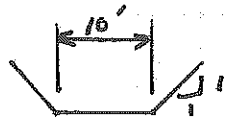
USED to Conduct Hydraulic Analysis

1) Adj US INV + 1.13' to 2823.93

2) Adj MH INVs + 1.48' US Pipe INV = 2820.48
DS Pipe INV = 2817.74

3) Adj DS Pipe + 1.48' DS pipe INV = 2811.91

TAILWATER SECTION :



n = 0.018
S_o = 0.5%

WEIR SEGMENT

Culvert Designer/Analyzer Report
CP I DS Pipes EXST

Comments: CP I
Downstream Pipes Analyses
Headwater on DS Pipes -> TW on US Pipes

Analysis Component			
Storm Event	Design	Discharge	71.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	71.00 cfs	Check Discharge	50.00 cfs

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	71.00 cfs	Bottom Elevation	11.91 ft
Depth	1.13 ft	Velocity	5.65 ft/s

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	2-42 x 29 inch Arch	71.00 cfs	20.63 ft	7.21 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
CP I DS Pipes EXST

Component:Culvert-1

Culvert Summary					
Computed Headwater Elev	20.63	ft	Discharge	71.00	cfs
Inlet Control HW Elev.	20.35	ft	Tailwater Elevation	13.04	ft
Outlet Control HW Elev.	20.63	ft	Control Type	Outlet Control	
Headwater Depth/Height	1.19				

Grades					
Upstream Invert	17.74	ft	Downstream Invert	11.91	ft
Length	500.00	ft	Constructed Slope	0.009915	ft/ft

Hydraulic Profile					
Profile	M2		Depth, Downstream	1.56	ft
Slope Type	Mild		Normal Depth	2.20	ft
Flow Regime	Subcritical		Critical Depth	1.56	ft
Velocity Downstream	7.21	ft/s	Critical Slope	0.017503	ft/ft

Section					
Section Shape	Arch		Mannings Coefficient	0.024	
Section Material	Steel and Aluminum Var CR		Span	3.50	ft
Section Size	42 x 29 inch		Rise	2.42	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	20.63	ft	Upstream Velocity Head	0.46	ft
Ke	0.50		Entrance Loss	0.23	ft

Inlet Control Properties					
Inlet Control HW Elev.	20.35	ft	Flow Control	Transition	
Inlet Type	90° headwall		Area Full	13.0	ft^2
K	0.00830		HDS 5 Chart	34	
M	2.00000		HDS 5 Scale	1	
C	0.03790		Equation Form	1	
Y	0.69000				

Rating Table Report
CP I DS Pipes EXST

Range Data:

	Minimum	Maximum	Increment	
Discharge	0.00	100.00	5.00	cfs

Discharge (cfs)	HW Elev. (ft)	TW Elev. (ft)	(I) Hwi	(O) Hwo	(D) Dn. V	(D) Dn. depth
0.00	17.74	11.91	17.74	17.74	0.00	0.00
5.00	18.29	12.14	18.22	18.29	2.95	0.36
10.00	18.55	12.26	18.45	18.55	3.63	0.52
15.00	18.77	12.35	18.65	18.77	4.12	0.65
20.00	18.96	12.44	18.82	18.96	4.52	0.76
25.00	19.13	12.51	18.99	19.13	4.86	0.86
30.00	19.29	12.58	19.14	19.29	5.16	0.96
35.00	19.45	12.65	19.29	19.45	5.45	1.04
40.00	19.60	12.71	19.44	19.60	5.72	1.13
45.00	19.74	12.77	19.59	19.74	5.98	1.21
50.00	19.89	12.83	19.73	19.89	6.22	1.28
55.00	20.04	12.88	19.88	20.04	6.46	1.35
60.00	20.19	12.93	20.02	20.19	6.70	1.42
65.00	20.35	12.98	20.17	20.35	6.93	1.49
70.00	20.56	13.03	20.32	20.56	7.16	1.55
75.00	22.30	13.08	20.56	22.30	7.39	1.61
80.00	23.68	13.12	20.82	23.68	7.62	1.67
85.00	24.98	13.17	21.02	24.98	7.85	1.73
90.00	26.32	13.21	21.21	26.32	8.09	1.78
95.00	27.71	13.25	21.42	27.71	8.33	1.84
100.00	29.16	13.29	21.64	29.16	8.58	1.88

Culvert Designer/Analyzer Report
CP I US Pipes EXST

Comments: HW Rating for DS Pipes 2-42"x29" CMPA ->
TW Rating for US Pipes 2-45"x29" HERCP

Analysis Component			
Storm Event	Design	Discharge	71.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	71.00 cfs	Check Discharge	50.00 cfs

Tailwater Conditions: Tailwater Rating

Discharge (cfs)	TW Elev. (ft)
0.00	17.74
5.00	18.29
10.00	18.55
15.00	18.77
20.00	18.96
25.00	19.13
30.00	19.29
35.00	19.45
40.00	19.60
45.00	19.74
50.00	19.89
55.00	20.04
60.00	20.19
65.00	20.35
70.00	20.56
75.00	22.30
80.00	23.68
85.00	24.98
90.00	26.32
95.00	27.71
100.00	29.16

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	2-29x45 inch Horiz Ellipse	71.00 cfs	26.58 ft	12.35 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
CP I US Pipes EXST

Component:Culvert-1

Culvert Summary					
Computed Headwater Elev:	26.58	ft	Discharge	71.00	cfs
Inlet Control HW Elev.	26.42	ft	Tailwater Elevation	20.91	ft
Outlet Control HW Elev.	26.58	ft	Control Type	Entrance Control	
Headwater Depth/Height	1.11				

Grades					
Upstream Invert	23.93	ft	Downstream Invert	20.48	ft
Length	150.00	ft	Constructed Slope	0.023000	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	1.01	ft
Slope Type	Steep		Normal Depth	1.00	ft
Flow Regime	Supercritical		Critical Depth	1.57	ft
Velocity Downstream	12.35	ft/s	Critical Slope	0.003921	ft/ft

Section					
Section Shape	Horizontal Ellipse		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.79	ft
Section Size	29x45 inch		Rise	2.40	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	26.58	ft	Upstream Velocity Head	0.72	ft
Ke	0.50		Entrance Loss	0.36	ft

Inlet Control Properties					
Inlet Control HW Elev.	26.42	ft	Flow Control	Unsubmerged	
Inlet Type	Square edge with headwall (horizontal ellipse)		Area Full	14.8	ft²
K	0.01000		HDS 5 Chart	29	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

PARSONS BRINCKERHOFF COMPUTATION SHEET

Page 1 of 1
Made by Bambaum
Date 05 Nov 07
Checked by
Date

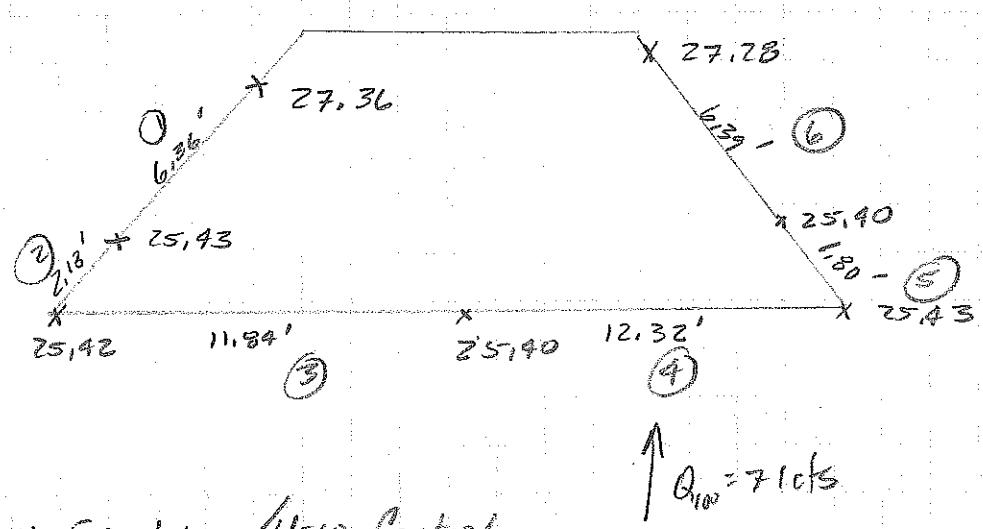
Subject Houghton Road
East Hydraulic Analysis
CP I 1

EXISTING WEIR - INLET

CULV HW_{EXST} = 26.58

WEIR CONFIGURATION:

STA ELEV



CHECK FOR INLET/WEIR CONTROL

WSE_{CULV} = 26.58

$Q_{WEIR\,(2-5)} = C L h^{3/2}$ → C = 3.0
L = 28.1'
WEIR ELEV ~ 25.42
h = 1.16'

$Q_{W\,(2-5)} = (3.0)(28.1)(1.16)^{1.5}$

= 105 cfs → Culvert Controls Weir Section → Drowns out Weir (Note Does not Include Sloped Weir Segments 1 & 6)

CHECK Submergence for Weir Flow

Irregular Submerged Weir Computation

Houghton Road
Existing Condition Hydraulics
CP I Drop Inlet Irregular Weir

$Qw = Cw \times DL \times d^{3/2}$ Cw = 3.0

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Irregular Weir Cross-Section:

SUBMERGED PORTION OF WEIR	STA (ft)	ELEV (ft)	SEGMENT
1	2.59	2826.58	
			A
2	6.4	2825.43	
			B
3	8.5	2825.42	
			C
4	20.3	2825.40	
			D
5	32.6	2825.43	
			E
6	34.4	2825.40	
			F
7	38.4	2826.58	
			G
8			
			H
9			
			I
10			
			J
11			
			K
12			
			L
13			

$$Q_{SUB} = Q_{FREEFLOW}\left[1-\left(\frac{H_{DS}}{H_{US}}\right)^{3/2}\right]^{0.385}$$

Referenc Civil Engineering Reference Manual, 6th Edition, Lindeburg, Michael, 1997 Professional Publications, Inc.

Culvert Head Water = 26.58

Base Elevation 2800 feet

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 26.58 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 26.72 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	f_{SUBMER} (--)	Q_{SUBMER}	WSE = 26.73 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	f_{SUBMER} (--)	
A	2.6	26.58				0.00				0.14						0.15				
	6.4	25.43	3.8	-0.3018	3.81	1.15	0.58	5.0	3.81	1.29	0.72	6.9	0.612	4.2	3.81	1.30	0.73	7.1	0.624	4.4
B	6.4	25.43				1.15				1.29						1.30				
	8.5	25.42	2.1	-0.0048	2.10	1.16	1.16	7.8	2.10	1.30	1.30	9.3	0.491	4.6	2.10	1.31	1.31	9.4	0.502	4.7
C	8.5	25.42				1.16				1.30						1.31				
	20.3	25.40	11.8	-0.0017	11.80	1.18	1.17	44.8	11.80	1.32	1.31	53.1	0.489	26.0	11.80	1.33	1.32	53.7	0.500	26.9
D	20.3	25.40				1.18				1.32						1.33				
	32.6	25.43	12.3	0.0024	12.30	1.15	1.17	46.4	12.30	1.29	1.31	55.0	0.490	26.9	12.30	1.30	1.32	55.6	0.501	27.9
E	32.6	25.43				1.15				1.29						1.30				
	34.4	25.40	1.8	-0.0167	1.80	1.18	1.17	6.8	1.80	1.32	1.31	8.1	0.490	3.9	1.80	1.33	1.32	8.1	0.501	4.1
F	34.4	25.40				1.18				1.32						1.33				
	38.4	26.58	4.0	0.2935	4.02	0.00	0.59	5.5	4.02	0.14	0.73	7.5	0.607	4.6	4.02	0.15	0.74	7.7	0.619	4.8
G	38.4	26.58																		
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0			0.00			0.0		
H	0.0	0.00																		
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0			0.00			0.0		
I	0.0	0.00																		
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0			0.00			0.0		
J	0.0	0.00																		
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0			0.00			0.0		
K	0.0	0.00																		
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0			0.00			0.0		
L	0.0	0.00																		
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0			0.00			0.0		
								116.3				139.9		70.2				141.6		72.7
												Q-Unsubmerged-->		0.1				Q-Unsubmerged-->		0.1
												Q-Total -->		70.2				Q-Total -->		72.8

UNSUBMERGED WEIR ANALYSIS

Houghton Road
Existing Condition Hydraulics
CP I Drop Inlet Irregular Weir

$Qw = Cw \times DL \times d^{3/2}$ Cw = 3.0

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation 2800 feet

UNSUBMERGED PORTION OF WEIR

Irregular Weir Cross-Section:

	STA (ft)	ELEV (ft)	SEGMENT
1	0	2827.36	A
2	2.59	2826.58	B
3	4.99	2827.28	C
4			D
5			E
6			F
7			G
8			H
9			I
10			J
11			K
12			L
13			

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 26.58 Adj'd DL	Yi / Yii	Yave	Qweir (ft³/sec)	WSE = 26.72 Adj'd DL	Yi / Yii	Yave	Qweir (ft³/sec)	WSE = 26.73 Adj'd DL	Yi / Yii	Yave	Qweir (ft³/sec)
A	0.0	27.36														
	2.6	26.58	2.6	-0.3012	0.00	0.00	0.00	0.0	0.46	0.14	0.07	0.0	0.50	0.15	0.08	0.0
B	2.6	26.58				0.00				0.14				0.15		
	5.0	27.28	2.4	0.2917	0.00		0.00	0.0	0.48		0.07	0.0	0.51		0.08	0.0
C	5.0	27.28														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
D	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
E	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
F	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								0.0				0.1				0.1

B-5

TSMS NODE MG-N0040

Houghton Road SW-OST
PB Proj No. 11515
TSMS Node MG-N0040

Existing Condition

```
HEC-RAS Version 3.1.3 May 2005
U.S. Army Corp 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: TSMS Node: MG N0040
Project File : N0040.prj
Run Date and Time: 9/2/2008 9:22:07 AM

Project in English units

Project Description:
TSMS NODE - MG N0040

EXISTING CONDITION --
NO CULVERT -- WEIR ONLY AT THIS
LOCATION
MODEL HYDRAULIC RESPONSE OF EXISTING DIP CROSSING
EXISTING DIP
CROSSING EVALUATED AS INLINE WEIR
--EXISTING DIP CROSSING IS NOT AT GRADE
WITH WASH
--MANNING'S ROUGHNESS ESTIMATE:
NCH = 0.06
NOB = 0.08
ONLY
DIFFERENCE BETWEEN MAIN CHANNEL AND OVERBANK
ROUGHNESS IS THAT THERE ARE
MINOR FLOW PATHS IN THE MAIN CHANNEL --> MINOR REDUCTION IN
ROUGHNESS.

PROPOSED CONDITION --
REPLACE EXISTING ELEVATED DIP WITH CULVERT
TO CONVEY
100-YEAR EVENT UNDER ROADWAY PROVIDING FOR ALL WEATHER ACCESS.

FLOW DATA

Flow Title: TSMS NODE MG N0040
Flow File : l:\11515\Drainage\HECRAS\TSMS MG_N0040\N0040.f01

Flow Data (cfs)

River	Reach	RS	100-YR	10-YR
Stream	Reach	1250	243	71

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Stream	Reach	100-YR	Critical	Normal S = 0.023
Stream	Reach	10-YR	Critical	Normal S = 0.023

Houghton Road SW-OST
PB Proj No. 11515
TSMS Node MG-N0040 Existing Condition

GEOMETRY DATA

Geometry Title: MG N0040 EXST
Geometry File : l:\11515\Drainage\HECRAS\TSMS MG_N0040\N0040.g01

CROSS SECTION

RIVER: Stream
REACH: Reach RS: 1250

INPUT
Description:
Station Elevation Data num= 51

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2841.47	2.51	2841.36	7.03	2841.23	8.31	2841.14	10.07	2840.86
13.14	2840.63	14.56	2840.48	16.17	2840.44	22.47	2840.39	24.94	2840.22
26.76	2840	27.67	2840.13	40.06	2839.96	131.15	2835.68	139.2	2835.22
140.03	2835.23	149.74	2834.93	154.01	2834.85	160.2	2834.58	161.33	2834.62
167	2834.12	173.42	2834.39	185.06	2834.54	200.86	2834.46	200.87	2834.46
218.54	2834.36	223.18	2834.61	226.35	2834.7	234.7	2835.11	277.54	2837.43
329.35	2839.78	352.68	2841.16	354.21	2841.22	357.62	2841.48	363.91	2841.42
369.9	2841.45	370.79	2841.51	374.88	2841.95	378.02	2842.16	389.81	2842.3
393.09	2842.46	396.23	2842.5	403.96	2842.42	404.83	2842.38	405.97	2842.4
426.33	2843.26	431.63	2843.4	452.58	2844.15	454.8	2844.21	501.33	2845.92
504.92	2845.99								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	40.06	.06	352.68	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
40.06	352.68	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	2835.69	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.09	Wt. n-Val.		0.060
W.S. Elev (ft)	2835.59	Reach Len. (ft)	100.00	100.00
100.00				
Crit W.S. (ft)	2835.17	Flow Area (sq ft)		98.89
E.G. Slope (ft/ft)	0.011489	Area (sq ft)		98.89
Q Total (cfs)	243.00	Flow (cfs)		243.00
Top Width (ft)	110.94	Top Width (ft)		110.94
Vel Total (ft/s)	2.46	Avg. Vel. (ft/s)		2.46
Max Chl Dpth (ft)	1.47	Hydr. Depth (ft)		0.89
Conv. Total (cfs)	2267.1	Conv. (cfs)		2267.1
Length Wtd. (ft)	100.00	Wetted Per. (ft)		111.02
Min Ch El (ft)	2834.12	Shear (lb/sq ft)		0.64
Alpha	1.00	Stream Power (lb/ft s)		1.57
Frctn Loss (ft)	0.06	Cum Volume (acre-ft)	0.31	2.02
0.30				
C & E Loss (ft)	0.03	Cum SA (acres)	0.22	1.09
0.19				

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: Stream
REACH: Reach RS: 1150

INPUT
Description:
Station Elevation Data num= 51

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2841.67	8.21	2841.23	10.33	2841.05	13.35	2840.94	15.06	2840.78
19.02	2840.62	47.96	2838.77	51.02	2838.44	60.15	2837.72	76.63	2836.68

Houghton Road SW-OST
PB Proj No. 11515
TSMS Node MG-N0040 Existing Condition

80.58	2836.35	98.51	2835.24	105.49	2835.08	110.27	2834.83	115.17	2834.87
118.56	2834.7	124.79	2833.85	137.16	2833	161.64	2832.32	171.47	2832.21
175.3	2831.88	189.48	2832.46	200	2832.43	200.02	2832.43	228.76	2832.71
236.99	2833.17	249.9	2834.64	260.56	2835.61	265.04	2835.81	269.95	2836.35
277.13	2836.79	282.3	2837.2	286.36	2837.42	299.55	2837.67	303.58	2837.28
309.59	2837.26	313.88	2837.65	329.9	2837.67	337.95	2837.92	345.84	2838.06
353.35	2838.43	368.65	2838.92	371.16	2838.92	393.68	2839.72	427.31	2841.18
439.38	2841.43	457.78	2841.98	462.98	2842.23	473.64	2842.06	499.02	2842.08
502.27	2842.16								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	118.56	.06	286.36	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
118.56	286.36	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	2835.60	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.01	Wt. n-Val.	0.080	0.060
W.S. Elev (ft)	2835.59	Reach Len. (ft)	100.00	100.00
100.00				
Crit W.S. (ft)	2833.06	Flow Area (sq ft)	13.47	370.42
E.G. Slope (ft/ft)	0.000192	Area (sq ft)	13.47	370.42
Q Total (cfs)	243.00	Flow (cfs)	2.25	240.75
Top Width (ft)	167.58	Top Width (ft)	25.76	141.82
Vel Total (ft/s)	0.63	Avg. Vel. (ft/s)	0.17	0.65
Max Chl Dpth (ft)	3.71	Hydr. Depth (ft)	0.52	2.61
Conv. Total (cfs)	17539.6	Conv. (cfs)	162.3	17377.3
Length Wtd. (ft)	100.00	Wetted Per. (ft)	25.78	142.08
Min Ch El (ft)	2831.88	Shear (lb/sq ft)	0.01	0.03
Alpha	1.05	Stream Power (lb/ft s)	0.00	0.02
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	0.30	1.48
0.30				
C & E Loss (ft)	0.00	Cum SA (acres)	0.19	0.80
0.19				

CROSS SECTION

RIVER: Stream
REACH: Reach RS: 1050

INPUT
Description:
Station Elevation Data num= 51

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2840.77	15.17	2840.76	31.42	2840.49	40.34	2840.15	58.25	2839.17
69.32	2838.19	88.57	2836.25	98.29	2835.57	102.12	2835.04	110.39	2834.45
112.85	2834.53	124.45	2833.75	131.85	2833.94	135.07	2834.16	139.83	2834.13
141.84	2833.68	148.35	2832.72	151.74	2832.88	168.02	2833.02	172.55	2832.85
181.27	2831.63	188.91	2831.41	198.18	2831.43	199.99	2831.6	200	2831.6
210.84	2831.92	233.43	2832.18	237.88	2832.32	247.13	2832.82	259.99	2833.15
272.26	2833.21	296.06	2833.78	313.13	2834.1	325.04	2834.5	331.54	2834.92
337.27	2835.45	344.3	2835.66	346.75	2835.85	360.94	2836.4	364.61	2836.65
374.84	2836.76	393.89	2837.23	401.06	2837.24	413.76	2837.94	450.85	2838.52
472.43	2838.5	482.05	2838.79	492.34	2838.91	496.42	2839.2	499.62	2839.24
511.61	2839.86								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	168.02	.06	259.99	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
168.02	259.99	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	2835.59	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.00	Wt. n-Val.	0.080	0.060
0.080				

Houghton Road SW-OST
PB Proj No. 11515
TSMS Node MG-N0040

Existing Condition

W.S. Elev (ft)	2835.58	Reach Len. (ft)	100.00	100.00
100.00				
Crit W.S. (ft)	2832.63	Flow Area (sq ft)	123.19	315.46
130.68				
E.G. Slope (ft/ft)	0.000099	Area (sq ft)	123.19	315.46
130.68				
Q Total (cfs)	243.00	Flow (cfs)	33.17	176.78
33.04				
Top Width (ft)	243.57	Top Width (ft)	69.90	91.97
81.70				
Vel Total (ft/s)	0.43	Avg. Vel. (ft/s)	0.27	0.56
0.25				
Max Chl Dpth (ft)	4.17	Hydr. Depth (ft)	1.76	3.43
1.60				
Conv. Total (cfs)	24401.7	Conv. (cfs)	3331.3	17752.4
3318.1				
Length Wtd. (ft)	100.00	Wetted Per. (ft)	70.12	92.10
81.76				
Min Ch El (ft)	2831.41	Shear (lb/sq ft)	0.01	0.02
0.01				
Alpha	1.36	Stream Power (lb/ft s)	0.00	0.01
0.00				
Frctn Loss (ft)		Cum Volume (acre-ft)	0.14	0.69
0.15				
C & E Loss (ft)		Cum SA (acres)	0.08	0.53
0.09				

INLINE STRUCTURE

RIVER: Stream
REACH: Reach RS: 1000

INPUT
Description: ROADWAY SEGMENT AS INLINE WEIR

Distance from Upstream XS = 30
Deck/Roadway Width = 44
Weir Coefficient = 2.6
Weir Embankment Coordinates num = 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2837.7	100	2836.27	135.8	2835.61	234.1	2834.79	274.4	2834.71
355.6	2835.08	409.2	2835.56	426.3	2835.56	444.2	2835.85		

Upstream Embankment side slope = 3 horiz. to 1.0 vertical
Downstream Embankment side slope = 3 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Weir crest shape = Broad Crested

INLINE STRUCTURE OUTPUT Profile #100-YR Inl Struct:

E.G. Elev (ft)	2835.59	Q Gates (cfs)	
W.S. Elev (ft)	2835.58	Q Gate Group (cfs)	2832.63
Q Total (cfs)	243.00	Gate Open Ht (ft)	1.00
Q Weir (cfs)	243.00	Gate #Open	2833
Weir Flow Area (sq ft)	116.86	Gate Area (sq ft)	
Weir Sta Lft (ft)	138.70	Gate Submerg	
Weir Sta Rgt (ft)	341.82	Gate Invert (ft)	2832.99
Weir Max Depth (ft)	0.88		
Weir Avg Depth (ft)	0.58		
Weir Submerg	0.00		
Min El Weir Flow (ft)	2834.72		
Wr Top Wdth (ft)	203.13		

CROSS SECTION

RIVER: Stream
REACH: Reach RS: 950

INPUT
Description:

Houghton Road SW-OST
PB Proj No. 11515
TSMS Node MG-N0040 Existing Condition

Station Elevation Data num= 50

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2835.41	5.23	2835.3	17.65	2835.26	31.9	2835.54	34.27	2835.7
39.38	2835.84	56.61	2835.87	74.2	2835.53	78.65	2835.37	82.33	2835.36
92.39	2835.05	96.95	2834.81	105.61	2834.98	107.46	2834.13	115.01	2833.6
134.73	2831.4	142.85	2830.94	148.83	2830.37	161.27	2831.54	168.67	2831.7
178.49	2831.54	182.29	2831.98	186.53	2830.23	190.47	2829.4	191.75	2829.25
200.02	2828.86	206.76	2828.9	227.87	2829.55	247.75	2829.75	266.09	2829.83
291.52	2830.71	310.84	2830.71	326.24	2830.55	333.05	2830.66	343.26	2831.21
364.81	2832.01	365.83	2831.98	389.62	2832.71	398.57	2832.78	401.54	2832.93
406.67	2832.94	413.85	2833.16	416.24	2833.12	420.92	2833.27	429.43	2833.83
438.26	2834.96	448.06	2835.75	457.86	2835.96	489.41	2835.98	500.02	2835.89

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	182.29	.06	291.52	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
182.29	291.52	160	160	160	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	2830.46	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.21	Wt. n-Val.		0.060
W.S. Elev (ft)	2830.25	Reach Len. (ft)	160.00	160.00
160.00				
Crit W.S. (ft)	2830.10	Flow Area (sq ft)		66.61
E.G. Slope (ft/ft)	0.033324	Area (sq ft)		66.61
Q Total (cfs)	243.00	Flow (cfs)		243.00
Top Width (ft)	91.76	Top Width (ft)		91.76
Vel Total (ft/s)	3.65	Avg. Vel. (ft/s)		3.65
Max Chl Dpth (ft)	1.39	Hydr. Depth (ft)		0.73
Conv. Total (cfs)	1331.2	Conv. (cfs)		1331.2
Length Wtd. (ft)	160.00	Wetted Per. (ft)		91.89
Min Ch El (ft)	2828.86	Shear (lb/sq ft)		1.51
Alpha	1.00	Stream Power (lb/ft s)		5.50
Frctn Loss (ft)	4.39	Cum Volume (acre-ft)	0.00	0.25
C & E Loss (ft)	0.01	Cum SA (acres)	0.00	0.32

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Stream
REACH: Reach RS: 790

INPUT
Description:
Station Elevation Data num= 50

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2828.27	10.23	2828.12	30.04	2827.43	32.85	2827.16	42.05	2825.86
45.51	2827.82	47.37	2829.1	61.57	2830.99	66.64	2831.3	79.68	2831.31
83.85	2831.15	87.35	2830.79	104.01	2829.54	125.42	2828.65	139.94	2827.8
144.18	2827.86	160.43	2827.4	166.26	2827.09	170.23	2826.68	180.04	2826.29
185.2	2825.94	211.25	2825.22	213.5	2825.08	217.47	2824.55	224.97	2824.07
231.34	2824.5	240.34	2824.61	249.84	2824.95	253.76	2824.98	264.53	2825.18
266.35	2825.41	290.24	2827.33	305.1	2828.11	323.02	2828.48	342.75	2829.2
353.72	2829.41	369.1	2829.93	375.99	2829.97	388.26	2830.45	405.32	2830.72
426.58	2831.72	434.73	2832.31	437.02	2832.16	448.12	2834.95	453.73	2835.8
454.99	2836.23	465.66	2836.29	477.92	2835.61	496.56	2835.9	503.96	2835.89

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	144.18	.06	305.1	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
144.18	305.1	0	0	0	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

Houghton Road SW-OST
PB Proj No. 11515
TSMS Node MG-N0040

Existing Condition

		Element	Left OB	Channel
E.G. Elev (ft)	2826.05			
Right OB				
Vel Head (ft)	0.18	Wt. n-Val.	0.000	0.060
W.S. Elev (ft)	2825.87	Reach Len. (ft)		
Crit W.S. (ft)	2825.60	Flow Area (sq ft)	0.00	71.99
E.G. Slope (ft/ft)	0.023016	Area (sq ft)	0.00	71.99
Q Total (cfs)	243.00	Flow (cfs)	0.00	243.00
Top Width (ft)	84.52	Top Width (ft)	0.10	84.42
Vel Total (ft/s)	3.38	Avg. Vel. (ft/s)	0.09	3.38
Max Chl Dpth (ft)	1.80	Hydr. Depth (ft)	0.01	0.85
Conv. Total (cfs)	1601.7	Conv. (cfs)	0.0	1601.7
Length Wtd. (ft)		Wetted Per. (ft)	0.11	84.54
Min Ch El (ft)	2824.07	Shear (lb/sq ft)		1.22
Alpha	1.00	Stream Power (lb/ft s)		4.13
Frctn Loss (ft)		Cum Volume (acre-ft)		
C & E Loss (ft)		Cum SA (acres)		

Warning: Divided flow computed for this cross-section.

SUMMARY OF MANNING'S N VALUES

River:Stream

Reach	River Sta.	n1	n2	n3
Reach	1250	.08	.06	.08
Reach	1150	.08	.06	.08
Reach	1050	.08	.06	.08
Reach	1000	Inl Struct		
Reach	950	.08	.06	.08
Reach	790	.08	.06	.08

SUMMARY OF REACH LENGTHS

River: Stream

Reach	River Sta.	Left	Channel	Right
Reach	1250	100	100	100
Reach	1150	100	100	100
Reach	1050	100	100	100
Reach	1000	Inl Struct		
Reach	950	160	160	160
Reach	790	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Stream

Reach	River Sta.	Contr.	Expan.
Reach	1250	.1	.3
Reach	1150	.1	.3
Reach	1050	.1	.3
Reach	1000	Inl Struct	
Reach	950	.1	.3
Reach	790	.1	.3

Houghton Road SW-OST
PB Proj No. 11515
TSMS Node MG-N0040

Existing Condition

Profile Output Table - Standard Table 1

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach	1250	100-YR	243.00	2834.12	2835.59	2835.17	2835.69	0.011489	2.46	98.89	110.94	0.46
Reach	1150	100-YR	243.00	2831.88	2835.59	2833.06	2835.60	0.000192	0.65	383.89	167.58	0.07
Reach	1050	100-YR	243.00	2831.41	2835.58	2832.63	2835.59	0.000099	0.56	569.32	243.57	0.05
Reach	1000		Inl Struct									
Reach	950	100-YR	243.00	2828.86	2830.25	2830.10	2830.46	0.033324	3.65	66.61	91.76	0.75
Reach	790	100-YR	243.00	2824.07	2825.87	2825.60	2826.05	0.023016	3.38	71.99	84.52	0.64

Profile Output Table - Standard Table 2

Reach	River Sta	Profile	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
Reach	1250	100-YR	2835.69	2835.59	0.09	0.06	0.03		243.00		110.94
Reach	1150	100-YR	2835.60	2835.59	0.01	0.01	0.00	2.25	240.75		167.58
Reach	1050	100-YR	2835.59	2835.58	0.00			33.17	176.78	33.04	243.57
Reach	1000		Inl Struct								
Reach	950	100-YR	2830.46	2830.25	0.21	4.39	0.01		243.00		91.76
Reach	790	100-YR	2826.05	2825.87	0.18			0.00	243.00		84.52

Profile Output Table - Inline Structure

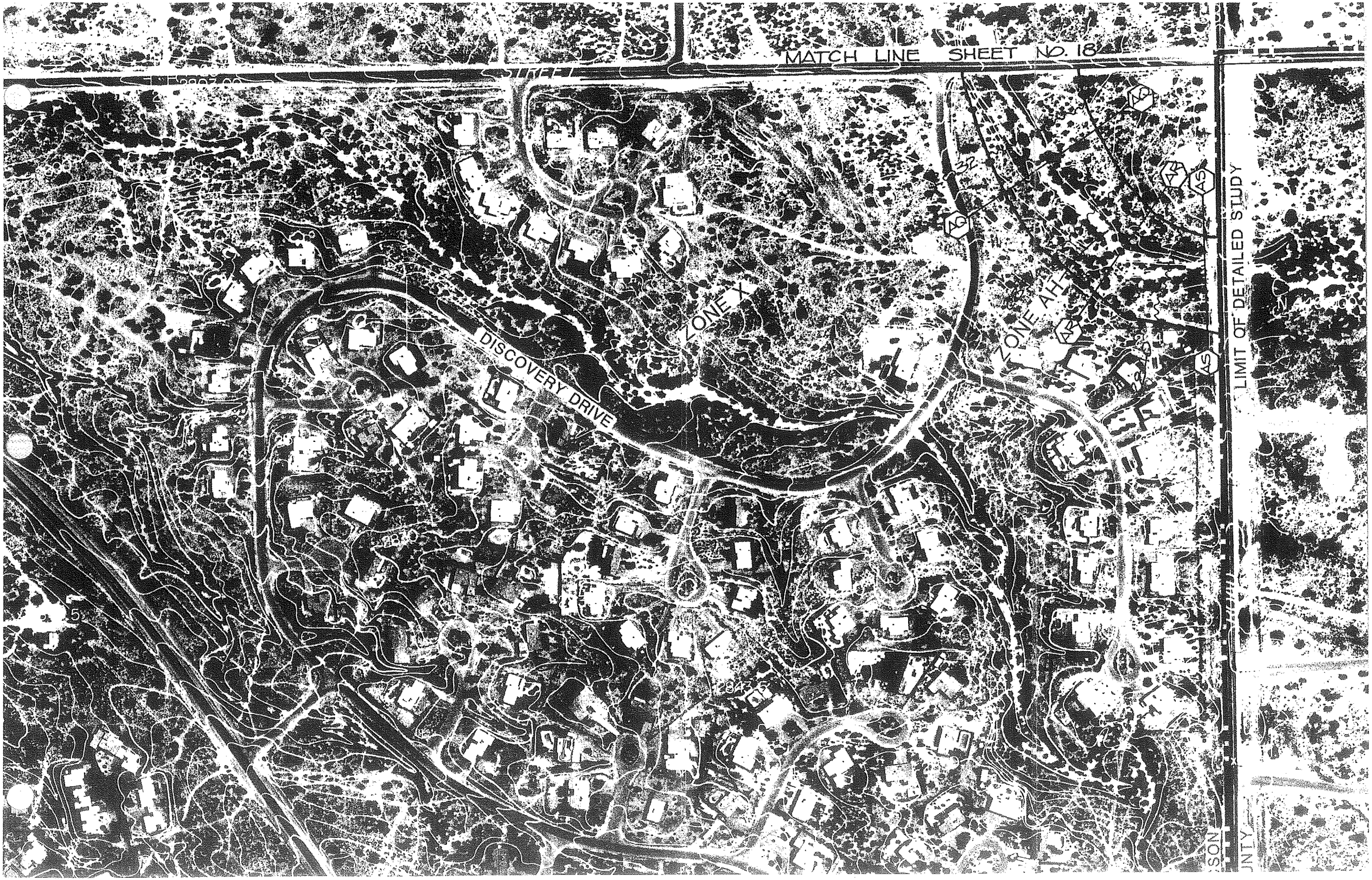
Reach	River Sta	Profile	E.G. Elev (ft)	W.S. Elev (ft)	Q Total (cfs)	Q Weir (cfs)	Q Gates (cfs)
Reach	1000	100-YR	2835.59	2835.58	243.00	243.00	

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : MGN0040EXST

River: Stream Reach: Reach RS: 1250 Profile: 100-YR
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.
River: Stream Reach: Reach RS: 950 Profile: 100-YR
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Stream Reach: Reach RS: 790 Profile: 100-YR
Warning:Divided flow computed for this cross-section.

B-6

ESTE WASH


MATCH LINE SHEET NO. 18
DISCOVERY DRIVE
ZONE X
ZONE AH
LIMIT OF DETAILED STUDY
AQ
AR
AS

Este Wash

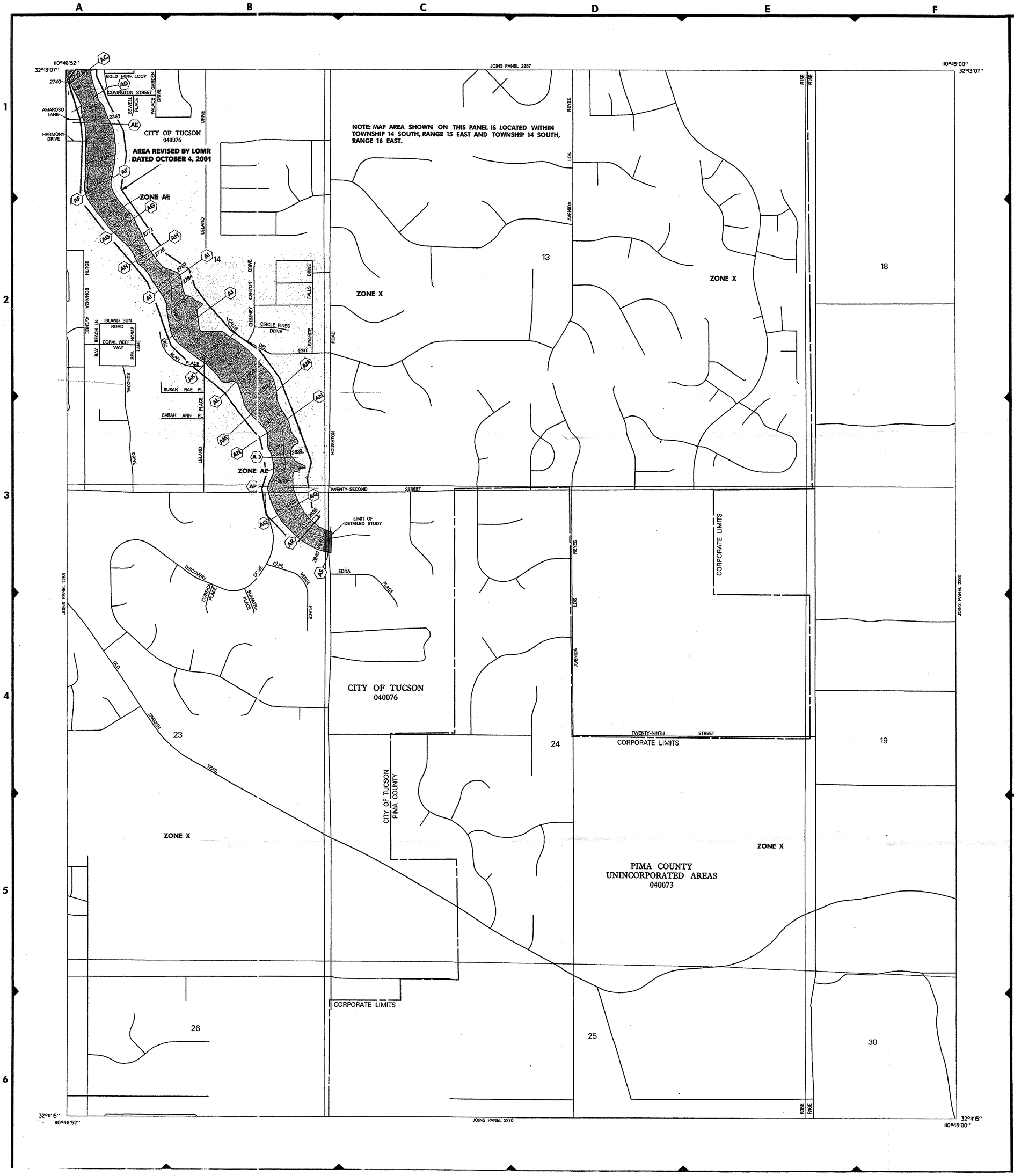
MAY 18, 1983

MMLD Job No. 88151-02-45

CIT

DEPARTM

35-34



LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

ZONE A No base flood elevations determined.

ZONE AE Base flood elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE A99 To be protected from 100-year flood by Federal flood protection system under construction ; no base flood elevations determined.

ZONE V Coastal flood with velocity hazard (wave action); no base flood elevations determined.

ZONE VE Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

ZONE X Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

ZONE X Areas determined to be outside 500-year floodplain.

ZONE D Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS

Identified 1983 | Identified 1990 | Otherwise Protected Areas

Coastal barrier areas are normally located within or adjacent to Special Flood Hazard Areas.

Floodplain Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.

~~~513~~~ Base Flood Elevation Line; Elevation in Feet. See Map Index for Elevation Datum.

D—D Cross Section Line

(EL 987) Base Flood Elevation in Feet Where Uniform Within Zone. See Map Index for Elevation Datum.

RM7 × Elevation Reference Mark

● M2 River Mile

97°07'30", 32°22'30" Horizontal Coordinates Based on North American Datum of 1927 (NAD 27) Projection.

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas. The community map repository should be consulted for more detailed data on BFE's, and for any information on floodway delineations, prior to use of this map for property purchase or construction purposes.

Areas of Special Flood Hazard (100-year flood) include Zones A, AE, A1-A30, AH, AO, A99, V, VE and V1-V30.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Refer to Floodway Data Table where floodway width is shown as 1/20 inch.

Coastal base flood elevations apply only landward of 0.0 NGVD, and include the effects of wave action; these elevations may also differ significantly from those developed by the National Weather Service for hurricane evacuation planning.

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of this map.

This map may incorporate approximate boundaries of Coastal Barrier Resource System Units and/or Otherwise Protected Areas established under the Coastal Barrier Improvement Act of 1990 (PL 101-591).

For community map revision history prior to countywide mapping, see Section 6.0 of the Flood Insurance Study Report.

For adjoining map panels and base map source see separately printed Map Index.

MAP REPOSITORY
Refer to Repository Listing on Map Index

EFFECTIVE DATE OF
COUNTYWIDE FLOOD INSURANCE RATE MAP:
FEBRUARY 8, 1999

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL:

Refer to the FLOOD INSURANCE RATE MAP EFFECTIVE DATE shown on this map to determine when actuarial rates apply to structures in zones where elevations or depths have been established.

To determine if flood insurance is available, contact an insurance agent or call the National Flood Insurance Program at (800) 638-6620.

N

APPROXIMATE SCALE IN FEET
500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

PIMA COUNTY,
ARIZONA AND
INCORPORATED AREAS

PANEL 2259 OF 4700
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
TUCSON, CITY OF	040076	2259	K
PIMA COUNTY, UNINCORPORATED AREAS	040073	2259	K

MAP NUMBER
04019C2259 K

EFFECTIVE DATE:
FEBRUARY 8, 1999

Federal Emergency Management Agency
~~~

PB Proj No. 11515
Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

HEC-RAS Version 3.1.3 May 2005
U.S. Army Corp 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: Este Wash Regulatory HEC2 IMP
Project File : EWHEC2IMP.prj
Run Date and Time: 11/16/2007 3:18:57 PM

Project in English units

Project Description:
88151-02-39
FIS City of Tucson
ESTE WASH
Imported FEMA
Geometry File: .g01
Imported FEMA Geometry File Adjusted Vertically by +2.23
ft to account for Vertical Datum Change: .g02

New Existing Conditions
Geometry File (Project 1' C.I. Topo with PAG 1999 2' C.I. Topo): .g12
Proposed
Conditions Geometry File (4-10'x6' RCBC's at Houghton Rd and 22nd St
crossings): .g13

PLAN DATA

Plan Title: Imported Geom 01 Adjusted
Plan File : 1:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2IMP.p02

Geometry Title: Imported Geom 01 Adjusted
Geometry File : 1:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2IMP.g02

Flow Title : Imported Flow 01
Flow File : 1:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2IMP.f01

Plan Summary Information:

Number of:	Cross Sections =	45	Multiple Openings =	0
	Culverts =	3	Inline Structures =	0
	Bridges =	0	Lateral Structures =	0

Computational Information

Water surface calculation tolerance =	0.01
Critical depth calculation tolerance =	0.01
Maximum number of iterations =	20
Maximum difference tolerance =	0.3
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

PB Proj No. 11515
Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: Imported Flow 01
Flow File : 1:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2IMP.f01

Flow Data (cfs)

River	Reach	RS	PF 1
RIVER-1	Reach-1	45	1974
RIVER-1	Reach-1	25	2113
RIVER-1	Reach-1	16	3183
RIVER-1	Reach-1	8	3308
RIVER-1	Reach-1	4	4490

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
RIVER-1	Reach-1	PF 1		

Known WS = 2570

GEOMETRY DATA

Geometry Title: Imported Geom 01 Adjusted
Geometry File : 1:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2IMP.g02

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 45

INPUT
Description: XSEC AS
Houghton Road End of Detailed Study
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2844.33	50	2843.23	100	2842.63	150	2841.73	164	2841.23
167	2840.33	200	2840.53	223	2840.73	227	2842.33	250	2842.33
300	2844.53	350	2846.03	400	2847.23				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	164	.028	227	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
164	227	260	220	180	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2844.40	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.83	Wt. n-Val.	0.045	0.028	0.045
W.S. Elev (ft)	2843.57	Reach Len. (ft)	260.00	220.00	180.00
Crit W.S. (ft)	2843.57	Flow Area (sq ft)	132.83	187.50	45.77
E.G. Slope (ft/ft)	0.005607	Area (sq ft)	132.83	187.50	45.77

PB Proj No. 11515
Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

Q Total (cfs)	1974.00	Flow (cfs)	334.44	1534.42 105.14
Top Width (ft)	243.34	Top Width (ft)	129.26	63.00 51.08
Vel Total (ft/s)	5.39	Avg. Vel. (ft/s)	2.52	8.18 2.30
Max Chl Dpth (ft)	3.24	Hydr. Depth (ft)	1.03	2.98 0.90
Conv. Total (cfs)	26361.7	Conv. (cfs)	4466.3	20491.4 1404.1
Length Wtd. (ft)	219.75	Wetted Per. (ft)	129.28	63.44 51.11
Min Ch El (ft)	2840.33	Shear (lb/sq ft)	0.36	1.03 0.31
Alpha	1.84	Stream Power (lb/ft s)	0.91	8.47 0.72
Frctn Loss (ft)	1.31	Cum Volume (acre-ft)	25.73	53.37 36.14
C & E Loss (ft)	0.01	Cum SA (acres)	20.52	15.35 30.00

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 44

INPUT
Description: XSEC AR
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2843.83	50	2841.73	100	2839.03	145	2839.43	157	2837.73
169	2838.63	186	2838.73	192	2836.33	200	2836.23	218	2837.53
225	2838.43	250	2837.93	300	2838.63	350	2840.43	400	2842.63

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	186	.028	225	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
186	225	340	300	270	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2840.85	Element	Left OB	Channel Right OB
Vel Head (ft)	0.73	Wt. n-Val.	0.045	0.028 0.045
W.S. Elev (ft)	2840.12	Reach Len. (ft)	340.00	300.00 270.00
Crit W.S. (ft)	2840.12	Flow Area (sq ft)	117.36	119.58 171.42
E.G. Slope (ft/ft)	0.006373	Area (sq ft)	117.36	119.58 171.42
Q Total (cfs)	1974.00	Flow (cfs)	330.29	1058.99 584.72

PB Proj No. 11515
Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

Top Width (ft)	261.60	Top Width (ft)	106.20	39.00
116.41				
Vel Total (ft/s)	4.83	Avg. Vel. (ft/s)	2.81	8.86
3.41				
Max Chl Dpth (ft)	3.89	Hydr. Depth (ft)	1.11	3.07
1.47				
Conv. Total (cfs)	24727.8	Conv. (cfs)	4137.4	13265.7
7324.7				
Length Wtd. (ft)	298.24	Wetted Per. (ft)	106.38	39.57
116.44				
Min Ch El (ft)	2836.23	Shear (lb/sq ft)	0.44	1.20
0.59				
Alpha	2.00	Stream Power (lb/ft s)	1.24	10.65
2.00				
Frctn Loss (ft)	1.98	Cum Volume (acre-ft)	24.98	52.59
35.69				
C & E Loss (ft)	0.00	Cum SA (acres)	19.82	15.09
29.65				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 43

INPUT
Description: XSEC AQ
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2841.03	50	2838.43	100	2835.73	124	2834.53	143	2833.13
150	2833.03	156	2834.03	173	2834.13	178	2831.93	200	2833.03
226	2832.63	238	2833.83	250	2834.03	300	2834.03	350	2834.33
400	2835.33	450	2835.93						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	173	.028	238	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
173	238	400	355	310	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2835.99	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.71	Wt. n-Val.	0.045	0.028
0.045				
W.S. Elev (ft)	2835.28	Reach Len. (ft)	400.00	355.00
310.00				
Crit W.S. (ft)	2835.28	Flow Area (sq ft)	79.40	161.07
156.06				
E.G. Slope (ft/ft)	0.006956	Area (sq ft)	79.40	161.07
156.06				
Q Total (cfs)	1974.00	Flow (cfs)	252.13	1298.18
423.69				
Top Width (ft)	288.41	Top Width (ft)	63.98	65.00
159.44				

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Vel Total (ft/s)	4.98	Avg. Vel. (ft/s)	3.18	8.06
2.71				
Max Chl Dpth (ft)	3.35	Hydr. Depth (ft)	1.24	2.48
0.98				
Conv. Total (cfs)	23668.4	Conv. (cfs)	3023.0	15565.2
5080.1				
Length Wtd. (ft)	347.80	Wetted Per. (ft)	64.13	65.55
159.45				
Min Ch El (ft)	2831.93	Shear (lb/sq ft)	0.54	1.07
0.43				
Alpha	1.84	Stream Power (lb/ft s)	1.71	8.60
1.15				
Frctn Loss (ft)	2.25	Cum Volume (acre-ft)	24.21	51.63
34.68				
C & E Loss (ft)	0.00	Cum SA (acres)	19.16	14.73
28.80				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 42

INPUT
Description: XSEC AP
DS 22ND STREET
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2835.93	19	2835.93	44	2829.43	68	2829.53	80	2827.73
100	2827.53	122	2828.23	129	2829.43	150	2829.53	200	2829.13
250	2829.73	300	2830.33	350	2831.53	400	2833.23		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	68	.028	129	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
68	129	320	320	320	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2831.46	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.70	Wt. n-Val.	0.045	0.028
0.045				
W.S. Elev (ft)	2830.76	Reach Len. (ft)	320.00	320.00
320.00				
Crit W.S. (ft)	2830.76	Flow Area (sq ft)	34.12	165.03
205.24				
E.G. Slope (ft/ft)	0.006055	Area (sq ft)	34.12	165.03
205.24				
Q Total (cfs)	1974.00	Flow (cfs)	97.09	1319.63
557.29				
Top Width (ft)	279.03	Top Width (ft)	29.12	61.00
188.91				
Vel Total (ft/s)	4.88	Avg. Vel. (ft/s)	2.85	8.00
2.72				

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Max Chl Dpth (ft)	3.23	Hydr. Depth (ft)	1.17	2.71	1.09
Conv. Total (cfs)	25367.5	Conv. (cfs)	1247.6	16958.3	7161.6
Length Wtd. (ft)	320.00	Wetted Per. (ft)	29.29	61.25	188.93
Min Ch El (ft)	2827.53	Shear (lb/sq ft)	0.44	1.02	0.41
Alpha	1.90	Stream Power (lb/ft s)	1.25	8.14	1.12
Frctn Loss (ft)	1.84	Cum Volume (acre-ft)	23.69	50.30	33.39
C & E Loss (ft)	0.07	Cum SA (acres)	18.73	14.22	27.56

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 41

INPUT
Description: XSEC AO
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2831.33	50	2829.43	100	2827.13	150	2826.13	200	2825.03
240	2823.43	245	2822.23	250	2822.03	258	2821.73	267	2825.33
286	2825.83	300	2824.93	307	2823.43	310	2823.43	311	2824.43
350	2828.43	400	2831.03						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	240	.028	267	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
240	267	320	370	420	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2827.73	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.93	Wt. n-Val.	0.045	0.028	0.045
W.S. Elev (ft)	2826.80	Reach Len. (ft)	320.00	370.00	420.00
Crit W.S. (ft)	2826.80	Flow Area (sq ft)	174.55	111.89	101.50
E.G. Slope (ft/ft)	0.005483	Area (sq ft)	174.55	111.89	101.50
Q Total (cfs)	1974.00	Flow (cfs)	537.93	1111.27	324.81
Top Width (ft)	217.38	Top Width (ft)	123.31	27.00	67.07
Vel Total (ft/s)	5.09	Avg. Vel. (ft/s)	3.08	9.93	3.20
Max Chl Dpth (ft)	5.07	Hydr. Depth (ft)	1.42	4.14	1.51

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Conv. Total (cfs)	26658.0	Conv. (cfs)	7264.5	15007.1 4386.4
Length Wtd. (ft)	362.60	Wetted Per. (ft)	123.36	27.84 67.80
Min Ch El (ft)	2821.73	Shear (lb/sq ft)	0.48	1.38 0.51
Alpha	2.31	Stream Power (lb/ft s)	1.49	13.66 1.64
Frctn Loss (ft)	2.05	Cum Volume (acre-ft)	22.93	49.28 32.26
C & E Loss (ft)	0.01	Cum SA (acres)	18.17	13.89 26.62

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 40

INPUT
Description: XSEC AN
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2824.53	50	2822.13	100	2820.43	150	2819.03	200	2819.13
250	2819.03	263	2818.33	271	2817.23	300	2817.33	326	2816.63
335	2820.23	350	2820.93	400	2822.33	450	2823.83	500	2826.93

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	263	.028	335	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
263	335	290	305	320	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2820.98	Element	Left OB	Channel Right OB
Vel Head (ft)	0.82	Wt. n-Val.	0.045	0.028
W.S. Elev (ft)	2820.16	Reach Len. (ft)	290.00	305.00 320.00
Crit W.S. (ft)	2820.16	Flow Area (sq ft)	149.62	200.62
E.G. Slope (ft/ft)	0.005841	Area (sq ft)	149.62	200.62
Q Total (cfs)	1974.00	Flow (cfs)	371.52	1602.48
Top Width (ft)	225.08	Top Width (ft)	153.26	71.82
Vel Total (ft/s)	5.64	Avg. Vel. (ft/s)	2.48	7.99
Max Chl Dpth (ft)	3.53	Hydr. Depth (ft)	0.98	2.79
Conv. Total (cfs)	25829.6	Conv. (cfs)	4861.3	20968.3
Length Wtd. (ft)	303.45	Wetted Per. (ft)	153.29	72.58
Min Ch El (ft)	2816.63	Shear (lb/sq ft)	0.36	1.01
Alpha	1.67	Stream Power (lb/ft s)	0.88	8.05
Frctn Loss (ft)	2.08	Cum Volume (acre-ft)	21.74	47.95 31.77
C & E Loss (ft)	0.02	Cum SA (acres)	17.15	13.47 26.30

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Este Wash
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Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 39

INPUT
Description: XSEC AM
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2822.43	50	2818.83	99	2814.43	150	2815.23	200	2814.93
234	2814.23	239	2813.63	250	2813.33	260	2813.23	264	2814.13
300	2814.93	350	2814.73	400	2815.43	450	2817.13	500	2818.13
550	2820.23								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	234	.028	264	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
234	264	380	380	380	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2816.72	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.58	Wt. n-Val.	0.045	0.028	0.045
W.S. Elev (ft)	2816.14	Reach Len. (ft)	380.00	380.00	380.00
Crit W.S. (ft)	2816.14	Flow Area (sq ft)	189.23	78.77	183.98
E.G. Slope (ft/ft)	0.008162	Area (sq ft)	189.23	78.77	183.98
Q Total (cfs)	1974.00	Flow (cfs)	647.25	716.52	610.23
Top Width (ft)	340.95	Top Width (ft)	154.05	30.00	156.90
Vel Total (ft/s)	4.37	Avg. Vel. (ft/s)	3.42	9.10	3.32
Max Chl Dpth (ft)	2.91	Hydr. Depth (ft)	1.23	2.63	1.17
Conv. Total (cfs)	21850.0	Conv. (cfs)	7164.3	7931.1	6754.6
Length Wtd. (ft)	380.00	Wetted Per. (ft)	154.14	30.14	156.93
Min Ch El (ft)	2813.23	Shear (lb/sq ft)	0.63	1.33	0.60
Alpha	1.95	Stream Power (lb/ft s)	2.14	12.11	1.98
Frctn Loss (ft)	3.91	Cum Volume (acre-ft)	20.61	46.98	31.10
C & E Loss (ft)	0.01	Cum SA (acres)	16.13	13.12	25.72

Warning: The energy equation could not be balanced within the specified number of iterations. The

program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 38

INPUT
Description: XSEC AL
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2814.23	20	2813.83	70	2812.33	120	2811.43	170	2810.23
200	2809.83	209	2808.73	220	2808.53	227	2808.43	233	2809.23
270	2809.83	286	2809.43	292	2808.83	313	2808.63	320	2809.63
370	2809.53	420	2808.73	470	2808.83	490	2810.23	500	2812.23

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	200	.028	233	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
200	233	400	400	400	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2811.02	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.52	Wt. n-Val.	0.045	0.028
0.045				
W.S. Elev (ft)	2810.51	Reach Len. (ft)	400.00	400.00
400.00				
Crit W.S. (ft)	2810.46	Flow Area (sq ft)	15.84	55.89
326.26				
E.G. Slope (ft/ft)	0.013391	Area (sq ft)	15.84	55.89
326.26				
Q Total (cfs)	1974.00	Flow (cfs)	31.86	486.43
1455.71				
Top Width (ft)	332.85	Top Width (ft)	41.48	33.00
258.38				
Vel Total (ft/s)	4.96	Avg. Vel. (ft/s)	2.01	8.70
4.46				
Max Chl Dpth (ft)	2.08	Hydr. Depth (ft)	0.38	1.69
1.26				
Conv. Total (cfs)	17058.4	Conv. (cfs)	275.3	4203.5
12579.6				
Length Wtd. (ft)	400.00	Wetted Per. (ft)	41.48	33.12
258.57				
Min Ch El (ft)	2808.43	Shear (lb/sq ft)	0.32	1.41
1.05				
Alpha	1.36	Stream Power (lb/ft s)	0.64	12.28
4.71				
Frctn Loss (ft)	6.70	Cum Volume (acre-ft)	19.71	46.39
28.87				
C & E Loss (ft)	0.00	Cum SA (acres)	15.28	12.84
23.91				

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

PB Proj No. 11515
Este Wash
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CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 37

INPUT
Description: XSEC AK
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2806.23	30	2804.23	50	2803.53	100	2803.23	120	2801.73
130	2802.73	150	2802.63	200	2803.33	238	2803.23	243	2802.63
250	2802.43	257	2802.33	260	2804.43	300	2803.03	350	2803.13
400	2802.33	407	2800.83	430	2801.53	450	2803.73	460	2806.23

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	238	.028	260	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
238	260	450	450	450	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2804.32	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.47	Wt. n-Val.	0.045	0.028
0.045				
W.S. Elev (ft)	2803.84	Reach Len. (ft)	450.00	450.00
450.00				
Crit W.S. (ft)	2803.84	Flow Area (sq ft)	155.84	25.64
204.71				
E.G. Slope (ft/ft)	0.021524	Area (sq ft)	155.84	25.64
204.71				
Q Total (cfs)	1974.00	Flow (cfs)	645.61	223.31
1105.08				
Top Width (ft)	391.82	Top Width (ft)	196.96	21.16
173.70				
Vel Total (ft/s)	5.11	Avg. Vel. (ft/s)	4.14	8.71
5.40				
Max Chl Dpth (ft)	3.01	Hydr. Depth (ft)	0.79	1.21
1.18				
Conv. Total (cfs)	13455.2	Conv. (cfs)	4400.6	1522.1
7532.4				
Length Wtd. (ft)	450.00	Wetted Per. (ft)	197.07	21.68
174.02				
Min Ch El (ft)	2802.33	Shear (lb/sq ft)	1.06	1.59
1.58				
Alpha	1.17	Stream Power (lb/ft s)	4.40	13.84
8.53				
Frctn Loss (ft)	5.68	Cum Volume (acre-ft)	18.92	46.01
26.44				
C & E Loss (ft)	0.05	Cum SA (acres)	14.18	12.59
21.92				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical

depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 36

INPUT
Description:
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2798.23	20	2796.23	30	2794.23	160	2792.23	170	2791.73
180	2792.23	195	2794.23	225	2794.73	250	2794.23	275	2793.93
300	2794.23	400	2796.23	440	2796.73				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	160	.028	195	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
160	195	490	490	490	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2795.63	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.63	Wt. n-Val.	0.045	0.028
0.045				
W.S. Elev (ft)	2795.00	Reach Len. (ft)	490.00	490.00
490.00				
Crit W.S. (ft)	2795.00	Flow Area (sq ft)	232.14	87.10
90.02				
E.G. Slope (ft/ft)	0.008277	Area (sq ft)	232.14	87.10
90.02				
Q Total (cfs)	1974.00	Flow (cfs)	1006.13	769.89
197.98				
Top Width (ft)	312.58	Top Width (ft)	133.87	35.00
143.71				
Vel Total (ft/s)	4.82	Avg. Vel. (ft/s)	4.33	8.84
2.20				
Max Chl Dpth (ft)	3.27	Hydr. Depth (ft)	1.73	2.49
0.63				
Conv. Total (cfs)	21697.2	Conv. (cfs)	11058.9	8462.3
2176.1				
Length Wtd. (ft)	490.00	Wetted Per. (ft)	133.96	35.16
143.73				
Min Ch El (ft)	2791.73	Shear (lb/sq ft)	0.90	1.28
0.32				
Alpha	1.74	Stream Power (lb/ft s)	3.88	11.32
0.71				
Frctn Loss (ft)	4.11	Cum Volume (acre-ft)	16.92	45.43
24.91				
C & E Loss (ft)	0.01	Cum SA (acres)	12.47	12.30
20.28				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

PB Proj No. 11515
Este Wash
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CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 35

INPUT
Description:
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2787.23	50	2786.13	100	2783.73	150	2783.13	164	2783.53
175	2782.63	200	2782.53	204	2782.53	215	2783.53	250	2783.63
300	2783.83	350	2784.93	360	2786.23				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	164	.028	215	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
164	215	400	400	400	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2785.74	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.66	Wt. n-Val.	0.045	0.028
0.045				
W.S. Elev (ft)	2785.07	Reach Len. (ft)	400.00	400.00
400.00				
Crit W.S. (ft)	2785.07	Flow Area (sq ft)	125.37	116.91
154.17				
E.G. Slope (ft/ft)	0.008515	Area (sq ft)	125.37	116.91
154.17				
Q Total (cfs)	1974.00	Flow (cfs)	469.42	994.19
510.39				
Top Width (ft)	279.09	Top Width (ft)	91.99	51.00
136.10				
Vel Total (ft/s)	4.98	Avg. Vel. (ft/s)	3.74	8.50
3.31				
Max Chl Dpth (ft)	2.54	Hydr. Depth (ft)	1.36	2.29
1.13				
Conv. Total (cfs)	21392.7	Conv. (cfs)	5087.2	10774.3
5531.2				
Length Wtd. (ft)	400.00	Wetted Per. (ft)	92.03	51.08
136.12				
Min Ch El (ft)	2782.53	Shear (lb/sq ft)	0.72	1.22
0.60				
Alpha	1.72	Stream Power (lb/ft s)	2.71	10.35
1.99				
Frctn Loss (ft)	3.36	Cum Volume (acre-ft)	14.91	44.29
23.54				
C & E Loss (ft)	0.08	Cum SA (acres)	11.20	11.82
18.71				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

PB Proj No. 11515
Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

RIVER: RIVER-1
REACH: Reach-1 RS: 34

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2778.93	50	2778.23	104	2777.73	130	2774.43	150	2775.23
175	2774.73	181	2775.63	200	2775.53	250	2776.93	300	2778.43
310	2780.23	360	2781.23						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	104	.028	181	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
104	181	380	380	380	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2778.60	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.93	Wt. n-Val.		0.028
0.045				
W.S. Elev (ft)	2777.67	Reach Len. (ft)	380.00	380.00
380.00				
Crit W.S. (ft)	2777.67	Flow Area (sq ft)		180.53
121.06				
E.G. Slope (ft/ft)	0.008298	Area (sq ft)		180.53
121.06				
Q Total (cfs)	1974.00	Flow (cfs)		1542.28
431.72				
Top Width (ft)	170.29	Top Width (ft)		76.55
93.75				
Vel Total (ft/s)	6.55	Avg. Vel. (ft/s)		8.54
3.57				
Max Chl Dpth (ft)	3.24	Hydr. Depth (ft)		2.36
1.29				
Conv. Total (cfs)	21670.7	Conv. (cfs)		16931.3
4739.4				
Length Wtd. (ft)	380.00	Wetted Per. (ft)		76.84
93.78				
Min Ch El (ft)	2774.43	Shear (lb/sq ft)		1.22
0.67				
Alpha	1.40	Stream Power (lb/ft s)		10.40
2.38				
Frctn Loss (ft)	2.62	Cum Volume (acre-ft)	14.33	42.92
22.28				
C & E Loss (ft)	0.02	Cum SA (acres)	10.78	11.24
17.66				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 33

PB Proj No. 11515
Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2773.23	45	2772.23	60	2770.23	75	2770.03	125	2770.03
151	2770.13	165	2768.53	167	2767.43	175	2767.43	182	2767.33
190	2769.73	225	2769.73	275	2769.93	300	2770.23	325	2772.23

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	165	.028	190	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
165	190	500	500	500	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2772.14	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.69	Wt. n-Val.	0.045	0.028
0.045				
W.S. Elev (ft)	2771.45	Reach Len. (ft)	500.00	500.00
500.00				
Crit W.S. (ft)	2771.45	Flow Area (sq ft)	161.90	91.00
185.00				
E.G. Slope (ft/ft)	0.005810	Area (sq ft)	161.90	91.00
185.00				
Q Total (cfs)	1974.00	Flow (cfs)	513.82	856.54
603.64				
Top Width (ft)	264.44	Top Width (ft)	114.16	25.00
125.27				
Vel Total (ft/s)	4.51	Avg. Vel. (ft/s)	3.17	9.41
3.26				
Max Chl Dpth (ft)	4.12	Hydr. Depth (ft)	1.42	3.64
1.48				
Conv. Total (cfs)	25897.8	Conv. (cfs)	6741.1	11237.3
7919.4				
Length Wtd. (ft)	500.00	Wetted Per. (ft)	114.34	25.64
125.33				
Min Ch El (ft)	2767.33	Shear (lb/sq ft)	0.51	1.29
0.54				
Alpha	2.18	Stream Power (lb/ft s)	1.63	12.12
1.75				
Frctn Loss (ft)	4.68	Cum Volume (acre-ft)	13.63	41.74
20.94				
C & E Loss (ft)	0.01	Cum SA (acres)	10.28	10.79
16.70				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1

PB Proj No. 11515
Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'
REACH: Reach-1 RS: 32

INPUT
Description:
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2765.73	50	2764.53	73	2763.83	90	2761.23	100	2761.23
110	2761.43	120.5	2761.93	150	2762.23	200	2761.83	250	2760.33
280	2762.23	320	2763.73	425	2764.23				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	73	.028	120.5	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
73	120.5	670	650	620	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2763.84	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.71	Wt. n-Val.		0.028
0.045				
W.S. Elev (ft)	2763.13	Reach Len. (ft)	670.00	650.00
620.00				
Crit W.S. (ft)	2763.13	Flow Area (sq ft)		64.04
254.84				
E.G. Slope (ft/ft)	0.017559	Area (sq ft)		64.04
254.84				
Q Total (cfs)	1974.00	Flow (cfs)		586.60
1387.40				
Top Width (ft)	226.44	Top Width (ft)		42.93
183.51				
Vel Total (ft/s)	6.19	Avg. Vel. (ft/s)		9.16
5.44				
Max Chl Dpth (ft)	2.80	Hydr. Depth (ft)		1.49
1.39				
Conv. Total (cfs)	14897.1	Conv. (cfs)		4426.8
10470.2				
Length Wtd. (ft)	635.65	Wetted Per. (ft)		43.08
183.61				
Min Ch El (ft)	2761.23	Shear (lb/sq ft)		1.63
1.52				
Alpha	1.19	Stream Power (lb/ft s)		14.93
8.28				
Frctn Loss (ft)	6.84	Cum Volume (acre-ft)	12.70	40.85
18.42				
C & E Loss (ft)	0.01	Cum SA (acres)	9.63	10.40
14.93				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

PB Proj No. 11515
Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

RIVER: RIVER-1
REACH: Reach-1 RS: 31

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2751.63	12	2751.13	60	2749.83	64	2749.13	72	2749.03
78	2749.23	79	2749.63	90	2749.43	94	2748.93	120	2749.23
127	2749.83	172	2750.93	222	2750.03	272	2750.23	300	2752.23

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	60	.028	127	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
60	127	220	300	370	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2752.22	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.66	Wt. n-Val.	0.045	0.028
0.045				
W.S. Elev (ft)	2751.56	Reach Len. (ft)	220.00	300.00
370.00				
Crit W.S. (ft)	2751.56	Flow Area (sq ft)	54.22	155.60
191.43				
E.G. Slope (ft/ft)	0.007258	Area (sq ft)	54.22	155.60
191.43				
Q Total (cfs)	1974.00	Flow (cfs)	145.14	1231.18
597.68				
Top Width (ft)	289.05	Top Width (ft)	58.39	67.00
163.66				
Vel Total (ft/s)	4.92	Avg. Vel. (ft/s)	2.68	7.91
3.12				
Max Chl Dpth (ft)	2.63	Hydr. Depth (ft)	0.93	2.32
1.17				
Conv. Total (cfs)	23170.7	Conv. (cfs)	1703.6	14451.6
7015.5				
Length Wtd. (ft)	305.93	Wetted Per. (ft)	58.42	67.20
163.73				
Min Ch El (ft)	2748.93	Shear (lb/sq ft)	0.42	1.05
0.53				
Alpha	1.76	Stream Power (lb/ft s)	1.13	8.30
1.65				
Frctn Loss (ft)	2.06	Cum Volume (acre-ft)	12.28	39.21
15.24				
C & E Loss (ft)	0.04	Cum SA (acres)	9.18	9.58
12.46				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 30

PB Proj No. 11515
Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

INPUT
Description: Retaining Wall @ Right Bank

Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2745.23	90	2743.43	124	2742.63	129	2741.93	140	2741.93
152	2741.63	155	2742.63	190	2743.03	205	2744.13	210	2745.23

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	124	.028	155	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
124	155	260	260	260	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2746.07	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.78	Wt. n-Val.	0.045	0.028
0.045				
W.S. Elev (ft)	2745.29	Reach Len. (ft)	260.00	260.00
260.00				
Crit W.S. (ft)	2745.29	Flow Area (sq ft)	163.43	103.66
114.89				
E.G. Slope (ft/ft)	0.006279	Area (sq ft)	163.43	103.66
114.89				
Q Total (cfs)	1974.00	Flow (cfs)	513.83	970.29
489.89				
Top Width (ft)	210.00	Top Width (ft)	124.00	31.00
55.00				
Vel Total (ft/s)	5.17	Avg. Vel. (ft/s)	3.14	9.36
4.26				
Max Chl Dpth (ft)	3.66	Hydr. Depth (ft)	1.32	3.34
2.09				
Conv. Total (cfs)	24911.0	Conv. (cfs)	6484.3	12244.6
6182.2				
Length Wtd. (ft)	260.00	Wetted Per. (ft)	124.09	31.21
55.22				
Min Ch El (ft)	2741.63	Shear (lb/sq ft)	0.52	1.30
0.82				
Alpha	1.88	Stream Power (lb/ft s)	1.62	12.19
3.48				
Frctn Loss (ft)	1.71	Cum Volume (acre-ft)	11.73	38.31
13.94				
C & E Loss (ft)	0.01	Cum SA (acres)	8.72	9.25
11.53				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.
Warning: The parabolic search method failed to converge on critical depth. The program will try the
cross section slice/secant method to find critical depth.

CROSS SECTION

RIVER: RIVER-1

PB Proj No. 11515
Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'
REACH: Reach-1 RS: 29

INPUT
Description: Retaining Wall @ Right Bank

Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2742.23	10	2740.23	50	2739.73	100	2739.93	113.5	2739.73
141	2738.53	150	2738.33	160	2738.43	166	2739.73	200	2740.63
250	2740.73	350	2743.23						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	113.5	.028	166	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
113.5	166	300	240	150	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2742.16	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.69	Wt. n-Val.	0.045	0.028	0.045
W.S. Elev (ft)	2741.47	Reach Len. (ft)	300.00	240.00	150.00
Crit W.S. (ft)	2741.47	Flow Area (sq ft)	167.50	136.91	94.23
E.G. Slope (ft/ft)	0.006872	Area (sq ft)	167.50	136.91	94.23
Q Total (cfs)	1974.00	Flow (cfs)	607.55	1138.72	227.74
Top Width (ft)	275.77	Top Width (ft)	109.70	52.50	113.57
Vel Total (ft/s)	4.95	Avg. Vel. (ft/s)	3.63	8.32	2.42
Max Chl Dpth (ft)	3.14	Hydr. Depth (ft)	1.53	2.61	0.83
Conv. Total (cfs)	23811.9	Conv. (cfs)	7328.7	13736.1	2747.1
Length Wtd. (ft)	222.31	Wetted Per. (ft)	109.82	52.67	113.59
Min Ch El (ft)	2738.33	Shear (lb/sq ft)	0.65	1.12	0.36
Alpha	1.82	Stream Power (lb/ft s)	2.37	9.28	0.86
Frctn Loss (ft)	1.76	Cum Volume (acre-ft)	10.74	37.60	13.32
C & E Loss (ft)	0.01	Cum SA (acres)	8.02	9.00	11.03

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 28

PB Proj No. 11515
Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

INPUT
Description: Retaining Wall @ Right Bank

Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2737.13	50	2737.23	80	2734.33	100	2734.43	110	2734.53
124	2735.13	150	2735.23	250	2735.23	330	2736.23	350	2736.73

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	80	.028	124	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
80	124	350	350	350	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2737.36	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.61	Wt. n-Val.	0.045	0.028
0.045				
W.S. Elev (ft)	2736.75	Reach Len. (ft)	350.00	350.00
350.00				
Crit W.S. (ft)	2736.75	Flow Area (sq ft)	30.31	97.01
279.99				
E.G. Slope (ft/ft)	0.009257	Area (sq ft)	30.31	97.01
279.99				
Q Total (cfs)	1974.00	Flow (cfs)	109.02	838.96
1026.02				
Top Width (ft)	295.04	Top Width (ft)	25.04	44.00
226.00				
Vel Total (ft/s)	4.85	Avg. Vel. (ft/s)	3.60	8.65
3.66				
Max Chl Dpth (ft)	2.42	Hydr. Depth (ft)	1.21	2.20
1.24				
Conv. Total (cfs)	20516.4	Conv. (cfs)	1133.1	8719.6
10663.7				
Length Wtd. (ft)	350.00	Wetted Per. (ft)	25.16	44.01
226.03				
Min Ch El (ft)	2734.33	Shear (lb/sq ft)	0.70	1.27
0.72				
Alpha	1.68	Stream Power (lb/ft s)	2.50	11.02
2.62				
Frctn Loss (ft)	3.35	Cum Volume (acre-ft)	10.06	36.95
12.67				
C & E Loss (ft)	0.00	Cum SA (acres)	7.56	8.73
10.44				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 27

INPUT

PB Proj No. 11515
Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'
Description: Retaining Wall @ Right Bank

Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2730.13	80	2730.13	130	2728.93	180	2727.63	230	2728.43
280	2729.03	330	2728.63	355	2727.83	368	2729.23	380	2729.83
480	2730.23								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	130	.028	368	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
130	368	260	255	250	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2730.35	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.60	Wt. n-Val.	0.045	0.028
0.045				
W.S. Elev (ft)	2729.75	Reach Len. (ft)	260.00	255.00
250.00				
Crit W.S. (ft)	2729.75	Flow Area (sq ft)	13.90	309.62
2.67				
E.G. Slope (ft/ft)	0.009877	Area (sq ft)	13.90	309.62
2.67				
Q Total (cfs)	1974.00	Flow (cfs)	25.11	1945.34
3.55				
Top Width (ft)	282.37	Top Width (ft)	34.04	238.00
10.34				
Vel Total (ft/s)	6.05	Avg. Vel. (ft/s)	1.81	6.28
1.33				
Max Chl Dpth (ft)	2.12	Hydr. Depth (ft)	0.41	1.30
0.26				
Conv. Total (cfs)	19862.7	Conv. (cfs)	252.7	19574.3
35.8				
Length Wtd. (ft)	256.16	Wetted Per. (ft)	34.05	238.12
10.35				
Min Ch El (ft)	2727.63	Shear (lb/sq ft)	0.25	0.80
0.16				
Alpha	1.06	Stream Power (lb/ft s)	0.45	5.04
0.21				
Frctn Loss (ft)	2.94	Cum Volume (acre-ft)	9.89	35.32
11.54				
C & E Loss (ft)	0.02	Cum SA (acres)	7.32	7.60
9.49				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 26

INPUT
Description: Broadway Blvd.

PB Proj No. 11515
Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2722.13	100	2721.33	120	2718.93	200	2719.93	300	2721.83
350	2721.93	380	2721.33	389	2719.83	390	2718.13	400	2717.93
427.5	2720.23	428	2721.73	450	2722.03	500	2722.13	510	2722.13
511	2720.13	560	2720.43	563	2723.33	600	2724.43	700	2722.53

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	389	.028	563	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
389	563	200	310	350	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2721.84	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.68	Wt. n-Val.	0.045	0.028
W.S. Elev (ft)	2721.17	Reach Len. (ft)	200.00	310.00
350.00				
Crit W.S. (ft)	2721.17	Flow Area (sq ft)	205.49	135.14
E.G. Slope (ft/ft)	0.013540	Area (sq ft)	205.49	135.14
Q Total (cfs)	1974.00	Flow (cfs)	893.99	1080.01
Top Width (ft)	260.88	Top Width (ft)	171.78	89.09
Vel Total (ft/s)	5.80	Avg. Vel. (ft/s)	4.35	7.99
Max Chl Dpth (ft)	3.24	Hydr. Depth (ft)	1.20	1.52
Conv. Total (cfs)	16964.6	Conv. (cfs)	7682.9	9281.7
Length Wtd. (ft)	293.22	Wetted Per. (ft)	172.04	91.78
Min Ch El (ft)	2717.93	Shear (lb/sq ft)	1.01	1.24
Alpha	1.30	Stream Power (lb/ft s)	4.39	9.95
Frctn Loss (ft)	2.01	Cum Volume (acre-ft)	9.23	34.02
11.53				
C & E Loss (ft)	0.00	Cum SA (acres)	6.70	6.64
9.46				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 25

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2720.23	20	2718.23	70	2717.33	170	2717.33	270	2717.33
320	2716.73	341.5	2717.13	354.5	2711.43	370	2712.13	387.5	2712.23
389.5	2716.93	410	2718.23	420	2716.53	470	2715.93	570	2715.73
670	2714.23	720	2714.23	770	2716.23				

Manning's n Values num= 3

PB Proj No. 11515
Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	341.5	.028	389.5	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
341.5	389.5	240	210	170	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2716.95	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.66	Wt. n-Val.		0.028
0.045				
W.S. Elev (ft)	2716.29	Reach Len. (ft)	240.00	210.00
170.00				
Crit W.S. (ft)	2716.29	Flow Area (sq ft)		172.45
339.63				
E.G. Slope (ft/ft)	0.004243	Area (sq ft)		172.45
339.63				
Q Total (cfs)	2113.00	Flow (cfs)		1369.02
743.99				
Top Width (ft)	376.13	Top Width (ft)		45.82
330.31				
Vel Total (ft/s)	4.13	Avg. Vel. (ft/s)		7.94
2.19				
Max Chl Dpth (ft)	4.86	Hydr. Depth (ft)		3.76
1.03				
Conv. Total (cfs)	32440.0	Conv. (cfs)		21017.9
11422.1				
Length Wtd. (ft)	202.83	Wetted Per. (ft)		49.54
330.43				
Min Ch El (ft)	2711.43	Shear (lb/sq ft)		0.92
0.27				
Alpha	2.50	Stream Power (lb/ft s)		7.32
0.60				
Frctn Loss (ft)	0.64	Cum Volume (acre-ft)	8.76	32.92
10.16				
C & E Loss (ft)	0.28	Cum SA (acres)	6.31	6.16
8.13				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 24

INPUT
Description:
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2712.73	50	2712.03	76	2712.03	81	2708.13	100	2707.43
119.5	2707.93	125	2711.53	150	2711.93	200	2712.53	250	2713.23

PB Proj No. 11515
Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	76	.018	125	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
76	125	100	100	100	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2713.96	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.60	Wt. n-Val.	0.045	0.018
0.045				
W.S. Elev (ft)	2712.35	Reach Len. (ft)	100.00	100.00
100.00				
Crit W.S. (ft)	2712.35	Flow Area (sq ft)	12.11	203.79
23.02				
E.G. Slope (ft/ft)	0.002451	Area (sq ft)	12.11	203.79
23.02				
Q Total (cfs)	2113.00	Flow (cfs)	7.79	2085.39
19.81				
Top Width (ft)	158.29	Top Width (ft)	49.06	49.00
60.23				
Vel Total (ft/s)	8.84	Avg. Vel. (ft/s)	0.64	10.23
0.86				
Max Chl Dpth (ft)	4.92	Hydr. Depth (ft)	0.25	4.16
0.38				
Conv. Total (cfs)	42683.1	Conv. (cfs)	157.4	42125.4
400.3				
Length Wtd. (ft)	100.00	Wetted Per. (ft)	49.06	51.43
60.24				
Min Ch El (ft)	2707.43	Shear (lb/sq ft)	0.04	0.61
0.06				
Alpha	1.32	Stream Power (lb/ft s)	0.02	6.20
0.05				
Frctn Loss (ft)	0.13	Cum Volume (acre-ft)	8.73	32.01
9.46				
C & E Loss (ft)	0.00	Cum SA (acres)	6.18	5.93
7.37				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 23

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2710.73	16.5	2709.73	25	2704.53	36	2704.73	47	2704.73
55	2709.23	72	2710.13	96	2712.23				

PB Proj No. 11515
Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	16.5	.012	55	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
16.5	55	75	75	75	.8	.6

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2712.62	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.61	Wt. n-Val.	0.080	0.012
0.080				
W.S. Elev (ft)	2711.01	Reach Len. (ft)	75.00	75.00
75.00				
Crit W.S. (ft)	2710.27	Flow Area (sq ft)	12.89	204.53
27.07				
E.G. Slope (ft/ft)	0.000805	Area (sq ft)	12.89	204.53
27.07				
Q Total (cfs)	2113.00	Flow (cfs)	5.69	2093.06
14.24				
Top Width (ft)	82.07	Top Width (ft)	16.50	38.50
27.07				
Vel Total (ft/s)	8.64	Avg. Vel. (ft/s)	0.44	10.23
0.53				
Max Chl Dpth (ft)	6.48	Hydr. Depth (ft)	0.78	5.31
1.00				
Conv. Total (cfs)	74468.5	Conv. (cfs)	200.6	73765.9
502.0				
Length Wtd. (ft)	75.00	Wetted Per. (ft)	16.81	41.15
27.13				
Min Ch El (ft)	2704.53	Shear (lb/sq ft)	0.04	0.25
0.05				
Alpha	1.39	Stream Power (lb/ft s)	0.02	2.56
0.03				
Frctn Loss (ft)		Cum Volume (acre-ft)	8.70	31.55
9.40				
C & E Loss (ft)		Cum SA (acres)	6.10	5.83
7.27				

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 22.5

INPUT
Description: Culvert #3 (2 10' x 5' Boxes)

Distance from Upstream XS = 12.5
Deck/Roadway Width = 50
Weir Coefficient = 2.8
Upstream Deck/Roadway Coordinates
num= 6

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2710.53	2703.03	16.5	2710.53	2703.03	16.5	2710.53	2703.03
55	2710.53	2703.03	55	2710.53	2703.03	96	2710.53	2703.03

Upstream Bridge Cross Section Data
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2710.73	16.5	2709.73	25	2704.53	36	2704.73	47	2704.73
55	2709.23	72	2710.13	96	2712.23				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	16.5	.012	55	.08

Bank Sta: Left Right Coeff Contr. Expan.

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Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

16.5	55	.8	.6

Downstream Deck/Roadway Coordinates
num= 6

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2710.53	2703.03	16.5	2710.53	2703.03	16.5	2710.53	2703.03
57.5	2710.53	2703.03	57.5	2710.53	2703.03	96	2710.53	2703.03

Downstream Bridge Cross Section Data
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2709.33	16.5	2708.93	26	2703.03	36.5	2703.03	47.5	2703.03
57.5	2708.83	71.5	2708.93	80	2710.23				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	16.5	.012	57.5	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
16.5	57.5	.8	.6

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins = 2710.53
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Box3	Box	5	10

FHWA Chart # 9 - flared wingwalls and Inlet top edge bevel
FHWA Scale # 1 - Wingwall flared 45 deg.; inlet top edge bevel=0.043D
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
Box3	12.5	50	.012	.012	0	.2	1

Number of Barrels = 2
Upstream Elevation = 2704.53
Centerline Stations

Sta.	Sta.
30.75	40.75

Downstream Elevation = 2703.23
Centerline Stations

Sta.	Sta.
32	42

CULVERT OUTPUT Profile #PF 1 Culv Group: Box3

Q Culv Group (cfs)	1384.39	Culv Full Len (ft)	50.00
# Barrels	2	Culv Vel US (ft/s)	13.84
Q Barrel (cfs)	692.20	Culv Vel DS (ft/s)	13.84
E.G. US. (ft)	2712.63	Culv Inv El Up (ft)	2704.53
W.S. US. (ft)	2711.01	Culv Inv El Dn (ft)	2703.23
E.G. DS (ft)	2710.95	Culv Frctn Ls (ft)	0.79
W.S. DS (ft)	2708.74	Culv Exit Loss (ft)	0.77
Delta EG (ft)	1.68	Culv Entr Loss (ft)	0.60
Delta WS (ft)	2.27	Q Weir (cfs)	728.61
E.G. IC (ft)	2712.96	Weir Sta Lft (ft)	0.00
E.G. OC (ft)	2712.63	Weir Sta Rgt (ft)	96.00
Culvert Control	Inlet	Weir Submerg	0.00
Culv WS Inlet (ft)	2709.53	Weir Max Depth (ft)	2.10
Culv WS Outlet (ft)	2708.23	Weir Avg Depth (ft)	1.93
Culv Nml Depth (ft)	2.48	Weir Flow Area (sq ft)	185.12
Culv Crt Depth (ft)	5.00	Min El Weir Flow (ft)	2710.54

Note: Culvert critical depth exceeds the height of the culvert.

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Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore,
the culvert inlet equations are not valid and the supercritical result has been discarded. The
outlet answer will be used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 22

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2709.33	16.5	2708.93	26	2703.03	36.5	2703.03	47.5	2703.03
57.5	2708.83	71.5	2708.93	80	2710.23				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	16.5	.012	57.5	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
16.5	57.5	440	440	440	.8	.6

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2710.95	Element	Left OB	Channel
Right OB				
Vel Head (ft)	2.21	Wt. n-Val.		0.012
W.S. Elev (ft)	2708.74	Reach Len. (ft)	440.00	440.00
440.00				
Crit W.S. (ft)	2708.74	Flow Area (sq ft)		177.25
E.G. Slope (ft/ft)	0.001434	Area (sq ft)		177.25
Q Total (cfs)	2113.00	Flow (cfs)		2113.00
Top Width (ft)	40.55	Top Width (ft)		40.55
Vel Total (ft/s)	11.92	Avg. Vel. (ft/s)		11.92
Max Chl Dpth (ft)	5.71	Hydr. Depth (ft)		4.37
Conv. Total (cfs)	55807.2	Conv. (cfs)		55807.2
Length Wtd. (ft)	440.00	Wetted Per. (ft)		43.72
Min Ch El (ft)	2703.03	Shear (lb/sq ft)		0.36
Alpha	1.00	Stream Power (lb/ft s)		4.33
Frctn Loss (ft)	0.82	Cum Volume (acre-ft)	8.69	31.22
9.38				
C & E Loss (ft)	0.04	Cum SA (acres)	6.09	5.76
7.25				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 21

INPUT

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Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2700.23	50	2697.43	67.5	2696.93	77.5	2692.23	85.5	2692.03
92.5	2692.13	100.5	2697.23	120	2698.33	135	2700.23		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	67.5	.018	100.5	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
67.5	100.5	410	410	410	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2700.86	Element			
Vel Head (ft)	2.13	Wt. n-Val.	0.080	0.018	0.080
W.S. Elev (ft)	2698.73	Reach Len. (ft)	410.00	410.00	410.00
Crit W.S. (ft)	2698.73	Flow Area (sq ft)	42.13	173.18	19.11
E.G. Slope (ft/ft)	0.002506	Area (sq ft)	42.13	173.18	19.11
Q Total (cfs)	2113.00	Flow (cfs)	40.07	2057.09	15.84
Top Width (ft)	96.32	Top Width (ft)	40.68	33.00	22.64
Vel Total (ft/s)	9.01	Avg. Vel. (ft/s)	0.95	11.88	0.83
Max Chl Dpth (ft)	6.70	Hydr. Depth (ft)	1.04	5.25	0.84
Conv. Total (cfs)	42206.4	Conv. (cfs)	800.4	41089.6	316.4
Length Wtd. (ft)	410.00	Wetted Per. (ft)	40.72	35.54	22.70
Min Ch El (ft)	2692.03	Shear (lb/sq ft)	0.16	0.76	0.13
Alpha	1.69	Stream Power (lb/ft s)	0.15	9.06	0.11
Frctn Loss (ft)	1.00	Cum Volume (acre-ft)	8.47	29.45	9.28
C & E Loss (ft)	0.00	Cum SA (acres)	5.88	5.39	7.14

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 20

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2690.23	55	2688.63	74.5	2688.33	84.5	2682.13	90	2681.63

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Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

95.5 2682.23 104.5 2688.03 140 2689.23 170 2690.23

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	74.5	.018	104.5	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
74.5	104.5	415	410	405	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2691.84	Element	Left OB	Channel
Right OB				
Vel Head (ft)	2.14	Wt. n-Val.	0.080	0.018
0.080				
W.S. Elev (ft)	2689.70	Reach Len. (ft)	415.00	410.00
405.00				
Crit W.S. (ft)	2689.70	Flow Area (sq ft)	43.47	171.57
41.30				
E.G. Slope (ft/ft)	0.002368	Area (sq ft)	43.47	171.57
41.30				
Q Total (cfs)	2113.00	Flow (cfs)	33.07	2046.91
33.02				
Top Width (ft)	135.88	Top Width (ft)	56.28	30.00
49.60				
Vel Total (ft/s)	8.24	Avg. Vel. (ft/s)	0.76	11.93
0.80				
Max Chl Dpth (ft)	8.07	Hydr. Depth (ft)	0.77	5.72
0.83				
Conv. Total (cfs)	43418.0	Conv. (cfs)	679.5	42059.9
678.6				
Length Wtd. (ft)	409.98	Wetted Per. (ft)	56.30	33.53
49.63				
Min Ch El (ft)	2681.63	Shear (lb/sq ft)	0.11	0.76
0.12				
Alpha	2.03	Stream Power (lb/ft s)	0.09	9.03
0.10				
Frctn Loss (ft)	0.99	Cum Volume (acre-ft)	8.07	27.83
8.99				
C & E Loss (ft)	0.01	Cum SA (acres)	5.42	5.09
6.80				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 19

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2679.23	30	2677.13	48.5	2677.23	57	2672.03	64.5	2671.83
73	2672.03	81	2676.93	101.5	2676.83	121.5	2679.23		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val

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Este Wash
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0	.08	48.5	.018	81	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
48.5	81	380	380	380	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2680.61	Element	Left OB	Channel
Right OB				
Vel Head (ft)	2.05	Wt. n-Val.	0.080	0.018
0.080				
W.S. Elev (ft)	2678.56	Reach Len. (ft)	380.00	380.00
380.00				
Crit W.S. (ft)	2678.56	Flow Area (sq ft)	40.26	172.22
47.01				
E.G. Slope (ft/ft)	0.002451	Area (sq ft)	40.26	172.22
47.01				
Q Total (cfs)	2113.00	Flow (cfs)	37.79	2022.63
52.58				
Top Width (ft)	106.41	Top Width (ft)	38.97	32.50
34.94				
Vel Total (ft/s)	8.14	Avg. Vel. (ft/s)	0.94	11.74
1.12				
Max Chl Dpth (ft)	6.73	Hydr. Depth (ft)	1.03	5.30
1.35				
Conv. Total (cfs)	42682.8	Conv. (cfs)	763.4	40857.2
1062.2				
Length Wtd. (ft)	380.00	Wetted Per. (ft)	39.02	35.35
35.05				
Min Ch El (ft)	2671.83	Shear (lb/sq ft)	0.16	0.75
0.21				
Alpha	1.99	Stream Power (lb/ft s)	0.15	8.75
0.23				
Frctn Loss (ft)	0.87	Cum Volume (acre-ft)	7.67	26.21
8.58				
C & E Loss (ft)	0.02	Cum SA (acres)	4.97	4.80
6.40				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 18

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2670.23	40	2668.13	61	2667.43	67.5	2663.73	77	2663.73
85	2663.93	92.5	2667.83	113.5	2668.63	168.5	2670.23		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	61	.018	92.5	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
61	92.5	460	460	460	.3	.1

PB Proj No. 11515
Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2671.95	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.84	Wt. n-Val.	0.080	0.018	0.080
W.S. Elev (ft)	2670.11	Reach Len. (ft)	460.00	460.00	460.00
Crit W.S. (ft)	2670.11	Flow Area (sq ft)	85.96	171.86	76.75
E.G. Slope (ft/ft)	0.002128	Area (sq ft)	85.96	171.86	76.75
Q Total (cfs)	2113.00	Flow (cfs)	95.01	1949.19	68.80
Top Width (ft)	161.81	Top Width (ft)	58.61	31.50	71.69
Vel Total (ft/s)	6.32	Avg. Vel. (ft/s)	1.11	11.34	0.90
Max Chl Dpth (ft)	6.37	Hydr. Depth (ft)	1.47	5.46	1.07
Conv. Total (cfs)	45803.9	Conv. (cfs)	2059.6	42252.9	1491.4
Length Wtd. (ft)	460.00	Wetted Per. (ft)	58.68	33.44	71.73
Min Ch El (ft)	2663.73	Shear (lb/sq ft)	0.19	0.68	0.14
Alpha	2.98	Stream Power (lb/ft s)	0.22	7.75	0.13
Frctn Loss (ft)	0.79	Cum Volume (acre-ft)	7.12	24.71	8.04
C & E Loss (ft)	0.13	Cum SA (acres)	4.54	4.52	5.94

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 17

INPUT
Description:
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2659.43	18	2658.63	26.5	2653.03	35	2652.93	47	2652.83
56	2658.83	73	2659.53						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	18	.012	56	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
18	56	100	100	100	.8	.6

CROSS SECTION OUTPUT Profile #PF 1

PB Proj No. 11515
Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

E.G. Elev (ft)	2661.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.28	Wt. n-Val.	0.080	0.012	0.000
W.S. Elev (ft)	2658.85	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	2658.82	Flow Area (sq ft)	0.55	174.42	0.01
E.G. Slope (ft/ft)	0.001411	Area (sq ft)	0.55	174.42	0.01
Q Total (cfs)	2113.00	Flow (cfs)	0.09	2112.91	0.00
Top Width (ft)	43.48	Top Width (ft)	4.97	38.00	0.50
Vel Total (ft/s)	12.08	Avg. Vel. (ft/s)	0.16	12.11	0.03
Max Chl Dpth (ft)	6.02	Hydr. Depth (ft)	0.11	4.59	0.01
Conv. Total (cfs)	56251.8	Conv. (cfs)	2.3	56249.5	0.0
Length Wtd. (ft)	100.00	Wetted Per. (ft)	4.98	41.50	0.50
Min Ch El (ft)	2652.83	Shear (lb/sq ft)	0.01	0.37	
Alpha	1.01	Stream Power (lb/ft s)	0.00	4.49	
Frctn Loss (ft)		Cum Volume (acre-ft)	6.66	22.88	7.64
C & E Loss (ft)		Cum SA (acres)	4.21	4.15	5.56

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 16.5

INPUT
Description: Culvert #2 (2 10' x 6' Boxes)

Distance from Upstream XS = 10
Deck/Roadway Width = 80
Weir Coefficient = 2.8
Upstream Deck/Roadway Coordinates
num= 6

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2659.23	2649.83	18	2659.23	2649.83	18	2659.23	2649.83
56	2659.23	2649.83	56	2659.23	2649.83	73	2659.23	2649.83

Upstream Bridge Cross Section Data
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2659.43	18	2658.63	26.5	2653.03	35	2652.93	47	2652.83
56	2658.83	73	2659.53						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	18	.012	56	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
18	56	.8	.6

Downstream Deck/Roadway Coordinates
num= 6

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2659.23	2649.83	20.5	2659.23	2649.83	20.5	2659.23	2649.83
66	2659.23	2649.83	66	2659.23	2649.83	73	2659.23	2649.83

Downstream Bridge Cross Section Data
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2660.73	7.5	2658.13	20.5	2658.03	34.5	2649.83	43.5	2649.83

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Este Wash
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53 2649.83 66 2657.63 78 2658.03 85 2660.33

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	20.5	.012	66	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
20.5	66	.8	.6

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins = 2659.23
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Box2	Box	6	10

FHWA Chart # 9 - flared wingwalls and Inlet top edge bevel
FHWA Scale # 1 - Wingwall flared 45 deg.; inlet top edge bevel=0.043D
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
1	10	80	.012	.012	0	.2	

Number of Barrels = 2
Upstream Elevation = 2652.33
Centerline Stations

Sta.	Sta.
32	42

Downstream Elevation = 2650.13
Centerline Stations

Sta.	Sta.
38.25	48.25

CULVERT OUTPUT Profile #PF 1 Culv Group: Box2

Q Culv Group (cfs)	1582.70	Culv Full Len (ft)	80.00
# Barrels	2	Culv Vel US (ft/s)	13.19
Q Barrel (cfs)	791.35	Culv Vel DS (ft/s)	13.19
E.G. US. (ft)	2661.14	Culv Inv El Up (ft)	2652.33
W.S. US. (ft)	2658.85	Culv Inv El Dn (ft)	2650.13
E.G. DS (ft)	2660.21	Culv Frctn Ls (ft)	0.83
W.S. DS (ft)	2657.46	Culv Exit Loss (ft)	
Delta EG (ft)	0.93	Culv Entr Loss (ft)	0.54
Delta WS (ft)	1.39	Q Weir (cfs)	530.30
E.G. IC (ft)	2661.49	Weir Sta Lft (ft)	0.00
E.G. OC (ft)	2661.14	Weir Sta Rgt (ft)	73.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	2658.33	Weir Max Depth (ft)	1.91
Culv WS Outlet (ft)	2656.13	Weir Avg Depth (ft)	1.89
Culv Nml Depth (ft)	2.66	Weir Flow Area (sq ft)	137.81
Culv Crt Depth (ft)	5.79	Min El Weir Flow (ft)	2659.24

Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore,
the culvert inlet equations are not valid and the supercritical result has been discarded. The
outlet answer will be used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 16

PB Proj No. 11515
Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2660.73	7.5	2658.13	20.5	2658.03	34.5	2649.83	43.5	2649.83
53	2649.83	66	2657.63	78	2658.03	85	2660.33		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	20.5	.012	66	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
20.5	66	35	35	35	.8	.6

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2660.21	Element	Left OB	Channel
Right OB				
Vel Head (ft)	2.74	Wt. n-Val.		0.012
W.S. Elev (ft)	2657.46	Reach Len. (ft)	35.00	35.00
35.00				
Crit W.S. (ft)	2657.46	Flow Area (sq ft)		239.51
E.G. Slope (ft/ft)	0.001367	Area (sq ft)		239.51
Q Total (cfs)	3183.00	Flow (cfs)		3183.00
Top Width (ft)	44.26	Top Width (ft)		44.26
Vel Total (ft/s)	13.29	Avg. Vel. (ft/s)		13.29
Max Chl Dpth (ft)	7.63	Hydr. Depth (ft)		5.41
Conv. Total (cfs)	86078.5	Conv. (cfs)		86078.5
Length Wtd. (ft)	35.00	Wetted Per. (ft)		48.44
Min Ch El (ft)	2649.83	Shear (lb/sq ft)		0.42
Alpha	1.00	Stream Power (lb/ft s)		5.61
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	6.66	22.40
7.64				
C & E Loss (ft)	1.85	Cum SA (acres)	4.20	4.06
5.56				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 15

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2661.33	9	2657.43	22	2657.23	34	2646.23	45	2645.33
56.5	2646.23	67.5	2656.83	85	2657.33				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	22	.018	67.5	.08

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Este Wash
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Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
22	67.5	90	90	90	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2656.48	Element	Left OB	Channel
Right OB				
Vel Head (ft)	3.02	Wt. n-Val.		0.018
W.S. Elev (ft)	2653.46	Reach Len. (ft)	90.00	90.00
90.00				
Crit W.S. (ft)	2653.46	Flow Area (sq ft)		228.26
E.G. Slope (ft/ft)	0.003146	Area (sq ft)		228.26
Q Total (cfs)	3183.00	Flow (cfs)		3183.00
Top Width (ft)	37.88	Top Width (ft)		37.88
Vel Total (ft/s)	13.94	Avg. Vel. (ft/s)		13.94
Max Chl Dpth (ft)	8.13	Hydr. Depth (ft)		6.03
Conv. Total (cfs)	56744.9	Conv. (cfs)		56744.9
Length Wtd. (ft)	90.00	Wetted Per. (ft)		43.68
Min Ch El (ft)	2645.33	Shear (lb/sq ft)		1.03
Alpha	1.00	Stream Power (lb/ft s)		14.32
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)	6.66	22.21
7.64				
C & E Loss (ft)	0.02	Cum SA (acres)	4.20	4.03
5.56				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 14

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
100	2653.03	125	2651.73	133.7	2643.83	145	2643.33	156	2643.83
164	2649.83	195	2650.83	235	2652.23				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
100	.08	125	.018	164	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
125	164	125	125	125	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2653.99	Element	Left OB	Channel
Right OB				
Vel Head (ft)	2.78	Wt. n-Val.		0.018
0.080				
W.S. Elev (ft)	2651.22	Reach Len. (ft)	125.00	125.00
125.00				
Crit W.S. (ft)	2651.22	Flow Area (sq ft)		235.44
29.62				

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Este Wash
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E.G. Slope (ft/ft)	0.002766	Area (sq ft)		235.44
29.62				
Q Total (cfs)	3183.00	Flow (cfs)		3160.10
22.90				
Top Width (ft)	80.48	Top Width (ft)		38.43
42.05				
Vel Total (ft/s)	12.01	Avg. Vel. (ft/s)		13.42
0.77				
Max Chl Dpth (ft)	7.89	Hydr. Depth (ft)		6.13
0.70				
Conv. Total (cfs)	60523.3	Conv. (cfs)		60087.8
435.5				
Length Wtd. (ft)	125.00	Wetted Per. (ft)		43.31
42.07				
Min Ch El (ft)	2643.33	Shear (lb/sq ft)		0.94
0.12				
Alpha	1.24	Stream Power (lb/ft s)		12.60
0.09				
Frctn Loss (ft)	0.34	Cum Volume (acre-ft)	6.66	21.74
7.61				
C & E Loss (ft)	0.04	Cum SA (acres)	4.20	3.95
5.51				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 13

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2648.23	35	2645.93	53.5	2645.53	58.5	2641.03	75.5	2640.83
95	2641.63	99.5	2645.93	112.5	2646.23	115.5	2647.53		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	53.5	.018	99.5	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
53.5	99.5	380	390	400	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2649.45	Element	Left OB	Channel
Right OB				
Vel Head (ft)	2.42	Wt. n-Val.	0.080	0.018
0.080				
W.S. Elev (ft)	2647.03	Reach Len. (ft)	380.00	390.00
400.00				
Crit W.S. (ft)	2647.03	Flow Area (sq ft)	33.07	249.93
13.01				
E.G. Slope (ft/ft)	0.002674	Area (sq ft)	33.07	249.93
13.01				
Q Total (cfs)	3183.00	Flow (cfs)	30.47	3141.17
11.36				

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Top Width (ft)	95.99	Top Width (ft)	35.16	46.00	14.83
Vel Total (ft/s)	10.75	Avg. Vel. (ft/s)	0.92	12.57	0.87
Max Chl Dpth (ft)	6.19	Hydr. Depth (ft)	0.94	5.43	0.88
Conv. Total (cfs)	61556.8	Conv. (cfs)	589.2	60747.9	219.7
Length Wtd. (ft)	389.98	Wetted Per. (ft)	35.20	49.47	15.00
Min Ch El (ft)	2640.83	Shear (lb/sq ft)	0.16	0.84	0.14
Alpha	1.35	Stream Power (lb/ft s)	0.14	10.60	0.13
Frctn Loss (ft)	1.09	Cum Volume (acre-ft)	6.62	21.04	7.55
C & E Loss (ft)	0.03	Cum SA (acres)	4.15	3.83	5.43

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 12

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2637.73	17.5	2637.43	23.5	2631.73	41.5	2631.73	60.5	2632.13
65	2637.13	77	2636.83	87.5	2642.43				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	17.5	.018	65	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
17.5	65	470	470	470	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2640.21	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.51	Wt. n-Val.	0.080	0.018	0.080
W.S. Elev (ft)	2637.70	Reach Len. (ft)	470.00	470.00	470.00
Crit W.S. (ft)	2637.70	Flow Area (sq ft)	2.08	249.47	9.31
E.G. Slope (ft/ft)	0.002938	Area (sq ft)	2.08	249.47	9.31
Q Total (cfs)	3183.00	Flow (cfs)	0.55	3175.27	7.19
Top Width (ft)	76.69	Top Width (ft)	15.56	47.50	13.63
Vel Total (ft/s)	12.20	Avg. Vel. (ft/s)	0.26	12.73	0.77

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Max Chl Dpth (ft)	5.97	Hydr. Depth (ft)	0.13	5.25
0.68				
Conv. Total (cfs)	58719.5	Conv. (cfs)	10.1	58576.8
132.6				
Length Wtd. (ft)	470.00	Wetted Per. (ft)	15.57	52.01
13.85				
Min Ch El (ft)	2631.73	Shear (lb/sq ft)	0.02	0.88
0.12				
Alpha	1.09	Stream Power (lb/ft s)	0.01	11.20
0.10				
Frctn Loss (ft)	1.24	Cum Volume (acre-ft)	6.46	18.80
7.44				
C & E Loss (ft)	0.04	Cum SA (acres)	3.93	3.41
5.30				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 11

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2632.23	35	2630.23	61	2630.23	77	2625.43	85	2625.63
103	2625.23	109	2629.63	135	2629.63	175	2632.23		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	61	.018	109	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
61	109	520	510	490	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2633.85	Element	Left OB	Channel
Right OB				
Vel Head (ft)	2.07	Wt. n-Val.	0.080	0.018
0.080				
W.S. Elev (ft)	2631.78	Reach Len. (ft)	520.00	510.00
490.00				
Crit W.S. (ft)	2631.78	Flow Area (sq ft)	61.23	253.52
91.36				
E.G. Slope (ft/ft)	0.002386	Area (sq ft)	61.23	253.52
91.36				
Q Total (cfs)	3183.00	Flow (cfs)	61.06	3011.14
110.80				
Top Width (ft)	160.15	Top Width (ft)	53.10	48.00
59.05				
Vel Total (ft/s)	7.84	Avg. Vel. (ft/s)	1.00	11.88
1.21				
Max Chl Dpth (ft)	6.55	Hydr. Depth (ft)	1.15	5.28
1.55				
Conv. Total (cfs)	65162.6	Conv. (cfs)	1250.1	61644.2
2268.3				

PB Proj No. 11515
Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

Length Wtd. (ft)	509.30	Wetted Per. (ft)	53.14	50.15
59.12				
Min Ch El (ft)	2625.23	Shear (lb/sq ft)	0.17	0.75
0.23				
Alpha	2.17	Stream Power (lb/ft s)	0.17	8.94
0.28				
Frctn Loss (ft)	1.23	Cum Volume (acre-ft)	6.12	16.09
6.90				
C & E Loss (ft)	0.12	Cum SA (acres)	3.56	2.89
4.91				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 10

INPUT
Description:
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2622.23	20.5	2619.03	27.7	2615.73	27.8	2614.43	38.5	2614.13
49	2614.23	49.3	2615.03	58	2618.93	82.5	2619.03	125	2622.23

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	20.5	.018	58	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
20.5	58	210	180	150	.3	.1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2624.12	Element	Left OB	Channel
Right OB				
Vel Head (ft)	2.48	Wt. n-Val.	0.080	0.018
0.080				
W.S. Elev (ft)	2621.64	Reach Len. (ft)	210.00	180.00
150.00				
Crit W.S. (ft)	2621.64	Flow Area (sq ft)	21.82	231.06
110.41				
E.G. Slope (ft/ft)	0.002460	Area (sq ft)	21.82	231.06
110.41				
Q Total (cfs)	3183.00	Flow (cfs)	23.82	3005.16
154.02				
Top Width (ft)	113.39	Top Width (ft)	16.72	37.50
59.17				
Vel Total (ft/s)	8.76	Avg. Vel. (ft/s)	1.09	13.01
1.39				
Max Chl Dpth (ft)	7.51	Hydr. Depth (ft)	1.31	6.16
1.87				
Conv. Total (cfs)	64171.5	Conv. (cfs)	480.2	60586.2
3105.2				
Length Wtd. (ft)	179.39	Wetted Per. (ft)	16.92	40.82
59.26				
Min Ch El (ft)	2614.13	Shear (lb/sq ft)	0.20	0.87
0.29				

PB Proj No. 11515
Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

Alpha	2.08	Stream Power (lb/ft s)	0.22	11.31
0.40				
Frctn Loss (ft)	0.32	Cum Volume (acre-ft)	5.63	13.25
5.77				
C & E Loss (ft)	0.03	Cum SA (acres)	3.14	2.39
4.24				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 9

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2617.53	28.5	2615.33	32	2610.53	50	2610.53	72	2610.53
75.5	2615.03	85	2617.73	120	2618.53				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	28.5	.012	75.5	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
28.5	75.5	60	60	60	.8	.6

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2618.70	Element	Left OB	Channel
Right OB				
Vel Head (ft)	2.60	Wt. n-Val.	0.080	0.012
0.080				
W.S. Elev (ft)	2616.11	Reach Len. (ft)	60.00	60.00
60.00				
Crit W.S. (ft)	2616.11	Flow Area (sq ft)	3.92	245.87
2.04				
E.G. Slope (ft/ft)	0.001363	Area (sq ft)	3.92	245.87
2.04				
Q Total (cfs)	3183.00	Flow (cfs)	1.43	3180.67
0.90				
Top Width (ft)	60.87	Top Width (ft)	10.07	47.00
3.79				
Vel Total (ft/s)	12.64	Avg. Vel. (ft/s)	0.36	12.94
0.44				
Max Chl Dpth (ft)	5.58	Hydr. Depth (ft)	0.39	5.23
0.54				
Conv. Total (cfs)	86229.1	Conv. (cfs)	38.7	86165.9
24.5				
Length Wtd. (ft)	60.00	Wetted Per. (ft)	10.10	51.64
3.94				
Min Ch El (ft)	2610.53	Shear (lb/sq ft)	0.03	0.41
0.04				
Alpha	1.05	Stream Power (lb/ft s)	0.01	5.24
0.02				
Frctn Loss (ft)		Cum Volume (acre-ft)	5.56	12.27
5.57				

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Este Wash
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C & E Loss (ft)	Cum SA (acres)	3.08	2.22
4.13			

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 8.5

INPUT
Description: Culvert #1 (4 12' x 6' Boxes)

Distance from Upstream XS = 5
Deck/Roadway Width = 50
Weir Coefficient = 2.8
Upstream Deck/Roadway Coordinates
num= 6

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2616.03	2609.13	28.5	2616.03	2609.13	28.5	2616.03	2609.13
75.5	2616.03	2609.13	75.5	2616.03	2609.13	120	2616.03	2609.13

Upstream Bridge Cross Section Data
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2617.53	28.5	2615.33	32	2610.53	50	2610.53	72	2610.53
75.5	2615.03	85	2617.73	120	2618.53				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	28.5	.012	75.5	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
28.5	75.5	.8	.6

Downstream Deck/Roadway Coordinates
num= 6

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2616.03	2609.13	25	2616.03	2609.13	25	2616.03	2609.13
71	2616.03	2609.13	71	2616.03	2609.13	120	2616.03	2609.13

Downstream Bridge Cross Section Data
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2616.43	25	2614.13	31.5	2609.23	47.5	2609.13	61.5	2609.13
71	2615.03	97.5	2617.53	147.5	2618.03				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	25	.012	71	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
25	71	.8	.6

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins = 2616.03
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Box1	Box	6	12

FHWA Chart # 9 - flared wingwalls and Inlet top edge bevel
FHWA Scale # 1 - Wingwall flared 45 deg.; inlet top edge bevel=0.043D

PB Proj No. 11515
Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
1	5	50	.012	.012	0	.2	

Number of Barrels = 4
Upstream Elevation = 2610.03
Centerline Stations

Sta.	Sta.	Sta.	Sta.
34	46	58	70

Downstream Elevation = 2609.53
Centerline Stations

Sta.	Sta.	Sta.	Sta.
30	42	54	66

CULVERT OUTPUT Profile #PF 1 Culv Group: Box1

Q Culv Group (cfs)	2328.01	Culv Full Len (ft)	50.00
# Barrels	4	Culv Vel US (ft/s)	8.08
Q Barrel (cfs)	582.00	Culv Vel DS (ft/s)	8.08
E.G. US. (ft)	2618.54	Culv Inv El Up (ft)	2610.03
W.S. US. (ft)	2616.11	Culv Inv El Dn (ft)	2609.53
E.G. DS (ft)	2618.26	Culv Frctn Ls (ft)	0.08
W.S. DS (ft)	2615.57	Culv Exit Loss (ft)	
Delta EG (ft)	0.29	Culv Entr Loss (ft)	0.20
Delta WS (ft)	0.53	Q Weir (cfs)	854.99
E.G. IC (ft)	2618.26	Weir Sta Lft (ft)	0.00
E.G. OC (ft)	2618.54	Weir Sta Rgt (ft)	120.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	2616.03	Weir Max Depth (ft)	2.51
Culv WS Outlet (ft)	2615.53	Weir Avg Depth (ft)	1.74
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	208.60
Culv Crt Depth (ft)	4.18	Min El Weir Flow (ft)	2616.04

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 8

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2616.43	25	2614.13	31.5	2609.23	47.5	2609.13	61.5	2609.13
71	2615.03	97.5	2617.53	147.5	2618.03				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	25	.012	71	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
25	71	270	270	270	.8	.6

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2618.26	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.68	Wt. n-Val.	0.080	0.012	0.080
W.S. Elev (ft)	2615.57	Reach Len. (ft)	270.00	270.00	270.00
Crit W.S. (ft)	2615.57	Flow Area (sq ft)	11.31	250.97	1.56
E.G. Slope (ft/ft)	0.001290	Area (sq ft)	11.31	250.97	1.56

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Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

Q Total (cfs)	3308.00	Flow (cfs)	6.05	3301.51
0.44				
Top Width (ft)	67.44	Top Width (ft)	15.68	46.00
5.75				
Vel Total (ft/s)	12.54	Avg. Vel. (ft/s)	0.54	13.15
0.28				
Max Chl Dpth (ft)	6.44	Hydr. Depth (ft)	0.72	5.46
0.27				
Conv. Total (cfs)	92116.0	Conv. (cfs)	168.6	91935.3
12.1				
Length Wtd. (ft)	270.00	Wetted Per. (ft)	15.75	49.32
5.78				
Min Ch El (ft)	2609.13	Shear (lb/sq ft)	0.06	0.41
0.02				
Alpha	1.10	Stream Power (lb/ft s)	0.03	5.39
0.01				
Frctn Loss (ft)	0.35	Cum Volume (acre-ft)	5.55	11.93
5.57				
C & E Loss (ft)	0.29	Cum SA (acres)	3.06	2.15
4.13				

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program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 7

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2614.23	15	2613.03	33	2605.23	41	2606.73	51	2606.63
62.5	2606.93	71.5	2611.33	84.5	2620.63				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	33	.012	71.5	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
33	71.5	320	345	370	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2616.02	Element	Left OB	Channel
Right OB				
Vel Head (ft)	3.05	Wt. n-Val.	0.080	0.012
0.080				
W.S. Elev (ft)	2612.97	Reach Len. (ft)	320.00	345.00
370.00				
Crit W.S. (ft)	2612.97	Flow Area (sq ft)	69.13	224.58
1.88				
E.G. Slope (ft/ft)	0.001311	Area (sq ft)	69.13	224.58
1.88				
Q Total (cfs)	3308.00	Flow (cfs)	108.22	3198.82
0.97				
Top Width (ft)	58.66	Top Width (ft)	17.86	38.50
2.29				

PB Proj No. 11515
Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

Vel Total (ft/s)	11.19	Avg. Vel. (ft/s)	1.57	14.24
0.51				
Max Chl Dpth (ft)	7.74	Hydr. Depth (ft)	3.87	5.83
0.82				
Conv. Total (cfs)	91363.8	Conv. (cfs)	2988.8	88348.3
26.7				
Length Wtd. (ft)	344.59	Wetted Per. (ft)	19.47	39.66
2.82				
Min Ch El (ft)	2605.23	Shear (lb/sq ft)	0.29	0.46
0.05				
Alpha	1.57	Stream Power (lb/ft s)	0.45	6.60
0.03				
Frctn Loss (ft)	0.46	Cum Volume (acre-ft)	5.30	10.45
5.56				
C & E Loss (ft)	0.05	Cum SA (acres)	2.96	1.89
4.10				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 6

INPUT
Description:
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2609.93	17	2609.83	26.5	2601.23	37	2601.23	47	2601.83
65	2612.03	71	2612.43						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	17	.012	65	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
17	65	300	330	360	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2612.07	Element	Left OB	Channel
Right OB				
Vel Head (ft)	2.88	Wt. n-Val.		0.012
W.S. Elev (ft)	2609.19	Reach Len. (ft)	300.00	330.00
360.00				
Crit W.S. (ft)	2609.19	Flow Area (sq ft)		243.00
E.G. Slope (ft/ft)	0.001364	Area (sq ft)		243.00
Q Total (cfs)	3308.00	Flow (cfs)		3308.00
Top Width (ft)	42.28	Top Width (ft)		42.28
Vel Total (ft/s)	13.61	Avg. Vel. (ft/s)		13.61
Max Chl Dpth (ft)	7.96	Hydr. Depth (ft)		5.75
Conv. Total (cfs)	89576.1	Conv. (cfs)		89576.1
Length Wtd. (ft)	330.07	Wetted Per. (ft)		47.31
Min Ch El (ft)	2601.23	Shear (lb/sq ft)		0.44
Alpha	1.00	Stream Power (lb/ft s)		5.95
Frctn Loss (ft)	0.43	Cum Volume (acre-ft)	5.05	8.60
5.55				

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Este Wash
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C & E Loss (ft)	0.00	Cum SA (acres)	2.89	1.57	4.09

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 5

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2603.93	16	2603.33	24.5	2596.33	34.5	2595.83	46.5	2596.03
55.5	2601.33	70.5	2602.93	85	2604.23				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	16	.012	55.5	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
16	55.5	330	330	330	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2606.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.91	Wt. n-Val.	0.080	0.012	0.080
W.S. Elev (ft)	2603.50	Reach Len. (ft)	330.00	330.00	330.00
Crit W.S. (ft)	2603.50	Flow Area (sq ft)	0.40	239.78	22.45
E.G. Slope (ft/ft)	0.001262	Area (sq ft)	0.40	239.78	22.45
Q Total (cfs)	3308.00	Flow (cfs)	0.05	3292.71	15.24
Top Width (ft)	65.55	Top Width (ft)	4.64	39.50	21.40
Vel Total (ft/s)	12.60	Avg. Vel. (ft/s)	0.13	13.73	0.68
Max Chl Dpth (ft)	7.67	Hydr. Depth (ft)	0.09	6.07	1.05
Conv. Total (cfs)	93120.0	Conv. (cfs)	1.5	92689.5	429.0
Length Wtd. (ft)	330.00	Wetted Per. (ft)	4.65	43.47	21.52
Min Ch El (ft)	2595.83	Shear (lb/sq ft)	0.01	0.43	0.08
Alpha	1.18	Stream Power (lb/ft s)	0.00	5.97	0.06
Frctn Loss (ft)	0.45	Cum Volume (acre-ft)	5.05	6.77	5.46
C & E Loss (ft)	0.59	Cum SA (acres)	2.88	1.26	4.00

PB Proj No. 11515
Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 4

INPUT
Description: Speedway Blvd.

Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2594.13	50	2593.63	100	2592.83	150	2593.03	200	2591.13
230	2589.73	234	2583.43	250	2583.43	265	2584.43	279	2589.63
300	2589.13	350	2590.43	400	2589.53	450	2589.63	500	2589.93
670	2590.23	820	2592.23						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	230	.02	279	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
230	279	300	200	200	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2592.44	Element			
Vel Head (ft)	0.94	Wt. n-Val.	0.035	0.020	0.035
W.S. Elev (ft)	2591.50	Reach Len. (ft)	300.00	200.00	200.00
Crit W.S. (ft)	2591.50	Flow Area (sq ft)	33.89	324.92	690.31
E.G. Slope (ft/ft)	0.001430	Area (sq ft)	33.89	324.92	690.31
Q Total (cfs)	4490.00	Flow (cfs)	48.91	3041.29	1399.80
Top Width (ft)	574.97	Top Width (ft)	39.73	49.00	486.23
Vel Total (ft/s)	4.28	Avg. Vel. (ft/s)	1.44	9.36	2.03
Max Chl Dpth (ft)	8.07	Hydr. Depth (ft)	0.85	6.63	1.42
Conv. Total (cfs)	118738.8	Conv. (cfs)	1293.5	80427.4	37018.0
Length Wtd. (ft)	226.06	Wetted Per. (ft)	39.77	53.43	486.27
Min Ch El (ft)	2583.43	Shear (lb/sq ft)	0.08	0.54	0.13
Alpha	3.31	Stream Power (lb/ft s)	0.11	5.08	0.26
Frctn Loss (ft)	0.66	Cum Volume (acre-ft)	4.92	4.63	2.76
C & E Loss (ft)	0.02	Cum SA (acres)	2.71	0.93	2.08

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Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 3

INPUT
Description:
Station Elevation Data num= 29

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
50	2586.23	100	2583.63	150	2582.43	200	2582.93	250	2584.03
300	2586.53	318	2585.53	321	2583.43	338	2584.13	338	2580.63
339	2580.43	350	2580.43	358	2580.53	365	2582.63	373	2583.13
382	2585.93	400	2585.73	450	2587.93	500	2588.63	550	2588.63
589	2587.23	593	2582.73	600	2582.73	605	2582.93	606	2584.53
613	2585.03	622	2587.93	650	2588.33	700	2588.73		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
50	.045	338	.028	382	.045	589	.028	613	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
338	606	280	280	280	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2586.64	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.09	Wt. n-Val.	0.045	0.028	0.028
W.S. Elev (ft)	2585.55	Reach Len. (ft)	280.00	280.00	280.00
Crit W.S. (ft)	2585.55	Flow Area (sq ft)	464.24	199.01	5.79
E.G. Slope (ft/ft)	0.009147	Area (sq ft)	464.24	199.01	5.79
Q Total (cfs)	4490.00	Flow (cfs)	2291.05	2175.63	23.33
Top Width (ft)	304.41	Top Width (ft)	237.53	58.27	8.61
Vel Total (ft/s)	6.71	Avg. Vel. (ft/s)	4.94	10.93	4.03
Max Chl Dpth (ft)	5.12	Hydr. Depth (ft)	1.95	3.41	0.67
Conv. Total (cfs)	46947.6	Conv. (cfs)	23955.3	22748.4	243.9
Length Wtd. (ft)	280.00	Wetted Per. (ft)	238.33	64.64	8.70
Min Ch El (ft)	2580.43	Shear (lb/sq ft)	1.11	1.76	0.38
Alpha	1.56	Stream Power (lb/ft s)	5.49	19.22	1.53

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Frctn Loss (ft)	1.78	Cum Volume (acre-ft)	3.20	3.43
1.16				
C & E Loss (ft)	0.05	Cum SA (acres)	1.75	0.68
0.95				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 2

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2583.13	60	2581.03	100	2580.23	140	2579.83	166	2579.53
169	2577.93	184	2576.63	200	2575.23	214	2575.73	226	2581.43
250	2582.33	300	2582.43						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	166	.028	226	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
166	226	230	230	230	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2583.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.58	Wt. n-Val.	0.045	0.028	0.045
W.S. Elev (ft)	2582.32	Reach Len. (ft)	230.00	230.00	230.00
Crit W.S. (ft)	2582.32	Flow Area (sq ft)	251.86	329.36	10.60
E.G. Slope (ft/ft)	0.004676	Area (sq ft)	251.86	329.36	10.60
Q Total (cfs)	4490.00	Flow (cfs)	829.66	3646.37	13.97
Top Width (ft)	226.69	Top Width (ft)	142.91	60.00	23.78
Vel Total (ft/s)	7.59	Avg. Vel. (ft/s)	3.29	11.07	1.32
Max Chl Dpth (ft)	7.09	Hydr. Depth (ft)	1.76	5.49	0.45
Conv. Total (cfs)	65659.2	Conv. (cfs)	12132.5	53322.5	204.3
Length Wtd. (ft)	230.00	Wetted Per. (ft)	142.94	61.81	23.80
Min Ch El (ft)	2575.23	Shear (lb/sq ft)	0.51	1.56	0.13
Alpha	1.76	Stream Power (lb/ft s)	1.69	17.22	0.17
Frctn Loss (ft)	0.91	Cum Volume (acre-ft)	0.90	1.73	1.11

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C & E Loss (ft)	0.12	Cum SA (acres)	0.53	0.30
0.84				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 1

INPUT
Description: Confluence with Tanque Verde Creek

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2583.73	50	2582.73	100	2582.13	150	2580.13	200	2578.53
250	2575.93	270	2574.73	286	2571.33	300	2571.13	320	2571.33
324	2574.03	350	2575.83	450	2576.23	650	2578.23		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	270	.028	324	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
270	324	0	0	0	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2579.09	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.18	Wt. n-Val.	0.045	0.028	0.045
W.S. Elev (ft)	2577.92	Reach Len. (ft)			
Crit W.S. (ft)	2577.92	Flow Area (sq ft)	89.83	326.62	409.30
E.G. Slope (ft/ft)	0.003358	Area (sq ft)	89.83	326.62	409.30
Q Total (cfs)	4490.00	Flow (cfs)	229.21	3286.47	974.32
Top Width (ft)	407.17	Top Width (ft)	58.25	54.00	294.92
Vel Total (ft/s)	5.44	Avg. Vel. (ft/s)	2.55	10.06	2.38
Max Chl Dpth (ft)	6.79	Hydr. Depth (ft)	1.54	6.05	1.39
Conv. Total (cfs)	77481.7	Conv. (cfs)	3955.4	56713.0	16813.3
Length Wtd. (ft)		Wetted Per. (ft)	58.34	55.19	294.99
Min Ch El (ft)	2571.13	Shear (lb/sq ft)	0.32	1.24	0.29
Alpha	2.56	Stream Power (lb/ft s)	0.82	12.49	0.69
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

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SUMMARY OF MANNING'S N VALUES

River:RIVER-1

Reach	River Sta.	n1	n2	n3	n4	n5
Reach-1	45	.045	.028	.045		
Reach-1	44	.045	.028	.045		
Reach-1	43	.045	.028	.045		
Reach-1	42	.045	.028	.045		
Reach-1	41	.045	.028	.045		
Reach-1	40	.045	.028	.045		
Reach-1	39	.045	.028	.045		
Reach-1	38	.045	.028	.045		
Reach-1	37	.045	.028	.045		
Reach-1	36	.045	.028	.045		
Reach-1	35	.045	.028	.045		
Reach-1	34	.045	.028	.045		
Reach-1	33	.045	.028	.045		
Reach-1	32	.045	.028	.045		
Reach-1	31	.045	.028	.045		
Reach-1	30	.045	.028	.045		
Reach-1	29	.045	.028	.045		
Reach-1	28	.045	.028	.045		
Reach-1	27	.045	.028	.045		
Reach-1	26	.045	.028	.045		
Reach-1	25	.045	.028	.045		
Reach-1	24	.045	.018	.045		
Reach-1	23	.08	.012	.08		
Reach-1	22.5	Culvert				
Reach-1	22	.08	.012	.08		
Reach-1	21	.08	.018	.08		
Reach-1	20	.08	.018	.08		
Reach-1	19	.08	.018	.08		
Reach-1	18	.08	.018	.08		
Reach-1	17	.08	.012	.08		
Reach-1	16.5	Culvert				
Reach-1	16	.08	.012	.08		
Reach-1	15	.08	.018	.08		
Reach-1	14	.08	.018	.08		
Reach-1	13	.08	.018	.08		
Reach-1	12	.08	.018	.08		
Reach-1	11	.08	.018	.08		
Reach-1	10	.08	.018	.08		
Reach-1	9	.08	.012	.08		
Reach-1	8.5	Culvert				
Reach-1	8	.08	.012	.08		
Reach-1	7	.08	.012	.08		
Reach-1	6	.08	.012	.08		
Reach-1	5	.08	.012	.08		
Reach-1	4	.035	.02	.035		
Reach-1	3	.045	.028	.045	.028	.045
Reach-1	2	.045	.028	.045		
Reach-1	1	.045	.028	.045		

SUMMARY OF REACH LENGTHS

River: RIVER-1

Reach	River Sta.	Left	Channel	Right
Reach-1	45	260	220	180
Reach-1	44	340	300	270
Reach-1	43	400	355	310
Reach-1	42	320	320	320
Reach-1	41	320	370	420
Reach-1	40	290	305	320

Reach-1	39	380	380	380
Reach-1	38	400	400	400
Reach-1	37	450	450	450
Reach-1	36	490	490	490
Reach-1	35	400	400	400
Reach-1	34	380	380	380
Reach-1	33	500	500	500
Reach-1	32	670	650	620
Reach-1	31	220	300	370
Reach-1	30	260	260	260
Reach-1	29	300	240	150
Reach-1	28	350	350	350
Reach-1	27	260	255	250
Reach-1	26	200	310	350
Reach-1	25	240	210	170
Reach-1	24	100	100	100
Reach-1	23	75	75	75
Reach-1	22.5	Culvert		
Reach-1	22	440	440	440
Reach-1	21	410	410	410
Reach-1	20	415	410	405
Reach-1	19	380	380	380
Reach-1	18	460	460	460
Reach-1	17	100	100	100
Reach-1	16.5	Culvert		
Reach-1	16	35	35	35
Reach-1	15	90	90	90
Reach-1	14	125	125	125
Reach-1	13	380	390	400
Reach-1	12	470	470	470
Reach-1	11	520	510	490
Reach-1	10	210	180	150
Reach-1	9	60	60	60
Reach-1	8.5	Culvert		
Reach-1	8	270	270	270
Reach-1	7	320	345	370
Reach-1	6	300	330	360
Reach-1	5	330	330	330
Reach-1	4	300	200	200
Reach-1	3	280	280	280
Reach-1	2	230	230	230
Reach-1	1	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: RIVER-1

Reach	River Sta.	Contr.	Expan.
Reach-1	45	.3	.1
Reach-1	44	.3	.1
Reach-1	43	.3	.1
Reach-1	42	.3	.1
Reach-1	41	.3	.1
Reach-1	40	.3	.1
Reach-1	39	.3	.1
Reach-1	38	.3	.1
Reach-1	37	.3	.1
Reach-1	36	.3	.1
Reach-1	35	.3	.1
Reach-1	34	.3	.1
Reach-1	33	.3	.1
Reach-1	32	.3	.1
Reach-1	31	.3	.1
Reach-1	30	.3	.1
Reach-1	29	.3	.1
Reach-1	28	.3	.1
Reach-1	27	.3	.1

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Reach-1	26		.3	.1
Reach-1	25		.3	.1
Reach-1	24		.3	.1
Reach-1	23		.8	.6
Reach-1	22.5	Culvert		
Reach-1	22		.8	.6
Reach-1	21		.3	.1
Reach-1	20		.3	.1
Reach-1	19		.3	.1
Reach-1	18		.3	.1
Reach-1	17		.8	.6
Reach-1	16.5	Culvert		
Reach-1	16		.8	.6
Reach-1	15		.3	.1
Reach-1	14		.3	.1
Reach-1	13		.3	.1
Reach-1	12		.3	.1
Reach-1	11		.3	.1
Reach-1	10		.3	.1
Reach-1	9		.8	.6
Reach-1	8.5	Culvert		
Reach-1	8		.8	.6
Reach-1	7		.1	.3
Reach-1	6		.1	.3
Reach-1	5		.1	.3
Reach-1	4		.1	.3
Reach-1	3		.1	.3
Reach-1	2		.1	.3
Reach-1	1		.1	.3

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Profile Output Table - Standard Table 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	45	PF 1	1974.00	2840.33	2843.57	2843.57	2844.40	0.005607	8.18	366.10	243.34	0.84
Reach-1	44	PF 1	1974.00	2836.23	2840.12	2840.12	2840.85	0.006373	8.86	408.36	261.60	0.89
Reach-1	43	PF 1	1974.00	2831.93	2835.28	2835.28	2835.99	0.006956	8.06	396.54	288.41	0.90
Reach-1	42	PF 1	1974.00	2827.53	2830.76	2830.76	2831.46	0.006055	8.00	404.39	279.03	0.86
Reach-1	41	PF 1	1974.00	2821.73	2826.80	2826.80	2827.73	0.005483	9.93	387.94	217.38	0.86
Reach-1	40	PF 1	1974.00	2816.63	2820.16	2820.16	2820.98	0.005841	7.99	350.24	225.08	0.84
Reach-1	39	PF 1	1974.00	2813.23	2816.14	2816.14	2816.72	0.008162	9.10	451.98	340.95	0.99
Reach-1	38	PF 1	1974.00	2808.43	2810.51	2810.46	2811.02	0.013391	8.70	397.99	332.85	1.18
Reach-1	37	PF 1	1974.00	2802.33	2803.84	2803.84	2804.32	0.021524	8.71	386.20	391.82	1.39
Reach-1	36	PF 1	1974.00	2791.73	2795.00	2795.00	2795.63	0.008277	8.84	409.26	312.58	0.99
Reach-1	35	PF 1	1974.00	2782.53	2785.07	2785.07	2785.74	0.008515	8.50	396.44	279.09	0.99
Reach-1	34	PF 1	1974.00	2774.43	2777.67	2777.67	2778.60	0.008298	8.54	301.59	170.29	0.98
Reach-1	33	PF 1	1974.00	2767.33	2771.45	2771.45	2772.14	0.005810	9.41	437.89	264.44	0.87
Reach-1	32	PF 1	1974.00	2761.23	2763.13	2763.13	2763.84	0.017559	9.16	318.88	226.44	1.32
Reach-1	31	PF 1	1974.00	2748.93	2751.56	2751.56	2752.22	0.007258	7.91	401.25	289.05	0.92
Reach-1	30	PF 1	1974.00	2741.63	2745.29	2745.29	2746.07	0.006279	9.36	381.98	210.00	0.90
Reach-1	29	PF 1	1974.00	2738.33	2741.47	2741.47	2742.16	0.006872	8.32	398.65	275.77	0.91
Reach-1	28	PF 1	1974.00	2734.33	2736.75	2736.75	2737.36	0.009257	8.65	407.31	295.04	1.03
Reach-1	27	PF 1	1974.00	2727.63	2729.75	2729.75	2730.35	0.009877	6.28	326.19	282.37	0.97
Reach-1	26	PF 1	1974.00	2717.93	2721.17	2721.17	2721.84	0.013540	7.99	340.62	260.88	1.14
Reach-1	25	PF 1	2113.00	2711.43	2716.29	2716.29	2716.95	0.004243	7.94	512.08	376.13	0.72
Reach-1	24	PF 1	2113.00	2707.43	2712.35	2712.35	2713.96	0.002451	10.23	238.93	158.29	0.88
Reach-1	23	PF 1	2113.00	2704.53	2711.01	2710.27	2712.62	0.000805	10.23	244.49	82.07	0.78
Reach-1	22.5		Culvert									

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Reach-1	22		PF 1	2113.00	2703.03	2708.74	2708.74	2710.95	0.001434	11.92	177.25
40.55	1.00										
Reach-1	21		PF 1	2113.00	2692.03	2698.73	2698.73	2700.86	0.002506	11.88	234.41
96.32	0.91										
Reach-1	20		PF 1	2113.00	2681.63	2689.70	2689.70	2691.84	0.002368	11.93	256.34
135.88	0.88										
Reach-1	19		PF 1	2113.00	2671.83	2678.56	2678.56	2680.61	0.002451	11.74	259.49
106.41	0.90										
Reach-1	18		PF 1	2113.00	2663.73	2670.11	2670.11	2671.95	0.002128	11.34	334.57
161.81	0.86										
Reach-1	17		PF 1	2113.00	2652.83	2658.85	2658.82	2661.13	0.001411	12.11	174.97
43.48	1.00										
Reach-1	16.5			Culvert							
Reach-1	16		PF 1	3183.00	2649.83	2657.46	2657.46	2660.21	0.001367	13.29	239.51
44.26	1.01										
Reach-1	15		PF 1	3183.00	2645.33	2653.46	2653.46	2656.48	0.003146	13.94	228.26
37.88	1.00										
Reach-1	14		PF 1	3183.00	2643.33	2651.22	2651.22	2653.99	0.002766	13.42	265.06
80.48	0.96										
Reach-1	13		PF 1	3183.00	2640.83	2647.03	2647.03	2649.45	0.002674	12.57	296.01
95.99	0.95										
Reach-1	12		PF 1	3183.00	2631.73	2637.70	2637.70	2640.21	0.002938	12.73	260.86
76.69	0.98										
Reach-1	11		PF 1	3183.00	2625.23	2631.78	2631.78	2633.85	0.002386	11.88	406.12
160.15	0.91										
Reach-1	10		PF 1	3183.00	2614.13	2621.64	2621.64	2624.12	0.002460	13.01	363.30
113.39	0.92										
Reach-1	9		PF 1	3183.00	2610.53	2616.11	2616.11	2618.70	0.001363	12.94	251.83
60.87	1.00										
Reach-1	8.5			Culvert							
Reach-1	8		PF 1	3308.00	2609.13	2615.57	2615.57	2618.26	0.001290	13.15	263.85
67.44	0.99										
Reach-1	7		PF 1	3308.00	2605.23	2612.97	2612.97	2616.02	0.001311	14.24	295.60
58.66	1.04										
Reach-1	6		PF 1	3308.00	2601.23	2609.19	2609.19	2612.07	0.001364	13.61	243.00
42.28	1.00										
Reach-1	5		PF 1	3308.00	2595.83	2603.50	2603.50	2606.42	0.001262	13.73	262.63
65.55	0.98										
Reach-1	4		PF 1	4490.00	2583.43	2591.50	2591.50	2592.44	0.001430	9.36	1049.13
574.97	0.64										
Reach-1	3		PF 1	4490.00	2580.43	2585.55	2585.55	2586.64	0.009147	10.93	669.03
304.41	1.04										
Reach-1	2		PF 1	4490.00	2575.23	2582.32	2582.32	2583.90	0.004676	11.07	591.83
226.69	0.83										
Reach-1	1		PF 1	4490.00	2571.13	2577.92	2577.92	2579.09	0.003358	10.06	825.75
407.17	0.72										

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Profile Output Table - Standard Table 2

Reach	River Sta	Profile	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
Reach-1	45	PF 1	2844.40	2843.57	0.83	1.31	0.01	334.44	1534.42	105.14	243.34
Reach-1	44	PF 1	2840.85	2840.12	0.73	1.98	0.00	330.29	1058.99	584.72	261.60
Reach-1	43	PF 1	2835.99	2835.28	0.71	2.25	0.00	252.13	1298.18	423.69	288.41
Reach-1	42	PF 1	2831.46	2830.76	0.70	1.84	0.07	97.09	1319.63	557.29	279.03
Reach-1	41	PF 1	2827.73	2826.80	0.93	2.05	0.01	537.93	1111.27	324.81	217.38
Reach-1	40	PF 1	2820.98	2820.16	0.82	2.08	0.02	371.52	1602.48		225.08
Reach-1	39	PF 1	2816.72	2816.14	0.58	3.91	0.01	647.25	716.52	610.23	340.95
Reach-1	38	PF 1	2811.02	2810.51	0.52	6.70	0.00	31.86	486.43	1455.71	332.85
Reach-1	37	PF 1	2804.32	2803.84	0.47	5.68	0.05	645.61	223.31	1105.08	391.82
Reach-1	36	PF 1	2795.63	2795.00	0.63	4.11	0.01	1006.13	769.89	197.98	312.58
Reach-1	35	PF 1	2785.74	2785.07	0.66	3.36	0.08	469.42	994.19	510.39	279.09
Reach-1	34	PF 1	2778.60	2777.67	0.93	2.62	0.02		1542.28	431.72	170.29
Reach-1	33	PF 1	2772.14	2771.45	0.69	4.68	0.01	513.82	856.54	603.64	264.44
Reach-1	32	PF 1	2763.84	2763.13	0.71	6.84	0.01		586.60	1387.40	226.44
Reach-1	31	PF 1	2752.22	2751.56	0.66	2.06	0.04	145.14	1231.18	597.68	289.05
Reach-1	30	PF 1	2746.07	2745.29	0.78	1.71	0.01	513.83	970.29	489.89	210.00
Reach-1	29	PF 1	2742.16	2741.47	0.69	1.76	0.01	607.55	1138.72	227.74	275.77
Reach-1	28	PF 1	2737.36	2736.75	0.61	3.35	0.00	109.02	838.96	1026.02	295.04
Reach-1	27	PF 1	2730.35	2729.75	0.60	2.94	0.02	25.11	1945.34	3.55	282.37
Reach-1	26	PF 1	2721.84	2721.17	0.68	2.01	0.00	893.99	1080.01		260.88
Reach-1	25	PF 1	2716.95	2716.29	0.66	0.64	0.28		1369.02	743.99	376.13
Reach-1	24	PF 1	2713.96	2712.35	1.60	0.13	0.00	7.79	2085.39	19.81	158.29
Reach-1	23	PF 1	2712.62	2711.01	1.61			5.69	2093.06	14.24	82.07
Reach-1	22.5		Culvert								
Reach-1	22	PF 1	2710.95	2708.74	2.21	0.82	0.04		2113.00		40.55
Reach-1	21	PF 1	2700.86	2698.73	2.13	1.00	0.00	40.07	2057.09	15.84	96.32
Reach-1	20	PF 1	2691.84	2689.70	2.14	0.99	0.01	33.07	2046.91	33.02	135.88
Reach-1	19	PF 1	2680.61	2678.56	2.05	0.87	0.02	37.79	2022.63	52.58	106.41
Reach-1	18	PF 1	2671.95	2670.11	1.84	0.79	0.13	95.01	1949.19	68.80	161.81
Reach-1	17	PF 1	2661.13	2658.85	2.28			0.09	2112.91	0.00	43.48
Reach-1	16.5		Culvert								
Reach-1	16	PF 1	2660.21	2657.46	2.74	0.01	1.85		3183.00		44.26
Reach-1	15	PF 1	2656.48	2653.46	3.02	0.27	0.02		3183.00		37.88
Reach-1	14	PF 1	2653.99	2651.22	2.78	0.34	0.04		3160.10	22.90	80.48
Reach-1	13	PF 1	2649.45	2647.03	2.42	1.09	0.03	30.47	3141.17	11.36	95.99
Reach-1	12	PF 1	2640.21	2637.70	2.51	1.24	0.04	0.55	3175.27	7.19	76.69
Reach-1	11	PF 1	2633.85	2631.78	2.07	1.23	0.12	61.06	3011.14	110.80	160.15
Reach-1	10	PF 1	2624.12	2621.64	2.48	0.32	0.03	23.82	3005.16	154.02	113.39
Reach-1	9	PF 1	2618.70	2616.11	2.60			1.43	3180.67	0.90	60.87
Reach-1	8.5		Culvert								
Reach-1	8	PF 1	2618.26	2615.57	2.68	0.35	0.29	6.05	3301.51	0.44	67.44
Reach-1	7	PF 1	2616.02	2612.97	3.05	0.46	0.05	108.22	3198.82	0.97	58.66
Reach-1	6	PF 1	2612.07	2609.19	2.88	0.43	0.00		3308.00		42.28
Reach-1	5	PF 1	2606.42	2603.50	2.91	0.45	0.59	0.05	3292.71	15.24	65.55
Reach-1	4	PF 1	2592.44	2591.50	0.94	0.66	0.02	48.91	3041.29	1399.80	574.97
Reach-1	3	PF 1	2586.64	2585.55	1.09	1.78	0.05	2291.05	2175.63	23.33	304.41
Reach-1	2	PF 1	2583.90	2582.32	1.58	0.91	0.12	829.66	3646.37	13.97	226.69
Reach-1	1	PF 1	2579.09	2577.92	1.18			229.21	3286.47	974.32	407.17

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ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : P01

River: RIVER-1 Reach: Reach-1 RS: 45 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: RIVER-1 Reach: Reach-1 RS: 44 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: RIVER-1 Reach: Reach-1 RS: 43 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: RIVER-1 Reach: Reach-1 RS: 42 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: RIVER-1 Reach: Reach-1 RS: 41 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: RIVER-1 Reach: Reach-1 RS: 40 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

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River: RIVER-1 Reach: Reach-1 RS: 39 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 38 Profile: PF 1
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

River: RIVER-1 Reach: Reach-1 RS: 37 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 36 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 35 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 34 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 33 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated

water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 32 Profile: PF 1

Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

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.

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 31 Profile: PF 1

Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 30 Profile: PF 1

Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

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

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

Warning:The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

River: RIVER-1 Reach: Reach-1 RS: 29 Profile: PF 1

Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 28 Profile: PF 1

Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

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

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 27 Profile: PF 1

Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated

water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 26 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

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.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 25 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 24 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

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.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 22.5 Profile: PF 1 Culv: Box3

Note: Culvert critical depth exceeds the height of the culvert.

Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.

Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations are not valid and the supercritical result has been discarded. The outlet answer will be used.

River: RIVER-1 Reach: Reach-1 RS: 22 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 21 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The

program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 20 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 19 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 18 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 16.5 Profile: PF 1 Culv: Box2

Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.

Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations are not valid and the supercritical result has been discarded. The outlet answer will be used.

River: RIVER-1 Reach: Reach-1 RS: 16 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

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.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 15 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 14 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The

program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 13 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 12 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 11 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 10 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 9 Profile: PF 1

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 8.5 Profile: PF 1

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 8 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 7 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 6 Profile: PF 1

PB Proj No. 11515
Este Wash
Exist Condition - Imported FEMA Adj'd 2.23'

Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 5 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 4 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 3 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:Divided flow computed for this cross-section.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 2 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

PB Proj. No. 11515
Este Wash
Exist Topo with TSMS Future Flow

HEC-RAS Version 3.1.3 May 2005
U.S. Army Corp 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: Este Wash New Topo HEC2
Project File : EWHEC2TSMS.prj
Run Date and Time: 8/11/2008 1:23:42 PM

Project in English units

Project Description:
88151-02-39
FIS City of Tucson
ESTE WASH
Imported FEMA
Geometry File: .g01
Imported FEMA Geometry File Adjusted Vertically by +2.23
ft to account for Vertical Datum Change: .g02

New Existing Conditions
Geometry File (Project 1' C.I. Topo with PAG 1999 2' C.I. Topo): .g06
Proposed
Conditions Geometry File (3-10'x6' RCBC's at Houghton Rd and 22nd St
crossings): ,g07
Proposed Conditions Geometry File (4-10'x6' RCBC's at
Houghton Rd and 22nd St crossings): ,g05

PLAN DATA

Plan Title: Existing Cond Topo with TSMS Future Flow
Plan File : l:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2TSMS.p01

Geometry Title: New Existing Geom
Geometry File : l:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2TSMS.g06

Flow Title : TSMS Future Flow
Flow File : l:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2TSMS.f03

Plan Summary Information:

Number of:	Cross Sections =	24	Multiple Openings =	0
	Culverts =	0	Inline Structures =	0
	Bridges =	0	Lateral Structures =	0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
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: Subcritical Flow

PB Proj. No. 11515
Este Wash
Exist Topo with TSMS Future Flow

FLOW DATA

Flow Title: TSMS Future Flow
Flow File : l:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2TSMS.f03

Flow Data (cfs)

River	Reach	RS	PF 1
Este Wash	1	4085	1208
Este Wash	1	1465	1256

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Este Wash	1	PF 1	Normal S = 0.0133	Normal S = 0.0133

GEOMETRY DATA

Geometry Title: New Existing Geom
Geometry File : l:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2TSMS.g06

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 4085

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2862.5	9	2862	20	2860	30	2858	33	2856.4
50	2856.4	53	2857.7	80	2857.7	116	2858	127	2857.7
142	2858.1	159	2857.3	173	2857.7	209	2857.5	230	2858

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	33	.022	50	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
30	53	250	275	260	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2859.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.55	Wt. n-Val.	0.080	0.039	0.060
W.S. Elev (ft)	2858.91	Reach Len. (ft)	250.00	275.00	260.00
Crit W.S. (ft)	2858.91	Flow Area (sq ft)	2.06	53.32	209.02
E.G. Slope (ft/ft)	0.016871	Area (sq ft)	2.06	53.32	209.02
Q Total (cfs)	1208.00	Flow (cfs)	2.89	456.58	748.53
Top Width (ft)	204.54	Top Width (ft)	4.54	23.00	177.00
Vel Total (ft/s)	4.57	Avg. Vel. (ft/s)	1.41	8.56	3.58
Max Chl Dpth (ft)	2.51	Hydr. Depth (ft)	0.45	2.32	1.18
Conv. Total (cfs)	9300.3	Conv. (cfs)	22.3	3515.1	5762.9
Length Wtd. (ft)	265.86	Wetted Per. (ft)	4.63	23.67	177.95
Min Ch El (ft)	2856.40	Shear (lb/sq ft)	0.47	2.37	1.24
Alpha	1.71	Stream Power (lb/ft s)	0.66	20.32	4.43
Frctn Loss (ft)	3.19	Cum Volume (acre-ft)	8.26	9.59	10.77
C & E Loss (ft)	0.00	Cum SA (acres)	8.38	5.09	11.39

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross

section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3810

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2856	8	2854.5	116	2854	150	2854	169	2853.8
183	2854.1	200	2852.7	220	2852.7	235	2854	250	2856
250.1	2862								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	200	.022	220	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
183	235	155	170	180	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2855.72	Element			
Vel Head (ft)	0.55	Wt. n-Val.	0.060	0.032	0.060
W.S. Elev (ft)	2855.16	Reach Len. (ft)	155.00	170.00	180.00
Crit W.S. (ft)	2855.16	Flow Area (sq ft)	180.49	106.48	5.08
E.G. Slope (ft/ft)	0.008987	Area (sq ft)	180.49	106.48	5.08
Q Total (cfs)	1208.00	Flow (cfs)	426.70	773.03	8.27
Top Width (ft)	239.27	Top Width (ft)	178.54	52.00	8.73
Vel Total (ft/s)	4.14	Avg. Vel. (ft/s)	2.36	7.26	1.63
Max Chl Dpth (ft)	2.46	Hydr. Depth (ft)	1.01	2.05	0.58
Conv. Total (cfs)	12742.5	Conv. (cfs)	4501.0	8154.2	87.2
Length Wtd. (ft)	162.31	Wetted Per. (ft)	178.61	52.11	8.81
Min Ch El (ft)	2852.70	Shear (lb/sq ft)	0.57	1.15	0.32
Alpha	2.09	Stream Power (lb/ft s)	1.34	8.32	0.53
Frctn Loss (ft)	1.91	Cum Volume (acre-ft)	7.73	9.09	10.13
C & E Loss (ft)	0.05	Cum SA (acres)	7.85	4.85	10.84

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3640

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2854	15	2852	38	2851	126	2850.6	173	2851.2
205	2851.8	218	2850.8	238	2850.8	249	2851.8	270	2852
336	2854	360	2856	385	2858	410	2860	495	2862

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	218	.022	238	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
205	249	90	150	205	.1	.3

PB Proj. No. 11515
Este Wash
Exist Topo with TSMS Future Flow

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2852.64	Element			
Vel Head (ft)	0.39	Wt. n-Val.	0.060	0.029	0.080
W.S. Elev (ft)	2852.24	Reach Len. (ft)	90.00	150.00	205.00
Crit W.S. (ft)	2852.13	Flow Area (sq ft)	231.08	51.46	8.16
E.G. Slope (ft/ft)	0.016149	Area (sq ft)	231.08	51.46	8.16
Q Total (cfs)	1208.00	Flow (cfs)	823.20	376.53	8.27
Top Width (ft)	264.82	Top Width (ft)	191.82	44.00	29.00
Vel Total (ft/s)	4.16	Avg. Vel. (ft/s)	3.56	7.32	1.01
Max Chl Dpth (ft)	1.64	Hydr. Depth (ft)	1.20	1.17	0.28
Conv. Total (cfs)	9506.0	Conv. (cfs)	6478.0	2963.0	65.1
Length Wtd. (ft)	111.58	Wetted Per. (ft)	191.87	44.08	29.00
Min Ch El (ft)	2850.80	Shear (lb/sq ft)	1.21	1.18	0.28
Alpha	1.47	Stream Power (lb/ft s)	4.33	8.61	0.29
Frctn Loss (ft)	1.97	Cum Volume (acre-ft)	7.00	8.78	10.10
C & E Loss (ft)	0.05	Cum SA (acres)	7.20	4.66	10.76

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3490

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2854	13	2852	42	2850	116	2848.4	240	2849.9
258	2849.2	270	2849.2	280	2849.8	320	2850	350	2850
367	2849.6	388	2850	415	2850	460	2851	480	2851

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	116	.06	258	.022	270	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
240	280	90	140	190	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2850.63	Element			
Vel Head (ft)	0.24	Wt. n-Val.	0.066	0.035	0.060
W.S. Elev (ft)	2850.38	Reach Len. (ft)	90.00	140.00	190.00
Crit W.S. (ft)	2850.21	Flow Area (sq ft)	241.38	37.99	66.50
E.G. Slope (ft/ft)	0.019434	Area (sq ft)	241.38	37.99	66.50
Q Total (cfs)	1208.00	Flow (cfs)	852.69	223.12	132.19
Top Width (ft)	395.75	Top Width (ft)	203.54	40.00	152.20
Vel Total (ft/s)	3.49	Avg. Vel. (ft/s)	3.53	5.87	1.99
Max Chl Dpth (ft)	1.98	Hydr. Depth (ft)	1.19	0.95	0.44
Conv. Total (cfs)	8665.3	Conv. (cfs)	6116.6	1600.5	948.2
Length Wtd. (ft)	136.40	Wetted Per. (ft)	203.58	40.03	152.22
Min Ch El (ft)	2849.20	Shear (lb/sq ft)	1.44	1.15	0.53
Alpha	1.28	Stream Power (lb/ft s)	5.08	6.76	1.05
Frctn Loss (ft)	1.87	Cum Volume (acre-ft)	6.51	8.63	9.93
C & E Loss (ft)	0.03	Cum SA (acres)	6.79	4.52	10.34

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3350

INPUT
Description:

PB Proj. No. 11515
Este Wash
Exist Topo with TSMS Future Flow

Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2854	15	2852	35	2850	75	2848.1	90	2848.2
105	2848	128	2847.3	182	2848.1	198	2847.7	245	2847.6
250	2848	260	2847.9	297	2847.9	357	2846.9	430	2846.6
465	2848	495	2850	525	2850.5				

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	182	.06	245	.028	297	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
245	297	135	120	115	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2848.74	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.	0.070	0.028	0.060
W.S. Elev (ft)	2848.59	Reach Len. (ft)	135.00	120.00	115.00
Crit W.S. (ft)	2848.19	Flow Area (sq ft)	140.86	35.74	252.98
E.G. Slope (ft/ft)	0.010184	Area (sq ft)	140.86	35.74	252.98
Q Total (cfs)	1208.00	Flow (cfs)	256.33	149.01	802.66
Top Width (ft)	409.06	Top Width (ft)	180.25	52.00	176.81
Vel Total (ft/s)	2.81	Avg. Vel. (ft/s)	1.82	4.17	3.17
Max Chl Dpth (ft)	1.99	Hydr. Depth (ft)	0.78	0.69	1.43
Conv. Total (cfs)	11970.2	Conv. (cfs)	2540.0	1476.6	7953.7
Length Wtd. (ft)	121.43	Wetted Per. (ft)	180.29	52.02	176.86
Min Ch El (ft)	2847.60	Shear (lb/sq ft)	0.50	0.44	0.91
Alpha	1.21	Stream Power (lb/ft s)	0.90	1.82	2.89
Frctn Loss (ft)	1.39	Cum Volume (acre-ft)	6.12	8.51	9.23
C & E Loss (ft)	0.01	Cum SA (acres)	6.39	4.37	9.62

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3230

INPUT
Description:
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2852	23	2850	32	2848	58	2846	88	2846
100	2845.8	147	2846.1	162	2846	207	2846	210	2845.5
228	2845.5	248	2846	290	2845	305	2845.3	318	2844.9
335	2846	343	2847	365	2850	390	2853		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	210	.025	228	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
207	248	100	70	55	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2847.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	Wt. n-Val.	0.080	0.038	0.080
W.S. Elev (ft)	2847.12	Reach Len. (ft)	100.00	70.00	55.00
Crit W.S. (ft)	2846.73	Flow Area (sq ft)	177.53	60.59	157.08
E.G. Slope (ft/ft)	0.012892	Area (sq ft)	177.53	60.59	157.08
Q Total (cfs)	1208.00	Flow (cfs)	395.39	352.61	460.00
Top Width (ft)	300.40	Top Width (ft)	163.54	41.00	95.87
Vel Total (ft/s)	3.06	Avg. Vel. (ft/s)	2.23	5.82	2.93
Max Chl Dpth (ft)	2.22	Hydr. Depth (ft)	1.09	1.48	1.64
Conv. Total (cfs)	10639.1	Conv. (cfs)	3482.3	3105.5	4051.4
Length Wtd. (ft)	77.96	Wetted Per. (ft)	163.58	41.05	95.99
Min Ch El (ft)	2845.50	Shear (lb/sq ft)	0.87	1.19	1.32
Alpha	1.58	Stream Power (lb/ft s)	1.95	6.91	3.86
Frctn Loss (ft)	0.77	Cum Volume (acre-ft)	5.62	8.37	8.69

C & E Loss (ft)	0.05	Cum SA (acres)	5.86	4.24	9.26

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3160

INPUT
Description:
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2848	10	2846	28	2845	60	2844	73	2844.5
113	2844.7	123	2843.9	140	2844.6	161	2844.6	200	2844
205	2843.8	230	2843.5	235	2844	253	2845	266	2846
280	2847	290	2848	307	2850	322	2852	335	2853

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	200	.025	235	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
200	235	35	35	35	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2846.53	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.68	Wt. n-Val.	0.080	0.025	0.080
W.S. Elev (ft)	2845.85	Reach Len. (ft)	35.00	35.00	35.00
Crit W.S. (ft)	2845.85	Flow Area (sq ft)	250.33	75.33	29.06
E.G. Slope (ft/ft)	0.007847	Area (sq ft)	250.33	75.33	29.06
Q Total (cfs)	1208.00	Flow (cfs)	499.50	660.77	47.73
Top Width (ft)	251.42	Top Width (ft)	187.34	35.00	29.08
Vel Total (ft/s)	3.41	Avg. Vel. (ft/s)	2.00	8.77	1.64
Max Chl Dpth (ft)	2.35	Hydr. Depth (ft)	1.34	2.15	1.00
Conv. Total (cfs)	13636.9	Conv. (cfs)	5638.8	7459.3	538.9
Length Wtd. (ft)	35.00	Wetted Per. (ft)	187.44	35.03	29.14
Min Ch El (ft)	2843.50	Shear (lb/sq ft)	0.65	1.05	0.49
Alpha	3.78	Stream Power (lb/ft s)	1.31	9.24	0.80
Frctn Loss (ft)	0.43	Cum Volume (acre-ft)	5.13	8.26	8.57
C & E Loss (ft)	0.04	Cum SA (acres)	5.46	4.18	9.18

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3125

INPUT
Description:
Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2847	12	2846	40	2845	95	2844	100	2843.8
103	2844	110	2844.2	130	2844.2	135	2843.5	140	2844
178	2844	240	2843.2	260	2842.8	262	2843	265	2844
275	2845	287	2846	298	2847	310	2848	330	2849
340	2850	370	2851						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	240	.025	260	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
178	262	75	75	75	.1	.3

PB Proj. No. 11515
Este Wash
Exist Topo with TSMS Future Flow

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2845.60	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.55	Wt. n-Val.	0.080	0.045	0.080
W.S. Elev (ft)	2845.05	Reach Len. (ft)	75.00	75.00	75.00
Crit W.S. (ft)	2845.05	Flow Area (sq ft)	115.13	134.96	10.13
E.G. Slope (ft/ft)	0.021583	Area (sq ft)	115.13	134.96	10.13
Q Total (cfs)	1208.00	Flow (cfs)	276.54	908.96	22.50
Top Width (ft)	236.88	Top Width (ft)	139.32	84.00	13.57
Vel Total (ft/s)	4.64	Avg. Vel. (ft/s)	2.40	6.74	2.22
Max Chl Dpth (ft)	2.25	Hydr. Depth (ft)	0.83	1.61	0.75
Conv. Total (cfs)	8222.7	Conv. (cfs)	1882.4	6187.2	153.2
Length Wtd. (ft)	75.00	Wetted Per. (ft)	139.42	84.02	13.78
Min Ch El (ft)	2842.80	Shear (lb/sq ft)	1.11	2.16	0.99
Alpha	1.65	Stream Power (lb/ft s)	2.67	14.58	2.20
Frctn Loss (ft)	0.48	Cum Volume (acre-ft)	4.99	8.18	8.55
C & E Loss (ft)	0.00	Cum SA (acres)	5.32	4.14	9.16

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3050

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2847	33	2846	80	2845	130	2844	195	2843
243	2842.3	281	2842.3	330	2843	423	2844	468	2844
510	2845								

Manning's n Values num= 1

Sta	n Val
0	.016

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
195	330	75	75	75	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
340	510		T

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2844.43	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.55	Wt. n-Val.	0.016	0.016	0.016
W.S. Elev (ft)	2843.88	Reach Len. (ft)	75.00	75.00	75.00
Crit W.S. (ft)	2843.88	Flow Area (sq ft)	24.86	178.60	8.21
E.G. Slope (ft/ft)	0.003019	Area (sq ft)	24.86	178.60	35.57
Q Total (cfs)	1208.00	Flow (cfs)	73.06	1098.23	36.71
Top Width (ft)	273.17	Top Width (ft)	56.84	135.00	81.33
Vel Total (ft/s)	5.71	Avg. Vel. (ft/s)	2.94	6.15	4.47
Max Chl Dpth (ft)	1.57	Hydr. Depth (ft)	0.44	1.32	0.82
Conv. Total (cfs)	21986.7	Conv. (cfs)	1329.7	19988.8	668.2
Length Wtd. (ft)	75.00	Wetted Per. (ft)	56.85	135.01	10.00
Min Ch El (ft)	2842.30	Shear (lb/sq ft)	0.08	0.25	0.15
Alpha	1.09	Stream Power (lb/ft s)	0.24	1.53	0.69
Frctn Loss (ft)	0.32	Cum Volume (acre-ft)	4.87	7.91	8.52
C & E Loss (ft)	0.02	Cum SA (acres)	5.16	3.95	9.08

Warning: The energy equation could not be balanced within the specified number of iterations. The

program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2975

INPUT
Description: AS
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2845.5	8	2845	25	2844	62	2843	100	2842.5
108	2842.5	130	2842.7	150	2842	190	2841	210	2840
220	2839	228	2840	233	2840.2	240	2840	242	2839.6
262	2839.6	265	2840	275	2840.8	305	2841	342	2842
356	2843	372	2844	390	2844.2	405	2844	427	2845
460	2845.2								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	100	.025	108	.06	240	.025	265	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
240	265	270	180	110	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2843.05	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.74	Wt. n-Val.	0.060	0.025	0.060
W.S. Elev (ft)	2842.31	Reach Len. (ft)	270.00	180.00	110.00
Crit W.S. (ft)	2842.31	Flow Area (sq ft)	146.81	66.68	91.83
E.G. Slope (ft/ft)	0.006658	Area (sq ft)	146.81	66.68	91.83
Q Total (cfs)	1208.00	Flow (cfs)	385.95	620.89	201.16
Top Width (ft)	205.09	Top Width (ft)	98.78	25.00	81.30
Vel Total (ft/s)	3.96	Avg. Vel. (ft/s)	2.63	9.31	2.19
Max Chl Dpth (ft)	3.31	Hydr. Depth (ft)	1.49	2.67	1.13
Conv. Total (cfs)	14804.6	Conv. (cfs)	4730.0	7609.3	2465.3
Length Wtd. (ft)	184.99	Wetted Per. (ft)	98.94	25.07	81.36
Min Ch El (ft)	2839.60	Shear (lb/sq ft)	0.62	1.11	0.47
Alpha	3.04	Stream Power (lb/ft s)	1.62	10.30	1.03
Frctn Loss (ft)	1.29	Cum Volume (acre-ft)	4.72	7.70	8.41
C & E Loss (ft)	0.01	Cum SA (acres)	5.02	3.81	8.94

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2795

INPUT
Description: AR
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2847	38	2846	72	2844	128	2842	160	2840
252	2838	260	2836.9	270	2837.8	283	2836.5	308	2836.5
320	2837.5	330	2837.2	343	2837.2	360	2838.5	380	2838.3
413	2839	440	2840	482	2842	510	2843	555	2844

PB Proj. No. 11515
Este Wash
Exist Topo with TSMS Future Flow

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	252	.028	320	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
252	320	360	300	250	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2839.70	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.70	Wt. n-Val.	0.060	0.028	0.060
W.S. Elev (ft)	2839.00	Reach Len. (ft)	360.00	300.00	250.00
Crit W.S. (ft)	2839.00	Flow Area (sq ft)	22.79	139.13	82.57
E.G. Slope (ft/ft)	0.007319	Area (sq ft)	22.79	139.13	82.57
Q Total (cfs)	1208.00	Flow (cfs)	30.32	1015.90	161.79
Top Width (ft)	206.57	Top Width (ft)	45.79	68.00	92.78
Vel Total (ft/s)	4.94	Avg. Vel. (ft/s)	1.33	7.30	1.96
Max Chl Dpth (ft)	2.50	Hydr. Depth (ft)	0.50	2.05	0.89
Conv. Total (cfs)	14119.9	Conv. (cfs)	354.3	11874.5	1891.1
Length Wtd. (ft)	297.51	Wetted Per. (ft)	45.80	68.22	92.84
Min Ch El (ft)	2836.50	Shear (lb/sq ft)	0.23	0.93	0.41
Alpha	1.86	Stream Power (lb/ft s)	0.30	6.80	0.80
Frctn Loss (ft)	2.30	Cum Volume (acre-ft)	4.19	7.27	8.19
C & E Loss (ft)	0.01	Cum SA (acres)	4.57	3.62	8.72

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2495

INPUT
Description: AQ
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2846	10	2842	15	2840.8	20	2841.3	48	2841.1
87	2840	120	2838	160	2836	198	2834	210	2833.4
237	2834.1	246	2832.5	280	2833	290	2833.8	310	2833.8
320	2833.2	326	2834	450	2836	496	2837	536	2838

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.04	10	.016	48	.06	246	.025	280	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
237	290	175	155	130	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2835.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.68	Wt. n-Val.	0.060	0.029	0.060
W.S. Elev (ft)	2835.11	Reach Len. (ft)	175.00	155.00	130.00
Crit W.S. (ft)	2835.11	Flow Area (sq ft)	65.26	113.56	89.41
E.G. Slope (ft/ft)	0.008200	Area (sq ft)	65.26	113.56	89.41
Q Total (cfs)	1208.00	Flow (cfs)	154.60	873.04	180.36
Top Width (ft)	217.80	Top Width (ft)	60.06	53.00	104.74
Vel Total (ft/s)	4.50	Avg. Vel. (ft/s)	2.37	7.69	2.02
Max Chl Dpth (ft)	2.61	Hydr. Depth (ft)	1.09	2.14	0.85
Conv. Total (cfs)	13339.8	Conv. (cfs)	1707.3	9640.8	1991.7
Length Wtd. (ft)	155.24	Wetted Per. (ft)	60.12	53.18	104.82
Min Ch El (ft)	2832.50	Shear (lb/sq ft)	0.56	1.09	0.44
Alpha	2.17	Stream Power (lb/ft s)	1.32	8.41	0.88
Frctn Loss (ft)	0.99	Cum Volume (acre-ft)	3.83	6.40	7.69
C & E Loss (ft)	0.05	Cum SA (acres)	4.14	3.20	8.15

PB Proj. No. 11515
Este Wash
Exist Topo with TSMS Future Flow

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2340

INPUT
Description:
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2836	49	2837.7	62	2837	77	2836	84	2835
101	2832	115	2831.4	145	2831.1	165	2831	167	2830.8
183	2830.8	186	2831	193	2832	220	2832	258	2832.2
264	2833								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	165	.025	186	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
165	186	60	45	20	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2834.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.50	Wt. n-Val.	0.060	0.025	0.060
W.S. Elev (ft)	2833.58	Reach Len. (ft)	60.00	45.00	20.00
Crit W.S. (ft)	2833.26	Flow Area (sq ft)	153.60	57.79	119.02
E.G. Slope (ft/ft)	0.005129	Area (sq ft)	153.60	57.79	119.02
Q Total (cfs)	1208.00	Flow (cfs)	446.98	482.88	278.14
Top Width (ft)	171.93	Top Width (ft)	72.93	21.00	78.00
Vel Total (ft/s)	3.66	Avg. Vel. (ft/s)	2.91	8.36	2.34
Max Chl Dpth (ft)	2.78	Hydr. Depth (ft)	2.11	2.75	1.53
Conv. Total (cfs)	16867.2	Conv. (cfs)	6241.2	6742.4	3883.7
Length Wtd. (ft)	44.59	Wetted Per. (ft)	73.08	21.02	78.70
Min Ch El (ft)	2830.80	Shear (lb/sq ft)	0.67	0.88	0.48
Alpha	2.42	Stream Power (lb/ft s)	1.96	7.36	1.13
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)	3.39	6.10	7.38
C & E Loss (ft)	0.03	Cum SA (acres)	3.87	3.07	7.88

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

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2295

INPUT
Description: AP2
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2836.8	15	2836	40	2832	46	2831	65	2830.8
82	2831	96	2831	110	2830	111	2829.8	129	2829.8
130	2830	143	2831	165	2831.9	183	2831.8	215	2832
280	2833	340	2834	380	2835	410	2836	428	2836

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	110	.022	130	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
110	130	75	75	75	.1	.3

PB Proj. No. 11515
Este Wash
Exist Topo with TSMS Future Flow

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2833.84	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.79	Wt. n-Val.	0.070	0.022	0.070
W.S. Elev (ft)	2833.05	Reach Len. (ft)	75.00	75.00	75.00
Crit W.S. (ft)	2833.05	Flow Area (sq ft)	154.70	64.84	162.88
E.G. Slope (ft/ft)	0.004301	Area (sq ft)	154.70	64.84	162.88
Q Total (cfs)	1208.00	Flow (cfs)	343.53	628.26	236.21
Top Width (ft)	249.70	Top Width (ft)	76.58	20.00	153.12
Vel Total (ft/s)	3.16	Avg. Vel. (ft/s)	2.22	9.69	1.45
Max Chl Dpth (ft)	3.25	Hydr. Depth (ft)	2.02	3.24	1.06
Conv. Total (cfs)	18420.7	Conv. (cfs)	5238.5	9580.2	3602.0
Length Wtd. (ft)	75.00	Wetted Per. (ft)	76.78	20.04	153.19
Min Ch El (ft)	2829.80	Shear (lb/sq ft)	0.54	0.87	0.29
Alpha	5.08	Stream Power (lb/ft s)	1.20	8.42	0.41
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)	3.18	6.04	7.32
C & E Loss (ft)	0.09	Cum SA (acres)	3.77	3.05	7.83

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2220

INPUT
Description: AP1
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2831	50	2830.5	90	2830	165	2829	225	2829.5
253	2830	300	2831	347	2832	380	2833	412	2834
447	2835								

Manning's n Values num= 1

Sta	n Val
0	.016

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
90	253	40	40	40	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	43		T

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2831.15	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.49	Wt. n-Val.	0.016	0.016	0.016
W.S. Elev (ft)	2830.66	Reach Len. (ft)	40.00	40.00	40.00
Crit W.S. (ft)	2830.66	Flow Area (sq ft)	17.48	197.78	10.37
E.G. Slope (ft/ft)	0.002962	Area (sq ft)	17.92	197.78	10.37
Q Total (cfs)	1208.00	Flow (cfs)	45.68	1137.19	25.14
Top Width (ft)	250.65	Top Width (ft)	56.43	163.00	31.22
Vel Total (ft/s)	5.35	Avg. Vel. (ft/s)	2.61	5.75	2.42
Max Chl Dpth (ft)	1.66	Hydr. Depth (ft)	0.37	1.21	0.33
Conv. Total (cfs)	22195.9	Conv. (cfs)	839.3	20894.8	461.9
Length Wtd. (ft)	40.00	Wetted Per. (ft)	47.00	163.01	31.23
Min Ch El (ft)	2829.00	Shear (lb/sq ft)	0.07	0.22	0.06
Alpha	1.10	Stream Power (lb/ft s)	0.18	1.29	0.15
Frctn Loss (ft)	0.17	Cum Volume (acre-ft)	3.03	5.81	7.17
C & E Loss (ft)	0.04	Cum SA (acres)	3.65	2.89	7.67

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.

PB Proj. No. 11515
Este Wash
Exist Topo with TSMS Future Flow

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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2180

INPUT
Description: AP
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2831.1	40	2831	52	2831	72	2830	85	2829
106	2828	118	2827	128	2827	148	2828	155	2829
225	2829.5	243	2830	320	2830	352	2831	392	2832
422	2833	440	2834						

Manning's n Values num= 2

Sta	n Val	Sta	n Val
0	.028	148	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
106	148	34	34	34	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2830.88	Element			
Vel Head (ft)	0.90	Wt. n-Val.	0.028	0.028	0.060
W.S. Elev (ft)	2829.98	Reach Len. (ft)	34.00	34.00	34.00
Crit W.S. (ft)	2829.98	Flow Area (sq ft)	37.41	109.27	65.86
E.G. Slope (ft/ft)	0.007073	Area (sq ft)	37.41	109.27	65.86
Q Total (cfs)	1208.00	Flow (cfs)	178.55	921.59	107.86
Top Width (ft)	170.15	Top Width (ft)	33.77	42.00	94.38
Vel Total (ft/s)	5.68	Avg. Vel. (ft/s)	4.77	8.43	1.64
Max Chl Dpth (ft)	2.98	Hydr. Depth (ft)	1.11	2.60	0.70
Conv. Total (cfs)	14363.3	Conv. (cfs)	2123.0	10957.9	1282.5
Length Wtd. (ft)	34.00	Wetted Per. (ft)	33.84	42.07	94.46
Min Ch El (ft)	2827.00	Shear (lb/sq ft)	0.49	1.15	0.31
Alpha	1.79	Stream Power (lb/ft s)	2.33	9.67	0.50
Frctn Loss (ft)	0.22	Cum Volume (acre-ft)	3.00	5.67	7.13
C & E Loss (ft)	0.09	Cum SA (acres)	3.61	2.80	7.61

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2146

INPUT
Description:
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2832	23	2830	38	2829	60	2827	73	2826.5
88	2827	98	2828	118	2828.8	150	2828.1	195	2828.6
215	2828	260	2829	290	2830	331	2831	361	2832
384	2833	402	2834						

Manning's n Values num= 2

Sta	n Val	Sta	n Val
0	.028	88	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
60	88	230	210	180	.1	.3

PB Proj. No. 11515
Este Wash
Exist Topo with TSMS Future Flow

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2830.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.61	Wt. n-Val.	0.028	0.028	0.060
W.S. Elev (ft)	2829.51	Reach Len. (ft)	230.00	210.00	180.00
Crit W.S. (ft)	2829.51	Flow Area (sq ft)	35.09	77.21	201.46
E.G. Slope (ft/ft)	0.006177	Area (sq ft)	35.09	77.21	201.46
Q Total (cfs)	1208.00	Flow (cfs)	163.51	632.89	411.60
Top Width (ft)	244.83	Top Width (ft)	29.61	28.00	187.22
Vel Total (ft/s)	3.85	Avg. Vel. (ft/s)	4.66	8.20	2.04
Max Chl Dpth (ft)	3.01	Hydr. Depth (ft)	1.19	2.76	1.08
Conv. Total (cfs)	15370.7	Conv. (cfs)	2080.5	8053.0	5237.3
Length Wtd. (ft)	207.43	Wetted Per. (ft)	29.72	28.02	187.32
Min Ch El (ft)	2826.50	Shear (lb/sq ft)	0.46	1.06	0.41
Alpha	2.67	Stream Power (lb/ft s)	2.12	8.71	0.85
Frctn Loss (ft)	1.55	Cum Volume (acre-ft)	2.97	5.60	7.03
C & E Loss (ft)	0.03	Cum SA (acres)	3.59	2.77	7.50

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2000

INPUT
Description:
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2835	.1	2831	50	2830	98	2828	170	2826
220	2824.5	225	2823.2	245	2823.2	248	2824	260	2826
295	2828	390	2830	420	2832				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	225	.025	245	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
220	248	100	135	150	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2827.82	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.93	Wt. n-Val.	0.060	0.037	0.060
W.S. Elev (ft)	2826.89	Reach Len. (ft)	100.00	135.00	150.00
Crit W.S. (ft)	2826.89	Flow Area (sq ft)	95.87	98.74	29.48
E.G. Slope (ft/ft)	0.009274	Area (sq ft)	95.87	98.74	29.48
Q Total (cfs)	1208.00	Flow (cfs)	253.94	880.74	73.32
Top Width (ft)	137.36	Top Width (ft)	81.87	28.00	27.49
Vel Total (ft/s)	5.39	Avg. Vel. (ft/s)	2.65	8.92	2.49
Max Chl Dpth (ft)	3.69	Hydr. Depth (ft)	1.17	3.53	1.07
Conv. Total (cfs)	12544.2	Conv. (cfs)	2637.0	9145.9	761.4
Length Wtd. (ft)	129.93	Wetted Per. (ft)	81.90	28.27	27.68
Min Ch El (ft)	2823.20	Shear (lb/sq ft)	0.68	2.02	0.62
Alpha	2.06	Stream Power (lb/ft s)	1.79	18.04	1.53
Frctn Loss (ft)	1.40	Cum Volume (acre-ft)	2.63	5.17	6.55
C & E Loss (ft)	0.01	Cum SA (acres)	3.29	2.63	7.06

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there

is not a valid subcritical answer. The program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 1865

INPUT
Description: AO
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2835	.1	2829	35	2828	105	2826	173	2824
203	2822	207	2821.5	222	2821.5	242	2822	252	2824
273	2826	292	2828	335	2830	360	2830.5		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	207	.025	222	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
203	242	375	400	440	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2825.61	Element			
Vel Head (ft)	1.06	Wt. n-Val.	0.060	0.038	0.060
W.S. Elev (ft)	2824.55	Reach Len. (ft)	375.00	400.00	440.00
Crit W.S. (ft)	2824.55	Flow Area (sq ft)	51.43	112.78	17.02
E.G. Slope (ft/ft)	0.012600	Area (sq ft)	51.43	112.78	17.02
Q Total (cfs)	1208.00	Flow (cfs)	148.42	1010.18	49.40
Top Width (ft)	103.28	Top Width (ft)	48.55	39.00	15.73
Vel Total (ft/s)	6.67	Avg. Vel. (ft/s)	2.89	8.96	2.90
Max Chl Dpth (ft)	3.05	Hydr. Depth (ft)	1.06	2.89	1.08
Conv. Total (cfs)	10761.8	Conv. (cfs)	1322.2	8999.5	440.1
Length Wtd. (ft)	398.11	Wetted Per. (ft)	48.63	39.04	15.95
Min Ch El (ft)	2821.50	Shear (lb/sq ft)	0.83	2.27	0.84
Alpha	1.54	Stream Power (lb/ft s)	2.40	20.36	2.44
Frctn Loss (ft)	4.59	Cum Volume (acre-ft)	2.46	4.84	6.47
C & E Loss (ft)	0.11	Cum SA (acres)	3.14	2.53	6.98

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 1465

INPUT
Description: AN
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2827	.1	2821	15	2820	65	2818.2	95	2819
133	2819	180	2818	199	2816.3	240	2816.3	242	2818
248	2820	290	2822	290.1	2828				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	199	.028	240	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
180	242	280	290	320	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	133	2819	F

PB Proj. No. 11515
Este Wash
Exist Topo with TSMS Future Flow

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2819.89	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.68	Wt. n-Val.	0.060	0.042	0.080
W.S. Elev (ft)	2819.21	Reach Len. (ft)	280.00	290.00	320.00
Crit W.S. (ft)	2819.21	Flow Area (sq ft)	74.09	162.69	2.20
E.G. Slope (ft/ft)	0.010624	Area (sq ft)	74.09	162.69	2.20
Q Total (cfs)	1256.00	Flow (cfs)	121.92	1131.16	2.92
Top Width (ft)	208.75	Top Width (ft)	143.11	62.00	3.64
Vel Total (ft/s)	5.26	Avg. Vel. (ft/s)	1.65	6.95	1.32
Max Chl Dpth (ft)	2.91	Hydr. Depth (ft)	0.52	2.62	0.61
Conv. Total (cfs)	12185.8	Conv. (cfs)	1182.9	10974.6	28.3
Length Wtd. (ft)	292.12	Wetted Per. (ft)	143.15	62.70	3.83
Min Ch El (ft)	2816.30	Shear (lb/sq ft)	0.34	1.72	0.38
Alpha	1.59	Stream Power (lb/ft s)	0.56	11.97	0.50
Frctn Loss (ft)	3.55	Cum Volume (acre-ft)	1.92	3.58	6.37
C & E Loss (ft)	0.06	Cum SA (acres)	2.32	2.07	6.89

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 1175

INPUT
Description: AM
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2824	.1	2818	50	2814	60	2813	69	2814
90	2814.5	108	2814	170	2812.7	197	2812.7	222	2813.9
238	2813.9	288	2813.3	323	2814	410	2816	410.1	2822

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	170	.022	197	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
108	222	365	360	360	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2815.02	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.47	Wt. n-Val.	0.060	0.036	0.060
W.S. Elev (ft)	2814.55	Reach Len. (ft)	365.00	360.00	360.00
Crit W.S. (ft)	2814.55	Flow Area (sq ft)	33.65	155.81	96.20
E.G. Slope (ft/ft)	0.013999	Area (sq ft)	33.65	155.81	96.20
Q Total (cfs)	1256.00	Flow (cfs)	63.56	955.73	236.71
Top Width (ft)	303.88	Top Width (ft)	64.88	114.00	125.00
Vel Total (ft/s)	4.40	Avg. Vel. (ft/s)	1.89	6.13	2.46
Max Chl Dpth (ft)	1.85	Hydr. Depth (ft)	0.52	1.37	0.77
Conv. Total (cfs)	10615.3	Conv. (cfs)	537.2	8077.6	2000.6
Length Wtd. (ft)	360.15	Wetted Per. (ft)	65.02	114.04	125.02
Min Ch El (ft)	2812.70	Shear (lb/sq ft)	0.45	1.19	0.67
Alpha	1.55	Stream Power (lb/ft s)	0.85	7.32	1.65
Frctn Loss (ft)	4.85	Cum Volume (acre-ft)	1.57	2.52	6.01
C & E Loss (ft)	0.00	Cum SA (acres)	1.65	1.48	6.41

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical

depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 815

INPUT
Description: AL
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2816	.1	2810	92	2808	112	2807	140	2807
150	2808	212	2808	232	2807	262	2808	315	2806.8
365	2808	382	2814						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	112	.022	140	.06	315	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
92	150	390	390	420	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2809.15	Element			
Vel Head (ft)	0.49	Wt. n-Val.	0.060	0.029	0.065
W.S. Elev (ft)	2808.67	Reach Len. (ft)	390.00	390.00	420.00
Crit W.S. (ft)	2808.67	Flow Area (sq ft)	10.20	81.64	230.67
E.G. Slope (ft/ft)	0.012970	Area (sq ft)	10.20	81.64	230.67
Q Total (cfs)	1256.00	Flow (cfs)	13.82	613.55	628.63
Top Width (ft)	305.50	Top Width (ft)	30.61	58.00	216.89
Vel Total (ft/s)	3.89	Avg. Vel. (ft/s)	1.36	7.51	2.73
Max Chl Dpth (ft)	1.87	Hydr. Depth (ft)	0.33	1.41	1.06
Conv. Total (cfs)	11028.7	Conv. (cfs)	121.4	5387.4	5519.9
Length Wtd. (ft)	403.59	Wetted Per. (ft)	30.62	58.07	217.07
Min Ch El (ft)	2807.00	Shear (lb/sq ft)	0.27	1.14	0.86
Alpha	2.07	Stream Power (lb/ft s)	0.37	8.55	2.34
Frctn Loss (ft)	3.18	Cum Volume (acre-ft)	1.39	1.54	4.66
C & E Loss (ft)	0.00	Cum SA (acres)	1.25	0.77	5.00

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 425

INPUT
Description: AK
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2803	10	2802	72	2800	73	2799.2	105	2799.2
115	2800	150	2801	180	2800	270	2800.5	350	2801.3
410	2799.9	425	2802	430	2802.2				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	72	.025	150	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
72	115	450	425	405	.1	.3

PB Proj. No. 11515
Este Wash
Exist Topo with TSMS Future Flow
CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2802.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.49	Wt. n-Val.	0.080	0.025	0.063
W.S. Elev (ft)	2801.54	Reach Len. (ft)	450.00	425.00	405.00
Crit W.S. (ft)	2801.54	Flow Area (sq ft)	36.61	96.09	299.94
E.G. Slope (ft/ft)	0.005276	Area (sq ft)	36.61	96.09	299.94
Q Total (cfs)	1256.00	Flow (cfs)	41.42	705.61	508.97
Top Width (ft)	397.33	Top Width (ft)	47.64	43.00	306.69
Vel Total (ft/s)	2.90	Avg. Vel. (ft/s)	1.13	7.34	1.70
Max Chl Dpth (ft)	2.34	Hydr. Depth (ft)	0.77	2.23	0.98
Conv. Total (cfs)	17292.1	Conv. (cfs)	570.3	9714.5	7007.3
Length Wtd. (ft)	425.55	Wetted Per. (ft)	47.67	43.31	306.86
Min Ch El (ft)	2799.20	Shear (lb/sq ft)	0.25	0.73	0.32
Alpha	3.74	Stream Power (lb/ft s)	0.29	5.37	0.55
Frctn Loss (ft)	2.83	Cum Volume (acre-ft)	1.18	0.74	2.10
C & E Loss (ft)	0.00	Cum SA (acres)	0.90	0.32	2.48

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 0

INPUT
Description: AJ
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2798	21	2794	31	2793	144	2793	145	2792
165	2792	166	2793	197	2794	240	2794	276	2793.3
300	2794	332	2794.3	365	2794	420	2795.2		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	31	.06	145	.022	165	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
144	166	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2795.07	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.48	Wt. n-Val.	0.061	0.030	0.080
W.S. Elev (ft)	2794.59	Reach Len. (ft)			
Crit W.S. (ft)	2794.59	Flow Area (sq ft)	191.68	56.01	152.49
E.G. Slope (ft/ft)	0.008634	Area (sq ft)	191.68	56.01	152.49
Q Total (cfs)	1256.00	Flow (cfs)	583.14	470.50	202.36
Top Width (ft)	374.22	Top Width (ft)	126.11	22.00	226.11
Vel Total (ft/s)	3.14	Avg. Vel. (ft/s)	3.04	8.40	1.33
Max Chl Dpth (ft)	2.59	Hydr. Depth (ft)	1.52	2.55	0.67
Conv. Total (cfs)	13517.0	Conv. (cfs)	6275.7	5063.5	2177.8
Length Wtd. (ft)		Wetted Per. (ft)	126.21	22.83	226.16
Min Ch El (ft)	2792.00	Shear (lb/sq ft)	0.82	1.32	0.36
Alpha	3.15	Stream Power (lb/ft s)	2.49	11.11	0.48
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth). Water surface set to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

SUMMARY OF MANNING'S N VALUES

PB Proj. No. 11515
Este Wash
Exist Topo with TSMS Future Flow

River:Este Wash

Reach	River Sta.	n1	n2	n3	n4	n5
1	4085	.08	.022	.06		
1	3810	.06	.022	.06		
1	3640	.06	.022	.08		
1	3490	.08	.06	.022	.06	
1	3350	.08	.06	.028	.06	
1	3230	.08	.025	.08		
1	3160	.08	.025	.08		
1	3125	.08	.025	.08		
1	3050	.016				
1	2975	.06	.025	.06	.025	.06
1	2795	.06	.028	.06		
1	2495	.04	.016	.06	.025	.06
1	2340	.06	.025	.06		
1	2295	.07	.022	.07		
1	2220	.016				
1	2180	.028	.06			
1	2146	.028	.06			
1	2000	.06	.025	.06		
1	1865	.06	.025	.06		
1	1465	.06	.028	.08		
1	1175	.06	.022	.06		
1	815	.06	.022	.06	.08	
1	425	.08	.025	.08		
1	0	.08	.06	.022	.08	

SUMMARY OF REACH LENGTHS

River: Este Wash

Reach	River Sta.	Left	Channel	Right
1	4085	250	275	260
1	3810	155	170	180
1	3640	90	150	205
1	3490	90	140	190
1	3350	135	120	115
1	3230	100	70	55
1	3160	35	35	35
1	3125	75	75	75
1	3050	75	75	75
1	2975	270	180	110
1	2795	360	300	250
1	2495	175	155	130
1	2340	60	45	20
1	2295	75	75	75
1	2220	40	40	40
1	2180	34	34	34
1	2146	230	210	180
1	2000	100	135	150
1	1865	375	400	440
1	1465	280	290	320
1	1175	365	360	360
1	815	390	390	420
1	425	450	425	405
1	0			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Este Wash

Reach	River Sta.	Contr.	Expan.
1	4085	.1	.3

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1	3810	.1	.3
1	3640	.1	.3
1	3490	.1	.3
1	3350	.1	.3
1	3230	.1	.3
1	3160	.1	.3
1	3125	.1	.3
1	3050	.1	.3
1	2975	.1	.3
1	2795	.1	.3
1	2495	.1	.3
1	2340	.1	.3
1	2295	.1	.3
1	2220	.1	.3
1	2180	.1	.3
1	2146	.1	.3
1	2000	.1	.3
1	1865	.1	.3
1	1465	.1	.3
1	1175	.1	.3
1	815	.1	.3
1	425	.1	.3
1	0	.1	.3

HEC-RAS Version 3.1.3 May 2005
U.S. Army Corp 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: Este Wash New Topo HEC2
Project File : EWHEC2TSMS.prj
Run Date and Time: 9/2/2008 3:02:23 PM

Project in English units

Project Description:
88151-02-39
FIS City of Tucson
ESTE WASH
Imported FEMA
Geometry File: .g01
Imported FEMA Geometry File Adjusted Vertically by +2.23
ft to account for Vertical Datum Change: .g02

New Existing Conditions
Geometry File (Project 1' C.I. Topo with PAG 1999 2' C.I. Topo): .g06
Proposed
Conditions Geometry File (3-10'x6' RCBC's at Houghton Rd and 22nd St
crossings): ,g07
Proposed Conditions Geometry File (4-10'x6' RCBC's at
Houghton Rd and 22nd St crossings): ,g05

PLAN DATA

Plan Title: Existing Cond Topo with TSMS Future Flow

PB Proj. No. 11515
Este Wash
Exist Topo with TSMS Future Flow
Plan File : l:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2TSMS.p01

Geometry Title: New Existing Geom
Geometry File : l:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2TSMS.g06

Flow Title : TSMS Future Flow
Flow File : l:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2TSMS.f03

Plan Summary Information:

Number of:	Cross Sections =	24	Multiple Openings =	0
	Culverts =	0	Inline Structures =	0
	Bridges =	0	Lateral Structures =	0

Computational Information

Water surface calculation tolerance =	0.01
Critical depth calculation tolerance =	0.01
Maximum number of iterations =	20
Maximum difference tolerance =	0.3
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:	Subcritical Flow

FLOW DATA

Flow Title: TSMS Future Flow
Flow File : l:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2TSMS.f03

Flow Data (cfs)

River	Reach	RS	PF 1
Este Wash	1	4085	1208
Este Wash	1	1465	1256

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Este Wash	1	PF 1	Normal S = 0.0133	Normal S = 0.0133

GEOMETRY DATA

Geometry Title: New Existing Geom
Geometry File : l:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2TSMS.g06

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 4085

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2862.5	9	2862	20	2860	30	2858	33	2856.4
50	2856.4	53	2857.7	80	2857.7	116	2858	127	2857.7
142	2858.1	159	2857.3	173	2857.7	209	2857.5	230	2858

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	33	.022	50	.06

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

PB Proj. No. 11515
Este Wash
Exist Topo with TSMS Future Flow

30	53	250	275	260	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2859.46	Element			
Vel Head (ft)	0.55	Wt. n-Val.	0.080	0.039	0.060
W.S. Elev (ft)	2858.91	Reach Len. (ft)	250.00	275.00	260.00
Crit W.S. (ft)	2858.91	Flow Area (sq ft)	2.06	53.32	209.02
E.G. Slope (ft/ft)	0.016871	Area (sq ft)	2.06	53.32	209.02
Q Total (cfs)	1208.00	Flow (cfs)	2.89	456.58	748.53
Top Width (ft)	204.54	Top Width (ft)	4.54	23.00	177.00
Vel Total (ft/s)	4.57	Avg. Vel. (ft/s)	1.41	8.56	3.58
Max Chl Dpth (ft)	2.51	Hydr. Depth (ft)	0.45	2.32	1.18
Conv. Total (cfs)	9300.3	Conv. (cfs)	22.3	3515.1	5762.9
Length Wtd. (ft)	265.86	Wetted Per. (ft)	4.63	23.67	177.95
Min Ch El (ft)	2856.40	Shear (lb/sq ft)	0.47	2.37	1.24
Alpha	1.71	Stream Power (lb/ft s)	0.66	20.32	4.43
Frctn Loss (ft)	3.20	Cum Volume (acre-ft)	8.11	9.66	10.89
C & E Loss (ft)	0.00	Cum SA (acres)	8.22	5.14	11.56

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3810

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2856	8	2854.5	116	2854	150	2854	169	2853.8
183	2854.1	200	2852.7	220	2852.7	235	2854	250	2856
250.1	2862								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	200	.022	220	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
183	235	155	170	180	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2855.72	Element			
Vel Head (ft)	0.56	Wt. n-Val.	0.060	0.032	0.060
W.S. Elev (ft)	2855.16	Reach Len. (ft)	155.00	170.00	180.00
Crit W.S. (ft)	2855.16	Flow Area (sq ft)	180.27	106.42	5.07
E.G. Slope (ft/ft)	0.009011	Area (sq ft)	180.27	106.42	5.07
Q Total (cfs)	1208.00	Flow (cfs)	426.41	773.34	8.26
Top Width (ft)	239.26	Top Width (ft)	178.54	52.00	8.72
Vel Total (ft/s)	4.14	Avg. Vel. (ft/s)	2.37	7.27	1.63
Max Chl Dpth (ft)	2.46	Hydr. Depth (ft)	1.01	2.05	0.58
Conv. Total (cfs)	12725.9	Conv. (cfs)	4492.1	8146.9	87.0
Length Wtd. (ft)	162.31	Wetted Per. (ft)	178.60	52.11	8.80
Min Ch El (ft)	2852.70	Shear (lb/sq ft)	0.57	1.15	0.32
Alpha	2.09	Stream Power (lb/ft s)	1.34	8.35	0.53
Frctn Loss (ft)	1.95	Cum Volume (acre-ft)	7.59	9.16	10.25
C & E Loss (ft)	0.04	Cum SA (acres)	7.69	4.90	11.01

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross

section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3640

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2854	15	2852	38	2851	126	2850.6	173	2851.2
205	2851.8	218	2850.8	238	2850.8	249	2851.8	270	2852
336	2854	360	2856	385	2858	410	2860	495	2862

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	218	.022	238	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
205	249	90	150	205	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2852.63	Element			
Vel Head (ft)	0.41	Wt. n-Val.	0.060	0.029	0.080
W.S. Elev (ft)	2852.23	Reach Len. (ft)	90.00	150.00	205.00
Crit W.S. (ft)	2852.13	Flow Area (sq ft)	227.89	50.73	7.68
E.G. Slope (ft/ft)	0.016894	Area (sq ft)	227.89	50.73	7.68
Q Total (cfs)	1208.00	Flow (cfs)	823.11	377.14	7.75
Top Width (ft)	264.15	Top Width (ft)	191.69	44.00	28.45
Vel Total (ft/s)	4.22	Avg. Vel. (ft/s)	3.61	7.43	1.01
Max Chl Dpth (ft)	1.63	Hydr. Depth (ft)	1.19	1.15	0.27
Conv. Total (cfs)	9293.9	Conv. (cfs)	6332.7	2901.6	59.6
Length Wtd. (ft)	111.88	Wetted Per. (ft)	191.74	44.08	28.46
Min Ch El (ft)	2850.80	Shear (lb/sq ft)	1.25	1.21	0.28
Alpha	1.47	Stream Power (lb/ft s)	4.53	9.02	0.29
Frctn Loss (ft)	1.94	Cum Volume (acre-ft)	6.86	8.85	10.23
C & E Loss (ft)	0.05	Cum SA (acres)	7.03	4.71	10.93

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3490

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2854	13	2852	42	2850	116	2848.4	240	2849.9
258	2849.2	270	2849.2	280	2849.8	320	2850	350	2850
367	2849.6	388	2850	415	2850	460	2851	480	2851

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	116	.06	258	.022	270	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
240	280	90	140	190	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2850.64	Element			
Vel Head (ft)	0.23	Wt. n-Val.	0.066	0.035	0.060
W.S. Elev (ft)	2850.41	Reach Len. (ft)	90.00	140.00	190.00

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Este Wash
Exist Topo with TSMS Future Flow

Crit W.S. (ft)	2850.21	Flow Area (sq ft)	246.75	39.05	70.53
E.G. Slope (ft/ft)	0.017833	Area (sq ft)	246.75	39.05	70.53
Q Total (cfs)	1208.00	Flow (cfs)	846.28	222.77	138.94
Top Width (ft)	397.32	Top Width (ft)	203.93	40.00	153.39
Vel Total (ft/s)	3.39	Avg. Vel. (ft/s)	3.43	5.70	1.97
Max Chl Dpth (ft)	2.01	Hydr. Depth (ft)	1.21	0.98	0.46
Conv. Total (cfs)	9046.1	Conv. (cfs)	6337.4	1668.2	1040.5
Length Wtd. (ft)	142.00	Wetted Per. (ft)	203.97	40.03	153.40
Min Ch El (ft)	2849.20	Shear (lb/sq ft)	1.35	1.09	0.51
Alpha	1.28	Stream Power (lb/ft s)	4.62	6.20	1.01
Frctn Loss (ft)	1.88	Cum Volume (acre-ft)	6.37	8.70	10.04
C & E Loss (ft)	0.03	Cum SA (acres)	6.63	4.57	10.50

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3350

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2854	15	2852	35	2850	75	2848.1	90	2848.2
105	2848	128	2847.3	182	2848.1	198	2847.7	245	2847.6
250	2848	260	2847.9	297	2847.9	357	2846.9	430	2846.6
465	2848	495	2850	525	2850.5				

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	182	.06	245	.028	297	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
182	250	135	120	115	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2848.73	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.	0.080	0.056	0.056
W.S. Elev (ft)	2848.58	Reach Len. (ft)	135.00	120.00	115.00
Crit W.S. (ft)		Flow Area (sq ft)	85.50	58.79	284.18
E.G. Slope (ft/ft)	0.010262	Area (sq ft)	85.50	58.79	284.18
Q Total (cfs)	1208.00	Flow (cfs)	130.36	143.43	934.21
Top Width (ft)	408.97	Top Width (ft)	117.20	68.00	223.77
Vel Total (ft/s)	2.82	Avg. Vel. (ft/s)	1.52	2.44	3.29
Max Chl Dpth (ft)	1.98	Hydr. Depth (ft)	0.73	0.86	1.27
Conv. Total (cfs)	11924.8	Conv. (cfs)	1286.9	1415.9	9222.1
Length Wtd. (ft)	120.38	Wetted Per. (ft)	117.23	68.02	223.82
Min Ch El (ft)	2847.60	Shear (lb/sq ft)	0.47	0.55	0.81
Alpha	1.17	Stream Power (lb/ft s)	0.71	1.35	2.67
Frctn Loss (ft)	1.38	Cum Volume (acre-ft)	6.03	8.54	9.27
C & E Loss (ft)	0.01	Cum SA (acres)	6.29	4.39	9.68

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3230

INPUT
Description:
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2852	23	2850	32	2848	58	2846	88	2846
100	2845.8	147	2846.1	162	2846	207	2846	210	2845.5
228	2845.5	248	2846	290	2845	305	2845.3	318	2844.9

335	2846	343	2847	365	2850	390	2853

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	210	.025	228	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
207	248	100	70	55	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2847.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	Wt. n-Val.	0.080	0.038	0.080
W.S. Elev (ft)	2847.12	Reach Len. (ft)	100.00	70.00	55.00
Crit W.S. (ft)		Flow Area (sq ft)	177.53	60.59	157.08
E.G. Slope (ft/ft)	0.012892	Area (sq ft)	177.53	60.59	157.08
Q Total (cfs)	1208.00	Flow (cfs)	395.39	352.61	460.00
Top Width (ft)	300.40	Top Width (ft)	163.54	41.00	95.87
Vel Total (ft/s)	3.06	Avg. Vel. (ft/s)	2.23	5.82	2.93
Max Chl Dpth (ft)	2.22	Hydr. Depth (ft)	1.09	1.48	1.64
Conv. Total (cfs)	10639.1	Conv. (cfs)	3482.3	3105.5	4051.4
Length Wtd. (ft)	77.96	Wetted Per. (ft)	163.58	41.05	95.99
Min Ch El (ft)	2845.50	Shear (lb/sq ft)	0.87	1.19	1.32
Alpha	1.58	Stream Power (lb/ft s)	1.95	6.91	3.86
Frctn Loss (ft)	0.77	Cum Volume (acre-ft)	5.62	8.37	8.69
C & E Loss (ft)	0.05	Cum SA (acres)	5.86	4.24	9.26

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3160

INPUT
Description:
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2848	10	2846	28	2845	60	2844	73	2844.5
113	2844.7	123	2843.9	140	2844.6	161	2844.6	200	2844
205	2843.8	230	2843.5	235	2844	253	2845	266	2846
280	2847	290	2848	307	2850	322	2852	335	2853

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	200	.025	235	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
200	235	35	35	35	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2846.53	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.68	Wt. n-Val.	0.080	0.025	0.080
W.S. Elev (ft)	2845.85	Reach Len. (ft)	35.00	35.00	35.00
Crit W.S. (ft)	2845.85	Flow Area (sq ft)	250.33	75.33	29.06
E.G. Slope (ft/ft)	0.007847	Area (sq ft)	250.33	75.33	29.06
Q Total (cfs)	1208.00	Flow (cfs)	499.50	660.77	47.73
Top Width (ft)	251.42	Top Width (ft)	187.34	35.00	29.08
Vel Total (ft/s)	3.41	Avg. Vel. (ft/s)	2.00	8.77	1.64
Max Chl Dpth (ft)	2.35	Hydr. Depth (ft)	1.34	2.15	1.00
Conv. Total (cfs)	13636.9	Conv. (cfs)	5638.8	7459.3	538.9
Length Wtd. (ft)	35.00	Wetted Per. (ft)	187.44	35.03	29.14
Min Ch El (ft)	2843.50	Shear (lb/sq ft)	0.65	1.05	0.49
Alpha	3.78	Stream Power (lb/ft s)	1.31	9.24	0.80
Frctn Loss (ft)	0.43	Cum Volume (acre-ft)	5.13	8.26	8.57
C & E Loss (ft)	0.04	Cum SA (acres)	5.46	4.18	9.18

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
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.

PB Proj. No. 11515
Este Wash
Exist Topo with TSMS Future Flow

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3125

INPUT
Description:
Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2847	12	2846	40	2845	95	2844	100	2843.8
103	2844	110	2844.2	130	2844.2	135	2843.5	140	2844
178	2844	240	2843.2	260	2842.8	262	2843	265	2844
275	2845	287	2846	298	2847	310	2848	330	2849
340	2850	370	2851						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	240	.025	260	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
178	262	75	75	75	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2845.60	Element			
Vel Head (ft)	0.55	Wt. n-Val.	0.080	0.045	0.080
W.S. Elev (ft)	2845.05	Reach Len. (ft)	75.00	75.00	75.00
Crit W.S. (ft)	2845.05	Flow Area (sq ft)	115.13	134.96	10.13
E.G. Slope (ft/ft)	0.021583	Area (sq ft)	115.13	134.96	10.13
Q Total (cfs)	1208.00	Flow (cfs)	276.54	908.96	22.50
Top Width (ft)	236.88	Top Width (ft)	139.32	84.00	13.57
Vel Total (ft/s)	4.64	Avg. Vel. (ft/s)	2.40	6.74	2.22
Max Chl Dpth (ft)	2.25	Hydr. Depth (ft)	0.83	1.61	0.75
Conv. Total (cfs)	8222.7	Conv. (cfs)	1882.4	6187.2	153.2
Length Wtd. (ft)	75.00	Wetted Per. (ft)	139.42	84.02	13.78
Min Ch El (ft)	2842.80	Shear (lb/sq ft)	1.11	2.16	0.99
Alpha	1.65	Stream Power (lb/ft s)	2.67	14.58	2.20
Frctn Loss (ft)	0.48	Cum Volume (acre-ft)	4.99	8.18	8.55
C & E Loss (ft)	0.00	Cum SA (acres)	5.32	4.14	9.16

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3050

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2847	33	2846	80	2845	130	2844	195	2843
243	2842.3	281	2842.3	330	2843	423	2844	468	2844
510	2845								

Manning's n Values num= 1

Sta	n Val
0	.016

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Este Wash
Exist Topo with TSMS Future Flow

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
195	330	75	75	75	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
340	510		T

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2844.43	Element			
Vel Head (ft)	0.55	Wt. n-Val.	0.016	0.016	0.016
W.S. Elev (ft)	2843.88	Reach Len. (ft)	75.00	75.00	75.00
Crit W.S. (ft)	2843.88	Flow Area (sq ft)	24.86	178.60	8.21
E.G. Slope (ft/ft)	0.003019	Area (sq ft)	24.86	178.60	35.57
Q Total (cfs)	1208.00	Flow (cfs)	73.06	1098.23	36.71
Top Width (ft)	273.17	Top Width (ft)	56.84	135.00	81.33
Vel Total (ft/s)	5.71	Avg. Vel. (ft/s)	2.94	6.15	4.47
Max Chl Dpth (ft)	1.57	Hydr. Depth (ft)	0.44	1.32	0.82
Conv. Total (cfs)	21986.7	Conv. (cfs)	1329.7	19988.8	668.2
Length Wtd. (ft)	75.00	Wetted Per. (ft)	56.85	135.01	10.00
Min Ch El (ft)	2842.30	Shear (lb/sq ft)	0.08	0.25	0.15
Alpha	1.09	Stream Power (lb/ft s)	0.24	1.53	0.69
Frctn Loss (ft)	0.32	Cum Volume (acre-ft)	4.87	7.91	8.52
C & E Loss (ft)	0.02	Cum SA (acres)	5.16	3.95	9.08

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2975

INPUT
Description: AS
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2845.5	8	2845	25	2844	62	2843	100	2842.5
108	2842.5	130	2842.7	150	2842	190	2841	210	2840
220	2839	228	2840	233	2840.2	240	2840	242	2839.6
262	2839.6	265	2840	275	2840.8	305	2841	342	2842
356	2843	372	2844	390	2844.2	405	2844	427	2845
460	2845.2								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	100	.025	108	.06	240	.025	265	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
240	265	270	180	110	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2843.05	Element			
Vel Head (ft)	0.74	Wt. n-Val.	0.060	0.025	0.060
W.S. Elev (ft)	2842.31	Reach Len. (ft)	270.00	180.00	110.00
Crit W.S. (ft)	2842.31	Flow Area (sq ft)	146.81	66.68	91.83
E.G. Slope (ft/ft)	0.006658	Area (sq ft)	146.81	66.68	91.83
Q Total (cfs)	1208.00	Flow (cfs)	385.95	620.89	201.16
Top Width (ft)	205.09	Top Width (ft)	98.78	25.00	81.30
Vel Total (ft/s)	3.96	Avg. Vel. (ft/s)	2.63	9.31	2.19
Max Chl Dpth (ft)	3.31	Hydr. Depth (ft)	1.49	2.67	1.13
Conv. Total (cfs)	14804.6	Conv. (cfs)	4730.0	7609.3	2465.3
Length Wtd. (ft)	184.99	Wetted Per. (ft)	98.94	25.07	81.36
Min Ch El (ft)	2839.60	Shear (lb/sq ft)	0.62	1.11	0.47
Alpha	3.04	Stream Power (lb/ft s)	1.62	10.30	1.03

Frctn Loss (ft)	1.29	Cum Volume (acre-ft)	4.72	7.70	8.41
C & E Loss (ft)	0.01	Cum SA (acres)	5.02	3.81	8.94

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2795

INPUT
Description: AR
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2847	38	2846	72	2844	128	2842	160	2840
252	2838	260	2836.9	270	2837.8	283	2836.5	308	2836.5
320	2837.5	330	2837.2	343	2837.2	360	2838.5	380	2838.3
413	2839	440	2840	482	2842	510	2843	555	2844

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	252	.028	320	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
252	320	360	300	250	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2839.70	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.70	Wt. n-Val.	0.060	0.028	0.060
W.S. Elev (ft)	2839.00	Reach Len. (ft)	360.00	300.00	250.00
Crit W.S. (ft)	2839.00	Flow Area (sq ft)	22.79	139.13	82.57
E.G. Slope (ft/ft)	0.007319	Area (sq ft)	22.79	139.13	82.57
Q Total (cfs)	1208.00	Flow (cfs)	30.32	1015.90	161.79
Top Width (ft)	206.57	Top Width (ft)	45.79	68.00	92.78
Vel Total (ft/s)	4.94	Avg. Vel. (ft/s)	1.33	7.30	1.96
Max Chl Dpth (ft)	2.50	Hydr. Depth (ft)	0.50	2.05	0.89
Conv. Total (cfs)	14119.9	Conv. (cfs)	354.3	11874.5	1891.1
Length Wtd. (ft)	297.51	Wetted Per. (ft)	45.80	68.22	92.84
Min Ch El (ft)	2836.50	Shear (lb/sq ft)	0.23	0.93	0.41
Alpha	1.86	Stream Power (lb/ft s)	0.30	6.80	0.80
Frctn Loss (ft)	2.30	Cum Volume (acre-ft)	4.19	7.27	8.19
C & E Loss (ft)	0.01	Cum SA (acres)	4.57	3.62	8.72

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2495

INPUT
Description: AQ
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2846	10	2842	15	2840.8	20	2841.3	48	2841.1
87	2840	120	2838	160	2836	198	2834	210	2833.4
237	2834.1	246	2832.5	280	2833	290	2833.8	310	2833.8

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320	2833.2	326	2834	450	2836	496	2837	536	2838

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.04	10	.016	48	.06	246	.025	280	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
237	290	175	155	130	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2835.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.68	Wt. n-Val.	0.060	0.029	0.060
W.S. Elev (ft)	2835.11	Reach Len. (ft)	175.00	155.00	130.00
Crit W.S. (ft)	2835.11	Flow Area (sq ft)	65.26	113.56	89.41
E.G. Slope (ft/ft)	0.008200	Area (sq ft)	65.26	113.56	89.41
Q Total (cfs)	1208.00	Flow (cfs)	154.60	873.04	180.36
Top Width (ft)	217.80	Top Width (ft)	60.06	53.00	104.74
Vel Total (ft/s)	4.50	Avg. Vel. (ft/s)	2.37	7.69	2.02
Max Chl Dpth (ft)	2.61	Hydr. Depth (ft)	1.09	2.14	0.85
Conv. Total (cfs)	13339.8	Conv. (cfs)	1707.3	9640.8	1991.7
Length Wtd. (ft)	155.24	Wetted Per. (ft)	60.12	53.18	104.82
Min Ch El (ft)	2832.50	Shear (lb/sq ft)	0.56	1.09	0.44
Alpha	2.17	Stream Power (lb/ft s)	1.32	8.41	0.88
Frctn Loss (ft)	0.99	Cum Volume (acre-ft)	3.83	6.40	7.69
C & E Loss (ft)	0.05	Cum SA (acres)	4.14	3.20	8.15

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m), between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2340

INPUT
Description:
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2836	49	2837.7	62	2837	77	2836	84	2835
101	2832	115	2831.4	145	2831.1	165	2831	167	2830.8
183	2830.8	186	2831	193	2832	220	2832	258	2832.2
264	2833								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	165	.025	186	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
165	186	60	45	20	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2834.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.50	Wt. n-Val.	0.060	0.025	0.060
W.S. Elev (ft)	2833.58	Reach Len. (ft)	60.00	45.00	20.00
Crit W.S. (ft)		Flow Area (sq ft)	153.60	57.79	119.02
E.G. Slope (ft/ft)	0.005129	Area (sq ft)	153.60	57.79	119.02
Q Total (cfs)	1208.00	Flow (cfs)	446.98	482.88	278.14
Top Width (ft)	171.93	Top Width (ft)	72.93	21.00	78.00
Vel Total (ft/s)	3.66	Avg. Vel. (ft/s)	2.91	8.36	2.34
Max Chl Dpth (ft)	2.78	Hydr. Depth (ft)	2.11	2.75	1.53
Conv. Total (cfs)	16867.2	Conv. (cfs)	6241.2	6742.4	3883.7
Length Wtd. (ft)	44.59	Wetted Per. (ft)	73.08	21.02	78.70
Min Ch El (ft)	2830.80	Shear (lb/sq ft)	0.67	0.88	0.48
Alpha	2.42	Stream Power (lb/ft s)	1.96	7.36	1.13
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)	3.39	6.10	7.38

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C & E Loss (ft)	0.03	Cum SA (acres)	3.87	3.07	7.88

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

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2295

INPUT
Description: AP2
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2836.8	15	2836	40	2832	46	2831	65	2830.8
82	2831	96	2831	110	2830	111	2829.8	129	2829.8
130	2830	143	2831	165	2831.9	183	2831.8	215	2832
280	2833	340	2834	380	2835	410	2836	428	2836

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	110	.022	130	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
110	130	75	75	75	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2833.84	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.79	Wt. n-Val.	0.070	0.022	0.070
W.S. Elev (ft)	2833.05	Reach Len. (ft)	75.00	75.00	75.00
Crit W.S. (ft)	2833.05	Flow Area (sq ft)	154.70	64.84	162.88
E.G. Slope (ft/ft)	0.004301	Area (sq ft)	154.70	64.84	162.88
Q Total (cfs)	1208.00	Flow (cfs)	343.53	628.26	236.21
Top Width (ft)	249.70	Top Width (ft)	76.58	20.00	153.12
Vel Total (ft/s)	3.16	Avg. Vel. (ft/s)	2.22	9.69	1.45
Max Chl Dpth (ft)	3.25	Hydr. Depth (ft)	2.02	3.24	1.06
Conv. Total (cfs)	18420.7	Conv. (cfs)	5238.5	9580.2	3602.0
Length Wtd. (ft)	75.00	Wetted Per. (ft)	76.78	20.04	153.19
Min Ch El (ft)	2829.80	Shear (lb/sq ft)	0.54	0.87	0.29
Alpha	5.08	Stream Power (lb/ft s)	1.20	8.42	0.41
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)	3.18	6.04	7.32
C & E Loss (ft)	0.09	Cum SA (acres)	3.77	3.05	7.83

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2220

INPUT
Description: AP1
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2831	50	2830.5	90	2830	165	2829	225	2829.5
253	2830	300	2831	347	2832	380	2833	412	2834
447	2835								

Manning's n Values num= 1

Sta	n Val
0	.016

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
90	253	40	40	40	.1	.3

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Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	43		T

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2831.15	Element			
Vel Head (ft)	0.49	Wt. n-Val.	0.016	0.016	0.016
W.S. Elev (ft)	2830.66	Reach Len. (ft)	40.00	40.00	40.00
Crit W.S. (ft)	2830.66	Flow Area (sq ft)	17.48	197.78	10.37
E.G. Slope (ft/ft)	0.002962	Area (sq ft)	17.92	197.78	10.37
Q Total (cfs)	1208.00	Flow (cfs)	45.68	1137.19	25.14
Top Width (ft)	250.65	Top Width (ft)	56.43	163.00	31.22
Vel Total (ft/s)	5.35	Avg. Vel. (ft/s)	2.61	5.75	2.42
Max Chl Dpth (ft)	1.66	Hydr. Depth (ft)	0.37	1.21	0.33
Conv. Total (cfs)	22195.9	Conv. (cfs)	839.3	20894.8	461.9
Length Wtd. (ft)	40.00	Wetted Per. (ft)	47.00	163.01	31.23
Min Ch El (ft)	2829.00	Shear (lb/sq ft)	0.07	0.22	0.06
Alpha	1.10	Stream Power (lb/ft s)	0.18	1.29	0.15
Frctn Loss (ft)	0.17	Cum Volume (acre-ft)	3.03	5.81	7.17
C & E Loss (ft)	0.04	Cum SA (acres)	3.65	2.89	7.67

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2180

INPUT
Description: AP
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2831.1	40	2831	52	2831	72	2830	85	2829
106	2828	118	2827	128	2827	148	2828	155	2829
225	2829.5	243	2830	320	2830	352	2831	392	2832
422	2833	440	2834						

Manning's n Values num= 2

Sta	n Val	Sta	n Val
0	.028	148	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
106	148	34	34	34	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2830.88	Element			
Vel Head (ft)	0.90	Wt. n-Val.	0.028	0.028	0.060
W.S. Elev (ft)	2829.98	Reach Len. (ft)	34.00	34.00	34.00
Crit W.S. (ft)	2829.98	Flow Area (sq ft)	37.41	109.27	65.86
E.G. Slope (ft/ft)	0.007073	Area (sq ft)	37.41	109.27	65.86
Q Total (cfs)	1208.00	Flow (cfs)	178.55	921.59	107.86
Top Width (ft)	170.15	Top Width (ft)	33.77	42.00	94.38
Vel Total (ft/s)	5.68	Avg. Vel. (ft/s)	4.77	8.43	1.64
Max Chl Dpth (ft)	2.98	Hydr. Depth (ft)	1.11	2.60	0.70
Conv. Total (cfs)	14363.3	Conv. (cfs)	2123.0	10957.9	1282.5
Length Wtd. (ft)	34.00	Wetted Per. (ft)	33.84	42.07	94.46
Min Ch El (ft)	2827.00	Shear (lb/sq ft)	0.49	1.15	0.31
Alpha	1.79	Stream Power (lb/ft s)	2.33	9.67	0.50
Frctn Loss (ft)	0.22	Cum Volume (acre-ft)	3.00	5.67	7.13
C & E Loss (ft)	0.09	Cum SA (acres)	3.61	2.80	7.61

Warning: The energy equation could not be balanced within the specified number of iterations. The

program used critical depth for the water surface and continued on with the calculations.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2146

INPUT
Description:
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2832	23	2830	38	2829	60	2827	73	2826.5
88	2827	98	2828	118	2828.8	150	2828.1	195	2828.6
215	2828	260	2829	290	2830	331	2831	361	2832
384	2833	402	2834						

Manning's n Values num= 2

Sta	n Val	Sta	n Val
0	.028	88	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
60	88	230	210	180	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2830.12	Element			
Vel Head (ft)	0.61	Wt. n-Val.	0.028	0.028	0.060
W.S. Elev (ft)	2829.51	Reach Len. (ft)	230.00	210.00	180.00
Crit W.S. (ft)	2829.51	Flow Area (sq ft)	35.09	77.21	201.46
E.G. Slope (ft/ft)	0.006177	Area (sq ft)	35.09	77.21	201.46
Q Total (cfs)	1208.00	Flow (cfs)	163.51	632.89	411.60
Top Width (ft)	244.83	Top Width (ft)	29.61	28.00	187.22
Vel Total (ft/s)	3.85	Avg. Vel. (ft/s)	4.66	8.20	2.04
Max Chl Dpth (ft)	3.01	Hydr. Depth (ft)	1.19	2.76	1.08
Conv. Total (cfs)	15370.7	Conv. (cfs)	2080.5	8053.0	5237.3
Length Wtd. (ft)	207.43	Wetted Per. (ft)	29.72	28.02	187.32
Min Ch El (ft)	2826.50	Shear (lb/sq ft)	0.46	1.06	0.41
Alpha	2.67	Stream Power (lb/ft s)	2.12	8.71	0.85
Frctn Loss (ft)	1.55	Cum Volume (acre-ft)	2.97	5.60	7.03
C & E Loss (ft)	0.03	Cum SA (acres)	3.59	2.77	7.50

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2000

INPUT
Description:
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2835	.1	2831	50	2830	98	2828	170	2826
220	2824.5	225	2823.2	245	2823.2	248	2824	260	2826
295	2828	390	2830	420	2832				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	225	.025	245	.06

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

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220	248	100	135	150	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2827.82	Element			
Vel Head (ft)	0.93	Wt. n-Val.	0.060	0.037	0.060
W.S. Elev (ft)	2826.89	Reach Len. (ft)	100.00	135.00	150.00
Crit W.S. (ft)	2826.89	Flow Area (sq ft)	95.87	98.74	29.48
E.G. Slope (ft/ft)	0.009274	Area (sq ft)	95.87	98.74	29.48
Q Total (cfs)	1208.00	Flow (cfs)	253.94	880.74	73.32
Top Width (ft)	137.36	Top Width (ft)	81.87	28.00	27.49
Vel Total (ft/s)	5.39	Avg. Vel. (ft/s)	2.65	8.92	2.49
Max Chl Dpth (ft)	3.69	Hydr. Depth (ft)	1.17	3.53	1.07
Conv. Total (cfs)	12544.2	Conv. (cfs)	2637.0	9145.9	761.4
Length Wtd. (ft)	129.93	Wetted Per. (ft)	81.90	28.27	27.68
Min Ch El (ft)	2823.20	Shear (lb/sq ft)	0.68	2.02	0.62
Alpha	2.06	Stream Power (lb/ft s)	1.79	18.04	1.53
Frctn Loss (ft)	1.40	Cum Volume (acre-ft)	2.63	5.17	6.55
C & E Loss (ft)	0.01	Cum SA (acres)	3.29	2.63	7.06

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 1865

INPUT
Description: AO
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2835	.1	2829	35	2828	105	2826	173	2824
203	2822	207	2821.5	222	2821.5	242	2822	252	2824
273	2826	292	2828	335	2830	360	2830.5		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	207	.025	222	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
203	242	375	400	440	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2825.61	Element			
Vel Head (ft)	1.06	Wt. n-Val.	0.060	0.038	0.060
W.S. Elev (ft)	2824.55	Reach Len. (ft)	375.00	400.00	440.00
Crit W.S. (ft)	2824.55	Flow Area (sq ft)	51.43	112.78	17.02
E.G. Slope (ft/ft)	0.012600	Area (sq ft)	51.43	112.78	17.02
Q Total (cfs)	1208.00	Flow (cfs)	148.42	1010.18	49.40
Top Width (ft)	103.28	Top Width (ft)	48.55	39.00	15.73
Vel Total (ft/s)	6.67	Avg. Vel. (ft/s)	2.89	8.96	2.90
Max Chl Dpth (ft)	3.05	Hydr. Depth (ft)	1.06	2.89	1.08
Conv. Total (cfs)	10761.8	Conv. (cfs)	1322.2	8999.5	440.1
Length Wtd. (ft)	398.11	Wetted Per. (ft)	48.63	39.04	15.95
Min Ch El (ft)	2821.50	Shear (lb/sq ft)	0.83	2.27	0.84
Alpha	1.54	Stream Power (lb/ft s)	2.40	20.36	2.44
Frctn Loss (ft)	4.59	Cum Volume (acre-ft)	2.46	4.84	6.47
C & E Loss (ft)	0.11	Cum SA (acres)	3.14	2.53	6.98

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross

section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 1465

INPUT
Description: AN
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2827	.1	2821	15	2820	65	2818.2	95	2819
133	2819	180	2818	199	2816.3	240	2816.3	242	2818
248	2820	290	2822	290.1	2828				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	199	.028	240	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
180	242	280	290	320	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	133	2819	F

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2819.89	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.68	Wt. n-Val.	0.060	0.042	0.080
W.S. Elev (ft)	2819.21	Reach Len. (ft)	280.00	290.00	320.00
Crit W.S. (ft)	2819.21	Flow Area (sq ft)	74.09	162.69	2.20
E.G. Slope (ft/ft)	0.010624	Area (sq ft)	74.09	162.69	2.20
Q Total (cfs)	1256.00	Flow (cfs)	121.92	1131.16	2.92
Top Width (ft)	208.75	Top Width (ft)	143.11	62.00	3.64
Vel Total (ft/s)	5.26	Avg. Vel. (ft/s)	1.65	6.95	1.32
Max Chl Dpth (ft)	2.91	Hydr. Depth (ft)	0.52	2.62	0.61
Conv. Total (cfs)	12185.8	Conv. (cfs)	1182.9	10974.6	28.3
Length Wtd. (ft)	292.12	Wetted Per. (ft)	143.15	62.70	3.83
Min Ch El (ft)	2816.30	Shear (lb/sq ft)	0.34	1.72	0.38
Alpha	1.59	Stream Power (lb/ft s)	0.56	11.97	0.50
Frctn Loss (ft)	3.55	Cum Volume (acre-ft)	1.92	3.58	6.37
C & E Loss (ft)	0.06	Cum SA (acres)	2.32	2.07	6.89

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 1175

INPUT
Description: AM
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2824	.1	2818	50	2814	60	2813	69	2814
90	2814.5	108	2814	170	2812.7	197	2812.7	222	2813.9
238	2813.9	288	2813.3	323	2814	410	2816	410.1	2822

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	170	.022	197	.06

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Exist Topo with TSMS Future Flow

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
108	222	365	360	360	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2815.02	Element			
Vel Head (ft)	0.47	Wt. n-Val.	0.060	0.036	0.060
W.S. Elev (ft)	2814.55	Reach Len. (ft)	365.00	360.00	360.00
Crit W.S. (ft)	2814.55	Flow Area (sq ft)	33.65	155.81	96.20
E.G. Slope (ft/ft)	0.013999	Area (sq ft)	33.65	155.81	96.20
Q Total (cfs)	1256.00	Flow (cfs)	63.56	955.73	236.71
Top Width (ft)	303.88	Top Width (ft)	64.88	114.00	125.00
Vel Total (ft/s)	4.40	Avg. Vel. (ft/s)	1.89	6.13	2.46
Max Chl Dpth (ft)	1.85	Hydr. Depth (ft)	0.52	1.37	0.77
Conv. Total (cfs)	10615.3	Conv. (cfs)	537.2	8077.6	2000.6
Length Wtd. (ft)	360.15	Wetted Per. (ft)	65.02	114.04	125.02
Min Ch El (ft)	2812.70	Shear (lb/sq ft)	0.45	1.19	0.67
Alpha	1.55	Stream Power (lb/ft s)	0.85	7.32	1.65
Frctn Loss (ft)	4.85	Cum Volume (acre-ft)	1.57	2.52	6.01
C & E Loss (ft)	0.00	Cum SA (acres)	1.65	1.48	6.41

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 815

INPUT
Description: AL
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2816	.1	2810	92	2808	112	2807	140	2807
150	2808	212	2808	232	2807	262	2808	315	2806.8
365	2808	382	2814						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	112	.022	140	.06	315	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
92	150	390	390	420	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2809.15	Element			
Vel Head (ft)	0.49	Wt. n-Val.	0.060	0.029	0.065
W.S. Elev (ft)	2808.67	Reach Len. (ft)	390.00	390.00	420.00
Crit W.S. (ft)	2808.67	Flow Area (sq ft)	10.20	81.64	230.67
E.G. Slope (ft/ft)	0.012970	Area (sq ft)	10.20	81.64	230.67
Q Total (cfs)	1256.00	Flow (cfs)	13.82	613.55	628.63
Top Width (ft)	305.50	Top Width (ft)	30.61	58.00	216.89
Vel Total (ft/s)	3.89	Avg. Vel. (ft/s)	1.36	7.51	2.73
Max Chl Dpth (ft)	1.87	Hydr. Depth (ft)	0.33	1.41	1.06
Conv. Total (cfs)	11028.7	Conv. (cfs)	121.4	5387.4	5519.9
Length Wtd. (ft)	403.59	Wetted Per. (ft)	30.62	58.07	217.07
Min Ch El (ft)	2807.00	Shear (lb/sq ft)	0.27	1.14	0.86
Alpha	2.07	Stream Power (lb/ft s)	0.37	8.55	2.34
Frctn Loss (ft)	3.18	Cum Volume (acre-ft)	1.39	1.54	4.66
C & E Loss (ft)	0.00	Cum SA (acres)	1.25	0.77	5.00

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 425

INPUT
Description: AK
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2803	10	2802	72	2800	73	2799.2	105	2799.2
115	2800	150	2801	180	2800	270	2800.5	350	2801.3
410	2799.9	425	2802	430	2802.2				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	72	.025	150	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
72	115	450	425	405	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2802.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.49	Wt. n-Val.	0.080	0.025	0.063
W.S. Elev (ft)	2801.54	Reach Len. (ft)	450.00	425.00	405.00
Crit W.S. (ft)	2801.54	Flow Area (sq ft)	36.61	96.09	299.94
E.G. Slope (ft/ft)	0.005276	Area (sq ft)	36.61	96.09	299.94
Q Total (cfs)	1256.00	Flow (cfs)	41.42	705.61	508.97
Top Width (ft)	397.33	Top Width (ft)	47.64	43.00	306.69
Vel Total (ft/s)	2.90	Avg. Vel. (ft/s)	1.13	7.34	1.70
Max Chl Dpth (ft)	2.34	Hydr. Depth (ft)	0.77	2.23	0.98
Conv. Total (cfs)	17292.1	Conv. (cfs)	570.3	9714.5	7007.3
Length Wtd. (ft)	425.55	Wetted Per. (ft)	47.67	43.31	306.86
Min Ch El (ft)	2799.20	Shear (lb/sq ft)	0.25	0.73	0.32
Alpha	3.74	Stream Power (lb/ft s)	0.29	5.37	0.55
Frctn Loss (ft)	2.83	Cum Volume (acre-ft)	1.18	0.74	2.10
C & E Loss (ft)	0.00	Cum SA (acres)	0.90	0.32	2.48

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 0

INPUT
Description: AJ
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2798	21	2794	31	2793	144	2793	145	2792
165	2792	166	2793	197	2794	240	2794	276	2793.3
300	2794	332	2794.3	365	2794	420	2795.2		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	31	.06	145	.022	165	.08

Bank Sta: Left Right Coeff Contr. Expan.

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144 166 .1 .3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2795.07	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.48	Wt. n-Val.	0.061	0.030	0.080
W.S. Elev (ft)	2794.59	Reach Len. (ft)			
Crit W.S. (ft)	2794.59	Flow Area (sq ft)	191.68	56.01	152.49
E.G. Slope (ft/ft)	0.008634	Area (sq ft)	191.68	56.01	152.49
Q Total (cfs)	1256.00	Flow (cfs)	583.14	470.50	202.36
Top Width (ft)	374.22	Top Width (ft)	126.11	22.00	226.11
Vel Total (ft/s)	3.14	Avg. Vel. (ft/s)	3.04	8.40	1.33
Max Chl Dpth (ft)	2.59	Hydr. Depth (ft)	1.52	2.55	0.67
Conv. Total (cfs)	13517.0	Conv. (cfs)	6275.7	5063.5	2177.8
Length Wtd. (ft)		Wetted Per. (ft)	126.21	22.83	226.16
Min Ch El (ft)	2792.00	Shear (lb/sq ft)	0.82	1.32	0.36
Alpha	3.15	Stream Power (lb/ft s)	2.49	11.11	0.48
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth). Water surface set to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

SUMMARY OF MANNING'S N VALUES

River:Este Wash

Reach	River Sta.	n1	n2	n3	n4	n5
1	4085	.08	.022	.06		
1	3810	.06	.022	.06		
1	3640	.06	.022	.08		
1	3490	.08	.06	.022	.06	
1	3350	.08	.06	.028	.06	
1	3230	.08	.025	.08		
1	3160	.08	.025	.08		
1	3125	.08	.025	.08		
1	3050	.016				
1	2975	.06	.025	.06	.025	.06
1	2795	.06	.028	.06		
1	2495	.04	.016	.06	.025	.06
1	2340	.06	.025	.06		
1	2295	.07	.022	.07		
1	2220	.016				
1	2180	.028	.06			
1	2146	.028	.06			
1	2000	.06	.025	.06		
1	1865	.06	.025	.06		
1	1465	.06	.028	.08		
1	1175	.06	.022	.06		
1	815	.06	.022	.06	.08	
1	425	.08	.025	.08		
1	0	.08	.06	.022	.08	

SUMMARY OF REACH LENGTHS

River: Este Wash

Reach	River Sta.	Left	Channel	Right
1	4085	250	275	260
1	3810	155	170	180
1	3640	90	150	205
1	3490	90	140	190
1	3350	135	120	115
1	3230	100	70	55
1	3160	35	35	35

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1	3125	75	75	75
1	3050	75	75	75
1	2975	270	180	110
1	2795	360	300	250
1	2495	175	155	130
1	2340	60	45	20
1	2295	75	75	75
1	2220	40	40	40
1	2180	34	34	34
1	2146	230	210	180
1	2000	100	135	150
1	1865	375	400	440
1	1465	280	290	320
1	1175	365	360	360
1	815	390	390	420
1	425	450	425	405
1	0			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Este Wash

Reach	River Sta.	Contr.	Expan.
1	4085	.1	.3
1	3810	.1	.3
1	3640	.1	.3
1	3490	.1	.3
1	3350	.1	.3
1	3230	.1	.3
1	3160	.1	.3
1	3125	.1	.3
1	3050	.1	.3
1	2975	.1	.3
1	2795	.1	.3
1	2495	.1	.3
1	2340	.1	.3
1	2295	.1	.3
1	2220	.1	.3
1	2180	.1	.3
1	2146	.1	.3
1	2000	.1	.3
1	1865	.1	.3
1	1465	.1	.3
1	1175	.1	.3
1	815	.1	.3
1	425	.1	.3
1	0	.1	.3

PB Proj. No. 11515
Este Wash
Exist Topo with TSMS Future Flow
Profile Output Table - Standard Table 1

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	4085	1208.00	2856.40	2858.91	2858.91	2859.46	0.016871	8.56	264.41	204.54	0.99
1	3810	1208.00	2852.70	2855.16	2855.16	2855.72	0.009011	7.27	291.76	239.26	0.90
1	3640	1208.00	2850.80	2852.23	2852.13	2852.63	0.016894	7.43	286.31	264.15	1.22
1	3490	1208.00	2849.20	2850.41	2850.21	2850.64	0.017833	5.70	356.33	397.32	1.02
1	3350	1208.00	2847.60	2848.58		2848.73	0.010262	2.44	428.48	408.97	0.46
1	3230	1208.00	2845.50	2847.12		2847.35	0.012892	5.82	395.20	300.40	0.84
1	3160	1208.00	2843.50	2845.85	2845.85	2846.53	0.007847	8.77	354.72	251.42	1.05
1	3125	1208.00	2842.80	2845.05	2845.05	2845.60	0.021583	6.74	260.22	236.88	0.94
1	3050	1208.00	2842.30	2843.88	2843.88	2844.43	0.003019	6.15	211.67	273.17	0.94
1	2975	1208.00	2839.60	2842.31	2842.31	2843.05	0.006658	9.31	305.32	205.09	1.00
1	2795	1208.00	2836.50	2839.00	2839.00	2839.70	0.007319	7.30	244.49	206.57	0.90
1	2495	1208.00	2832.50	2835.11	2835.11	2835.79	0.008200	7.69	268.23	217.80	0.93
1	2340	1208.00	2830.80	2833.58		2834.08	0.005129	8.36	330.41	171.93	0.89
1	2295	1208.00	2829.80	2833.05	2833.05	2833.84	0.004301	9.69	382.42	249.70	0.95
1	2220	1208.00	2829.00	2830.66	2830.66	2831.15	0.002962	5.75	225.63	250.65	0.92
1	2180	1208.00	2827.00	2829.98	2829.98	2830.88	0.007073	8.43	212.54	170.15	0.92
1	2146	1208.00	2826.50	2829.51	2829.51	2830.12	0.006177	8.20	313.76	244.83	0.87
1	2000	1208.00	2823.20	2826.89	2826.89	2827.82	0.009274	8.92	224.09	137.36	0.84
1	1865	1208.00	2821.50	2824.55	2824.55	2825.61	0.012600	8.96	181.23	103.28	0.93
1	1465	1256.00	2816.30	2819.21	2819.21	2819.89	0.010624	6.95	238.98	208.75	0.76
1	1175	1256.00	2812.70	2814.55	2814.55	2815.02	0.013999	6.13	285.66	303.88	0.92
1	815	1256.00	2807.00	2808.67	2808.67	2809.15	0.012970	7.51	322.51	305.50	1.12
1	425	1256.00	2799.20	2801.54	2801.54	2802.03	0.005276	7.34	432.64	397.33	0.87
1	0	1256.00	2792.00	2794.59	2794.59	2795.07	0.008634	8.40	400.18	374.22	0.93

PB Proj. No. 11515
Este Wash
Exist Topo with TSMS Future Flow

Profile Output Table - Standard Table 2

Reach	River Sta	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
1	4085	2859.46	2858.91	0.55	3.20	0.00	2.89	456.58	748.53	204.54
1	3810	2855.72	2855.16	0.56	1.95	0.04	426.41	773.34	8.26	239.26
1	3640	2852.63	2852.23	0.41	1.94	0.05	823.11	377.14	7.75	264.15
1	3490	2850.64	2850.41	0.23	1.88	0.03	846.28	222.77	138.94	397.32
1	3350	2848.73	2848.58	0.14	1.38	0.01	130.36	143.43	934.21	408.97
1	3230	2847.35	2847.12	0.23	0.77	0.05	395.39	352.61	460.00	300.40
1	3160	2846.53	2845.85	0.68	0.43	0.04	499.50	660.77	47.73	251.42
1	3125	2845.60	2845.05	0.55	0.48	0.00	276.54	908.96	22.50	236.88
1	3050	2844.43	2843.88	0.55	0.32	0.02	73.06	1098.23	36.71	273.17
1	2975	2843.05	2842.31	0.74	1.29	0.01	385.95	620.89	201.16	205.09
1	2795	2839.70	2839.00	0.70	2.30	0.01	30.32	1015.90	161.79	206.57
1	2495	2835.79	2835.11	0.68	0.99	0.05	154.60	873.04	180.36	217.80
1	2340	2834.08	2833.58	0.50	0.21	0.03	446.98	482.88	278.14	171.93
1	2295	2833.84	2833.05	0.79	0.27	0.09	343.53	628.26	236.21	249.70
1	2220	2831.15	2830.66	0.49	0.17	0.04	45.68	1137.19	25.14	250.65
1	2180	2830.88	2829.98	0.90	0.22	0.09	178.55	921.59	107.86	170.15
1	2146	2830.12	2829.51	0.61	1.55	0.03	163.51	632.89	411.60	244.83
1	2000	2827.82	2826.89	0.93	1.40	0.01	253.94	880.74	73.32	137.36
1	1865	2825.61	2824.55	1.06	4.59	0.11	148.42	1010.18	49.40	103.28
1	1465	2819.89	2819.21	0.68	3.55	0.06	121.92	1131.16	2.92	208.75
1	1175	2815.02	2814.55	0.47	4.85	0.00	63.56	955.73	236.71	303.88
1	815	2809.15	2808.67	0.49	3.18	0.00	13.82	613.55	628.63	305.50
1	425	2802.03	2801.54	0.49	2.83	0.00	41.42	705.61	508.97	397.33
1	0	2795.07	2794.59	0.48			583.14	470.50	202.36	374.22

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : Exst TSMS

River: Este Wash Reach: 1 RS: 4085 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The cross-section end points had to be extended vertically for the computed water surface.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.
River: Este Wash Reach: 1 RS: 3810 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated

water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 3640 Profile: PF 1

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

River: Este Wash Reach: 1 RS: 3490 Profile: PF 1

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

River: Este Wash Reach: 1 RS: 3350 Profile: PF 1

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

River: Este Wash Reach: 1 RS: 3160 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.

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.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 3125 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

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.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 3050 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

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.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2975 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2795 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The

program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2495 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2340 Profile: PF 1

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

River: Este Wash Reach: 1 RS: 2295 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2220 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.

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.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2180 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2146 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2000 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

Note: Manning's n values were composited to a single value in the main channel.

River: Este Wash Reach: 1 RS: 1865 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate

the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 1465 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

Note: Manning's n values were composited to a single value in the main channel.

River: Este Wash Reach: 1 RS: 1175 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 815 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

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.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 425 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 0 Profile: PF 1

Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth). Water surface set to critical depth.

Note: Manning's n values were composited to a single value in the main channel.

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Profile Output Table - Standard Table 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	4085	PF 1	1208.00	2856.40	2858.91	2858.91	2859.46	0.016871	8.56	264.41	204.54	0.99
1	3810	PF 1	1208.00	2852.70	2855.16	2855.16	2855.72	0.008987	7.26	292.05	239.27	0.89
1	3640	PF 1	1208.00	2850.80	2852.24	2852.13	2852.64	0.016149	7.32	290.70	264.82	1.19
1	3490	PF 1	1208.00	2849.20	2850.38	2850.21	2850.63	0.019434	5.87	345.87	395.75	1.06
1	3350	PF 1	1208.00	2847.60	2848.59	2848.19	2848.74	0.010184	4.17	429.58	409.06	0.89
1	3230	PF 1	1208.00	2845.50	2847.12	2846.73	2847.35	0.012892	5.82	395.20	300.40	0.84
1	3160	PF 1	1208.00	2843.50	2845.85	2845.85	2846.53	0.007847	8.77	354.72	251.42	1.05
1	3125	PF 1	1208.00	2842.80	2845.05	2845.05	2845.60	0.021583	6.74	260.22	236.88	0.94
1	3050	PF 1	1208.00	2842.30	2843.88	2843.88	2844.43	0.003019	6.15	211.67	273.17	0.94
1	2975	PF 1	1208.00	2839.60	2842.31	2842.31	2843.05	0.006658	9.31	305.32	205.09	1.00
1	2795	PF 1	1208.00	2836.50	2839.00	2839.00	2839.70	0.007319	7.30	244.49	206.57	0.90
1	2495	PF 1	1208.00	2832.50	2835.11	2835.11	2835.79	0.008200	7.69	268.23	217.80	0.93
1	2340	PF 1	1208.00	2830.80	2833.58	2833.26	2834.08	0.005129	8.36	330.41	171.93	0.89
1	2295	PF 1	1208.00	2829.80	2833.05	2833.05	2833.84	0.004301	9.69	382.42	249.70	0.95
1	2220	PF 1	1208.00	2829.00	2830.66	2830.66	2831.15	0.002962	5.75	225.63	250.65	0.92
1	2180	PF 1	1208.00	2827.00	2829.98	2829.98	2830.88	0.007073	8.43	212.54	170.15	0.92
1	2146	PF 1	1208.00	2826.50	2829.51	2829.51	2830.12	0.006177	8.20	313.76	244.83	0.87
1	2000	PF 1	1208.00	2823.20	2826.89	2826.89	2827.82	0.009274	8.92	224.09	137.36	0.84
1	1865	PF 1	1208.00	2821.50	2824.55	2824.55	2825.61	0.012600	8.96	181.23	103.28	0.93
1	1465	PF 1	1256.00	2816.30	2819.21	2819.21	2819.89	0.010624	6.95	238.98	208.75	0.76
1	1175	PF 1	1256.00	2812.70	2814.55	2814.55	2815.02	0.013999	6.13	285.66	303.88	0.92
1	815	PF 1	1256.00	2807.00	2808.67	2808.67	2809.15	0.012970	7.51	322.51	305.50	1.12
1	425	PF 1	1256.00	2799.20	2801.54	2801.54	2802.03	0.005276	7.34	432.64	397.33	0.87

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1	0	PF 1	1256.00	2792.00	2794.59	2794.59	2795.07	0.008634	8.40	400.18
374.22	0.93									

Profile Output Table - Standard Table 2

Reach	River Sta	Profile	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
1	4085	PF 1	2859.46	2858.91	0.55	3.19	0.00	2.89	456.58	748.53	204.54
1	3810	PF 1	2855.72	2855.16	0.55	1.91	0.05	426.70	773.03	8.27	239.27
1	3640	PF 1	2852.64	2852.24	0.39	1.97	0.05	823.20	376.53	8.27	264.82
1	3490	PF 1	2850.63	2850.38	0.24	1.87	0.03	852.69	223.12	132.19	395.75
1	3350	PF 1	2848.74	2848.59	0.15	1.39	0.01	256.33	149.01	802.66	409.06
1	3230	PF 1	2847.35	2847.12	0.23	0.77	0.05	395.39	352.61	460.00	300.40
1	3160	PF 1	2846.53	2845.85	0.68	0.43	0.04	499.50	660.77	47.73	251.42
1	3125	PF 1	2845.60	2845.05	0.55	0.48	0.00	276.54	908.96	22.50	236.88
1	3050	PF 1	2844.43	2843.88	0.55	0.32	0.02	73.06	1098.23	36.71	273.17
1	2975	PF 1	2843.05	2842.31	0.74	1.29	0.01	385.95	620.89	201.16	205.09
1	2795	PF 1	2839.70	2839.00	0.70	2.30	0.01	30.32	1015.90	161.79	206.57
1	2495	PF 1	2835.79	2835.11	0.68	0.99	0.05	154.60	873.04	180.36	217.80
1	2340	PF 1	2834.08	2833.58	0.50	0.21	0.03	446.98	482.88	278.14	171.93
1	2295	PF 1	2833.84	2833.05	0.79	0.27	0.09	343.53	628.26	236.21	249.70
1	2220	PF 1	2831.15	2830.66	0.49	0.17	0.04	45.68	1137.19	25.14	250.65
1	2180	PF 1	2830.88	2829.98	0.90	0.22	0.09	178.55	921.59	107.86	170.15
1	2146	PF 1	2830.12	2829.51	0.61	1.55	0.03	163.51	632.89	411.60	244.83
1	2000	PF 1	2827.82	2826.89	0.93	1.40	0.01	253.94	880.74	73.32	137.36
1	1865	PF 1	2825.61	2824.55	1.06	4.59	0.11	148.42	1010.18	49.40	103.28
1	1465	PF 1	2819.89	2819.21	0.68	3.55	0.06	121.92	1131.16	2.92	208.75
1	1175	PF 1	2815.02	2814.55	0.47	4.85	0.00	63.56	955.73	236.71	303.88
1	815	PF 1	2809.15	2808.67	0.49	3.18	0.00	13.82	613.55	628.63	305.50
1	425	PF 1	2802.03	2801.54	0.49	2.83	0.00	41.42	705.61	508.97	397.33
1	0	PF 1	2795.07	2794.59	0.48			583.14	470.50	202.36	374.22

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ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : Exst TSMS

River: Este Wash Reach: 1 RS: 4085 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The cross-section end points had to be extended vertically for the computed water surface.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.
River: Este Wash Reach: 1 RS: 3810 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: Este Wash Reach: 1 RS: 3640 Profile: PF 1
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Este Wash Reach: 1 RS: 3490 Profile: PF 1
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Este Wash Reach: 1 RS: 3350 Profile: PF 1
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Este Wash Reach: 1 RS: 3160 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: Este Wash Reach: 1 RS: 3125 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: Este Wash Reach: 1 RS: 3050 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate

the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2975 Profile: PF 1

Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2795 Profile: PF 1

Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2495 Profile: PF 1

Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2340 Profile: PF 1

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

River: Este Wash Reach: 1 RS: 2295 Profile: PF 1

Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2220 Profile: PF 1

Warning:The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.

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.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2180 Profile: PF 1

Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2146 Profile: PF 1

Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth

for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2000 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

River: Este Wash Reach: 1 RS: 1865 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 1465 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

River: Este Wash Reach: 1 RS: 1175 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 815 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 425 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate

the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 0 Profile: PF 1

Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth). Water surface set to critical depth.

Note: Manning's n values were composited to a single value in the main channel.

PB Proj. No. 11515
Este Wash
Exist Topo with FEMA Flow

```
                    HEC-RAS Version 3.1.3 May 2005
                     U.S. Army Corp 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: Este Wash New Topo HEC2
Project File : EWHEC2TSMS.prj
Run Date and Time: 9/2/2008 2:34:50 PM

Project in English units

Project Description:
88151-02-39
FIS City of Tucson
ESTE WASH
Imported FEMA
Geometry File: .g01
Imported FEMA Geometry File Adjusted Vertically by +2.23
ft to account for Vertical Datum Change: .g02

New Existing Conditions
Geometry File (Project 1' C.I. Topo with PAG 1999 2' C.I. Topo): .g06
Proposed
Conditions Geometry File (3-10'x6' RCBC's at Houghton Rd and 22nd St
crossings): ,g07
Proposed Conditions Geometry File (4-10'x6' RCBC's at
Houghton Rd and 22nd St crossings): ,g05

PLAN DATA

Plan Title: Existing Cond Topo with FEMA Flow
Plan File : 1:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2TSMS.p03

Geometry Title: New Existing Geom
Geometry File : 1:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2TSMS.g06

Flow Title : FEMA Flow
Flow File : 1:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2TSMS.f01

Plan Summary Information:

Number of:	Cross Sections =	24	Multiple Openings =	0
	Culverts =	0	Inline Structures =	0
	Bridges =	0	Lateral Structures =	0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed at all cross sections
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

PB Proj. No. 11515
Este Wash
Exist Topo with FEMA Flow

FLOW DATA

Flow Title: FEMA Flow
Flow File : 1:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2TSMS.f01

Flow Data (cfs)

River	Reach	RS	PF 1
Este Wash	1	4085	1974

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Este Wash	1	PF 1	Normal S = 0.0133	Normal S = 0.0133

GEOMETRY DATA

Geometry Title: New Existing Geom
Geometry File : 1:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2TSMS.g06

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 4085

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2862.5	9	2862	20	2860	30	2858	33	2856.4
50	2856.4	53	2857.7	80	2857.7	116	2858	127	2857.7
142	2858.1	159	2857.3	173	2857.7	209	2857.5	230	2858

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	33	.022	50	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
30	53	250	275	260	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2860.08	Element			
Vel Head (ft)	0.75	Wt. n-Val.	0.080	0.039	0.060
W.S. Elev (ft)	2859.33	Reach Len. (ft)	250.00	275.00	260.00
Crit W.S. (ft)	2859.33	Flow Area (sq ft)	4.41	63.01	283.57
E.G. Slope (ft/ft)	0.019136	Area (sq ft)	4.41	63.01	283.57
Q Total (cfs)	1974.00	Flow (cfs)	8.52	642.22	1323.26
Top Width (ft)	206.64	Top Width (ft)	6.64	23.00	177.00
Vel Total (ft/s)	5.62	Avg. Vel. (ft/s)	1.93	10.19	4.67
Max Chl Dpth (ft)	2.93	Hydr. Depth (ft)	0.66	2.74	1.60
Conv. Total (cfs)	14269.9	Conv. (cfs)	61.6	4642.6	9565.8
Length Wtd. (ft)	264.57	Wetted Per. (ft)	6.77	23.67	178.37
Min Ch El (ft)	2856.40	Shear (lb/sq ft)	0.78	3.18	1.90
Alpha	1.53	Stream Power (lb/ft s)	1.50	32.41	8.86
Frctn Loss (ft)	3.65	Cum Volume (acre-ft)	12.85	12.17	16.13
C & E Loss (ft)	0.01	Cum SA (acres)	9.75	5.14	12.69

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross

section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3810

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2856	8	2854.5	116	2854	150	2854	169	2853.8
183	2854.1	200	2852.7	220	2852.7	235	2854	250	2856
250.1	2862								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	200	.022	220	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
183	235	155	170	180	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2856.33	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.73	Wt. n-Val.	0.060	0.032	0.060
W.S. Elev (ft)	2855.60	Reach Len. (ft)	155.00	170.00	180.00
Crit W.S. (ft)	2855.60	Flow Area (sq ft)	259.24	129.27	9.63
E.G. Slope (ft/ft)	0.010418	Area (sq ft)	259.24	129.27	9.63
Q Total (cfs)	1974.00	Flow (cfs)	832.69	1120.44	20.87
Top Width (ft)	244.90	Top Width (ft)	180.88	52.00	12.02
Vel Total (ft/s)	4.96	Avg. Vel. (ft/s)	3.21	8.67	2.17
Max Chl Dpth (ft)	2.90	Hydr. Depth (ft)	1.43	2.49	0.80
Conv. Total (cfs)	19339.6	Conv. (cfs)	8158.0	10977.2	204.5
Length Wtd. (ft)	161.87	Wetted Per. (ft)	180.99	52.11	12.12
Min Ch El (ft)	2852.70	Shear (lb/sq ft)	0.93	1.61	0.52
Alpha	1.91	Stream Power (lb/ft s)	2.99	13.98	1.12
Frctn Loss (ft)	2.15	Cum Volume (acre-ft)	12.10	11.56	15.25
C & E Loss (ft)	0.05	Cum SA (acres)	9.21	4.90	12.13

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3640

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2854	15	2852	38	2851	126	2850.6	173	2851.2
205	2851.8	218	2850.8	238	2850.8	249	2851.8	270	2852
336	2854	360	2856	385	2858	410	2860	495	2862

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	218	.022	238	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
205	249	90	150	205	.1	.3

PB Proj. No. 11515
Este Wash
Exist Topo with FEMA Flow

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2853.19	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.56	Wt. n-Val.	0.060	0.030	0.080
W.S. Elev (ft)	2852.62	Reach Len. (ft)	90.00	150.00	205.00
Crit W.S. (ft)	2852.51	Flow Area (sq ft)	304.77	68.24	21.62
E.G. Slope (ft/ft)	0.017438	Area (sq ft)	304.77	68.24	21.62
Q Total (cfs)	1974.00	Flow (cfs)	1343.47	596.26	34.28
Top Width (ft)	280.26	Top Width (ft)	194.68	44.00	41.58
Vel Total (ft/s)	5.00	Avg. Vel. (ft/s)	4.41	8.74	1.59
Max Chl Dpth (ft)	2.02	Hydr. Depth (ft)	1.57	1.55	0.52
Conv. Total (cfs)	14948.6	Conv. (cfs)	10173.7	4515.3	259.6
Length Wtd. (ft)	115.45	Wetted Per. (ft)	194.75	44.08	41.60
Min Ch El (ft)	2850.80	Shear (lb/sq ft)	1.70	1.69	0.57
Alpha	1.45	Stream Power (lb/ft s)	7.51	14.72	0.90
Frctn Loss (ft)	2.05	Cum Volume (acre-ft)	11.09	11.17	15.19
C & E Loss (ft)	0.08	Cum SA (acres)	8.54	4.71	12.02

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3490

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2854	13	2852	42	2850	116	2848.4	240	2849.9
258	2849.2	270	2849.2	280	2849.8	320	2850	350	2850
367	2849.6	388	2850	415	2850	460	2851	480	2851

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	116	.06	258	.022	270	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
240	280	90	140	190	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2851.06	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.31	Wt. n-Val.	0.066	0.036	0.060
W.S. Elev (ft)	2850.75	Reach Len. (ft)	90.00	140.00	190.00
Crit W.S. (ft)	2850.50	Flow Area (sq ft)	316.94	52.65	125.30
E.G. Slope (ft/ft)	0.018143	Area (sq ft)	316.94	52.65	125.30
Q Total (cfs)	1974.00	Flow (cfs)	1275.44	355.79	342.77
Top Width (ft)	417.55	Top Width (ft)	208.86	40.00	168.70
Vel Total (ft/s)	3.99	Avg. Vel. (ft/s)	4.02	6.76	2.74
Max Chl Dpth (ft)	2.35	Hydr. Depth (ft)	1.52	1.32	0.74
Conv. Total (cfs)	14655.4	Conv. (cfs)	9469.1	2641.5	2544.8
Length Wtd. (ft)	143.22	Wetted Per. (ft)	208.91	40.03	168.71
Min Ch El (ft)	2849.20	Shear (lb/sq ft)	1.72	1.49	0.84
Alpha	1.26	Stream Power (lb/ft s)	6.92	10.07	2.30
Frctn Loss (ft)	1.83	Cum Volume (acre-ft)	10.45	10.97	14.84
C & E Loss (ft)	0.04	Cum SA (acres)	8.13	4.57	11.52

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3350

INPUT
Description:

PB Proj. No. 11515
Este Wash
Exist Topo with FEMA Flow

Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2854	15	2852	35	2850	75	2848.1	90	2848.2
105	2848	128	2847.3	182	2848.1	198	2847.7	245	2847.6
250	2848	260	2847.9	297	2847.9	357	2846.9	430	2846.6
465	2848	495	2850	525	2850.5				

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	182	.06	245	.028	297	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
182	250	135	120	115	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2849.20	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.19	Wt. n-Val.	0.080	0.056	0.054
W.S. Elev (ft)	2849.00	Reach Len. (ft)	135.00	120.00	115.00
Crit W.S. (ft)	2848.48	Flow Area (sq ft)	136.45	87.28	379.24
E.G. Slope (ft/ft)	0.009472	Area (sq ft)	136.45	87.28	379.24
Q Total (cfs)	1974.00	Flow (cfs)	260.05	267.17	1446.78
Top Width (ft)	424.07	Top Width (ft)	126.02	68.00	230.05
Vel Total (ft/s)	3.27	Avg. Vel. (ft/s)	1.91	3.06	3.81
Max Chl Dpth (ft)	2.40	Hydr. Depth (ft)	1.08	1.28	1.65
Conv. Total (cfs)	20282.2	Conv. (cfs)	2671.9	2745.1	14865.2
Length Wtd. (ft)	121.11	Wetted Per. (ft)	126.06	68.02	230.12
Min Ch El (ft)	2847.60	Shear (lb/sq ft)	0.64	0.76	0.97
Alpha	1.16	Stream Power (lb/ft s)	1.22	2.32	3.72
Frctn Loss (ft)	1.14	Cum Volume (acre-ft)	9.98	10.74	13.74
C & E Loss (ft)	0.01	Cum SA (acres)	7.78	4.39	10.65

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3230

INPUT
Description:
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2852	23	2850	32	2848	58	2846	88	2846
100	2845.8	147	2846.1	162	2846	207	2846	210	2845.5
228	2845.5	248	2846	290	2845	305	2845.3	318	2844.9
335	2846	343	2847	365	2850	390	2853		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	210	.025	228	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
207	248	100	70	55	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2848.05	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.26	Wt. n-Val.	0.080	0.039	0.080
W.S. Elev (ft)	2847.79	Reach Len. (ft)	100.00	70.00	55.00
Crit W.S. (ft)	2847.10	Flow Area (sq ft)	291.10	88.32	223.59
E.G. Slope (ft/ft)	0.009367	Area (sq ft)	291.10	88.32	223.59
Q Total (cfs)	1974.00	Flow (cfs)	742.01	549.27	682.72
Top Width (ft)	314.15	Top Width (ft)	172.33	41.00	100.83
Vel Total (ft/s)	3.27	Avg. Vel. (ft/s)	2.55	6.22	3.05
Max Chl Dpth (ft)	2.89	Hydr. Depth (ft)	1.69	2.15	2.22
Conv. Total (cfs)	20395.9	Conv. (cfs)	7666.7	5675.2	7054.0
Length Wtd. (ft)	79.50	Wetted Per. (ft)	172.40	41.05	101.00
Min Ch El (ft)	2845.50	Shear (lb/sq ft)	0.99	1.26	1.29
Alpha	1.53	Stream Power (lb/ft s)	2.52	7.83	3.95
Frctn Loss (ft)	0.70	Cum Volume (acre-ft)	9.32	10.50	12.95

C & E Loss (ft)	0.06	Cum SA (acres)	7.32	4.24	10.22

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3160

INPUT
Description:
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2848	10	2846	28	2845	60	2844	73	2844.5
113	2844.7	123	2843.9	140	2844.6	161	2844.6	200	2844
205	2843.8	230	2843.5	235	2844	253	2845	266	2846
280	2847	290	2848	307	2850	322	2852	335	2853

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	200	.025	235	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
200	235	35	35	35	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2847.29	Element			
Vel Head (ft)	0.89	Wt. n-Val.	0.080	0.025	0.080
W.S. Elev (ft)	2846.40	Reach Len. (ft)	35.00	35.00	35.00
Crit W.S. (ft)	2846.40	Flow Area (sq ft)	353.78	94.35	46.86
E.G. Slope (ft/ft)	0.008234	Area (sq ft)	353.78	94.35	46.86
Q Total (cfs)	1974.00	Flow (cfs)	895.82	985.08	93.10
Top Width (ft)	263.52	Top Width (ft)	191.98	35.00	36.54
Vel Total (ft/s)	3.99	Avg. Vel. (ft/s)	2.53	10.44	1.99
Max Chl Dpth (ft)	2.90	Hydr. Depth (ft)	1.84	2.70	1.28
Conv. Total (cfs)	21754.1	Conv. (cfs)	9872.2	10855.8	1026.0
Length Wtd. (ft)	35.00	Wetted Per. (ft)	192.12	35.03	36.62
Min Ch El (ft)	2843.50	Shear (lb/sq ft)	0.95	1.38	0.66
Alpha	3.62	Stream Power (lb/ft s)	2.40	14.46	1.31
Frctn Loss (ft)	0.45	Cum Volume (acre-ft)	8.58	10.35	12.78
C & E Loss (ft)	0.05	Cum SA (acres)	6.90	4.18	10.13

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3125

INPUT
Description:
Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2847	12	2846	40	2845	95	2844	100	2843.8
103	2844	110	2844.2	130	2844.2	135	2843.5	140	2844
178	2844	240	2843.2	260	2842.8	262	2843	265	2844
275	2845	287	2846	298	2847	310	2848	330	2849
340	2850	370	2851						

Manning's n Values num= 3

PB Proj. No. 11515
Este Wash
Exist Topo with FEMA Flow

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	240	.025	260	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
178	262	75	75	75	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2846.21	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.71	Wt. n-Val.	0.080	0.047	0.080
W.S. Elev (ft)	2845.49	Reach Len. (ft)	75.00	75.00	75.00
Crit W.S. (ft)	2845.49	Flow Area (sq ft)	179.95	172.37	17.36
E.G. Slope (ft/ft)	0.023038	Area (sq ft)	179.95	172.37	17.36
Q Total (cfs)	1974.00	Flow (cfs)	568.02	1360.14	45.84
Top Width (ft)	254.70	Top Width (ft)	151.79	84.00	18.91
Vel Total (ft/s)	5.34	Avg. Vel. (ft/s)	3.16	7.89	2.64
Max Chl Dpth (ft)	2.69	Hydr. Depth (ft)	1.19	2.05	0.92
Conv. Total (cfs)	13005.4	Conv. (cfs)	3742.3	8961.1	302.0
Length Wtd. (ft)	75.00	Wetted Per. (ft)	151.89	84.02	19.14
Min Ch El (ft)	2842.80	Shear (lb/sq ft)	1.70	2.95	1.30
Alpha	1.61	Stream Power (lb/ft s)	5.38	23.28	3.44
Frctn Loss (ft)	0.45	Cum Volume (acre-ft)	8.36	10.25	12.75
C & E Loss (ft)	0.00	Cum SA (acres)	6.76	4.14	10.11

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3050

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2847	33	2846	80	2845	130	2844	195	2843
243	2842.3	281	2842.3	330	2843	423	2844	468	2844
510	2845								

Manning's n Values num= 1

Sta	n Val
0	.016

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
195	330	75	75	75	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
340	510		T

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2845.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.70	Wt. n-Val.	0.016	0.016	0.016
W.S. Elev (ft)	2844.32	Reach Len. (ft)	75.00	75.00	75.00
Crit W.S. (ft)	2844.32	Flow Area (sq ft)	56.22	239.35	12.71
E.G. Slope (ft/ft)	0.002694	Area (sq ft)	56.22	239.35	93.49
Q Total (cfs)	1974.00	Flow (cfs)	212.06	1690.08	71.87
Top Width (ft)	367.85	Top Width (ft)	81.22	135.00	151.63
Vel Total (ft/s)	6.40	Avg. Vel. (ft/s)	3.77	7.06	5.66
Max Chl Dpth (ft)	2.02	Hydr. Depth (ft)	0.69	1.77	1.27
Conv. Total (cfs)	38029.6	Conv. (cfs)	4085.3	32559.8	1384.5
Length Wtd. (ft)	75.00	Wetted Per. (ft)	81.23	135.01	10.00
Min Ch El (ft)	2842.30	Shear (lb/sq ft)	0.12	0.30	0.21
Alpha	1.11	Stream Power (lb/ft s)	0.44	2.11	1.21

Frctn Loss (ft)	0.28	Cum Volume (acre-ft)	8.16	9.89	12.65
C & E Loss (ft)	0.01	Cum SA (acres)	6.56	3.95	9.96

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2975

INPUT
Description: AS
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2845.5	8	2845	25	2844	62	2843	100	2842.5
108	2842.5	130	2842.7	150	2842	190	2841	210	2840
220	2839	228	2840	233	2840.2	240	2840	242	2839.6
262	2839.6	265	2840	275	2840.8	305	2841	342	2842
356	2843	372	2844	390	2844.2	405	2844	427	2845
460	2845.2								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	100	.025	108	.06	240	.025	265	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
240	265	270	180	110	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2843.84	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.76	Wt. n-Val.	0.059	0.025	0.060
W.S. Elev (ft)	2843.08	Reach Len. (ft)	270.00	180.00	110.00
Crit W.S. (ft)	2843.08	Flow Area (sq ft)	257.47	86.00	158.84
E.G. Slope (ft/ft)	0.005563	Area (sq ft)	257.47	86.00	158.84
Q Total (cfs)	1974.00	Flow (cfs)	685.61	867.26	421.13
Top Width (ft)	298.24	Top Width (ft)	180.96	25.00	92.28
Vel Total (ft/s)	3.93	Avg. Vel. (ft/s)	2.66	10.08	2.65
Max Chl Dpth (ft)	4.08	Hydr. Depth (ft)	1.42	3.44	1.72
Conv. Total (cfs)	26466.2	Conv. (cfs)	9192.3	11627.7	5646.2
Length Wtd. (ft)	184.26	Wetted Per. (ft)	181.14	25.07	92.37
Min Ch El (ft)	2839.60	Shear (lb/sq ft)	0.49	1.19	0.60
Alpha	3.15	Stream Power (lb/ft s)	1.31	12.02	1.58
Frctn Loss (ft)	1.15	Cum Volume (acre-ft)	7.89	9.61	12.44
C & E Loss (ft)	0.01	Cum SA (acres)	6.34	3.81	9.75

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2795

INPUT
Description: AR
Station Elevation Data num= 20

PB Proj. No. 11515
Este Wash
Exist Topo with FEMA Flow

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2847	38	2846	72	2844	128	2842	160	2840
252	2838	260	2836.9	270	2837.8	283	2836.5	308	2836.5
320	2837.5	330	2837.2	343	2837.2	360	2838.5	380	2838.3
413	2839	440	2840	482	2842	510	2843	555	2844

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	252	.028	320	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
252	320	360	300	250	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2840.46	Element			
Vel Head (ft)	0.88	Wt. n-Val.	0.060	0.028	0.060
W.S. Elev (ft)	2839.58	Reach Len. (ft)	360.00	300.00	250.00
Crit W.S. (ft)	2839.58	Flow Area (sq ft)	57.71	179.16	141.91
E.G. Slope (ft/ft)	0.007047	Area (sq ft)	57.71	179.16	141.91
Q Total (cfs)	1974.00	Flow (cfs)	102.68	1519.21	352.11
Top Width (ft)	249.63	Top Width (ft)	72.86	68.00	108.77
Vel Total (ft/s)	5.21	Avg. Vel. (ft/s)	1.78	8.48	2.48
Max Chl Dpth (ft)	3.08	Hydr. Depth (ft)	0.79	2.63	1.30
Conv. Total (cfs)	23515.7	Conv. (cfs)	1223.2	18097.9	4194.6
Length Wtd. (ft)	296.64	Wetted Per. (ft)	72.88	68.22	108.84
Min Ch El (ft)	2836.50	Shear (lb/sq ft)	0.35	1.16	0.57
Alpha	2.08	Stream Power (lb/ft s)	0.62	9.80	1.42
Frctn Loss (ft)	2.26	Cum Volume (acre-ft)	6.91	9.06	12.06
C & E Loss (ft)	0.01	Cum SA (acres)	5.55	3.62	9.50

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2495

INPUT
Description: AQ
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2846	10	2842	15	2840.8	20	2841.3	48	2841.1
87	2840	120	2838	160	2836	198	2834	210	2833.4
237	2834.1	246	2832.5	280	2833	290	2833.8	310	2833.8
320	2833.2	326	2834	450	2836	496	2837	536	2838

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.04	10	.016	48	.06	246	.025	280	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
237	290	175	155	130	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2836.52	Element			
Vel Head (ft)	0.84	Wt. n-Val.	0.060	0.030	0.060
W.S. Elev (ft)	2835.69	Reach Len. (ft)	175.00	155.00	130.00
Crit W.S. (ft)	2835.69	Flow Area (sq ft)	103.09	144.15	160.19
E.G. Slope (ft/ft)	0.008290	Area (sq ft)	103.09	144.15	160.19
Q Total (cfs)	1974.00	Flow (cfs)	297.80	1282.21	393.99
Top Width (ft)	264.55	Top Width (ft)	71.03	53.00	140.52
Vel Total (ft/s)	4.85	Avg. Vel. (ft/s)	2.89	8.90	2.46
Max Chl Dpth (ft)	3.19	Hydr. Depth (ft)	1.45	2.72	1.14
Conv. Total (cfs)	21681.1	Conv. (cfs)	3270.9	14082.9	4327.3

Length Wtd. (ft)	154.31	Wetted Per. (ft)	71.10	53.18	140.60
Min Ch El (ft)	2832.50	Shear (lb/sq ft)	0.75	1.40	0.59
Alpha	2.29	Stream Power (lb/ft s)	2.17	12.48	1.45
Frctn Loss (ft)	1.03	Cum Volume (acre-ft)	6.25	7.95	11.19
C & E Loss (ft)	0.05	Cum SA (acres)	4.95	3.20	8.78

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2340

INPUT
Description:
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2836	49	2837.7	62	2837	77	2836	84	2835
101	2832	115	2831.4	145	2831.1	165	2831	167	2830.8
183	2830.8	186	2831	193	2832	220	2832	258	2832.2
264	2833								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	165	.025	186	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
165	186	60	45	20	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2834.94	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.68	Wt. n-Val.	0.060	0.025	0.060
W.S. Elev (ft)	2834.26	Reach Len. (ft)	60.00	45.00	20.00
Crit W.S. (ft)	2833.84	Flow Area (sq ft)	204.44	72.06	172.00
E.G. Slope (ft/ft)	0.005516	Area (sq ft)	204.44	72.06	172.00
Q Total (cfs)	1974.00	Flow (cfs)	721.03	723.23	529.74
Top Width (ft)	175.78	Top Width (ft)	76.78	21.00	78.00
Vel Total (ft/s)	4.40	Avg. Vel. (ft/s)	3.53	10.04	3.08
Max Chl Dpth (ft)	3.46	Hydr. Depth (ft)	2.66	3.43	2.21
Conv. Total (cfs)	26579.2	Conv. (cfs)	9708.4	9738.0	7132.7
Length Wtd. (ft)	43.25	Wetted Per. (ft)	76.99	21.02	79.38
Min Ch El (ft)	2830.80	Shear (lb/sq ft)	0.91	1.18	0.75
Alpha	2.27	Stream Power (lb/ft s)	3.22	11.85	2.30
Frctn Loss (ft)	0.22	Cum Volume (acre-ft)	5.63	7.57	10.69
C & E Loss (ft)	0.03	Cum SA (acres)	4.66	3.07	8.45

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

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2295

INPUT
Description: AP2
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2836.8	15	2836	40	2832	46	2831	65	2830.8
82	2831	96	2831	110	2830	111	2829.8	129	2829.8
130	2830	143	2831	165	2831.9	183	2831.8	215	2832
280	2833	340	2834	380	2835	410	2836	428	2836

Manning's n Values num= 3

PB Proj. No. 11515
Este Wash
Exist Topo with FEMA Flow

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	110	.022	130	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
110	130	75	75	75	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2834.69	Element			
Vel Head (ft)	0.97	Wt. n-Val.	0.070	0.022	0.070
W.S. Elev (ft)	2833.72	Reach Len. (ft)	75.00	75.00	75.00
Crit W.S. (ft)	2833.72	Flow Area (sq ft)	207.54	78.27	279.26
E.G. Slope (ft/ft)	0.004656	Area (sq ft)	207.54	78.27	279.26
Q Total (cfs)	1974.00	Flow (cfs)	562.74	894.68	516.58
Top Width (ft)	294.19	Top Width (ft)	80.77	20.00	193.42
Vel Total (ft/s)	3.49	Avg. Vel. (ft/s)	2.71	11.43	1.85
Max Chl Dpth (ft)	3.92	Hydr. Depth (ft)	2.57	3.91	1.44
Conv. Total (cfs)	28929.1	Conv. (cfs)	8246.9	13111.6	7570.5
Length Wtd. (ft)	75.00	Wetted Per. (ft)	81.03	20.04	193.49
Min Ch El (ft)	2829.80	Shear (lb/sq ft)	0.74	1.14	0.42
Alpha	5.10	Stream Power (lb/ft s)	2.02	12.98	0.78
Frctn Loss (ft)	0.20	Cum Volume (acre-ft)	5.35	7.49	10.59
C & E Loss (ft)	0.15	Cum SA (acres)	4.55	3.05	8.39

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2220

INPUT
Description: AP1
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2831	50	2830.5	90	2830	165	2829	225	2829.5
253	2830	300	2831	347	2832	380	2833	412	2834
447	2835								

Manning's n Values num= 1

Sta	n Val
0	.016

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
90	253	40	40	40	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	43		T

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2831.73	Element			
Vel Head (ft)	0.47	Wt. n-Val.	0.016	0.016	0.016
W.S. Elev (ft)	2831.25	Reach Len. (ft)	40.00	40.00	40.00
Crit W.S. (ft)	2831.06	Flow Area (sq ft)	45.20	293.93	36.96
E.G. Slope (ft/ft)	0.001761	Area (sq ft)	65.37	293.93	36.96
Q Total (cfs)	1974.00	Flow (cfs)	171.61	1696.88	105.52
Top Width (ft)	311.95	Top Width (ft)	90.00	163.00	58.95
Vel Total (ft/s)	5.25	Avg. Vel. (ft/s)	3.80	5.77	2.85
Max Chl Dpth (ft)	2.25	Hydr. Depth (ft)	0.96	1.80	0.63
Conv. Total (cfs)	47042.3	Conv. (cfs)	4089.6	40438.1	2514.5
Length Wtd. (ft)	40.00	Wetted Per. (ft)	47.00	163.01	58.96
Min Ch El (ft)	2829.00	Shear (lb/sq ft)	0.11	0.20	0.07
Alpha	1.10	Stream Power (lb/ft s)	0.40	1.14	0.20

Frctn Loss (ft)	0.11	Cum Volume (acre-ft)	5.11	7.17	10.32
C & E Loss (ft)	0.03	Cum SA (acres)	4.40	2.89	8.17

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: Este Wash
REACH: 1 RS: 2180

INPUT
Description: AP
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2831.1	40	2831	52	2831	72	2830	85	2829
106	2828	118	2827	128	2827	148	2828	155	2829
225	2829.5	243	2830	320	2830	352	2831	392	2832
422	2833	440	2834						

Manning's n Values num= 2

Sta	n Val	Sta	n Val
0	.028	148	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
106	148	34	34	34	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2831.58	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.78	Wt. n-Val.	0.028	0.028	0.060
W.S. Elev (ft)	2830.81	Reach Len. (ft)	34.00	34.00	34.00
Crit W.S. (ft)	2830.81	Flow Area (sq ft)	71.91	143.86	216.56
E.G. Slope (ft/ft)	0.005016	Area (sq ft)	71.91	143.86	216.56
Q Total (cfs)	1974.00	Flow (cfs)	343.40	1227.26	403.35
Top Width (ft)	289.92	Top Width (ft)	50.12	42.00	197.80
Vel Total (ft/s)	4.57	Avg. Vel. (ft/s)	4.78	8.53	1.86
Max Chl Dpth (ft)	3.81	Hydr. Depth (ft)	1.43	3.43	1.09
Conv. Total (cfs)	27872.9	Conv. (cfs)	4848.8	17328.9	5695.3
Length Wtd. (ft)	34.00	Wetted Per. (ft)	50.21	42.07	197.89
Min Ch El (ft)	2827.00	Shear (lb/sq ft)	0.45	1.07	0.34
Alpha	2.39	Stream Power (lb/ft s)	2.14	9.14	0.64
Frctn Loss (ft)	0.20	Cum Volume (acre-ft)	5.05	6.97	10.20
C & E Loss (ft)	0.00	Cum SA (acres)	4.34	2.80	8.06

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2146

INPUT
Description:
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2832	23	2830	38	2829	60	2827	73	2826.5
88	2827	98	2828	118	2828.8	150	2828.1	195	2828.6
215	2828	260	2829	290	2830	331	2831	361	2832
384	2833	402	2834						

Manning's n Values num= 2

Sta	n Val	Sta	n Val
0	.028	88	.06

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Exist Topo with FEMA Flow

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
60	88	230	210	180	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2830.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.77	Wt. n-Val.	0.028	0.028	0.060
W.S. Elev (ft)	2830.01	Reach Len. (ft)	230.00	210.00	180.00
Crit W.S. (ft)	2830.01	Flow Area (sq ft)	52.02	91.39	300.16
E.G. Slope (ft/ft)	0.006896	Area (sq ft)	52.02	91.39	300.16
Q Total (cfs)	1974.00	Flow (cfs)	286.20	885.80	802.00
Top Width (ft)	267.73	Top Width (ft)	37.16	28.00	202.57
Vel Total (ft/s)	4.45	Avg. Vel. (ft/s)	5.50	9.69	2.67
Max Chl Dpth (ft)	3.51	Hydr. Depth (ft)	1.40	3.26	1.48
Conv. Total (cfs)	23771.3	Conv. (cfs)	3446.5	10667.0	9657.8
Length Wtd. (ft)	206.92	Wetted Per. (ft)	37.28	28.02	202.68
Min Ch El (ft)	2826.50	Shear (lb/sq ft)	0.60	1.40	0.64
Alpha	2.50	Stream Power (lb/ft s)	3.30	13.61	1.70
Frctn Loss (ft)	1.62	Cum Volume (acre-ft)	5.00	6.87	10.00
C & E Loss (ft)	0.03	Cum SA (acres)	4.30	2.77	7.90

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2000

INPUT
Description:
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2835	.1	2831	50	2830	98	2828	170	2826
220	2824.5	225	2823.2	245	2823.2	248	2824	260	2826
295	2828	390	2830	420	2832				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	225	.025	245	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
220	248	100	135	150	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2828.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.05	Wt. n-Val.	0.060	0.037	0.060
W.S. Elev (ft)	2827.73	Reach Len. (ft)	100.00	135.00	150.00
Crit W.S. (ft)	2827.73	Flow Area (sq ft)	177.51	122.30	58.81
E.G. Slope (ft/ft)	0.008968	Area (sq ft)	177.51	122.30	58.81
Q Total (cfs)	1974.00	Flow (cfs)	565.22	1237.32	171.46
Top Width (ft)	182.38	Top Width (ft)	112.17	28.00	42.22
Vel Total (ft/s)	5.50	Avg. Vel. (ft/s)	3.18	10.12	2.92
Max Chl Dpth (ft)	4.53	Hydr. Depth (ft)	1.58	4.37	1.39
Conv. Total (cfs)	20845.1	Conv. (cfs)	5968.6	13065.9	1810.6
Length Wtd. (ft)	127.86	Wetted Per. (ft)	112.21	28.27	42.43
Min Ch El (ft)	2823.20	Shear (lb/sq ft)	0.89	2.42	0.78
Alpha	2.24	Stream Power (lb/ft s)	2.82	24.50	2.26
Frctn Loss (ft)	1.25	Cum Volume (acre-ft)	4.40	6.36	9.26
C & E Loss (ft)	0.01	Cum SA (acres)	3.91	2.63	7.39

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

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Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 1865

INPUT
Description: AO
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2835	.1	2829	35	2828	105	2826	173	2824
203	2822	207	2821.5	222	2821.5	242	2822	252	2824
273	2826	292	2828	335	2830	360	2830.5		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	207	.025	222	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
203	242	375	400	440	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2826.70	Element			
Vel Head (ft)	1.19	Wt. n-Val.	0.060	0.038	0.060
W.S. Elev (ft)	2825.51	Reach Len. (ft)	375.00	400.00	440.00
Crit W.S. (ft)	2825.51	Flow Area (sq ft)	114.18	150.45	37.11
E.G. Slope (ft/ft)	0.010645	Area (sq ft)	114.18	150.45	37.11
Q Total (cfs)	1974.00	Flow (cfs)	365.35	1488.89	119.76
Top Width (ft)	146.26	Top Width (ft)	81.39	39.00	25.87
Vel Total (ft/s)	6.54	Avg. Vel. (ft/s)	3.20	9.90	3.23
Max Chl Dpth (ft)	4.01	Hydr. Depth (ft)	1.40	3.86	1.43
Conv. Total (cfs)	19133.0	Conv. (cfs)	3541.1	14431.1	1160.8
Length Wtd. (ft)	396.45	Wetted Per. (ft)	81.48	39.04	26.14
Min Ch El (ft)	2821.50	Shear (lb/sq ft)	0.93	2.56	0.94
Alpha	1.79	Stream Power (lb/ft s)	2.98	25.35	3.04
Frctn Loss (ft)	4.26	Cum Volume (acre-ft)	4.06	5.94	9.09
C & E Loss (ft)	0.11	Cum SA (acres)	3.69	2.53	7.28

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 1465

INPUT
Description: AN
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2827	.1	2821	15	2820	65	2818.2	95	2819
133	2819	180	2818	199	2816.3	240	2816.3	242	2818
248	2820	290	2822	290.1	2828				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	199	.028	240	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
180	242	280	290	320	.1	.3

Ineffective Flow num= 1

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Este Wash
Exist Topo with FEMA Flow

Sta L	Sta R	Elev	Permanent
0	133	2819	F

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2820.56	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.80	Wt. n-Val.	0.060	0.042	0.080
W.S. Elev (ft)	2819.76	Reach Len. (ft)	280.00	290.00	320.00
Crit W.S. (ft)	2819.76	Flow Area (sq ft)	156.16	196.46	4.63
E.G. Slope (ft/ft)	0.010866	Area (sq ft)	156.16	196.46	4.63
Q Total (cfs)	1974.00	Flow (cfs)	399.52	1566.55	7.93
Top Width (ft)	225.51	Top Width (ft)	158.24	62.00	5.27
Vel Total (ft/s)	5.53	Avg. Vel. (ft/s)	2.56	7.97	1.71
Max Chl Dpth (ft)	3.46	Hydr. Depth (ft)	0.99	3.17	0.88
Conv. Total (cfs)	18937.2	Conv. (cfs)	3832.7	15028.4	76.1
Length Wtd. (ft)	291.97	Wetted Per. (ft)	158.29	62.70	5.55
Min Ch El (ft)	2816.30	Shear (lb/sq ft)	0.67	2.13	0.57
Alpha	1.70	Stream Power (lb/ft s)	1.71	16.95	0.97
Frctn Loss (ft)	3.72	Cum Volume (acre-ft)	2.90	4.34	8.88
C & E Loss (ft)	0.06	Cum SA (acres)	2.66	2.07	7.12

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 1175

INPUT
Description: AM
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2824	.1	2818	50	2814	60	2813	69	2814
90	2814.5	108	2814	170	2812.7	197	2812.7	222	2813.9
238	2813.9	288	2813.3	323	2814	410	2816	410.1	2822

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	170	.022	197	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
108	222	365	360	360	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2815.49	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.59	Wt. n-Val.	0.060	0.037	0.060
W.S. Elev (ft)	2814.90	Reach Len. (ft)	365.00	360.00	360.00
Crit W.S. (ft)	2814.90	Flow Area (sq ft)	56.62	194.88	141.60
E.G. Slope (ft/ft)	0.015158	Area (sq ft)	56.62	194.88	141.60
Q Total (cfs)	1974.00	Flow (cfs)	150.87	1387.95	435.18
Top Width (ft)	323.07	Top Width (ft)	69.16	114.00	139.91
Vel Total (ft/s)	5.02	Avg. Vel. (ft/s)	2.66	7.12	3.07
Max Chl Dpth (ft)	2.19	Hydr. Depth (ft)	0.82	1.71	1.01
Conv. Total (cfs)	16033.7	Conv. (cfs)	1225.5	11273.5	3534.7
Length Wtd. (ft)	360.25	Wetted Per. (ft)	69.31	114.04	139.93
Min Ch El (ft)	2812.70	Shear (lb/sq ft)	0.77	1.62	0.96
Alpha	1.52	Stream Power (lb/ft s)	2.06	11.52	2.94
Frctn Loss (ft)	5.20	Cum Volume (acre-ft)	2.21	3.04	8.35
C & E Loss (ft)	0.00	Cum SA (acres)	1.92	1.48	6.59

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross

section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 815

INPUT
Description: AL
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2816	.1	2810	92	2808	112	2807	140	2807
150	2808	212	2808	232	2807	262	2808	315	2806.8
365	2808	382	2814						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	112	.022	140	.06	315	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
92	150	390	390	420	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2809.64	Element			
Vel Head (ft)	0.63	Wt. n-Val.	0.060	0.029	0.065
W.S. Elev (ft)	2809.02	Reach Len. (ft)	390.00	390.00	420.00
Crit W.S. (ft)	2809.02	Flow Area (sq ft)	23.77	101.99	306.94
E.G. Slope (ft/ft)	0.013756	Area (sq ft)	23.77	101.99	306.94
Q Total (cfs)	1974.00	Flow (cfs)	43.98	888.51	1041.51
Top Width (ft)	322.62	Top Width (ft)	46.74	58.00	217.88
Vel Total (ft/s)	4.56	Avg. Vel. (ft/s)	1.85	8.71	3.39
Max Chl Dpth (ft)	2.22	Hydr. Depth (ft)	0.51	1.76	1.41
Conv. Total (cfs)	16830.6	Conv. (cfs)	374.9	7575.5	8880.1
Length Wtd. (ft)	404.90	Wetted Per. (ft)	46.75	58.07	218.13
Min Ch El (ft)	2807.00	Shear (lb/sq ft)	0.44	1.51	1.21
Alpha	1.94	Stream Power (lb/ft s)	0.81	13.14	4.10
Frctn Loss (ft)	3.55	Cum Volume (acre-ft)	1.88	1.81	6.49
C & E Loss (ft)	0.00	Cum SA (acres)	1.44	0.77	5.11

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 425

INPUT
Description: AK
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2803	10	2802	72	2800	73	2799.2	105	2799.2
115	2800	150	2801	180	2800	270	2800.5	350	2801.3
410	2799.9	425	2802	430	2802.2				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	72	.025	150	.08

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

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Exist Topo with FEMA Flow

72	115	450	425	405	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2802.52	Element			
Vel Head (ft)	0.62	Wt. n-Val.	0.080	0.025	0.063
W.S. Elev (ft)	2801.90	Reach Len. (ft)	450.00	425.00	405.00
Crit W.S. (ft)	2801.90	Flow Area (sq ft)	56.09	111.80	412.51
E.G. Slope (ft/ft)	0.006085	Area (sq ft)	56.09	111.80	412.51
Q Total (cfs)	1974.00	Flow (cfs)	78.58	975.44	919.98
Top Width (ft)	411.28	Top Width (ft)	58.97	43.00	309.30
Vel Total (ft/s)	3.40	Avg. Vel. (ft/s)	1.40	8.72	2.23
Max Chl Dpth (ft)	2.70	Hydr. Depth (ft)	0.95	2.60	1.33
Conv. Total (cfs)	25305.2	Conv. (cfs)	1007.3	12504.5	11793.4
Length Wtd. (ft)	424.29	Wetted Per. (ft)	59.00	43.31	309.49
Min Ch El (ft)	2799.20	Shear (lb/sq ft)	0.36	0.98	0.51
Alpha	3.46	Stream Power (lb/ft s)	0.51	8.56	1.13
Frctn Loss (ft)	3.28	Cum Volume (acre-ft)	1.52	0.86	3.02
C & E Loss (ft)	0.00	Cum SA (acres)	0.97	0.32	2.57

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 0

INPUT
Description: AJ
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2798	21	2794	31	2793	144	2793	145	2792
165	2792	166	2793	197	2794	240	2794	276	2793.3
300	2794	332	2794.3	365	2794	420	2795.2		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	31	.06	145	.022	165	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
144	166	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2795.57	Element			
Vel Head (ft)	0.61	Wt. n-Val.	0.061	0.030	0.080
W.S. Elev (ft)	2794.96	Reach Len. (ft)			
Crit W.S. (ft)	2794.96	Flow Area (sq ft)	238.06	64.04	238.07
E.G. Slope (ft/ft)	0.010145	Area (sq ft)	238.06	64.04	238.07
Q Total (cfs)	1974.00	Flow (cfs)	896.93	637.60	439.47
Top Width (ft)	392.87	Top Width (ft)	128.02	22.00	242.84
Vel Total (ft/s)	3.65	Avg. Vel. (ft/s)	3.77	9.96	1.85
Max Chl Dpth (ft)	2.96	Hydr. Depth (ft)	1.86	2.91	0.98
Conv. Total (cfs)	19598.3	Conv. (cfs)	8904.9	6330.3	4363.2
Length Wtd. (ft)		Wetted Per. (ft)	128.16	22.83	242.89
Min Ch El (ft)	2792.00	Shear (lb/sq ft)	1.18	1.78	0.62
Alpha	2.94	Stream Power (lb/ft s)	4.43	17.69	1.15
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth). Water surface set to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

PB Proj. No. 11515
Este Wash
Exist Topo with FEMA Flow

SUMMARY OF MANNING'S N VALUES

River:Este Wash

Reach	River Sta.	n1	n2	n3	n4	n5
1	4085	.08	.022	.06		
1	3810	.06	.022	.06		
1	3640	.06	.022	.08		
1	3490	.08	.06	.022	.06	
1	3350	.08	.06	.028	.06	
1	3230	.08	.025	.08		
1	3160	.08	.025	.08		
1	3125	.08	.025	.08		
1	3050	.016				
1	2975	.06	.025	.06	.025	.06
1	2795	.06	.028	.06		
1	2495	.04	.016	.06	.025	.06
1	2340	.06	.025	.06		
1	2295	.07	.022	.07		
1	2220	.016				
1	2180	.028	.06			
1	2146	.028	.06			
1	2000	.06	.025	.06		
1	1865	.06	.025	.06		
1	1465	.06	.028	.08		
1	1175	.06	.022	.06		
1	815	.06	.022	.06	.08	
1	425	.08	.025	.08		
1	0	.08	.06	.022	.08	

SUMMARY OF REACH LENGTHS

River: Este Wash

Reach	River Sta.	Left	Channel	Right
1	4085	250	275	260
1	3810	155	170	180
1	3640	90	150	205
1	3490	90	140	190
1	3350	135	120	115
1	3230	100	70	55
1	3160	35	35	35
1	3125	75	75	75
1	3050	75	75	75
1	2975	270	180	110
1	2795	360	300	250
1	2495	175	155	130
1	2340	60	45	20
1	2295	75	75	75
1	2220	40	40	40
1	2180	34	34	34
1	2146	230	210	180
1	2000	100	135	150
1	1865	375	400	440
1	1465	280	290	320
1	1175	365	360	360
1	815	390	390	420
1	425	450	425	405
1	0			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Este Wash

Reach	River Sta.	Contr.	Expan.

PB Proj. No. 11515
Este Wash
Exist Topo with FEMA Flow

1	4085	.1	.3
1	3810	.1	.3
1	3640	.1	.3
1	3490	.1	.3
1	3350	.1	.3
1	3230	.1	.3
1	3160	.1	.3
1	3125	.1	.3
1	3050	.1	.3
1	2975	.1	.3
1	2795	.1	.3
1	2495	.1	.3
1	2340	.1	.3
1	2295	.1	.3
1	2220	.1	.3
1	2180	.1	.3
1	2146	.1	.3
1	2000	.1	.3
1	1865	.1	.3
1	1465	.1	.3
1	1175	.1	.3
1	815	.1	.3
1	425	.1	.3
1	0	.1	.3

PB Proj. No. 11515
Este Wash
Exist Topo with FEMA Flow
Profile Output Table - Standard Table 1

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	4085	1974.00	2856.40	2859.33	2859.33	2860.08	0.019136	10.19	350.99	206.64	1.09
1	3810	1974.00	2852.70	2855.60	2855.60	2856.33	0.010418	8.67	398.14	244.90	0.97
1	3640	1974.00	2850.80	2852.62	2852.51	2853.19	0.017438	8.74	394.63	280.26	1.24
1	3490	1974.00	2849.20	2850.75	2850.50	2851.06	0.018143	6.76	494.89	417.55	1.04
1	3350	1974.00	2847.60	2849.00	2848.48	2849.20	0.009472	3.06	602.98	424.07	0.48
1	3230	1974.00	2845.50	2847.79	2847.10	2848.05	0.009367	6.22	603.00	314.15	0.75
1	3160	1974.00	2843.50	2846.40	2846.40	2847.29	0.008234	10.44	495.00	263.52	1.12
1	3125	1974.00	2842.80	2845.49	2845.49	2846.21	0.023038	7.89	369.67	254.70	0.97
1	3050	1974.00	2842.30	2844.32	2844.32	2845.03	0.002694	7.06	308.28	367.85	0.93
1	2975	1974.00	2839.60	2843.08	2843.08	2843.84	0.005563	10.08	502.31	298.24	0.96
1	2795	1974.00	2836.50	2839.58	2839.58	2840.46	0.007047	8.48	378.78	249.63	0.92
1	2495	1974.00	2832.50	2835.69	2835.69	2836.52	0.008290	8.90	407.43	264.55	0.95
1	2340	1974.00	2830.80	2834.26	2833.84	2834.94	0.005516	10.04	448.49	175.78	0.95
1	2295	1974.00	2829.80	2833.72	2833.72	2834.69	0.004656	11.43	565.06	294.19	1.02
1	2220	1974.00	2829.00	2831.25	2831.06	2831.73	0.001761	5.77	376.09	311.95	0.76
1	2180	1974.00	2827.00	2830.81	2830.81	2831.58	0.005016	8.53	432.32	289.92	0.81
1	2146	1974.00	2826.50	2830.01	2830.01	2830.78	0.006896	9.69	443.56	267.73	0.95
1	2000	1974.00	2823.20	2827.73	2827.73	2828.78	0.008968	10.12	358.63	182.38	0.85
1	1865	1974.00	2821.50	2825.51	2825.51	2826.70	0.010645	9.90	301.74	146.26	0.89
1	1465	1974.00	2816.30	2819.76	2819.76	2820.56	0.010866	7.97	357.25	225.51	0.79
1	1175	1974.00	2812.70	2814.90	2814.90	2815.49	0.015158	7.12	393.11	323.07	0.96
1	815	1974.00	2807.00	2809.02	2809.02	2809.64	0.013756	8.71	432.70	322.62	1.16
1	425	1974.00	2799.20	2801.90	2801.90	2802.52	0.006085	8.72	580.41	411.28	0.95
1	0	1974.00	2792.00	2794.96	2794.96	2795.57	0.010145	9.96	540.17	392.87	1.03

PB Proj. No. 11515
Este Wash
Exist Topo with FEMA Flow

Profile Output Table - Standard Table 2

Reach	River Sta	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
1	4085	2860.08	2859.33	0.75	3.65	0.01	8.52	642.22	1323.26	206.64
1	3810	2856.33	2855.60	0.73	2.15	0.05	832.69	1120.44	20.87	244.90
1	3640	2853.19	2852.62	0.56	2.05	0.08	1343.47	596.26	34.28	280.26
1	3490	2851.06	2850.75	0.31	1.83	0.04	1275.44	355.79	342.77	417.55
1	3350	2849.20	2849.00	0.19	1.14	0.01	260.05	267.17	1446.78	424.07
1	3230	2848.05	2847.79	0.26	0.70	0.06	742.01	549.27	682.72	314.15
1	3160	2847.29	2846.40	0.89	0.45	0.05	895.82	985.08	93.10	263.52
1	3125	2846.21	2845.49	0.71	0.45	0.00	568.02	1360.14	45.84	254.70
1	3050	2845.03	2844.32	0.70	0.28	0.01	212.06	1690.08	71.87	367.85
1	2975	2843.84	2843.08	0.76	1.15	0.01	685.61	867.26	421.13	298.24
1	2795	2840.46	2839.58	0.88	2.26	0.01	102.68	1519.21	352.11	249.63
1	2495	2836.52	2835.69	0.84	1.03	0.05	297.80	1282.21	393.99	264.55
1	2340	2834.94	2834.26	0.68	0.22	0.03	721.03	723.23	529.74	175.78
1	2295	2834.69	2833.72	0.97	0.20	0.15	562.74	894.68	516.58	294.19
1	2220	2831.73	2831.25	0.47	0.11	0.03	171.61	1696.88	105.52	311.95
1	2180	2831.58	2830.81	0.78	0.20	0.00	343.40	1227.26	403.35	289.92
1	2146	2830.78	2830.01	0.77	1.62	0.03	286.20	885.80	802.00	267.73
1	2000	2828.78	2827.73	1.05	1.25	0.01	565.22	1237.32	171.46	182.38
1	1865	2826.70	2825.51	1.19	4.26	0.11	365.35	1488.89	119.76	146.26
1	1465	2820.56	2819.76	0.80	3.72	0.06	399.52	1566.55	7.93	225.51
1	1175	2815.49	2814.90	0.59	5.20	0.00	150.87	1387.95	435.18	323.07
1	815	2809.64	2809.02	0.63	3.55	0.00	43.98	888.51	1041.51	322.62
1	425	2802.52	2801.90	0.62	3.28	0.00	78.58	975.44	919.98	411.28
1	0	2795.57	2794.96	0.61			896.93	637.60	439.47	392.87

Profile Output Table - Lateral Structures

Reach	River Sta	Q US	Q Leaving Total	Q DS	Q Weir	Q Gates	Wr Top Wdth	Weir Max Depth	Weir Avg Depth	Min El Weir Flow	E.G. US.	W.S. US.	E.G. DS	W.S. DS
		(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : Exst FEMA

River: Este Wash Reach: 1 RS: 4085 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning:The cross-section end points had to be extended vertically for the computed water surface.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The

program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.
River: Este Wash Reach: 1 RS: 3810 Profile: PF 1
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: Este Wash Reach: 1 RS: 3640 Profile: PF 1
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Este Wash Reach: 1 RS: 3490 Profile: PF 1
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Este Wash Reach: 1 RS: 3350 Profile: PF 1
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Este Wash Reach: 1 RS: 3230 Profile: PF 1
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
River: Este Wash Reach: 1 RS: 3160 Profile: PF 1
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: Este Wash Reach: 1 RS: 3125 Profile: PF 1
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: Este Wash Reach: 1 RS: 3050 Profile: PF 1
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: Este Wash Reach: 1 RS: 2975 Profile: PF 1
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

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Este Wash
Exist Topo with FEMA Flow

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2795 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2495 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2340 Profile: PF 1
Warning:The cross-section end points had to be extended vertically for the computed water surface.

River: Este Wash Reach: 1 RS: 2295 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2220 Profile: PF 1
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.

River: Este Wash Reach: 1 RS: 2180 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2146 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2000 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

PB Proj. No. 11515
Este Wash
Exist Topo with FEMA Flow

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

River: Este Wash Reach: 1 RS: 1865 Profile: PF 1
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 1465 Profile: PF 1
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

River: Este Wash Reach: 1 RS: 1175 Profile: PF 1
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 815 Profile: PF 1
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 425 Profile: PF 1
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 0 Profile: PF 1
Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth). Water surface set to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

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CP N, O & P

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Exisitng Condition)
CP P

Combined Rating Table (Weir Flow)

Total Discharge (cfs)	Houghton Road Weir Discharge (cfs)	Northern Weir Discharge (cfs)	HW Elev. (ft)
0.0	0.0	0.0	2,853.90
0.3	0.3	0.0	2,854.00
2.0	2.0	0.0	2,854.10
5.9	5.9	0.0	2,854.20
12.6	12.6	0.0	2,854.30
22.6	22.6	0.0	2,854.40
36.4	36.4	0.0	2,854.50
55.0	54.8	0.2	2,854.60
80.2	79.1	1.1	2,854.70
117.4	114.3	3.0	2,854.80
162.6	156.4	6.2	2,854.90
216.5	205.7	10.8	2,855.00

Q100 = 61.2 Peak 100-Year Flow (Local Runoff) Reaching CP P

By Linear Interpolation:
Qweir N = 1.9 Flow to North
Qweir H = 59.3 Flow Over Houghton Road
Total Q100 61.2
WSE100 = 2854.46

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Exisitng Condition)
CP P Houghton Road Weir

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Irregular Weir Cross-Section:

	STA (ft)	ELEV (ft)	SEGMENT
1	0	2853.90	
2	10	2854.00	A
3	121.2	2854.70	B
4	140.5	2855.00	C
5	161.8	2855.00	D
6	233.5	2854.50	E
7			F
8			G
9			H
10			I
11			J
12			K
13			L

Rating Table

WSE	Qweir
53.90	0.0
54.00	0.3
54.10	2.0
54.20	5.9
54.30	12.6
54.40	22.6
54.50	36.4
54.60	54.8
54.70	79.1
54.80	114.3
54.90	156.4
55.00	205.7

Base Elevation 2800 feet

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 53.90 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 54.00 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 54.10 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	53.90								0.10				0.20		
	10.0	54.00	10.0	0.0100	0.00			0.0	10.00		0.05	0.3	10.00	0.10	0.15	1.5
B	10.0	54.00												0.10		
	121.2	54.70	111.2	0.0063	0.00			0.0	0.00			0.0	15.89		0.05	0.5
C	121.2	54.70														
	140.5	55.00	19.3	0.0155	0.00			0.0	0.00			0.0	0.00			0.0
D	140.5	55.00														
	161.8	55.00	21.3	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
E	161.8	55.00														
	233.5	54.50	71.7	-0.0070	0.00			0.0	0.00			0.0	0.00			0.0
F	233.5	54.50														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								0.0				0.3				2.0

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Exisitng Condition)
CP P Houghton Road Weir

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation *2800 feet*

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 54.20 Adj'd DL	Yi / Yii	Yave	Qweir (ft³/sec)	WSE = 54.30 Adj'd DL	Yi / Yii	Yave	Qweir (ft³/sec)	WSE = 54.40 Adj'd DL	Yi / Yii	Yave	Qweir (ft³/sec)
A	0.0	53.90				0.30				0.40				0.50		
	10.0	54.00	10.0	0.0100	10.00	0.20	0.25	3.2	10.00	0.30	0.35	5.4	10.00	0.40	0.45	7.8
B	10.0	54.00				0.20				0.30				0.40		
	121.2	54.70	111.2	0.0063	31.77		0.10	2.6	47.66		0.15	7.2	63.54		0.20	14.8
C	121.2	54.70														
	140.5	55.00	19.3	0.0155	0.00			0.0	0.00			0.0	0.00			0.0
D	140.5	55.00														
	161.8	55.00	21.3	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
E	161.8	55.00														
	233.5	54.50	71.7	-0.0070	0.00			0.0	0.00			0.0	0.00			0.0
F	233.5	54.50														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								5.9				12.6				22.6

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Exisitng Condition)
CP P Houghton Road Weir

Qw = Cw x DL x d$^{3/2}$ Cw = 2.6

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation 2800 feet

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 54.50 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 54.60 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 54.70 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	53.90				0.60				0.70				0.80		
	10.0	54.00	10.0	0.0100	10.00	0.50	0.55	10.6	10.00	0.60	0.65	13.6	10.00	0.70	0.75	16.9
B	10.0	54.00				0.50				0.60				0.70		
	121.2	54.70	111.2	0.0063	79.43		0.25	25.8	95.31		0.30	40.7	111.20		0.35	59.9
C	121.2	54.70														
	140.5	55.00	19.3	0.0155	0.00			0.0	0.00			0.0	0.00			0.0
D	140.5	55.00														
	161.8	55.00	21.3	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
E	161.8	55.00														
	233.5	54.50	71.7	-0.0070	0.00			0.0	14.34	0.10	0.05	0.4	28.68	0.20	0.10	2.4
F	233.5	54.50														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								36.4				54.8				79.1

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
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CP P Houghton Road Weir

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation *2800 feet*

Irregular Weir Analysis					WSE =			54.80	WSE =			54.90	WSE =			55.00
Segmt	STA	ELEV	DL	So	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	53.90				0.90				1.00				1.10		
	10.0	54.00	10.0	0.0100	10.00	0.80	0.85	20.4	10.00	0.90	0.95	24.1	10.00	1.00	1.05	28.0
B	10.0	54.00				0.80				0.90				1.00		
	121.2	54.70	111.2	0.0063	111.20	0.10	0.45	87.3	111.20	0.20	0.55	117.9	111.20	0.30	0.65	151.5
C	121.2	54.70				0.10				0.20				0.30		
	140.5	55.00	19.3	0.0155	6.43		0.05	0.2	12.87		0.10	1.1	19.30		0.15	2.9
D	140.5	55.00														
	161.8	55.00	21.3	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
E	161.8	55.00														
	233.5	54.50	71.7	-0.0070	43.02	0.30	0.15	6.5	57.36	0.40	0.20	13.3	71.70	0.50	0.25	23.3
F	233.5	54.50														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								114.3				156.4				205.7

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
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CP P Northern Weir

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.5

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Irregular Weir Cross-Section:

	STA (ft)	ELEV (ft)	SEGMENT
1	0	2854.50	
2	34.7	2855.00	A
3	47.9	2856.00	B
4	76.2	2857.00	C
5	109.2	2859.00	D
6	145.2	2860.00	E
7			F
8			G
9			H
10			I
11			J
12			K
13			L

Rating Table

WSE	Qweir
53.90	0.0
54.00	0.0
54.10	0.0
54.20	0.0
54.30	0.0
54.40	0.0
54.50	0.0
54.60	0.2
54.70	1.1
54.80	3.0
54.90	6.2
55.00	10.8

Base Elevation *2800 feet*

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 53.90 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 54.00 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 54.10 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	54.50														
	34.7	55.00	34.7	0.0144	0.00			0.0	0.00			0.0	0.00			0.0
B	34.7	55.00														
	47.9	56.00	13.2	0.0758	0.00			0.0	0.00			0.0	0.00			0.0
C	47.9	56.00														
	76.2	57.00	28.3	0.0353	0.00			0.0	0.00			0.0	0.00			0.0
D	76.2	57.00														
	109.2	59.00	33.0	0.0606	0.00			0.0	0.00			0.0	0.00			0.0
E	109.2	59.00														
	145.2	60.00	36.0	0.0278	0.00			0.0	0.00			0.0	0.00			0.0
F	145.2	60.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								0.0				0.0				0.0

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CP P Northern Weir

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.5

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation *2800 feet*

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 54.20 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 54.30 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 54.40 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	54.50														
	34.7	55.00	34.7	0.0144	0.00			0.0	0.00			0.0	0.00			0.0
B	34.7	55.00														
	47.9	56.00	13.2	0.0758	0.00			0.0	0.00			0.0	0.00			0.0
C	47.9	56.00														
	76.2	57.00	28.3	0.0353	0.00			0.0	0.00			0.0	0.00			0.0
D	76.2	57.00														
	109.2	59.00	33.0	0.0606	0.00			0.0	0.00			0.0	0.00			0.0
E	109.2	59.00														
	145.2	60.00	36.0	0.0278	0.00			0.0	0.00			0.0	0.00			0.0
F	145.2	60.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								0.0				0.0				0.0

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CP P Northern Weir

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.5

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation 2800 feet

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 54.50 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 54.60 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 54.70 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	54.50								0.10				0.20		
	34.7	55.00	34.7	0.0144	0.00			0.0	6.94		0.05	0.2	13.88		0.10	1.1
B	34.7	55.00														
	47.9	56.00	13.2	0.0758	0.00			0.0	0.00			0.0	0.00			0.0
C	47.9	56.00														
	76.2	57.00	28.3	0.0353	0.00			0.0	0.00			0.0	0.00			0.0
D	76.2	57.00														
	109.2	59.00	33.0	0.0606	0.00			0.0	0.00			0.0	0.00			0.0
E	109.2	59.00														
	145.2	60.00	36.0	0.0278	0.00			0.0	0.00			0.0	0.00			0.0
F	145.2	60.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								0.0				0.2				1.1

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CP P Northern Weir

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.5

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation *2800 feet*

Irregular Weir Analysis					WSE = 54.80				WSE = 54.90				WSE = 55.00			
Segmt	STA	ELEV	DL	So	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	54.50				0.30				0.40				0.50		
	34.7	55.00	34.7	0.0144	20.82		0.15	3.0	27.76		0.20	6.2	34.70		0.25	10.8
B	34.7	55.00														
	47.9	56.00	13.2	0.0758	0.00			0.0	0.00			0.0	0.00			0.0
C	47.9	56.00														
	76.2	57.00	28.3	0.0353	0.00			0.0	0.00			0.0	0.00			0.0
D	76.2	57.00														
	109.2	59.00	33.0	0.0606	0.00			0.0	0.00			0.0	0.00			0.0
E	109.2	59.00														
	145.2	60.00	36.0	0.0278	0.00			0.0	0.00			0.0	0.00			0.0
F	145.2	60.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								3.0				6.2				10.8

Houghton Rd Speedway-Old Spanish Trail
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CP O

Combined Rating Table (Weir Flow)

Total Discharge (cfs)	Houghton Road Weir Discharge (cfs)	Northern Weir Discharge (cfs)	HW Elev. (ft)
0.0	0.0	0.0	2,853.90
0.3	0.3	0.0	2,854.00
3.7	2.0	1.7	2,854.10
10.8	5.9	5.0	2,854.20
21.7	12.6	9.1	2,854.30
36.7	22.6	14.1	2,854.40
56.2	36.4	19.8	2,854.50
80.9	54.8	26.1	2,854.60
112.1	79.1	33.0	2,854.70
154.8	114.3	40.5	2,854.80
204.9	156.4	48.5	2,854.90
262.6	205.7	56.9	2,855.00

Q100 = 33.4 Peak 100-Year Flow (Local Runoff) Reaching CP O
Q100 = 1.9 Weir Flow from CP P

Q100 Tot= 35.3

By Linear Interpolation:
Qweir N = 11.6 Flow to North
Qweir H = 23.7 Flow Over Houghton Road
Total Q100 35.3
WSE100 = 2854.16

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
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CP O

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Irregular Weir Cross-Section:

	STA (ft)	ELEV (ft)	SEGMENT
1	313.5	2855.40	
2	396.3	2854.50	A
3	513.4	2854.00	B
4			C
5			D
6			E
7			F
8			G
9			H
10			I
11			J
12			K
13			L

Rating Table

WSE	Qweir
53.90	0.0
54.00	0.0
54.10	0.7
54.20	3.9
54.30	10.6
54.40	21.8
54.50	38.1
54.60	63.3
54.70	93.4
54.80	128.4
54.90	168.1
55.00	212.7

Base Elevation *2800 feet*

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 53.90 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 54.00 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 54.10 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	313.5	55.40														
	396.3	54.50	82.8	-0.0109	0.00			0.0	0.00			0.0	0.00			0.0
B	396.3	54.50														
	513.4	54.00	117.1	-0.0043	0.00			0.0	0.00			0.0	23.42	0.10	0.05	0.7
C	513.4	54.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
D	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
E	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
F	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								0.0				0.0				0.7

Houghton Rd Speedway-Old Spanish Trail
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CP O

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation *2800 feet*

Irregular Weir Analysis					WSE = 54.20				WSE = 54.30				WSE = 54.40			
Segmt	STA	ELEV	DL	So	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	313.5	55.40														
	396.3	54.50	82.8	-0.0109	0.00			0.0	0.00			0.0	0.00			0.0
B	396.3	54.50														
	513.4	54.00	117.1	-0.0043	46.84	0.20	0.10	3.9	70.26	0.30	0.15	10.6	93.68	0.40	0.20	21.8
C	513.4	54.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
D	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
E	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
F	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								3.9				10.6				21.8

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PB Project No. 11515
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CP O

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation *2800 feet*

Irregular Weir Analysis					WSE = 54.50				WSE = 54.60				WSE = 54.70			
Segmt	STA	ELEV	DL	So	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	313.5	55.40														
	396.3	54.50	82.8	-0.0109	0.00			0.0	9.20	0.10	0.05	0.3	18.40	0.20	0.10	1.5
B	396.3	54.50								0.10				0.20		
	513.4	54.00	117.1	-0.0043	117.10	0.50	0.25	38.1	117.10	0.60	0.35	63.0	117.10	0.70	0.45	91.9
C	513.4	54.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
D	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
E	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
F	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								38.1				63.3				93.4

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
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CP O

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation *2800 feet*

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 54.80 Adj'd DL	Yi / Yii	Yave	Qweir (ft³/sec)	WSE = 54.90 Adj'd DL	Yi / Yii	Yave	Qweir (ft³/sec)	WSE = 55.00 Adj'd DL	Yi / Yii	Yave	Qweir (ft³/sec)
A	313.5	55.40														
	396.3	54.50	82.8	-0.0109	27.60	0.30	0.15	4.2	36.80	0.40	0.20	8.6	46.00	0.50	0.25	14.9
B	396.3	54.50				0.30				0.40				0.50		
	513.4	54.00	117.1	-0.0043	117.10	0.80	0.55	124.2	117.10	0.90	0.65	159.6	117.10	1.00	0.75	197.8
C	513.4	54.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
D	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
E	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
F	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								128.4				168.1				212.7

Houghton Rd Speedway-Old Spanish Trail
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Hydraulic Analysis (Exisitng Condition)
CP O

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.5

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Irregular Weir Cross-Section:

	STA (ft)	ELEV (ft)	SEGMENT
1	0	2854.00	
2	10.6	2854.00	A
3	22	2854.00	B
4	24.2	2855.00	C
5	32.4	2855.40	D
6	96.9	2856.80	E
7			F
8			G
9			H
10			I
11			J
12			K
13			L

Rating Table

WSE	Qweir
53.90	0.0
54.00	0.0
54.10	1.7
54.20	5.0
54.30	9.1
54.40	14.1
54.50	19.8
54.60	26.1
54.70	33.0
54.80	40.5
54.90	48.5
55.00	56.9

Base Elevation *2800 feet*

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 53.90 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 54.00 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 54.10 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	54.00												0.10		
	10.6	54.00	10.6	0.0000	0.00			0.0	0.00			0.0	10.60	0.10	0.10	0.8
B	10.6	54.00												0.10		
	22.0	54.00	11.4	0.0000	0.00			0.0	0.00			0.0	11.40	0.10	0.10	0.9
C	22.0	54.00												0.10		
	24.2	55.00	2.2	0.4545	0.00			0.0	0.00			0.0	0.22		0.05	0.0
D	24.2	55.00														
	32.4	55.40	8.2	0.0488	0.00			0.0	0.00			0.0	0.00			0.0
E	32.4	55.40														
	96.9	56.80	64.5	0.0217	0.00			0.0	0.00			0.0	0.00			0.0
F	96.9	56.80														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								0.0				0.0				1.7

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CP O

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.5

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation *2800 feet*

Irregular Weir Analysis					WSE = 54.20				WSE = 54.30				WSE = 54.40			
Segmt	STA	ELEV	DL	So	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	54.00				0.20				0.30				0.40		
	10.6	54.00	10.6	0.0000	10.60	0.20	0.20	2.4	10.60	0.30	0.30	4.4	10.60	0.40	0.40	6.7
B	10.6	54.00				0.20				0.30				0.40		
	22.0	54.00	11.4	0.0000	11.40	0.20	0.20	2.5	11.40	0.30	0.30	4.7	11.40	0.40	0.40	7.2
C	22.0	54.00				0.20				0.30				0.40		
	24.2	55.00	2.2	0.4545	0.44		0.10	0.0	0.66		0.15	0.1	0.88		0.20	0.2
D	24.2	55.00														
	32.4	55.40	8.2	0.0488	0.00			0.0	0.00			0.0	0.00			0.0
E	32.4	55.40														
	96.9	56.80	64.5	0.0217	0.00			0.0	0.00			0.0	0.00			0.0
F	96.9	56.80														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								5.0				9.1				14.1

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CP O

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.5

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation *2800 feet*

Irregular Weir Analysis					WSE =			54.50	WSE =			54.60	WSE =			54.70
Segmt	STA	ELEV	DL	So	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	54.00				0.50				0.60				0.70		
	10.6	54.00	10.6	0.0000	10.60	0.50	0.50	9.4	10.60	0.60	0.60	12.3	10.60	0.70	0.70	15.5
B	10.6	54.00				0.50				0.60				0.70		
	22.0	54.00	11.4	0.0000	11.40	0.50	0.50	10.1	11.40	0.60	0.60	13.2	11.40	0.70	0.70	16.7
C	22.0	54.00				0.50				0.60				0.70		
	24.2	55.00	2.2	0.4545	1.10		0.25	0.3	1.32		0.30	0.5	1.54		0.35	0.8
D	24.2	55.00														
	32.4	55.40	8.2	0.0488	0.00			0.0	0.00			0.0	0.00			0.0
E	32.4	55.40														
	96.9	56.80	64.5	0.0217	0.00			0.0	0.00			0.0	0.00			0.0
F	96.9	56.80														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								19.8				26.1				33.0

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
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CP O

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.5

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation *2800 feet*

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 54.80 Adj'd DL	Yi / Yii	Yave	Qweir (ft³/sec)	WSE = 54.90 Adj'd DL	Yi / Yii	Yave	Qweir (ft³/sec)	WSE = 55.00 Adj'd DL	Yi / Yii	Yave	Qweir (ft³/sec)
A	0.0	54.00				0.80				0.90				1.00		
	10.6	54.00	10.6	0.0000	10.60	0.80	0.80	19.0	10.60	0.90	0.90	22.6	10.60	1.00	1.00	26.5
B	10.6	54.00				0.80				0.90				1.00		
	22.0	54.00	11.4	0.0000	11.40	0.80	0.80	20.4	11.40	0.90	0.90	24.3	11.40	1.00	1.00	28.5
C	22.0	54.00				0.80				0.90				1.00		
	24.2	55.00	2.2	0.4545	1.76		0.40	1.1	1.98		0.45	1.5	2.20		0.50	1.9
D	24.2	55.00														
	32.4	55.40	8.2	0.0488	0.00			0.0	0.00			0.0	0.00			0.0
E	32.4	55.40														
	96.9	56.80	64.5	0.0217	0.00			0.0	0.00			0.0	0.00			0.0
F	96.9	56.80														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								40.5				48.5				56.9

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Exisitng Condition)
CP N

OUTPUT FROM CULVERT MASTER
Culvert Diameter = 3

Total Discharge (cfs)	Weir Discharge (cfs)	Northern Weir Discharge (cfs)	HW Elev. (ft)
0.0	0.0	0.0	2,852.70
1.0	0.8	0.2	2,852.80
5.6	4.6	0.9	2,852.90
15.3	12.8	2.5	2,853.00
33.4	28.0	5.4	2,853.10
57.3	48.2	9.1	2,853.20
87.0	73.8	13.3	2,853.30
122.8	104.8	18.0	2,853.40
164.8	141.5	23.2	2,853.50
213.2	184.2	28.9	2,853.60
268.2	233.1	35.1	2,853.70
334.2	292.5	41.7	2,853.80

Q100 = 35 Peak 100-Year Flow (Local Runoff) Reaching CP N
Q100 = 11.6 Weir Flow from CP O

Q100 Tot= 46.6

By Linear Interpolation:
Qweir N = 7.0 Flow to North
Qweir H = 39.6 Flow Over Houghton Road
Total Q100 46.6
WSE100 = 2852.96

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$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Irregular Weir Cross-Section:

	STA (ft)	ELEV (ft)	SEGMENT
1	513.4	2854.00	
2	543.8	2853.70	A
3	656.3	2853.00	B
4	741	2852.70	C
5			D
6			E
7			F
8			G
9			H
10			I
11			J
12			K
13			L

Rating Table

WSE	Qweir
52.70	0.0
52.80	0.8
52.90	4.6
53.00	12.8
53.10	28.0
53.20	48.2
53.30	73.8
53.40	104.8
53.50	141.5
53.60	184.2
53.70	233.1
53.80	292.5

Base Elevation *2800 feet*

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 52.70 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 52.80 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 52.90 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	513.4	54.00														
	543.8	53.70	30.4	-0.0099	0.00			0.0	0.00			0.0	0.00			0.0
B	543.8	53.70														
	656.3	53.00	112.5	-0.0062	0.00				0.00			0.0	0.00			0.0
C	656.3	53.00														
	741.0	52.70	84.7	-0.0035	0.00			0.0	28.23	0.10	0.05	0.8	56.47	0.20	0.10	4.6
D	741.0	52.70														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
E	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
F	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								0.0				0.8				4.6

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$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation *2800 feet*

Irregular Weir Analysis					WSE =			53.00	WSE =			53.10	WSE =			53.20
Segmt	STA	ELEV	DL	So	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	513.4	54.00														
	543.8	53.70	30.4	-0.0099	0.00			0.0	0.00			0.0	0.00			0.0
B	543.8	53.70														
	656.3	53.00	112.5	-0.0062	0.00			0.0	16.07	0.10	0.05	0.5	32.14	0.20	0.10	2.6
C	656.3	53.00								0.10				0.20		
	741.0	52.70	84.7	-0.0035	84.70	0.30	0.15	12.8	84.70	0.40	0.25	27.5	84.70	0.50	0.35	45.6
D	741.0	52.70														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
E	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
F	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								12.8				28.0				48.2

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
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CP N

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation *2800 feet*

Irregular Weir Analysis					WSE = 53.30				WSE = 53.40				WSE = 53.50			
Segmt	STA	ELEV	DL	So	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	513.4	54.00														
	543.8	53.70	30.4	-0.0099	0.00			0.0	0.00			0.0	0.00			0.0
B	543.8	53.70														
	656.3	53.00	112.5	-0.0062	48.21	0.30	0.15	7.3	64.29	0.40	0.20	14.9	80.36	0.50	0.25	26.1
C	656.3	53.00				0.30				0.40				0.50		
	741.0	52.70	84.7	-0.0035	84.70	0.60	0.45	66.5	84.70	0.70	0.55	89.8	84.70	0.80	0.65	115.4
D	741.0	52.70														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
E	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
F	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								73.8				104.8				141.5

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CP N

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation *2800 feet*

Irregular Weir Analysis					WSE =			53.60	WSE =			53.70	WSE =			53.80
Segmt	STA	ELEV	DL	So	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	513.4	54.00														
	543.8	53.70	30.4	-0.0099	0.00			0.0	0.00			0.0	10.13	0.10	0.05	0.3
B	543.8	53.70												0.10		
	656.3	53.00	112.5	-0.0062	96.43	0.60	0.30	41.2	112.50	0.70	0.35	60.6	112.50	0.80	0.45	88.3
C	656.3	53.00				0.60				0.70				0.80		
	741.0	52.70	84.7	-0.0035	84.70	0.90	0.75	143.0	84.70	1.00	0.85	172.6	84.70	1.10	0.95	203.9
D	741.0	52.70														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
E	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
F	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								184.2				233.1				292.5

Houghton Rd Speedway-Old Spanish Trail
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CP N

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.5

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Irregular Weir Cross-Section:

	STA (ft)	ELEV (ft)	SEGMENT
1	0	2852.70	
2	17.4	2853.00	A
3	20.2	2854.00	B
4	26	2855.00	C
5	40	2855.10	D
6	63.6	2855.50	E
7	80.6	2856.00	F
8	130.6	2856.70	G
9			H
10			I
11			J
12			K
13			L

Rating Table

WSE	Qweir
52.70	0.0
52.80	0.2
52.90	0.9
53.00	2.5
53.10	5.4
53.20	9.1
53.30	13.3
53.40	18.0
53.50	23.2
53.60	28.9
53.70	35.1
53.80	41.7

Base Elevation *2800 feet*

Irregular Weir Analysis					WSE = 52.70				WSE = 52.80				WSE = 52.90			
Segmt	STA	ELEV	DL	So	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	52.70								0.10				0.20		
	17.4	53.00	17.4	0.0172	0.00			0.0	5.80		0.05	0.2	11.60		0.10	0.9
B	17.4	53.00														
	20.2	54.00	2.8	0.3571	0.00				0.00			0.0	0.00			0.0
C	20.2	54.00														
	26.0	55.00	5.8	0.1724	0.00			0.0	0.00			0.0	0.00			0.0
D	26.0	55.00														
	40.0	55.10	14.0	0.0071	0.00			0.0	0.00			0.0	0.00			0.0
E	40.0	55.10														
	63.6	55.50	23.6	0.0169	0.00			0.0	0.00			0.0	0.00			0.0
F	63.6	55.50														
	80.6	56.00	17.0	0.0294	0.00			0.0	0.00			0.0	0.00			0.0
G	80.6	56.00														
	130.6	56.70	50.0	0.0140	0.00			0.0	0.00			0.0	0.00			0.0
H	130.6	56.70														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								0.0				0.2				0.9

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CP N

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.5

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation *2800 feet*

Irregular Weir Analysis					WSE = 53.00				WSE = 53.10				WSE = 53.20			
Segmt	STA	ELEV	DL	So	Adj'd DL	Yi / Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi / Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi / Yii	Yave	Qweir (ft³/sec)
A	0.0	52.70				0.30				0.40				0.50		
	17.4	53.00	17.4	0.0172	17.40		0.15	2.5	17.40	0.10	0.25	5.4	17.40	0.20	0.35	9.0
B	17.4	53.00								0.10				0.20		
	20.2	54.00	2.8	0.3571	0.00			0.0	0.28		0.05	0.0	0.56		0.10	0.0
C	20.2	54.00														
	26.0	55.00	5.8	0.1724	0.00			0.0	0.00			0.0	0.00			0.0
D	26.0	55.00														
	40.0	55.10	14.0	0.0071	0.00			0.0	0.00			0.0	0.00			0.0
E	40.0	55.10														
	63.6	55.50	23.6	0.0169	0.00			0.0	0.00			0.0	0.00			0.0
F	63.6	55.50														
	80.6	56.00	17.0	0.0294	0.00			0.0	0.00			0.0	0.00			0.0
G	80.6	56.00														
	130.6	56.70	50.0	0.0140	0.00			0.0	0.00			0.0	0.00			0.0
H	130.6	56.70														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								2.5				5.4				9.1

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CP N

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.5

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation *2800 feet*

Irregular Weir Analysis					WSE = 53.30				WSE = 53.40				WSE = 53.50			
Segmt	STA	ELEV	DL	So	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	52.70				0.60				0.70				0.80		
	17.4	53.00	17.4	0.0172	17.40	0.30	0.45	13.1	17.40	0.40	0.55	17.7	17.40	0.50	0.65	22.8
B	17.4	53.00				0.30				0.40				0.50		
	20.2	54.00	2.8	0.3571	0.84		0.15	0.1	1.12		0.20	0.3	1.40		0.25	0.4
C	20.2	54.00														
	26.0	55.00	5.8	0.1724	0.00			0.0	0.00			0.0	0.00			0.0
D	26.0	55.00														
	40.0	55.10	14.0	0.0071	0.00			0.0	0.00			0.0	0.00			0.0
E	40.0	55.10														
	63.6	55.50	23.6	0.0169	0.00			0.0	0.00			0.0	0.00			0.0
F	63.6	55.50														
	80.6	56.00	17.0	0.0294	0.00			0.0	0.00			0.0	0.00			0.0
G	80.6	56.00														
	130.6	56.70	50.0	0.0140	0.00			0.0	0.00			0.0	0.00			0.0
H	130.6	56.70														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								13.3				18.0				23.2

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Exisitng Condition)
CP N

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.5

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation *2800 feet*

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 53.60 Adj'd DL	Yi / Yii	Yave	Qweir (ft³/sec)	WSE = 53.70 Adj'd DL	Yi / Yii	Yave	Qweir (ft³/sec)	WSE = 53.80 Adj'd DL	Yi / Yii	Yave	Qweir (ft³/sec)
A	0.0	52.70				0.90				1.00				1.10		
	17.4	53.00	17.4	0.0172	17.40	0.60	0.75	28.3	17.40	0.70	0.85	34.1	17.40	0.80	0.95	40.3
B	17.4	53.00				0.60				0.70				0.80		
	20.2	54.00	2.8	0.3571	1.68		0.30	0.7	1.96		0.35	1.0	2.24		0.40	1.4
C	20.2	54.00														
	26.0	55.00	5.8	0.1724	0.00			0.0	0.00			0.0	0.00			0.0
D	26.0	55.00														
	40.0	55.10	14.0	0.0071	0.00			0.0	0.00			0.0	0.00			0.0
E	40.0	55.10														
	63.6	55.50	23.6	0.0169	0.00			0.0	0.00			0.0	0.00			0.0
F	63.6	55.50														
	80.6	56.00	17.0	0.0294	0.00			0.0	0.00			0.0	0.00			0.0
G	80.6	56.00														
	130.6	56.70	50.0	0.0140	0.00			0.0	0.00			0.0	0.00			0.0
H	130.6	56.70														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								28.9				35.1				41.7

APPENDIX C

PROPOSED CONDITION HYDRAULICS

C-1

CORONADO RIDGE WASH

PB Proj No. 11515
Coronado Ridge Wash *(Main Branch)*
Proposed Condition Analysis
a

HEC-RAS Version 3.1.3 May 2005
U.S. Army Corp 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: CRW (ERZ) Broadway to Houghton Main
Project File : CRW_MAIN.prj
Run Date and Time: 8/27/2008 1:28:37 PM

Project in English units

Project Description:
Coronado Ridge Wash
Limits of Study:
Main Reach--
US Broadway Blvd. Culvert
to 500' DS of Houghton Road

XSECs Developed from Project Mapping &
Supplimented with PAG 1998 Contours

FLOW DATA

Flow Title: CRW (ERZ) MAIN TSMS
Flow File : l:\11515\Drainage\HECRAS\Coronado Ridge Wash (ERZ) Restored\CRW_MAIN.f01

Flow Data (cfs)

River	Reach	RS	TSMS100Yr
Coronado Ridge	MAIN	2250	950

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Coronado Ridge	MAIN	TSMS100Yr	Critical	Normal S = 0.025

GEOMETRY DATA

Geometry Title: CRW (ERZ) MAIN PROP 3-8x4 CULV
Geometry File : l:\11515\Drainage\HECRAS\Coronado Ridge Wash (ERZ) Restored\CRW_MAIN.g01

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 2250

INPUT
Description:
Station Elevation Data num= 51

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2751	0	2747.58	.23	2747.55	5.05	2747.07	9.48	2747.01
9.73	2747	13.64	2747.01	14.03	2747	19.02	2746.99	19.28	2746.99
23.82	2746.94	24.12	2746.95	28.4	2746.92	32.78	2746.96	33.52	2746.97
33.76	2746.96	38.32	2747.04	38.63	2747.04	42.77	2747.17	46.99	2747.19
47.31	2747.2	51.89	2747.2	52	2747.2	56.4	2747.12	58.02	2747.16
62.18	2747.23	62.91	2747.33	63.42	2747.39	66.63	2747.59	67.87	2748.2
71.12	2748.37	72.35	2748.7	72.72	2748.78	76.36	2749.32	77.79	2749.45
80.92	2749.6	82.64	2749.68	85.61	2749.79	87.32	2749.72	89.88	2749.76
92.45	2749.86	94.15	2749.58	94.71	2749.53	98.13	2749.61	99.28	2749.63

101.11 2749.71 103.08 2749.66 104.09 2750.21 106.03 2750.79 107.84 2750.83
108.74 2750.86

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	0	.02	77.79	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	77.79	5	5	5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	5.5	2750.97	F
59.8	108.74	2750.91	F

CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2750.23	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.05	Wt. n-Val.		0.020	
W.S. Elev (ft)	2749.18	Reach Len. (ft)	5.00	5.00	5.00
Crit W.S. (ft)	2749.18	Flow Area (sq ft)		115.31	
E.G. Slope (ft/ft)	0.004506	Area (sq ft)		143.98	
Q Total (cfs)	950.00	Flow (cfs)		950.00	
Top Width (ft)	75.39	Top Width (ft)		75.39	
Vel Total (ft/s)	8.24	Avg. Vel. (ft/s)		8.24	
Max Chl Dpth (ft)	2.26	Hydr. Depth (ft)		2.12	
Conv. Total (cfs)	14151.9	Conv. (cfs)		14151.9	
Length Wtd. (ft)	5.00	Wetted Per. (ft)		54.31	
Min Ch El (ft)	2746.92	Shear (lb/sq ft)		0.60	
Alpha	1.00	Stream Power (lb/ft s)		4.92	
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	1.30	3.92	1.86
C & E Loss (ft)	0.24	Cum SA (acres)	1.31	1.76	2.39

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 2245

INPUT
Description:
Station Elevation Data num= 32

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2749.98	1.43	2749.32	7.81	2748.41	8.2	2748.6	8.2	2744.89
34.4	2745.24	62.9	2745.75	62.9	2748.5	65.4	2748.52	68.66	2748.86
71.6	2749.38	73.79	2750.14	75.02	2750.46	77.16	2750.9	77.68	2750.96
81.52	2751.27	86.3	2751.41	90.44	2751.15	90.72	2751.15	91.03	2751.16
94.96	2750.49	96.21	2750.36	98.27	2750.39	100.89	2750.4	102.04	2750.44
104.97	2750.34	106.04	2750.35	108.32	2750.1	108.92	2749.94	109.97	2749.66
110.01	2749.79	110.69	2749.71						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	8.2	.02	62.9	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
8.2	62.9	90	90	90	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	12.3	2750.97	F
56.9	110.69	2750.91	F

CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2749.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.57	Wt. n-Val.		0.020	
W.S. Elev (ft)	2748.77	Reach Len. (ft)	90.00	90.00	90.00
Crit W.S. (ft)	2747.70	Flow Area (sq ft)		156.13	
E.G. Slope (ft/ft)	0.001262	Area (sq ft)	0.56	190.36	0.94
Q Total (cfs)	950.00	Flow (cfs)		950.00	
Top Width (ft)	62.49	Top Width (ft)	2.91	54.70	4.89
Vel Total (ft/s)	6.08	Avg. Vel. (ft/s)		6.08	
Max Chl Dpth (ft)	3.88	Hydr. Depth (ft)		3.50	
Conv. Total (cfs)	26741.6	Conv. (cfs)		26741.6	

PB Proj No. 11515
Coronado Ridge Wash *(Main Branch)*
Proposed Condition Analysis

Length Wtd. (ft)	90.00	Wetted Per. (ft)		44.61	
Min Ch El (ft)	2744.89	Shear (lb/sq ft)		0.28	
Alpha	1.00	Stream Power (lb/ft s)		1.68	
Frctn Loss (ft)		Cum Volume (acre-ft)	1.30	3.90	1.86
C & E Loss (ft)		Cum SA (acres)	1.31	1.75	2.39

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CULVERT

RIVER: Coronado Ridge
REACH: MAIN RS: 2240

INPUT
Description:
Distance from Upstream XS = 11
Deck/Roadway Width = 65
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 11

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2751.53		1.4	2751.56		8.4	2751.48	
10.7	2750.97		35.3	2750.99		43.2	2750.91	
52.4	2751.34		74.1	2751.51		84.2	2751.98	
92.1	2751.95		117.4	2752.63				

Upstream Bridge Cross Section Data
Station Elevation Data num= 32

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2749.98	1.43	2749.32	7.81	2748.41	8.2	2748.6	8.2	2744.89
34.4	2745.24	62.9	2745.75	62.9	2748.5	65.4	2748.52	68.66	2748.86
71.6	2749.38	73.79	2750.14	75.02	2750.46	77.16	2750.9	77.68	2750.96
81.52	2751.27	86.3	2751.41	90.44	2751.15	90.72	2751.15	91.03	2751.16
94.96	2750.49	96.21	2750.36	98.27	2750.39	100.89	2750.4	102.04	2750.44
104.97	2750.34	106.04	2750.35	108.32	2750.1	108.92	2749.94	109.97	2749.66
110.01	2749.79	110.69	2749.71						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	8.2	.02	62.9	.04

Bank Sta: Left	Right	Coeff Contr.	Expan.
8.2	62.9	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	12.3	2750.97	F
56.9	110.69	2750.91	F

Downstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2750.95		20.6	2751.13		35.1	2751.22	
41.6	2750.85		123.7	2751.44		125.4	2751.86	
158	2751.55							

Downstream Bridge Cross Section Data
Station Elevation Data num= 50

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2750.8	.64	2750.8	.75	2751.2	4.18	2751.03	5.13	2750.65
9.2	2749.44	12.47	2748.39	13.91	2748.14	14.44	2748.09	14.9	2747.96
15.91	2747.85	16.9	2747.61	17.36	2747.57	18.15	2747.28	18.89	2747.22
22.02	2745.55	22.23	2745.53	23.07	2745	23.39	2744.77	23.53	2744.62
24.61	2744.74	33.73	2744.71	39.93	2744.43	41.72	2743.95	42.41	2743.77
53.85	2743.42	60.9	2743.88	61.31	2744.3	61.52	2745.61	61.72	2746.92
61.77	2746.91	63.99	2747.96	64.61	2747.91	68.81	2748.47	73.48	2748.36
79.11	2748.38	83.53	2748.47	84.55	2748.43	89.31	2748.35	95.69	2747.94
100.62	2747.97	105.59	2748.1	110.7	2748.15	120	2748.14	124.59	2748.06
140.83	2747.92	142.33	2747.86	145.71	2747.85	150.64	2747.72	157.32	2747.72

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	4.18	.035	68.81	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
4.18	68.81	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	21.6	2750	F
62.2	157.32	2750	F

Upstream Embankment side slope = 5 horiz. to 1.0 vertical

PB Proj No. 11515
Coronado Ridge Wash *(Main Branch)*
Proposed Condition Analysis

Downstream Embankment side slope = 5 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Box	3	8

FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	5	78	.013	.013	0	.2	1

Number of Barrels = 4
Upstream Elevation = 2744
Centerline Stations

Sta.	Sta.	Sta.	Sta.
20.8	29.6	38.3	47.1

Downstream Elevation = 2744
Centerline Stations

Sta.	Sta.	Sta.	Sta.
28.8	37.5	46.3	55

CULVERT OUTPUT Profile #TSMS100Yr Culv Group: Culvert #1

Q Culv Group (cfs)	950.00	Culv Full Len (ft)	78.00
# Barrels	4	Culv Vel US (ft/s)	9.90
Q Barrel (cfs)	237.50	Culv Vel DS (ft/s)	9.90
E.G. US. (ft)	2749.35	Culv Inv El Up (ft)	2744.00
W.S. US. (ft)	2748.77	Culv Inv El Dn (ft)	2744.00
E.G. DS (ft)	2748.08	Culv Frctn Ls (ft)	0.52
W.S. DS (ft)	2746.92	Culv Exit Loss (ft)	0.44
Delta EG (ft)	1.27	Culv Entr Loss (ft)	0.30
Delta WS (ft)	1.85	Q Weir (cfs)	
E.G. IC (ft)	2749.98	Weir Sta Lft (ft)	
E.G. OC (ft)	2749.35	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	2747.00	Weir Max Depth (ft)	
Culv WS Outlet (ft)	2747.00	Weir Avg Depth (ft)	
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	3.00	Min El Weir Flow (ft)	2750.92

Note: Culvert critical depth exceeds the height of the culvert.
Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations are not valid and the supercritical result has been discarded. The outlet answer will be used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 2155

INPUT
Description:
Station Elevation Data num= 50

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2750.8	.64	2750.8	.75	2751.2	4.18	2751.03	5.13	2750.65
9.2	2749.44	12.47	2748.39	13.91	2748.14	14.44	2748.09	14.9	2747.96
15.91	2747.85	16.9	2747.61	17.36	2747.57	18.15	2747.28	18.89	2747.22
22.02	2745.55	22.23	2745.53	23.07	2745	23.39	2744.77	23.53	2744.62
24.61	2744.74	33.73	2744.71	39.93	2744.43	41.72	2743.95	42.41	2743.77
53.85	2743.42	60.9	2743.88	61.31	2744.3	61.52	2745.61	61.72	2746.92
61.77	2746.91	63.99	2747.96	64.61	2747.91	68.81	2748.47	73.48	2748.36
79.11	2748.38	83.53	2748.47	84.55	2748.43	89.31	2748.35	95.69	2747.94
100.62	2747.97	105.59	2748.1	110.7	2748.15	120	2748.14	124.59	2748.06
140.83	2747.92	142.33	2747.86	145.71	2747.85	150.64	2747.72	157.32	2747.72

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	4.18	.035	68.81	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4.18	68.81	75	75	75	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	21.6	2750	F
62.2	157.32	2750	F

PB Proj No. 11515
Coronado Ridge Wash *(Main Branch)*
Proposed Condition Analysis
CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2748.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.16	Wt. n-Val.		0.035	
W.S. Elev (ft)	2746.92	Reach Len. (ft)	75.00	75.00	75.00
Crit W.S. (ft)	2746.78	Flow Area (sq ft)		109.77	
E.G. Slope (ft/ft)	0.011927	Area (sq ft)		110.98	
Q Total (cfs)	950.00	Flow (cfs)		950.00	
Top Width (ft)	42.29	Top Width (ft)		42.29	
Vel Total (ft/s)	8.65	Avg. Vel. (ft/s)		8.65	
Max Chl Dpth (ft)	3.49	Hydr. Depth (ft)		2.73	
Conv. Total (cfs)	8698.8	Conv. (cfs)		8698.8	
Length Wtd. (ft)	75.00	Wetted Per. (ft)		43.04	
Min Ch El (ft)	2743.42	Shear (lb/sq ft)		1.90	
Alpha	1.00	Stream Power (lb/ft s)		16.44	
Frctn Loss (ft)	0.73	Cum Volume (acre-ft)	1.30	3.59	1.86
C & E Loss (ft)	0.11	Cum SA (acres)	1.31	1.65	2.38

Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 2080

INPUT
Description:
Station Elevation Data num= 51

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2755	0	2747.56	.39	2747.41	1.86	2746.96	6.04	2745.38
12	2743.2	16.93	2742.52	21.83	2741.1	23.41	2740.64	27.62	2741.81
30.25	2742.58	37.17	2744.71	39.57	2745.47	44.42	2745.39	50.37	2745.05
53.11	2745.05	54.87	2745.09	62.27	2745.71	64.59	2745.86	67.05	2745.89
67.85	2745.88	68.82	2745.89	73.39	2745.85	79.64	2745.92	83.72	2746.06
103.94	2746.3	106.89	2746.29	111.13	2746.38	115.62	2746.44	119.07	2746.44
125.93	2746.52	129.31	2746.59	139.96	2746.54	150.35	2746.53	157.36	2746.33
161.16	2746.2	165.01	2746.09	169.45	2745.9	172.76	2745.78	176.14	2745.75
184.37	2745.78	200.82	2745.45	207.92	2744.67	208.21	2744.72	211.65	2745.52
222.96	2746.26	225.87	2746.23	229.09	2746.16	231.69	2746.19	233.69	2746.19
236.06	2746.26								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	1.86	.035	39.57	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1.86	39.57	80	80	80	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
76.54	236.06	2752.39	F

CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2747.24	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.95	Wt. n-Val.		0.035	0.080
W.S. Elev (ft)	2746.30	Reach Len. (ft)	80.00	80.00	80.00
Crit W.S. (ft)	2746.08	Flow Area (sq ft)		113.97	29.09
E.G. Slope (ft/ft)	0.008021	Area (sq ft)		113.97	74.01
Q Total (cfs)	950.00	Flow (cfs)		908.78	41.22
Top Width (ft)	180.24	Top Width (ft)		35.96	144.28
Vel Total (ft/s)	6.64	Avg. Vel. (ft/s)		7.97	1.42
Max Chl Dpth (ft)	5.66	Hydr. Depth (ft)		3.17	0.79
Conv. Total (cfs)	10607.2	Conv. (cfs)		10147.0	460.2
Length Wtd. (ft)	80.00	Wetted Per. (ft)		37.53	37.01
Min Ch El (ft)	2740.64	Shear (lb/sq ft)		1.52	0.39
Alpha	1.38	Stream Power (lb/ft s)		12.13	0.56
Frctn Loss (ft)	0.73	Cum Volume (acre-ft)	1.30	3.40	1.80
C & E Loss (ft)	0.05	Cum SA (acres)	1.31	1.58	2.26

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 2000

PB Proj No. 11515
Coronado Ridge Wash *(Main Branch)*
Proposed Condition Analysis

INPUT
Description:
Station Elevation Data num= 49

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2755	0	2745.79	4.21	2744.64	21.71	2742.82	28.81	2742.08
32.33	2741.76	40.08	2743.29	45.42	2744.31	52.11	2744.1	57.99	2744.02
60.72	2744.21	61.57	2744.23	64.27	2744.37	65.66	2744.37	67.25	2744.45
67.82	2744.48	69.56	2744.43	110.26	2745.02	117.55	2745.08	124.03	2745.15
125.44	2745.24	125.89	2745.25	126.39	2745.24	137.21	2745.37	138.95	2745.36
141.21	2745.3	144.02	2745.33	144.85	2745.33	145.25	2745.33	157.13	2744.98
158.72	2744.96	165.16	2744.63	171.39	2744.31	179.09	2744.71	183.11	2744.92
188.69	2743.95	189.97	2743.73	194.36	2744.52	195.1	2744.65	195.62	2744.75
195.9	2744.8	196.76	2744.96	197.48	2744.97	216.71	2745.23	219.01	2745.31
222.6	2745.37	223.39	2745.39	223.62	2745.39	228.94	2745.48		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	4.21	.035	45.42	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4.21	45.42	113	113	113	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
103.23	228.94	2752.39	F

CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2746.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.84	Wt. n-Val.	0.040	0.035	0.080
W.S. Elev (ft)	2745.62	Reach Len. (ft)	113.00	113.00	113.00
Crit W.S. (ft)	2745.62	Flow Area (sq ft)	1.75	102.20	65.55
E.G. Slope (ft/ft)	0.010519	Area (sq ft)	1.75	102.20	145.80
Q Total (cfs)	950.00	Flow (cfs)	4.04	810.22	135.74
Top Width (ft)	228.31	Top Width (ft)	3.58	41.21	183.52
Vel Total (ft/s)	5.60	Avg. Vel. (ft/s)	2.31	7.93	2.07
Max Chl Dpth (ft)	3.86	Hydr. Depth (ft)	0.49	2.48	1.13
Conv. Total (cfs)	9262.8	Conv. (cfs)	39.4	7899.9	1323.5
Length Wtd. (ft)	113.00	Wetted Per. (ft)	3.71	41.60	57.83
Min Ch El (ft)	2741.76	Shear (lb/sq ft)	0.31	1.61	0.74
Alpha	1.73	Stream Power (lb/ft s)	0.71	12.79	1.54
Frctn Loss (ft)	1.13	Cum Volume (acre-ft)	1.30	3.20	1.60
C & E Loss (ft)	0.10	Cum SA (acres)	1.30	1.51	1.95

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 1890

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2749	0	2743	2	2743	5	2742	12	2740
23	2739.8	29	2740	39	2742.2	64	2742.2	69	2742
89	2741	102	2741.3	167	2742	437	2744	479	2746

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	2	.035	39	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
2	39	140	140	92	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
241.36	479	2752.39	F

CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2743.40	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.50	Wt. n-Val.		0.035	0.080

PB Proj No. 11515
Coronado Ridge Wash *(Main Branch)*
Proposed Condition Analysis

W.S. Elev (ft)	2742.90	Reach Len. (ft)	140.00	140.00	92.00
Crit W.S. (ft)	2742.90	Flow Area (sq ft)		83.50	199.88
E.G. Slope (ft/ft)	0.009512	Area (sq ft)		83.50	208.09
Q Total (cfs)	950.00	Flow (cfs)		590.94	359.06
Top Width (ft)	286.15	Top Width (ft)		36.70	249.45
Vel Total (ft/s)	3.35	Avg. Vel. (ft/s)		7.08	1.80
Max Chl Dpth (ft)	3.10	Hydr. Depth (ft)		2.28	0.99
Conv. Total (cfs)	9740.8	Conv. (cfs)		6059.2	3681.6
Length Wtd. (ft)	129.40	Wetted Per. (ft)		37.37	202.40
Min Ch El (ft)	2739.80	Shear (lb/sq ft)		1.33	0.59
Alpha	2.88	Stream Power (lb/ft s)		9.39	1.05
Frctn Loss (ft)	1.44	Cum Volume (acre-ft)	1.30	2.96	1.14
C & E Loss (ft)	0.03	Cum SA (acres)	1.30	1.41	1.39

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 1750

INPUT
Description:
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2746	0	2740	5	2740	20	2738	28	2737.2
40	2737	40	2737.5	50	2737.5	50	2737	68	2737
70	2738	120	2739.5	215	2739.5	240	2739	260	2740
315	2746	325	2746.5						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	5	.035	70	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
5	70	100	140	155	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
195.3	325	2742	F

CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2740.27	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.82	Wt. n-Val.		0.035	0.080
W.S. Elev (ft)	2739.45	Reach Len. (ft)	100.00	140.00	155.00
Crit W.S. (ft)	2739.45	Flow Area (sq ft)		118.49	35.12
E.G. Slope (ft/ft)	0.013255	Area (sq ft)		118.49	42.26
Q Total (cfs)	950.00	Flow (cfs)		889.36	60.64
Top Width (ft)	140.89	Top Width (ft)		60.89	80.00
Vel Total (ft/s)	6.18	Avg. Vel. (ft/s)		7.51	1.73
Max Chl Dpth (ft)	2.45	Hydr. Depth (ft)		1.95	0.73
Conv. Total (cfs)	8251.6	Conv. (cfs)		7724.9	526.7
Length Wtd. (ft)	138.30	Wetted Per. (ft)		62.26	48.41
Min Ch El (ft)	2737.00	Shear (lb/sq ft)		1.57	0.60
Alpha	1.38	Stream Power (lb/ft s)		11.82	1.04
Frctn Loss (ft)	2.29	Cum Volume (acre-ft)	1.30	2.63	0.87
C & E Loss (ft)	0.08	Cum SA (acres)	1.30	1.25	1.05

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Coronado Ridge

PB Proj No. 11515
Coronado Ridge Wash *(Main Branch)*
Proposed Condition Analysis

REACH: MAIN RS: 1610

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
15	2737	45	2736.5	52	2736.2	55	2736	63	2735
77	2735	116	2736	120	2736	143	2734	147	2734
150	2736	155	2736.3	177	2736	205	2735	220	2735
260	2736	300	2738	315	2738.4				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
15	.08	120	.035	155	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
120	155	125	130	115	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2737.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.54	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (ft)	2736.60	Reach Len. (ft)	125.00	130.00	115.00
Crit W.S. (ft)	2736.60	Flow Area (sq ft)	79.72	54.11	111.83
E.G. Slope (ft/ft)	0.021271	Area (sq ft)	79.72	54.11	111.83
Q Total (cfs)	950.00	Flow (cfs)	213.96	442.05	293.99
Top Width (ft)	232.68	Top Width (ft)	80.76	35.00	116.92
Vel Total (ft/s)	3.87	Avg. Vel. (ft/s)	2.68	8.17	2.63
Max Chl Dpth (ft)	2.60	Hydr. Depth (ft)	0.99	1.55	0.96
Conv. Total (cfs)	6513.7	Conv. (cfs)	1467.0	3030.9	2015.7
Length Wtd. (ft)	124.88	Wetted Per. (ft)	80.85	35.70	116.97
Min Ch El (ft)	2734.00	Shear (lb/sq ft)	1.31	2.01	1.27
Alpha	2.33	Stream Power (lb/ft s)	3.51	16.44	3.34
Frctn Loss (ft)	2.03	Cum Volume (acre-ft)	1.21	2.35	0.60
C & E Loss (ft)	0.01	Cum SA (acres)	1.21	1.10	0.70

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 1480

INPUT
Description:
Station Elevation Data num= 33

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
24.9	2735.72	28.3	2736.79	33.5	2736.11	37.6	2735.89	60.2	2734.17
89.6	2731.53	94.4	2730.97	97.1	2730.87	101.3	2730.5	107.3	2729.61
114.9	2730.91	115.6	2730.96	119.5	2730.95	122.3	2730.97	127.6	2730.86
128.5	2730.93	136.8	2731.24	150.8	2731.77	168.2	2732.27	182.3	2733.01
196.2	2732.86	214.9	2733.68	244.9	2733.6	253.9	2732	264.9	2730.5
272.9	2730.3	276.9	2730.3	285.9	2732	294.9	2733	379.9	2732
394.9	2731	405.9	2732	429.9	2734				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
24.9	.08	244.9	.035	294.9	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
244.9	294.9	104.4	122	120.9	.1	.3

Left Levee Station= 214.9 Elevation= 2733.68

CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2733.95	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.60	Wt. n-Val.		0.035	0.080
W.S. Elev (ft)	2733.35	Reach Len. (ft)	104.40	122.00	120.90
Crit W.S. (ft)	2733.35	Flow Area (sq ft)		91.62	131.67
E.G. Slope (ft/ft)	0.012790	Area (sq ft)		91.62	131.67
Q Total (cfs)	950.00	Flow (cfs)		667.24	282.77
Top Width (ft)	175.85	Top Width (ft)		48.61	127.24
Vel Total (ft/s)	4.25	Avg. Vel. (ft/s)		7.28	2.15
Max Chl Dpth (ft)	3.74	Hydr. Depth (ft)		1.88	1.03
Conv. Total (cfs)	8400.2	Conv. (cfs)		5899.9	2500.3
Length Wtd. (ft)	119.53	Wetted Per. (ft)		49.05	127.38

Min Ch El (ft)	2730.30	Shear (lb/sq ft)		1.49	0.83
Alpha	2.13	Stream Power (lb/ft s)		10.86	1.77
Frctn Loss (ft)	1.37	Cum Volume (acre-ft)	1.09	2.14	0.28
C & E Loss (ft)	0.01	Cum SA (acres)	1.09	0.97	0.37

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 1358

INPUT
Description:
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
30.1	2733.18	41.3	2733.18	43.5	2732.51	47.4	2732.26	51.6	2731.91
64.4	2731.17	71.9	2730.07	84.1	2728.81	87.4	2728.64	88.7	2728.62
94.7	2728.69	99.8	2728.28	103.5	2728.92	112.4	2729	116.8	2728.94
127.2	2728.99	146.03	2730	160.03	2730	164.06	2729.67	175.39	2729.83
184.61	2730.01	195.12	2730.1	197.3	2730	207.9	2729.75	227.1	2729.95
275.2	2730	294.4	2728	304.4	2728	322.8	2730	347.3	2731.46

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
30.1	.08	275.2	.035	322.8	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
275.2	322.8	67.2	109	126.6	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
30.1	134.07	2733.18	F

Left Levee Station= 134.07 Elevation= 2730.1

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2731.44	Element			
Vel Head (ft)	0.57	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (ft)	2730.87	Reach Len. (ft)	67.20	109.00	126.60
Crit W.S. (ft)	2730.87	Flow Area (sq ft)	135.28	98.91	6.32
E.G. Slope (ft/ft)	0.010392	Area (sq ft)	255.43	98.91	6.32
Q Total (cfs)	950.00	Flow (cfs)	248.11	695.04	6.85
Top Width (ft)	270.91	Top Width (ft)	208.74	47.60	14.56
Vel Total (ft/s)	3.95	Avg. Vel. (ft/s)	1.83	7.03	1.08
Max Chl Dpth (ft)	2.87	Hydr. Depth (ft)	0.96	2.08	0.43
Conv. Total (cfs)	9319.1	Conv. (cfs)	2433.9	6818.0	67.2
Length Wtd. (ft)	101.08	Wetted Per. (ft)	141.91	47.81	14.59
Min Ch El (ft)	2728.00	Shear (lb/sq ft)	0.62	1.34	0.28
Alpha	2.37	Stream Power (lb/ft s)	1.13	9.43	0.30
Frctn Loss (ft)	1.07	Cum Volume (acre-ft)	0.79	1.87	0.09
C & E Loss (ft)	0.01	Cum SA (acres)	0.84	0.84	0.18

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

LATERAL STRUCTURE

RIVER: Coronado Ridge
REACH: MAIN RS: 1300

INPUT
Description: Right Bank Split Flow
Lateral structure position = Right overbank
Distance from Upstream XS = 0
Deck/Roadway Width = 10

PB Proj No. 11515
Coronado Ridge Wash *(Main Branch)*
Proposed Condition Analysis

Weir Coefficient = 2.5
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 3

Sta	Elev	Sta	Elev	Sta	Elev
0	2731.46	78.5	2730	126.6	2728.56

Weir crest shape = Broad Crested

LATERAL STRUCTURE OUTPUT Profile #TSMS100Yr Lat Struct

E.G. US. (ft)	2731.44	Weir Sta US (ft)	
W.S. US. (ft)	2730.87	Weir Sta DS (ft)	
E.G. DS (ft)	2729.17	Weir Max Depth (ft)	
W.S. DS (ft)	2728.52	Weir Avg Depth (ft)	
Q US (cfs)	950.00	Weir Submerg	
Q Leaving Total (cfs)	0.00	Min El Weir Flow (ft)	2728.56
Q DS (cfs)	950.00	Wr Top Wdth (ft)	
Perc Q Leaving	0.00	Q Gate Group (cfs)	
Q Weir (cfs)		Gate Open Ht (ft)	
Q Gates (cfs)		Gate #Open	
Q Culv (cfs)		Gate Area (sq ft)	
Q Lat RC (cfs)		Gate Submerg	
Weir Flow Area (sq ft)		Gate Invert (ft)	

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 1248

INPUT
Description:
Station Elevation Data num= 21

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
79.8	2731.01	90.7	2730.99	103	2727.39	117.4	2726.82	125.4	2727.11
136	2727.23	146.6	2727.27	158.8	2727.43	166	2727.42	192	2728.12
208	2728.13	218.77	2727.53	228.89	2727.83	242.97	2728.04	248.5	2727.95
268.9	2726	271.8	2725.8	283.9	2726	293.3	2726.1	310.6	2727.9
329.2	2728.56								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
79.8	.08	248.5	.035	310.6	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
248.5	310.6	106.5	102	109.1	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
79.8	147.6	2730.99	F

Left Levee Station= 208 Elevation= 2728.13

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2729.17	Element			
Vel Head (ft)	0.64	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (ft)	2728.52	Reach Len. (ft)	106.50	102.00	109.10
Crit W.S. (ft)	2728.52	Flow Area (sq ft)	74.15	120.55	5.48
E.G. Slope (ft/ft)	0.010862	Area (sq ft)	138.33	120.55	5.48
Q Total (cfs)	950.00	Flow (cfs)	116.87	828.25	4.87
Top Width (ft)	229.04	Top Width (ft)	149.37	62.10	17.57
Vel Total (ft/s)	4.75	Avg. Vel. (ft/s)	1.58	6.87	0.89
Max Chl Dpth (ft)	2.72	Hydr. Depth (ft)	0.73	1.94	0.31
Conv. Total (cfs)	9115.2	Conv. (cfs)	1121.4	7947.0	46.8
Length Wtd. (ft)	102.46	Wetted Per. (ft)	100.93	62.30	17.58
Min Ch El (ft)	2725.80	Shear (lb/sq ft)	0.50	1.31	0.21
Alpha	1.84	Stream Power (lb/ft s)	0.79	9.02	0.19
Frctn Loss (ft)	1.21	Cum Volume (acre-ft)	0.48	1.60	0.07
C & E Loss (ft)	0.02	Cum SA (acres)	0.56	0.70	0.13

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

LATERAL STRUCTURE

RIVER: Coronado Ridge
REACH: MAIN RS: 1200

INPUT
Description: Right Bank Split Flow
Lateral structure position = Right overbank
Distance from Upstream XS = 0
Deck/Roadway Width = 10
Weir Coefficient = 2.5
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2728.56	31	2727.09	40.5	2726.68	61	2726.24	70.9	2725.84
79.2	2725.69	81.3	2725.68	106.9	2725.02	109.1	2725.01		

Weir crest shape = Broad Crested

LATERAL STRUCTURE OUTPUT Profile #TSMS100Yr Lat Struct

E.G. US. (ft)	2729.17	Weir Sta US (ft)	1.51
W.S. US. (ft)	2728.52	Weir Sta DS (ft)	109.10
E.G. DS (ft)	2726.84	Weir Max Depth (ft)	1.04
W.S. DS (ft)	2726.00	Weir Avg Depth (ft)	0.78
Q US (cfs)	950.00	Weir Submerg	0.00
Q Leaving Total (cfs)	197.68	Min El Weir Flow (ft)	2725.01
Q DS (cfs)	752.54	Wr Top Wdth (ft)	107.59
Perc Q Leaving	20.79	Q Gate Group (cfs)	
Q Weir (cfs)	197.68	Gate Open Ht (ft)	
Q Gates (cfs)		Gate #Open	
Q Culv (cfs)		Gate Area (sq ft)	
Q Lat RC (cfs)		Gate Submerg	
Weir Flow Area (sq ft)	84.37	Gate Invert (ft)	

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 1146

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
60.5	2727.33	96.5	2727.22	106.2	2724.54	115.3	2724.82	128	2724.9
146.3	2725.35	148.93	2724.8	153.91	2723.63	163.29	2723.6	163.3	2723.6
175.84	2723.59	177.65	2724.1	183.54	2724.01	188.41	2724.61	192.75	2725

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
60.5	.08	146.3	.035	192.75	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
146.3	192.75	30	30	30	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
60.5	120.63	2727.33	F

Left Levee Station= 146.3 Elevation= 2725.35

CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2726.84	Element	Left OB	Channel	Right OB

Vel Head (ft)	0.84	Wt. n-Val.	0.080	0.035	
W.S. Elev (ft)	2726.00	Reach Len. (ft)	30.00	30.00	30.00
Crit W.S. (ft)	2726.00	Flow Area (sq ft)	24.33	92.72	
E.G. Slope (ft/ft)	0.013158	Area (sq ft)	46.43	92.72	
Q Total (cfs)	752.54	Flow (cfs)	50.00	702.53	
Top Width (ft)	91.84	Top Width (ft)	45.39	46.45	
Vel Total (ft/s)	6.43	Avg. Vel. (ft/s)	2.06	7.58	
Max Chl Dpth (ft)	2.41	Hydr. Depth (ft)	0.95	2.00	
Conv. Total (cfs)	6560.5	Conv. (cfs)	435.9	6124.6	
Length Wtd. (ft)	30.00	Wetted Per. (ft)	25.68	47.77	
Min Ch El (ft)	2723.59	Shear (lb/sq ft)	0.78	1.59	
Alpha	1.30	Stream Power (lb/ft s)	1.60	12.08	
Frctn Loss (ft)	0.06	Cum Volume (acre-ft)	0.26	1.35	0.06
C & E Loss (ft)	0.25	Cum SA (acres)	0.33	0.57	0.11

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

LATERAL STRUCTURE

RIVER: Coronado Ridge
REACH: MAIN RS: 1140

INPUT
Description: RIGHT BANK WEIR
Lateral structure position = Right overbank
Distance from Upstream XS = 0
Deck/Roadway Width = 2
Weir Coefficient = 2.6
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2725.01	6.4	2725	10.9	2724.9	30	2724.12

Weir crest shape = Broad Crested

LATERAL STRUCTURE OUTPUT Profile #TSMS100Yr Lat Struct

E.G. US. (ft)	2726.84	Weir Sta US (ft)	0.00
W.S. US. (ft)	2726.00	Weir Sta DS (ft)	12.01
E.G. DS (ft)	2723.47	Weir Max Depth (ft)	0.99
W.S. DS (ft)	2723.14	Weir Avg Depth (ft)	0.46
Q US (cfs)	752.54	Weir Submerg	0.00
Q Leaving Total (cfs)	11.14	Min El Weir Flow (ft)	2724.12
Q DS (cfs)	741.41	Wr Top Wdth (ft)	12.01
Perc Q Leaving	1.48	Q Gate Group (cfs)	
Q Weir (cfs)	11.14	Gate Open Ht (ft)	
Q Gates (cfs)		Gate #Open	
Q Culv (cfs)		Gate Area (sq ft)	
Q Lat RC (cfs)		Gate Submerg	
Weir Flow Area (sq ft)	5.47	Gate Invert (ft)	

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 1115

PB Proj No. 11515
Coronado Ridge Wash *(Main Branch)*
Proposed Condition Analysis

INPUT
Description: HOUGHTON RD CULVERT US XSEC
RS 11+15 CRW MAIN =
STA 11+20 CRW
CST CL

Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2725.96	2.6	2724.53	20.2	2718.27	43.9	2718.27	60.2	2724.45

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	0	.022	60.2	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	60.2	202	202	202	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	16.83	2726	F
60.95	60.2	2726	F

CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2723.47	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.33	Wt. n-Val.		0.022	
W.S. Elev (ft)	2723.14	Reach Len. (ft)	202.00	202.00	202.00
Crit W.S. (ft)	2721.08	Flow Area (sq ft)		160.94	
E.G. Slope (ft/ft)	0.000751	Area (sq ft)		179.85	
Q Total (cfs)	741.41	Flow (cfs)		741.41	
Top Width (ft)	50.22	Top Width (ft)		50.22	
Vel Total (ft/s)	4.61	Avg. Vel. (ft/s)		4.61	
Max Chl Dpth (ft)	4.87	Hydr. Depth (ft)		4.03	
Conv. Total (cfs)	27047.1	Conv. (cfs)		27047.1	
Length Wtd. (ft)	202.00	Wetted Per. (ft)		41.00	
Min Ch El (ft)	2718.27	Shear (lb/sq ft)		0.18	
Alpha	1.00	Stream Power (lb/ft s)		0.85	
Frctn Loss (ft)		Cum Volume (acre-ft)	0.24	1.25	0.06
C & E Loss (ft)		Cum SA (acres)	0.31	0.54	0.11

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CULVERT

RIVER: Coronado Ridge
REACH: MAIN RS: 1105

INPUT
Description:
Distance from Upstream XS = 18
Deck/Roadway Width = 174
Weir Coefficient = 2.6
Bridge Deck/Roadway Skew = 30
Upstream Deck/Roadway Coordinates
num= 2

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2727.31		129.904	2723.21	

Upstream Bridge Cross Section Data
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2725.96	2.6	2724.53	20.2	2718.27	43.9	2718.27	60.2	2724.45

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	0	.022	60.2	.03

Bank Sta: Left	Right	Coeff Contr.	Expan.
0	60.2	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	16.83	2726	F
60.95	60.2	2726	F

Downstream Deck/Roadway Coordinates
num= 2

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2725.43		129.904	2721.33	

Downstream Bridge Cross Section Data
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2723.34	12.3	2723.09	17	2722.41	21.7	2721.36	39.5	2715.42

```
    60.5 2715.42    73.7 2719.81    84.5 2721.38

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .08    21.7    .035    73.7     .08

Bank Sta: Left   Right    Coeff Contr.   Expan.
          21.7    73.7              .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    30.1    2723       F
    63.9    84.5    2721       F

Upstream Embankment side slope              =       3 horiz. to 1.0 vertical
Downstream Embankment side slope            =       3 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Culverts =  1

Culvert Name      Shape      Rise    Span
Culvert #1          Box       4       8
FHWA Chart # 11- Skewed headwall; Chamfered or beveled Inlet
FHWA Scale # 2 - Headwall skewed 30 deg.; inlet edges chamfered 3/4 inch
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss Coef
                 10     192     .013     .013        0                  .2                 1
Number of Barrels =  3
Upstream   Elevation =  2718.14
Centerline Stations
    Sta.    Sta.    Sta.
   24.15   34.25   44.35
Downstream Elevation =  2715.59
Centerline Stations
    Sta.    Sta.    Sta.
   43.45   53.55   63.65

CULVERT OUTPUT  Profile #TSMS100Yr  Culv Group:  Culvert #1

  Q Culv Group (cfs)        741.41    Culv Full Len (ft)
  # Barrels                      3    Culv Vel US (ft/s)          9.98
  Q Barrel (cfs)            247.14    Culv Vel DS (ft/s)         14.86
  E.G. US. (ft)            2723.47    Culv Inv El Up (ft)      2718.14
  W.S. US. (ft)            2723.14    Culv Inv El Dn (ft)      2715.59
  E.G. DS (ft)             2719.61    Culv Frctn Ls (ft)          1.68
  W.S. DS (ft)             2718.35    Culv Exit Loss (ft)         1.49
  Delta EG (ft)               3.86    Culv Entr Loss (ft)         0.68
  Delta WS (ft)               4.78    Q Weir (cfs)
  E.G. IC (ft)             2723.47    Weir Sta Lft (ft)
  E.G. OC (ft)             2723.09    Weir Sta Rgt (ft)
  Culvert Control            Inlet    Weir Submerg
  Culv WS Inlet (ft)       2721.24    Weir Max Depth (ft)
  Culv WS Outlet (ft)      2717.67    Weir Avg Depth (ft)
  Culv Nml Depth (ft)         1.95    Weir Flow Area (sq ft)
  Culv Crt Depth (ft)         3.09    Min El Weir Flow (ft)    2725.42


Note:    The flow in the culvert is entirely supercritical.

CROSS SECTION


RIVER: Coronado Ridge
REACH: MAIN                RS: 898

INPUT
Description: CULVERT DS XSEC
Station Elevation Data    num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2723.34    12.3 2723.09      17 2722.41    21.7 2721.36    39.5 2715.42
    60.5 2715.42    73.7 2719.81    84.5 2721.38

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .08    21.7    .035    73.7     .08

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          21.7    73.7              88      75      59              .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    30.1    2723       F
```

PB Proj No. 11515
Coronado Ridge Wash *(Main Branch)*
Proposed Condition Analysis
63.9 84.5 2721 F

CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2719.61	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.25	Wt. n-Val.		0.035	
W.S. Elev (ft)	2718.35	Reach Len. (ft)	88.00	75.00	59.00
Crit W.S. (ft)	2718.35	Flow Area (sq ft)		82.54	
E.G. Slope (ft/ft)	0.013641	Area (sq ft)		87.42	
Q Total (cfs)	741.41	Flow (cfs)		741.41	
Top Width (ft)	38.61	Top Width (ft)		38.61	
Vel Total (ft/s)	8.98	Avg. Vel. (ft/s)		8.98	
Max Chl Dpth (ft)	2.93	Hydr. Depth (ft)		2.49	
Conv. Total (cfs)	6347.9	Conv. (cfs)		6347.9	
Length Wtd. (ft)	74.85	Wetted Per. (ft)		33.85	
Min Ch El (ft)	2715.42	Shear (lb/sq ft)		2.08	
Alpha	1.00	Stream Power (lb/ft s)		18.65	
Frctn Loss (ft)	1.03	Cum Volume (acre-ft)	0.24	0.63	0.06
C & E Loss (ft)	0.18	Cum SA (acres)	0.31	0.33	0.11

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 830

INPUT
Description: ADJ'D XSEC FOR ROADWAY FILL
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2718	10	2718.3	19	2718	24	2717.2	30	2715.14
50	2715.14	70	2715.14	73	2716.2	87	2717	90	2717.75

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	24	.035	73	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
24	73	66	58	50	.3	.5

CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2718.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.90	Wt. n-Val.	0.000	0.035	0.080
W.S. Elev (ft)	2717.23	Reach Len. (ft)	66.00	58.00	50.00
Crit W.S. (ft)	2717.23	Flow Area (sq ft)	0.00	94.70	8.94
E.G. Slope (ft/ft)	0.013797	Area (sq ft)	0.00	94.70	8.94
Q Total (cfs)	741.41	Flow (cfs)	0.00	727.57	13.84
Top Width (ft)	64.12	Top Width (ft)	0.20	49.00	14.92
Vel Total (ft/s)	7.15	Avg. Vel. (ft/s)	0.14	7.68	1.55
Max Chl Dpth (ft)	2.09	Hydr. Depth (ft)	0.02	1.93	0.60
Conv. Total (cfs)	6312.0	Conv. (cfs)	0.0	6194.2	117.8
Length Wtd. (ft)	58.35	Wetted Per. (ft)	0.20	49.53	14.98
Min Ch El (ft)	2715.14	Shear (lb/sq ft)		1.65	0.51
Alpha	1.13	Stream Power (lb/ft s)		12.65	0.80
Frctn Loss (ft)	0.78	Cum Volume (acre-ft)	0.24	0.48	0.06
C & E Loss (ft)	0.09	Cum SA (acres)	0.31	0.26	0.10

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 772

PB Proj No. 11515
Coronado Ridge Wash *(Main Branch)*
Proposed Condition Analysis

INPUT
Description: XS at the tie in with natural ground
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-39	2717	-31	2716	-26	2715	-18	2715	0	2716
13	2716.5	25	2716	36	2715	54	2714.25	84	2715
90	2716	100	2717						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-39	.08	36	.035	84	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
36	84	64	72	70	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2717.18	Element			
Vel Head (ft)	0.71	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (ft)	2716.47	Reach Len. (ft)	64.00	72.00	70.00
Crit W.S. (ft)	2716.47	Flow Area (sq ft)	51.23	88.62	6.94
E.G. Slope (ft/ft)	0.012854	Area (sq ft)	51.23	88.62	6.94
Q Total (cfs)	741.41	Flow (cfs)	88.83	641.71	10.86
Top Width (ft)	128.04	Top Width (ft)	69.33	48.00	10.71
Vel Total (ft/s)	5.05	Avg. Vel. (ft/s)	1.73	7.24	1.57
Max Chl Dpth (ft)	2.22	Hydr. Depth (ft)	0.74	1.85	0.65
Conv. Total (cfs)	6539.3	Conv. (cfs)	783.5	5659.9	95.8
Length Wtd. (ft)	70.69	Wetted Per. (ft)	69.55	48.02	10.82
Min Ch El (ft)	2714.25	Shear (lb/sq ft)	0.59	1.48	0.51
Alpha	1.79	Stream Power (lb/ft s)	1.03	10.72	0.81
Frctn Loss (ft)	0.89	Cum Volume (acre-ft)	0.20	0.35	0.05
C & E Loss (ft)	0.03	Cum SA (acres)	0.26	0.19	0.08

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 700

INPUT
Description: ADJ'D XSEC FOR ROADWAY FILL
Station Elevation Data num= 44

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2716.46	5.92	2715.6	14.7	2715.61	15.49	2715.68	16.35	2715.72
17.55	2715.82	19.26	2715.93	19.81	2715.66	20.87	2716.07	23.75	2716.13
25.42	2716.2	30.06	2716.31	33.48	2716.33	37.2	2715.32	43.74	2713.6
44.54	2713.59	47.72	2713.59	58.84	2713.45	60.45	2713.44	65.55	2713.49
69.23	2713.55	75.28	2713.6	80.22	2713.57	81.77	2713.66	97.16	2713.79
98.48	2713.83	110.04	2714.06	116.63	2714.1	128.75	2713.84	130.18	2713.77
134.2	2713.41	140.27	2712.88	141.35	2712.75	143.79	2712.62	144.38	2712.6
150	2712.6	165.53	2712.6	173.14	2712.57	175.33	2713.79	180.78	2714.01
186.38	2714.3	188.78	2714.55	201.4	2715.69	205.8	2717.15		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	128.75	.035	175.33	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
128.75	175.33	105	100	100	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2715.23	Element			
Vel Head (ft)	0.60	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (ft)	2714.63	Reach Len. (ft)	105.00	100.00	100.00
Crit W.S. (ft)	2714.63	Flow Area (sq ft)	78.24	84.02	7.19
E.G. Slope (ft/ft)	0.012339	Area (sq ft)	78.24	84.02	7.19
Q Total (cfs)	741.41	Flow (cfs)	148.05	584.02	9.34
Top Width (ft)	149.86	Top Width (ft)	88.93	46.58	14.35
Vel Total (ft/s)	4.38	Avg. Vel. (ft/s)	1.89	6.95	1.30
Max Chl Dpth (ft)	2.06	Hydr. Depth (ft)	0.88	1.80	0.50
Conv. Total (cfs)	6674.4	Conv. (cfs)	1332.8	5257.5	84.1
Length Wtd. (ft)	100.54	Wetted Per. (ft)	89.08	46.95	14.38
Min Ch El (ft)	2712.57	Shear (lb/sq ft)	0.68	1.38	0.39

Alpha	2.03	Stream Power (lb/ft s)	1.28	9.58	0.50
Frctn Loss (ft)	1.23	Cum Volume (acre-ft)	0.11	0.21	0.04
C & E Loss (ft)	0.01	Cum SA (acres)	0.14	0.12	0.06

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Coronado Ridge
REACH: MAIN RS: 600

INPUT
Description: ADJ'D XSEC FOR ROADWAY FILL
Station Elevation Data num= 42

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2713.96	18.34	2714.23	24.34	2712.7	27.67	2712.21	31.59	2712.52
41.67	2713.41	50.77	2714.27	55.02	2714.54	66.81	2715.23	75.66	2713.86
82.33	2712.95	83.63	2712.81	92.09	2711.6	96.06	2711.67	103.06	2711.89
115.17	2711.8	115.53	2711.69	122.61	2710.39	124.36	2710.22	127.69	2710.71
128.15	2710.69	131.76	2710.32	137.66	2710.18	154.63	2709.79	157.34	2710.5
164.67	2710.5	170.25	2711.17	172.96	2711.29	174.8	2711.28	175.73	2711.32
179.17	2711.27	181.17	2711.41	181.58	2711.33	186.29	2711.48	192.75	2711.62
197.53	2711.76	201.98	2711.85	206.74	2712.01	210.67	2712.25	211.51	2712.26
211.8	2712.24	218.1	2714.25						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	115.17	.035	170.25	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
115.17	170.25	0	0	0	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	2712.91	Element			
Vel Head (ft)	0.70	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (ft)	2712.22	Reach Len. (ft)			
Crit W.S. (ft)	2712.22	Flow Area (sq ft)	11.25	100.05	24.79
E.G. Slope (ft/ft)	0.012069	Area (sq ft)	11.25	100.05	24.79
Q Total (cfs)	741.41	Flow (cfs)	12.67	691.94	36.80
Top Width (ft)	122.56	Top Width (ft)	27.58	55.08	39.91
Vel Total (ft/s)	5.45	Avg. Vel. (ft/s)	1.13	6.92	1.48
Max Chl Dpth (ft)	2.43	Hydr. Depth (ft)	0.41	1.82	0.62
Conv. Total (cfs)	6748.6	Conv. (cfs)	115.3	6298.3	335.0
Length Wtd. (ft)		Wetted Per. (ft)	27.63	55.42	39.94
Min Ch El (ft)	2709.79	Shear (lb/sq ft)	0.31	1.36	0.47
Alpha	1.51	Stream Power (lb/ft s)	0.35	9.41	0.69
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Warning: Divided flow computed for this cross-section.
Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth). Water surface set to critical depth.

SUMMARY OF MANNING'S N VALUES

River:Coronado Ridge

Reach	River Sta.	n1	n2	n3
MAIN	2250	.04	.02	.04
MAIN	2245	.04	.02	.04
MAIN	2240	Culvert		
MAIN	2155	.04	.035	.08
MAIN	2080	.04	.035	.08
MAIN	2000	.04	.035	.08
MAIN	1890	.08	.035	.08
MAIN	1750	.08	.035	.08
MAIN	1610	.08	.035	.08
MAIN	1480	.08	.035	.08
MAIN	1358	.08	.035	.08
MAIN	1300	Lat Struct		
MAIN	1248	.08	.035	.08

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MAIN	1200	Lat Struct		
MAIN	1146	.08	.035	.08
MAIN	1140	Lat Struct		
MAIN	1115	.03	.022	.03
MAIN	1105	Culvert		
MAIN	898	.08	.035	.08
MAIN	830	.08	.035	.08
MAIN	772	.08	.035	.08
MAIN	700	.08	.035	.08
MAIN	600	.08	.035	.08

SUMMARY OF REACH LENGTHS

River: Coronado Ridge

Reach	River Sta.	Left	Channel	Right
MAIN	2250	5	5	5
MAIN	2245	90	90	90
MAIN	2240	Culvert		
MAIN	2155	75	75	75
MAIN	2080	80	80	80
MAIN	2000	113	113	113
MAIN	1890	140	140	92
MAIN	1750	100	140	155
MAIN	1610	125	130	115
MAIN	1480	104.4	122	120.9
MAIN	1358	67.2	109	126.6
MAIN	1300	Lat Struct		
MAIN	1248	106.5	102	109.1
MAIN	1200	Lat Struct		
MAIN	1146	30	30	30
MAIN	1140	Lat Struct		
MAIN	1115	202	202	202
MAIN	1105	Culvert		
MAIN	898	88	75	59
MAIN	830	66	58	50
MAIN	772	64	72	70
MAIN	700	105	100	100
MAIN	600	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Coronado Ridge

Reach	River Sta.	Contr.	Expan.
MAIN	2250	.3	.5
MAIN	2245	.3	.5
MAIN	2240	Culvert	
MAIN	2155	.3	.5
MAIN	2080	.3	.5
MAIN	2000	.1	.3
MAIN	1890	.1	.3
MAIN	1750	.1	.3
MAIN	1610	.1	.3
MAIN	1480	.1	.3
MAIN	1358	.1	.3
MAIN	1300	Lat Struct	
MAIN	1248	.1	.3
MAIN	1200	Lat Struct	
MAIN	1146	.3	.5
MAIN	1140	Lat Struct	
MAIN	1115	.3	.5
MAIN	1105	Culvert	
MAIN	898	.3	.5
MAIN	830	.3	.5
MAIN	772	.1	.3
MAIN	700	.1	.3
MAIN	600	.1	.3

PB Proj No. 11515
Coronado Ridge Wash *(Main Branch)*
Proposed Condition Analysis

Profile Output Table - Standard Table 1

Reach	River Sta		Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
MAIN	2250		TSMS100Yr	950.00	2746.92	2749.18	2749.18	2750.23	0.004506	8.24	115.31	75.39	1.00
MAIN	2245		TSMS100Yr	950.00	2744.89	2748.77	2747.70	2749.34	0.001262	6.08	156.13	62.49	0.57
MAIN	2240	4-8'x3'x78' RCBC		Culvert									
MAIN	2155		TSMS100Yr	950.00	2743.42	2746.92	2746.78	2748.08	0.011927	8.65	109.77	42.29	0.92
MAIN	2080		TSMS100Yr	950.00	2740.64	2746.30	2746.08	2747.24	0.008021	7.97	143.06	180.24	0.79
MAIN	2000		TSMS100Yr	950.00	2741.76	2745.62	2745.62	2746.46	0.010519	7.93	169.50	228.31	0.89
MAIN	1890		TSMS100Yr	950.00	2739.80	2742.90	2742.90	2743.40	0.009512	7.08	283.38	286.15	0.83
MAIN	1750		TSMS100Yr	950.00	2737.00	2739.45	2739.45	2740.27	0.013255	7.51	153.61	140.89	0.95
MAIN	1610		TSMS100Yr	950.00	2734.00	2736.60	2736.60	2737.14	0.021271	8.17	245.66	232.68	1.16
MAIN	1480		TSMS100Yr	950.00	2730.30	2733.35	2733.35	2733.95	0.012790	7.28	223.29	175.85	0.93
MAIN	1358		TSMS100Yr	950.00	2728.00	2730.87	2730.87	2731.44	0.010392	7.03	240.52	270.91	0.86
MAIN	1300	RIGHT SPLIT		Lat Struct									
MAIN	1248		TSMS100Yr	950.00	2725.80	2728.52	2728.52	2729.17	0.010862	6.87	200.17	229.04	0.87
MAIN	1200	RIGHT SPLIT		Lat Struct									
MAIN	1146		TSMS100Yr	752.54	2723.59	2726.00	2726.00	2726.84	0.013158	7.58	117.04	91.84	0.95
MAIN	1140	RIGHT SPLIT		Lat Struct									
MAIN	1115		TSMS100Yr	741.41	2718.27	2723.14	2721.08	2723.47	0.000751	4.61	160.94	50.22	0.40
MAIN	1105	2-10'x4'x192' RC		Culvert									
MAIN	898		TSMS100Yr	741.41	2715.42	2718.35	2718.35	2719.61	0.013641	8.98	82.54	38.61	1.00
MAIN	830		TSMS100Yr	741.41	2715.14	2717.23	2717.23	2718.13	0.013797	7.68	103.65	64.12	0.97
MAIN	772		TSMS100Yr	741.41	2714.25	2716.47	2716.47	2717.18	0.012854	7.24	146.78	128.04	0.94
MAIN	700		TSMS100Yr	741.41	2712.57	2714.63	2714.63	2715.23	0.012339	6.95	169.44	149.86	0.91
MAIN	600		TSMS100Yr	741.41	2709.79	2712.22	2712.22	2712.91	0.012069	6.92	136.09	122.56	0.90

Profile Output Table - Standard Table 2

Reach	River Sta		Profile	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Prctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
MAIN	2250		TSMS100Yr	2750.23	2749.18	1.05	0.01	0.24		950.00		75.39
MAIN	2245		TSMS100Yr	2749.34	2748.77	0.57				950.00		62.49
MAIN	2240	4-8'x3'x78' RCBC		Culvert								
MAIN	2155		TSMS100Yr	2748.08	2746.92	1.16	0.73	0.11		950.00		42.29
MAIN	2080		TSMS100Yr	2747.24	2746.30	0.95	0.73	0.05		908.78	41.22	180.24
MAIN	2000		TSMS100Yr	2746.46	2745.62	0.84	1.13	0.10	4.04	810.22	135.74	228.31

MAIN	1890		TSMS100Yr	2743.40	2742.90	0.50	1.44	0.03		590.94	359.06	286.15
MAIN	1750		TSMS100Yr	2740.27	2739.45	0.82	2.29	0.08		889.36	60.64	140.89
MAIN	1610		TSMS100Yr	2737.14	2736.60	0.54	2.03	0.01	213.96	442.05	293.99	232.68
MAIN	1480		TSMS100Yr	2733.95	2733.35	0.60	1.37	0.01		667.24	282.77	175.85
MAIN	1358		TSMS100Yr	2731.44	2730.87	0.57	1.07	0.01	248.11	695.04	6.85	270.91
MAIN	1300	RIGHT SPLIT		Lat Struct								
MAIN	1248		TSMS100Yr	2729.17	2728.52	0.64	1.21	0.02	116.87	828.25	4.87	229.04
MAIN	1200	RIGHT SPLIT		Lat Struct								
MAIN	1146		TSMS100Yr	2726.84	2726.00	0.84	0.06	0.25	50.00	702.53		91.84
MAIN	1140	RIGHT SPLIT		Lat Struct								
MAIN	1115		TSMS100Yr	2723.47	2723.14	0.33				741.41		50.22
MAIN	1105	2-10'x4'x192' RC		Culvert								
MAIN	898		TSMS100Yr	2719.61	2718.35	1.25	1.03	0.18		741.41		38.61
MAIN	830		TSMS100Yr	2718.13	2717.23	0.90	0.78	0.09	0.00	727.57	13.84	64.12
MAIN	772		TSMS100Yr	2717.18	2716.47	0.71	0.89	0.03	88.83	641.71	10.86	128.04
MAIN	700		TSMS100Yr	2715.23	2714.63	0.60	1.23	0.01	148.05	584.02	9.34	149.86
MAIN	600		TSMS100Yr	2712.91	2712.22	0.70			12.67	691.94	36.80	122.56

Profile Output Table - Lateral Structures

Reach	River Sta		Profile	Q US	Q Leaving	Total	Q DS	Q Weir	Q Gates	Wr Top Wdth	Weir Max Depth	Weir Avg Depth	Min El Weir Flow	E.G. US.	W.S. US.	E.G. DS	W.S. DS
				(cfs)		(cfs)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
MAIN	1300	RIGHT SPLIT	TSMS100Yr	950.00		0.00	950.00						2728.56	2731.44	2730.87	2729.17	2728.52
MAIN	1200	RIGHT SPLIT	TSMS100Yr	950.00		197.68	752.54	197.68		107.59	1.04	0.78	2725.01	2729.17	2728.52	2726.84	2726.00
MAIN	1140	RIGHT SPLIT	TSMS100Yr	752.54		11.14	741.41	11.14		12.01	0.99	0.46	2724.12	2726.84	2726.00	2723.47	2723.14

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : PROP3-8x4

River: Coronado Ridge Reach: MAIN RS: 2250 Profile: TSMS100Yr
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
River: Coronado Ridge Reach: MAIN RS: 2245 Profile: TSMS100Yr
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Coronado Ridge Reach: MAIN RS: 2240 Profile: TSMS100Yr Culv: Culvert #1
Note: Culvert critical depth exceeds the height of the culvert.
Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations are not valid and the supercritical result has been discarded. The outlet answer will be used.
River: Coronado Ridge Reach: MAIN RS: 2155 Profile: TSMS100Yr
Warning:Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Coronado Ridge Reach: MAIN RS: 2080 Profile: TSMS100Yr
Warning:Divided flow computed for this cross-section.

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

River: Coronado Ridge Reach: MAIN RS: 2000 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

River: Coronado Ridge Reach: MAIN RS: 1890 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

River: Coronado Ridge Reach: MAIN RS: 1750 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

River: Coronado Ridge Reach: MAIN RS: 1610 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Coronado Ridge Reach: MAIN RS: 1480 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

River: Coronado Ridge Reach: MAIN RS: 1358 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Coronado Ridge Reach: MAIN RS: 1300 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
River: Coronado Ridge Reach: MAIN RS: 1248 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Coronado Ridge Reach: MAIN RS: 1200 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
River: Coronado Ridge Reach: MAIN RS: 1146 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Coronado Ridge Reach: MAIN RS: 1140 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
River: Coronado Ridge Reach: MAIN RS: 1115 Profile: TSMS100Yr
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Coronado Ridge Reach: MAIN RS: 1105 Profile: TSMS100Yr Culv: Culvert #1
Note: The flow in the culvert is entirely supercritical.
River: Coronado Ridge Reach: MAIN RS: 898 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate

```
            the need for additional cross sections.
     Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
            water surface came back below critical depth.  This indicates that there is not a valid subcritical answer.  The
            program defaulted to critical depth.
     Note:  Multiple critical depths were found at this location.  The critical depth with the lowest, valid, energy was used.
River: Coronado Ridge  Reach: MAIN     RS: 830     Profile: TSMS100Yr
     Warning:The energy equation could not be balanced within the specified number of iterations.  The program selected the water
            surface that had the least amount of error between computed and assumed values.
     Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
            water surface came back below critical depth.  This indicates that there is not a valid subcritical answer.  The
            program defaulted to critical depth.
River: Coronado Ridge  Reach: MAIN     RS: 772     Profile: TSMS100Yr
     Warning:The energy equation could not be balanced within the specified number of iterations.  The program used critical depth
            for the water surface and continued on with the calculations.
     Warning:Divided flow computed for this cross-section.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
            the need for additional cross sections.
     Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
            water surface came back below critical depth.  This indicates that there is not a valid subcritical answer.  The
            program defaulted to critical depth.
River: Coronado Ridge  Reach: MAIN     RS: 700     Profile: TSMS100Yr
     Warning:The energy equation could not be balanced within the specified number of iterations.  The program used critical depth
            for the water surface and continued on with the calculations.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
            the need for additional cross sections.
     Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
            water surface came back below critical depth.  This indicates that there is not a valid subcritical answer.  The
            program defaulted to critical depth.
River: Coronado Ridge  Reach: MAIN     RS: 600     Profile: TSMS100Yr
     Warning:Divided flow computed for this cross-section.
     Warning:Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical
            depth). Water surface set to critical depth.
```

HEC-RAS Plan: PROP3-8x4 River: Coronado Ridge Reach: MAIN Profile: TSMS100Yr

Reach	River Sta		E.G. Elev	W.S. Elev	Vel Head	Froude # Chl	Froude # XS	Frctn Loss	C & E Loss	Q Total	Q Left	Q Channel	Q Right	Top Width	Q Weir
			(ft)	(ft)	(ft)			(ft)	(ft)	(cfs)	(cfs)	(cfs)	(cfs)	(ft)	(cfs)
MAIN	2250		2750.23	2749.18	1.05	1.00	1.00	0.01	0.24	950.00		950.00		75.39	
MAIN	2245		2749.34	2748.77	0.57	0.57	0.57			950.00		950.00		62.49	
MAIN	2240	4-8'x3'x78' RCBC	Culvert												
MAIN	2155		2748.08	2746.92	1.16	0.92	0.92	0.73	0.11	950.00		950.00		42.29	
MAIN	2080		2747.24	2746.30	0.95	0.79	0.84	0.73	0.05	950.00		908.78	41.22	180.24	
MAIN	2000		2746.46	2745.62	0.84	0.89	0.77	1.13	0.10	950.00	4.04	810.22	135.74	228.31	
MAIN	1890		2743.40	2742.90	0.50	0.83	0.54	1.44	0.03	950.00		590.94	359.06	286.15	
MAIN	1750		2740.27	2739.45	0.82	0.95	0.92	2.29	0.08	950.00		889.36	60.64	140.89	
MAIN	1610		2737.14	2736.60	0.54	1.16	0.66	2.03	0.01	950.00	213.96	442.05	293.99	232.68	
MAIN	1480		2733.95	2733.35	0.60	0.93	0.67	1.37	0.01	950.00		667.24	282.77	175.85	
MAIN	1358		2731.44	2730.87	0.57	0.86	0.64	1.07	0.01	950.00	248.11	695.04	6.85	270.91	
MAIN	1300	RIGHT SPLIT	Lat Struct												
MAIN	1248		2729.17	2728.52	0.64	0.87	0.79	1.21	0.02	950.00	116.87	828.25	4.87	229.04	
MAIN	1200	RIGHT SPLIT	Lat Struct												
MAIN	1146		2726.84	2726.00	0.84	0.95	0.89	0.06	0.25	752.54	50.00	702.53		91.84	
MAIN	1140	RIGHT SPLIT	Lat Struct												
MAIN	1115		2723.47	2723.14	0.33	0.40	0.40			741.41		741.41		50.22	
MAIN	1105	3-8'x4'x192' RC	Culvert												
MAIN	898		2719.61	2718.35	1.25	1.00	1.00	1.03	0.18	741.41		741.41		38.61	
MAIN	830		2718.13	2717.23	0.90	0.97	0.99	0.78	0.09	741.41	0.00	727.57	13.84	64.12	
MAIN	772		2717.18	2716.47	0.71	0.94	0.83	0.89	0.03	741.41	88.83	641.71	10.86	128.04	
MAIN	700		2715.23	2714.63	0.60	0.91	0.73	1.23	0.01	741.41	148.05	584.02	9.34	149.86	
MAIN	600		2712.91	2712.22	0.70	0.90	0.91			741.41	12.67	691.94	36.80	122.56	

Prop CRW SPLT XSEC - 1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04200	ft/ft
Discharge	208.80	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	21.76
0+26	21.07
0+91	16.29
1+25	20.92
1+44	22.05

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 21.76)	(1+44, 22.05)	0.045

Results

Normal Depth	1.79	ft
Elevation Range	16.29 to 22.05 ft	
Flow Area	33.36	ft²
Wetted Perimeter	37.51	ft
Top Width	37.32	ft
Normal Depth	1.79	ft
Critical Depth	1.90	ft
Critical Slope	0.03021	ft/ft
Velocity	6.26	ft/s
Velocity Head	0.61	ft
Specific Energy	2.40	ft
Froude Number	1.17	
Flow Type	Supercritical	

Prop CRW SPLT XSEC - 1

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.79	ft
Critical Depth	1.90	ft
Channel Slope	0.04200	ft/ft
Critical Slope	0.03021	ft/ft

Prop CRW SPLT XSEC - 2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.02330	ft/ft
Discharge	208.80	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	16.93
0+42	16.09
0+81	12.52
1+37	17.43

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 16.93)	(1+37, 17.43)	0.045

Results

Normal Depth	1.95	ft
Elevation Range	12.52 to 17.43 ft	
Flow Area	42.30	ft^2
Wetted Perimeter	43.64	ft
Top Width	43.46	ft
Normal Depth	1.95	ft
Critical Depth	1.85	ft
Critical Slope	0.03044	ft/ft
Velocity	4.94	ft/s
Velocity Head	0.38	ft
Specific Energy	2.33	ft
Froude Number	0.88	
Flow Type	Subcritical	

Prop CRW SPLT XSEC - 2

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.95	ft
Critical Depth	1.85	ft
Channel Slope	0.02330	ft/ft
Critical Slope	0.03044	ft/ft

Prop CRW SPLT XSEC - 3

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.02440	ft/ft
Discharge	208.80	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	11.49
0+15	11.38
0+39	10.46
0+56	8.55
0+73	8.42
0+85	8.91
0+95	10.11
1+05	10.64

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 11.49)	(1+05, 10.64)	0.045

Results

Normal Depth	1.31	ft
Elevation Range	8.42 to 11.49 ft	
Flow Area	42.75	ft²
Wetted Perimeter	46.39	ft
Top Width	46.26	ft
Normal Depth	1.31	ft
Critical Depth	1.23	ft
Critical Slope	0.03096	ft/ft
Velocity	4.88	ft/s
Velocity Head	0.37	ft

Prop CRW SPLT XSEC - 3

Results

Specific Energy	1.68	ft
Froude Number	0.90	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.31	ft
Critical Depth	1.23	ft
Channel Slope	0.02440	ft/ft
Critical Slope	0.03096	ft/ft

HY-8 Culvert Analysis Report

Project Notes

Project Title: HOUGHTON ROAD SW-OST

Designer: BAMBAUER

Project Date: Monday, September 08, 2008

Notes:

CORONADO RIDGE WASH
PROPOSED CONDITION ANALYSIS
CULVERT DESIGN

Project Units: U.S. Customary Units

Outlet Control Option: Profiles

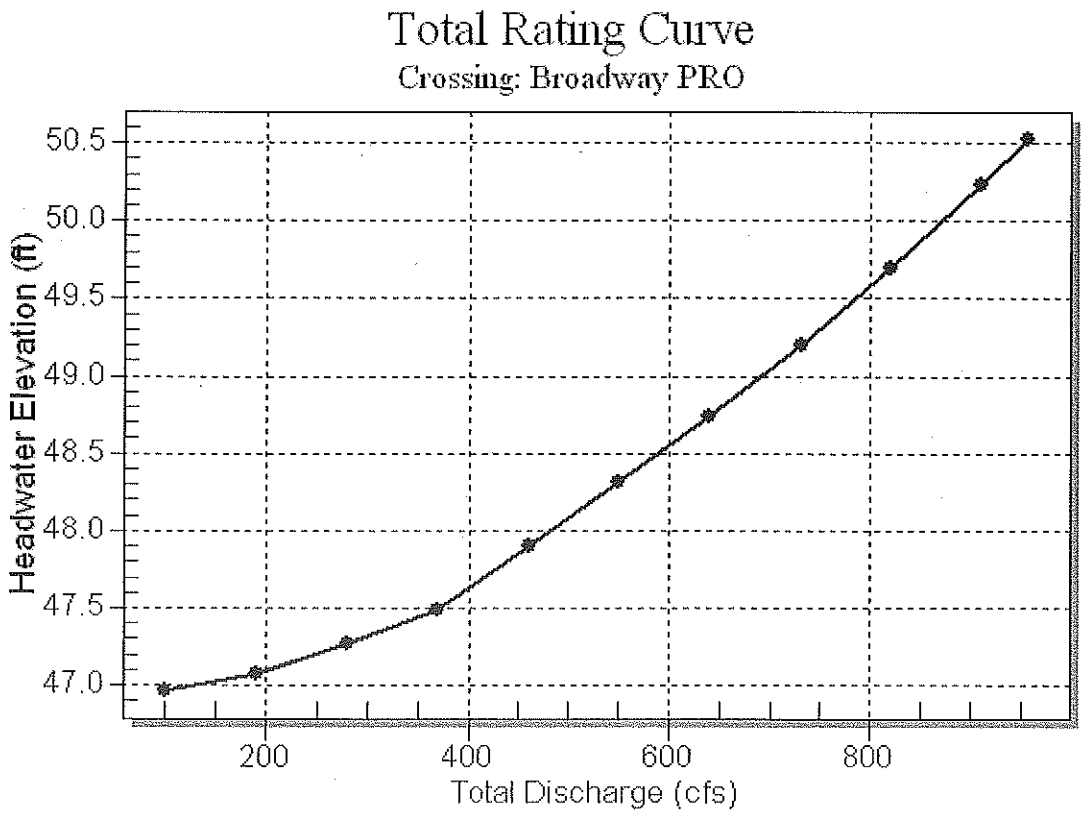
Crossing Notes: Broadway PRO

BRDWY CBC PROP

Table 1 - Summary of Culvert Flows at Crossing: Broadway PRO

Headwater Elevation (ft)	Total Discharge (cfs)	Broadway CBC Discharge (cfs)	Roadway Discharge (cfs)	Iterations
46.97	100.00	100.00	0.00	1
47.08	190.00	190.00	0.00	1
47.27	280.00	280.00	0.00	1
47.49	370.00	370.00	0.00	1
47.90	460.00	460.00	0.00	1
48.31	550.00	550.00	0.00	1
48.74	640.00	640.00	0.00	1
49.20	730.00	730.00	0.00	1
49.70	820.00	820.00	0.00	1
50.24	910.00	910.00	0.00	1
50.52	955.00	955.00	0.00	1

Rating Curve Plot for Crossing: Broadway PRO



Culvert Notes: Broadway CBC

Proposed Condition Analysis

Culvert Extended with Angle Points

Additional Headloss added to Outlet Control HW

Kb=(1-(90-Angle)/90)^2x1.25

Table 2 - Culvert Summary Table: Broadway CBC

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
100.00	100.00	46.97	1.069	1.977	1-S1t	0.595	0.673	2.660	6.270	1.175	0.000
190.00	190.00	47.08	1.626	2.089	1-S1t	0.899	1.033	2.660	6.270	2.232	0.000
280.00	280.00	47.27	2.078	2.276	1-S1t	1.155	1.338	2.660	6.270	3.289	0.000
370.00	370.00	47.49	2.499	2.499	1-S2n	1.390	1.611	1.391	6.270	8.315	0.000
460.00	460.00	47.90	2.908	2.908	1-S2n	1.611	1.862	1.615	6.270	8.901	0.000
550.00	550.00	48.31	3.321	3.321	5-S2n	1.821	2.098	1.823	6.270	9.429	0.000
640.00	640.00	48.74	3.751	3.751	5-S2n	2.021	2.321	2.024	6.270	9.882	0.000
730.00	730.00	49.20	4.210	4.210	5-S2n	2.215	2.534	2.223	6.270	10.263	0.000
820.00	820.00	49.70	4.706	4.706	5-S2n	2.405	2.738	2.407	6.270	10.646	0.000
910.00	910.00	50.24	5.245	5.245	5-S2n	2.589	2.935	2.594	6.270	10.964	0.000
955.00	955.00	50.52	5.533	5.088	5-S2n	2.680	3.000	2.900	6.270	10.291	0.000

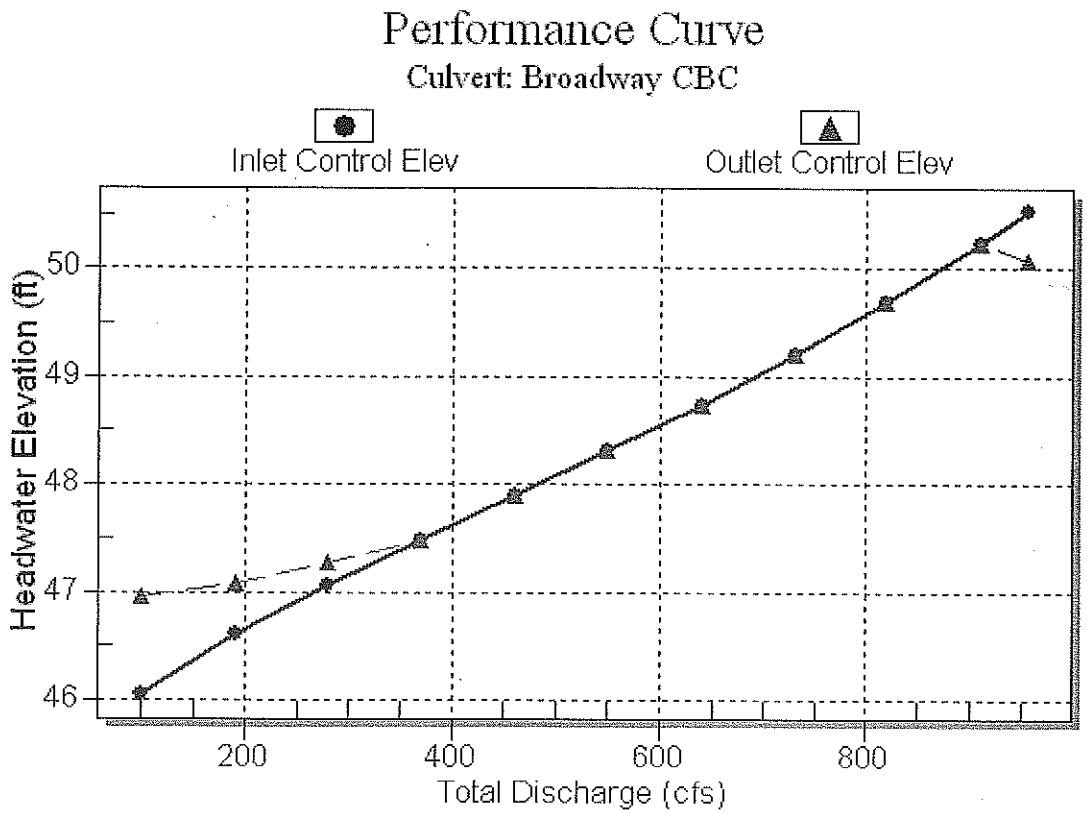
****

Inlet Elevation (invert): 44.99 ft, Outlet Elevation (invert): 44.26 ft

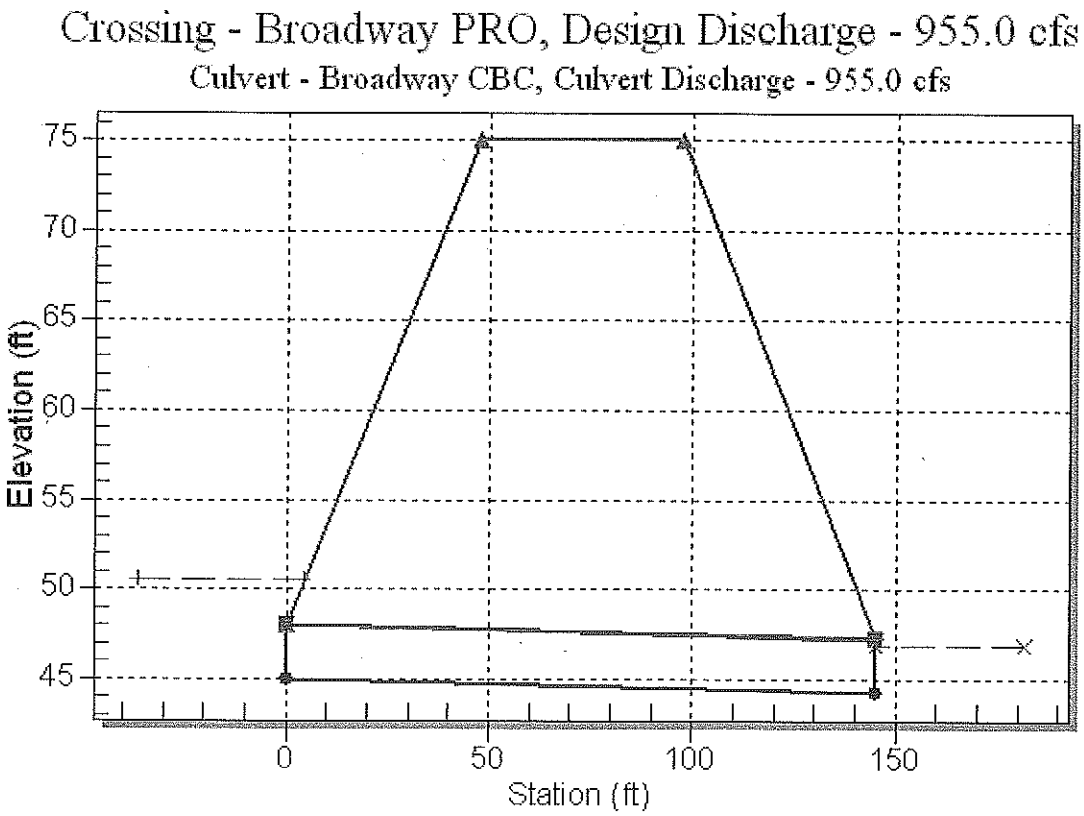
Culvert Length: 145.20 ft, Culvert Slope: 0.0050

****

Culvert Performance Curve Plot: Broadway CBC



Water Surface Profile Plot for Culvert: Broadway CBC



Site Data - Broadway CBC

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 44.99 ft

Outlet Station: 145.20 ft

Outlet Elevation: 44.26 ft

Number of Barrels: 4

Culvert Data Summary - Broadway CBC

Barrel Shape: Concrete Box

Barrel Span: 8.00 ft

Barrel Rise: 3.00 ft

Barrel Material: Concrete

Barrel Manning's n: 0.0130

Inlet Type: Conventional

Inlet Edge Condition: 1:1 Bevel Headwall

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: Broadway PRO)

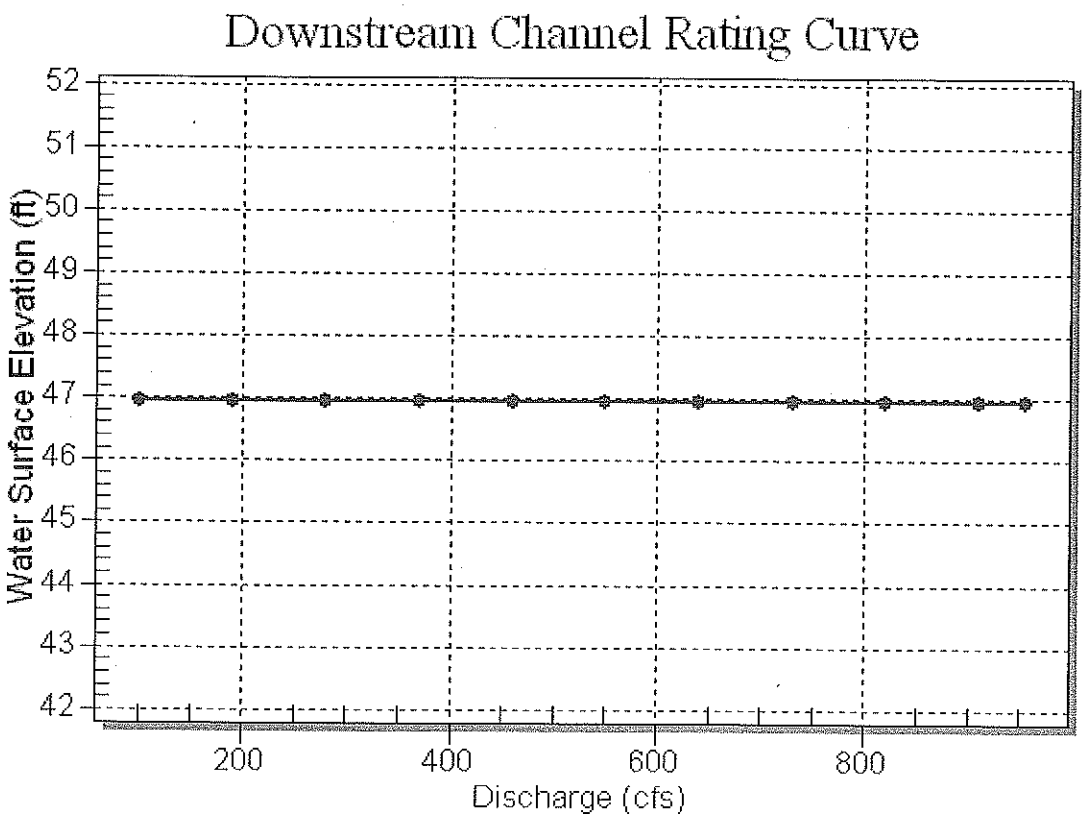
Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
100.00	46.92	6.27
190.00	46.92	6.27
280.00	46.92	6.27
370.00	46.92	6.27
460.00	46.92	6.27
550.00	46.92	6.27
640.00	46.92	6.27
730.00	46.92	6.27
820.00	46.92	6.27
910.00	46.92	6.27
955.00	46.92	6.27

Tailwater Channel Data - Broadway PRO

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 46.92 ft

Tailwater Rating Curve Plot for Crossing: Broadway PRO



Roadway Data for Crossing: Broadway PRO

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 400.00 ft

Crest Elevation: 75.00 ft

Roadway Surface: Paved

Roadway Top Width: 50.00 ft

PROJECT NAME: HOUGHTON ROAD SW-OST
PROJECT NUMBER: PB 11515
DATE: 9/8/2008

DESCRIPTION: EXSTERNAL HYDRAULIC ANALYSIS FOR CORONADO RIDGE WASH
BROADWAY CULVERT EXTENSION

PROCEEDURE: TO ACCOUNT FOR ANGLE POINT WITHIN CULVERT

1. EQN. 10.32 COT DRAINAGE MANUAL TO COMPUTE BEND LOSS COEFFICIENT
2. USE CULVERT OUTLET VELOCITY FOR OUTLET BEND AND NORMAL VELOCITY FOR INLET BEND
3. COMPUTE BEND LOSS FROM 1. ABOVE
4. ADD BEND LOSS TO OUTLET CONTROL HEADWATER RESULT
5. COMPARE INLET CONTROL AND REVISED OUTLET CONTROL HEADWATER USE HIGHER OF TWO

$$k_{b\text{-}15}=\boxed{\left(1-\left(\frac{90-15}{90}\right)^{2}\right)1.25} \qquad 0.38$$

Outlet Invert: 44.26
Inlet Invert: 44.99

Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)	Outlet Bend Loss (ft)	Normal Velocity (ft/s)	Inlet Bend Loss (ft)	Total Bend Loss (ft)	Revised Outlet HW (ft)	Revised HW Elevation (ft)
100	46.97	1.069	1.977	1-S1t	0.595	0.673	2.66	6.27	1.175	0	0.008	5.25	0.164	0.172	2.149	47.14
190	47.08	1.626	2.089	1-S1t	0.899	1.033	2.66	6.27	2.232	0	0.030	6.60	0.259	0.288	2.377	47.37
280	47.27	2.078	2.276	1-S1t	1.155	1.338	2.66	6.27	3.289	0	0.064	7.58	0.340	0.405	2.681	47.67
370	47.49	2.499	2.499	1-S2n	1.39	1.611	1.391	6.27	8.315	0	0.410	8.32	0.410	0.820	3.319	48.31
460	47.9	2.908	2.908	1-S2n	1.611	1.862	1.615	6.27	8.901	0	0.470	8.92	0.472	0.942	3.850	48.84
550	48.31	3.321	3.321	5-S2n	1.821	2.098	1.823	6.27	9.429	0	0.527	9.44	0.528	1.056	4.377	49.37
640	48.74	3.751	3.751	5-S2n	2.021	2.321	2.024	6.27	9.882	0	0.579	9.90	0.581	1.160	4.911	49.90
730	49.2	4.21	4.21	5-S2n	2.215	2.534	2.223	6.27	10.263	0	0.625	10.30	0.629	1.254	5.464	50.45
820	49.7	4.706	4.706	5-S2n	2.405	2.738	2.407	6.27	10.646	0	0.672	10.65	0.673	1.345	6.051	51.04
910	50.24	5.245	5.245	5-S2n	2.589	2.935	2.594	6.27	10.964	0	0.713	10.98	0.716	1.428	6.673	51.66
955	50.52	5.533	5.088	5-S2n	2.68	3	2.9	6.27	10.291	0	0.628	11.14	0.735	1.364	6.452	51.44

PB Proj No. 11515
CRW East Tributary
Proposed Condition

HEC-RAS Version 3.1.3 May 2005
U.S. Army Corp 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
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PROJECT DATA
Project Title: CRW (ERZ) RCBC To East Trib BRK BK CULV
Project File : EASTTRBBBK.prj
Run Date and Time: 3/11/2008 12:56:59 PM

Project in English units

Project Description:
Coronado Ridge Wash
Limits of Study:
East Trinbutary--
Conveys R/O from
Eastern Segemnt of Barrio Rincon Along Broadway West to RCBC Under Broadway.

XSECs Developed from Project Mapping & Supplimented with PAG 1998
Contours

Starting Condition Established from Broken Back Culvert Analysis

PLAN DATA

Plan Title: CRW EAST TRIB PROP BBK
Plan File : l:\11515\Drainage\HECRAS\Coronado Ridge Wash (ERZ) Restored\EASTTRBBBK.p05

Geometry Title: CRW EAST TRIB PROP GEOMETRY BBK
Geometry File : l:\11515\Drainage\HECRAS\Coronado Ridge Wash (ERZ) Restored\EASTTRBBBK.g05

Flow Title : CRW EAST TRIB FLOW
Flow File : l:\11515\Drainage\HECRAS\Coronado Ridge Wash (ERZ) Restored\EASTTRBBBK.f01

Plan Summary Information:

Number of:	Cross Sections =	8	Multiple Openings =	0
	Culverts =	0	Inline Structures =	0
	Bridges =	0	Lateral Structures =	0

Computational Information

Water surface calculation tolerance	=	0.01
Critical depth calculation tolerance	=	0.01
Maximum number of iterations	=	20
Maximum difference tolerance	=	0.3
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

PB Proj No. 11515
CRW East Tributary
Proposed Condition
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: CRW EAST TRIB FLOW
Flow File : l:\11515\Drainage\HECRAS\Coronado Ridge Wash (ERZ) Restored\EASTTRBBBK.f01

Flow Data (cfs)

River	Reach	RS	TSMS100Yr
Coronado Ridge	EAST BRANCH	1000	171

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Coronado Ridge	EAST BRANCH	TSMS100Yr	Critical	Known WS = 2755.44

GEOMETRY DATA

Geometry Title: CRW EAST TRIB PROP GEOMETRY BBK
Geometry File : l:\11515\Drainage\HECRAS\Coronado Ridge Wash (ERZ) Restored\EASTTRBBBK.g05

CROSS SECTION

RIVER: Coronado Ridge
REACH: EAST BRANCH RS: 1000

INPUT
Description: Cut from 2' Topo
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2778	0	2768.2	7	2768.	58	2770	85	2771.2
85	2781								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	0	.05	85	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	85	190	190	190	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2769.79	Element	Left OB	Channel Right OB
Vel Head (ft)	0.38	Wt. n-Val.		0.050
W.S. Elev (ft)	2769.41	Reach Len. (ft)	190.00	190.00 190.00
Crit W.S. (ft)	2769.38	Flow Area (sq ft)		34.36
E.G. Slope (ft/ft)	0.039120	Area (sq ft)		34.36
Q Total (cfs)	171.00	Flow (cfs)		171.00
Top Width (ft)	42.86	Top Width (ft)		42.86
Vel Total (ft/s)	4.98	Avg. Vel. (ft/s)		4.98
Max Chl Dpth (ft)	1.41	Hydr. Depth (ft)		0.80
Conv. Total (cfs)	864.6	Conv. (cfs)		864.6
Length Wtd. (ft)	190.00	Wetted Per. (ft)		44.10
Min Ch El (ft)	2768.00	Shear (lb/sq ft)		1.90
Alpha	1.00	Stream Power (lb/ft s)		9.47

Frctn Loss (ft)	5.48	Cum Volume (acre-ft)	0.16	0.54	0.04
C & E Loss (ft)	0.02	Cum SA (acres)	0.22	0.76	0.08

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Coronado Ridge
REACH: EAST BRANCH RS: 810

INPUT
Description: Cut From 2' Topo
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2773.8	0	2763.8	34	2763	40	2762.5	47	2763
66	2764	102	2766	108	2766.2	108	2776.2		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	34	.045	47	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
34	47	160	170	180	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2764.28	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.32	Wt. n-Val.	0.050	0.045	0.050
W.S. Elev (ft)	2763.97	Reach Len. (ft)	160.00	170.00	180.00
Crit W.S. (ft)	2763.97	Flow Area (sq ft)	19.29	15.82	8.89
E.G. Slope (ft/ft)	0.022165	Area (sq ft)	19.29	15.82	8.89
Q Total (cfs)	171.00	Flow (cfs)	58.27	88.52	24.21
Top Width (ft)	65.38	Top Width (ft)	34.00	13.00	18.38
Vel Total (ft/s)	3.89	Avg. Vel. (ft/s)	3.02	5.59	2.72
Max Chl Dpth (ft)	1.47	Hydr. Depth (ft)	0.57	1.22	0.48
Conv. Total (cfs)	1148.6	Conv. (cfs)	391.4	594.5	162.6
Length Wtd. (ft)	169.00	Wetted Per. (ft)	34.18	13.04	18.40
Min Ch El (ft)	2762.50	Shear (lb/sq ft)	0.78	1.68	0.67
Alpha	1.35	Stream Power (lb/ft s)	2.36	9.39	1.82
Frctn Loss (ft)	3.22	Cum Volume (acre-ft)	0.11	0.44	0.02
C & E Loss (ft)	0.06	Cum SA (acres)	0.15	0.64	0.04

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

PB Proj No. 11515
CRW East Tributary
Proposed Condition

Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Coronado Ridge
REACH: EAST BRANCH RS: 640

INPUT
Description:
Station Elevation Data num= 41

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2768	0	2758.92	8	2758.82	14.33	2758.47	15.54	2758.45
15.79	2758.4	21.64	2758.59	38.02	2759.3	47.36	2759.6	49.75	2759.74
64.69	2759.35	70.41	2759.16	82.81	2758.95	94.08	2758.77	94.34	2758.73
96.61	2758.63	104.36	2758.86	113.32	2759.01	117.36	2759.2	124.11	2758.73
125.24	2758.85	126.77	2759.24	129.95	2759.2	135.57	2759.49	140.53	2759.66
141.32	2759.72	143.55	2759.77	144.39	2759.84	146.87	2759.9	150.76	2759.93
156.96	2759.88	157.23	2759.9	158.37	2759.88	159.73	2760.53	160.46	2760.95
163.45	2761.97	167.69	2763.96	169.76	2764.97	172.42	2766.17	175.3	2767.04
176.84	2767.04								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	0	.045	176.84	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	176.84	55	90	115	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2759.61	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.12	Wt. n-Val.		0.045
W.S. Elev (ft)	2759.49	Reach Len. (ft)	55.00	90.00
115.00				
Crit W.S. (ft)	2759.34	Flow Area (sq ft)		62.57
E.G. Slope (ft/ft)	0.016513	Area (sq ft)		62.57
Q Total (cfs)	171.00	Flow (cfs)		171.00
Top Width (ft)	120.34	Top Width (ft)		120.34
Vel Total (ft/s)	2.73	Avg. Vel. (ft/s)		2.73
Max Chl Dpth (ft)	1.09	Hydr. Depth (ft)		0.52
Conv. Total (cfs)	1330.7	Conv. (cfs)		1330.7
Length Wtd. (ft)	90.00	Wetted Per. (ft)		121.05
Min Ch El (ft)	2758.40	Shear (lb/sq ft)		0.53
Alpha	1.00	Stream Power (lb/ft s)		1.46
Frctn Loss (ft)	2.14	Cum Volume (acre-ft)	0.08	0.28
0.00				
C & E Loss (ft)	0.01	Cum SA (acres)	0.08	0.38
0.00				

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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Coronado Ridge
REACH: EAST BRANCH RS: 550

PB Proj No. 11515
CRW East Tributary
Proposed Condition

INPUT
Description:
Station Elevation Data num= 32

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2768	0	2758.96	.74	2759.01	9.01	2758.33	9.43	2758.33
13.1	2757.94	16.48	2757.64	27.96	2757.63	34.08	2757.52	35.44	2757.46
36.42	2757.5	43.4	2757.47	49.53	2757.28	52.38	2757.02	103.62	2756.45
104.89	2756.83	110.27	2755.82	113.22	2756.53	113.76	2756.55	117.04	2756.72
122.42	2757.17	123.91	2756.65	124.78	2756.31	128.61	2756.63	137.53	2757.25
141.77	2757.46	146.46	2757.64	150.49	2757.54	155.09	2757.58	158.29	2757.74
159.8	2757.83	177.1	2761.78						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	43.4	.045	146.46	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
43.4	146.46	55	90	110	.1	.3

CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2757.46	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.25	Wt. n-Val.		0.045
W.S. Elev (ft)	2757.21	Reach Len. (ft)	55.00	90.00
110.00				
Crit W.S. (ft)	2757.21	Flow Area (sq ft)		42.96
E.G. Slope (ft/ft)	0.037285	Area (sq ft)		42.96
Q Total (cfs)	171.00	Flow (cfs)		171.00
Top Width (ft)	86.62	Top Width (ft)		86.62
Vel Total (ft/s)	3.98	Avg. Vel. (ft/s)		3.98
Max Chl Dpth (ft)	1.39	Hydr. Depth (ft)		0.50
Conv. Total (cfs)	885.6	Conv. (cfs)		885.6
Length Wtd. (ft)	81.77	Wetted Per. (ft)		87.07
Min Ch El (ft)	2755.82	Shear (lb/sq ft)		1.15
Alpha	1.00	Stream Power (lb/ft s)		4.57
Frctn Loss (ft)	0.62	Cum Volume (acre-ft)	0.08	0.17
0.00				
C & E Loss (ft)	0.04	Cum SA (acres)	0.08	0.17
0.00				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Coronado Ridge
REACH: EAST BRANCH RS: 460

INPUT
Description:
Station Elevation Data num= 32

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2759.22	1.28	2759.21	1.84	2759.15	9.13	2758.72	12.1	2758.7
15.97	2758.49	16.87	2758.51	21.9	2758.4	25.73	2758	26.56	2757.88

27.45	2757.85	33.8	2757.35	36.89	2757.2	39.78	2756.88	42.18	2756.66
49.35	2756.11	51.42	2755.99	62.64	2755.6	64.37	2755.49	74.4	2755.37
79.89	2755.26	84.15	2755.22	87.26	2755.26	100.45	2754.9	109.67	2755.01
114.48	2754.99	117.73	2754.93	122.78	2754.19	126.48	2754.43	130.47	2754.61
132.2	2754.63	147.3	2758.4						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	117.73	.035	147.3	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
117.73	147.3	41	40	39	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	80	2757	F

CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2756.32	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.10	Wt. n-Val.	0.050	0.035
W.S. Elev (ft)	2756.22	Reach Len. (ft)	41.00	40.00
39.00				
Crit W.S. (ft)	2755.69	Flow Area (sq ft)	43.77	30.06
E.G. Slope (ft/ft)	0.003140	Area (sq ft)	63.13	30.06
Q Total (cfs)	171.00	Flow (cfs)	80.46	90.54
Top Width (ft)	90.65	Top Width (ft)	69.81	20.84
Vel Total (ft/s)	2.32	Avg. Vel. (ft/s)	1.84	3.01
Max Chl Dpth (ft)	2.03	Hydr. Depth (ft)	1.16	1.44
Conv. Total (cfs)	3051.8	Conv. (cfs)	1436.0	1615.8
Length Wtd. (ft)	40.24	Wetted Per. (ft)	37.74	21.10
Min Ch El (ft)	2754.19	Shear (lb/sq ft)	0.23	0.28
Alpha	1.19	Stream Power (lb/ft s)	0.42	0.84
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	0.04	0.10
0.00				
C & E Loss (ft)	0.03	Cum SA (acres)	0.04	0.06
0.00				

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid,
water surface was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: EAST BRANCH RS: 418

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
26.5	2758.49	39.9	2757.93	42.6	2757.42	82	2754.48	97.5	2754.32
111.5	2753.67	122.5	2753.67	136.7	2757.26				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
26.5	.05	39.9	.035	136.7	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
39.9	136.7	13	13	13	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
26.5	55	2760	F

CROSS SECTION OUTPUT Profile #TSMS100Yr

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E.G. Elev (ft)	2756.24	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.		0.035	0.050
W.S. Elev (ft)	2756.21	Reach Len. (ft)	13.00	13.00	13.00
Crit W.S. (ft)	2754.85	Flow Area (sq ft)		119.57	4.66
E.G. Slope (ft/ft)	0.000599	Area (sq ft)		119.57	4.86
Q Total (cfs)	171.00	Flow (cfs)		171.00	2.39
Top Width (ft)	73.67	Top Width (ft)		73.67	6.25
Vel Total (ft/s)	1.43	Avg. Vel. (ft/s)		1.43	0.51
Max Chl Dpth (ft)	2.54	Hydr. Depth (ft)		1.62	0.93
Conv. Total (cfs)	6985.3	Conv. (cfs)		6985.3	
Length Wtd. (ft)	13.00	Wetted Per. (ft)		74.07	
Min Ch El (ft)	2753.67	Shear (lb/sq ft)		0.06	
Alpha	1.00	Stream Power (lb/ft s)		0.09	
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	0.01	0.03	0.00
C & E Loss (ft)	0.03	Cum SA (acres)	0.01	0.01	0.00

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid,
water surface was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: EAST BRANCH RS: 404

INPUT
Description: Toe of Drop Inlet
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
73.8	2757.33	87.4	2755.19	102.5	2753.96	105.4	2753.96	110.8	2753.81
110.8	2752.1	123.5	2752.1	123.5	2754.5	133.2	2756.91		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
73.8	.05	110.8	.018	123.5	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
110.8	123.5	4	4	4	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
73.8	105.8	2760	F
128.5	133.2	2760	F

CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2756.20	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.	0.050	0.018	0.050
W.S. Elev (ft)	2756.05	Reach Len. (ft)	4.00	4.00	4.00
Crit W.S. (ft)	2753.90	Flow Area (sq ft)	10.87	50.21	4.66
E.G. Slope (ft/ft)	0.000340	Area (sq ft)	42.48	50.21	4.86
Q Total (cfs)	171.00	Flow (cfs)	10.00	158.61	2.39
Top Width (ft)	47.84	Top Width (ft)	28.89	12.70	6.25
Vel Total (ft/s)	2.60	Avg. Vel. (ft/s)	0.92	3.16	0.51
Max Chl Dpth (ft)	3.95	Hydr. Depth (ft)	2.17	3.95	0.93

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Conv. Total (cfs)	9268.6	Conv. (cfs)	542.1	8596.9	129.7
Length Wtd. (ft)	4.00	Wetted Per. (ft)	5.00	16.81	5.15
Min Ch El (ft)	2752.10	Shear (lb/sq ft)	0.05	0.06	0.02
Alpha	1.38	Stream Power (lb/ft s)	0.04	0.20	0.01
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	0.00	0.00	0.00
C & E Loss (ft)	0.14	Cum SA (acres)	0.00	0.00	0.00

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid,
water surface was used.

CROSS SECTION

RIVER: Coronado Ridge
REACH: EAST BRANCH RS: 400

INPUT
Description: US FACE Proposed culvert
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
76.4	2757.24	114.5	2756.79	114.5	2752.04	122.5	2752.04	122.5	2756.79
132.4	2756.83								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
76.4	.05	114.5	.018	122.5	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
114.5	122.5	0	0	0	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
76.4	113.5	2760	F
123.5	132.4	2760	F

CROSS SECTION OUTPUT Profile #TSMS100Yr

E.G. Elev (ft)	2756.05	Element	Left OB	Channel
Vel Head (ft)	0.61	Wt. n-Val.		0.018
W.S. Elev (ft)	2755.44	Reach Len. (ft)		
Crit W.S. (ft)	2754.45	Flow Area (sq ft)		27.20
E.G. Slope (ft/ft)	0.002577	Area (sq ft)		27.20
Q Total (cfs)	171.00	Flow (cfs)		171.00
Top Width (ft)	8.00	Top Width (ft)		8.00
Vel Total (ft/s)	6.29	Avg. Vel. (ft/s)		6.29
Max Chl Dpth (ft)	3.40	Hydr. Depth (ft)		3.40
Conv. Total (cfs)	3368.8	Conv. (cfs)		3368.8
Length Wtd. (ft)		Wetted Per. (ft)		14.80
Min Ch El (ft)	2752.04	Shear (lb/sq ft)		0.30
Alpha	1.00	Stream Power (lb/ft s)		1.86
Frctn Loss (ft)		Cum Volume (acre-ft)		
C & E Loss (ft)		Cum SA (acres)		

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid,
water surface was used.

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SUMMARY OF MANNING'S N VALUES

River:Coronado Ridge

Reach	River Sta.	n1	n2	n3
EAST BRANCH	1000	.05	.05	.05
EAST BRANCH	810	.05	.045	.05
EAST BRANCH	640	.05	.045	.05
EAST BRANCH	550	.05	.045	.05
EAST BRANCH	460	.05	.035	.05
EAST BRANCH	418	.05	.035	.05
EAST BRANCH	404	.05	.018	.05
EAST BRANCH	400	.05	.018	.05

SUMMARY OF REACH LENGTHS

River: Coronado Ridge

Reach	River Sta.	Left	Channel	Right
EAST BRANCH	1000	190	190	190
EAST BRANCH	810	160	170	180
EAST BRANCH	640	55	90	115
EAST BRANCH	550	55	90	110
EAST BRANCH	460	41	40	39
EAST BRANCH	418	13	13	13
EAST BRANCH	404	4	4	4
EAST BRANCH	400	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Coronado Ridge

Reach	River Sta.	Contr.	Expan.
EAST BRANCH	1000	.1	.3
EAST BRANCH	810	.1	.3
EAST BRANCH	640	.1	.3
EAST BRANCH	550	.1	.3
EAST BRANCH	460	.3	.5
EAST BRANCH	418	.3	.5
EAST BRANCH	404	.3	.5
EAST BRANCH	400	.3	.5

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CRW East Tributary
Proposed Condition

Profile Output Table - Standard Table 1

Reach	River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
EAST BRANCH	1000	171.00	2768.00	2769.41	2769.38	2769.79	0.039120	4.98	34.36	42.86	0.98
EAST BRANCH	810	171.00	2762.50	2763.97	2763.97	2764.28	0.022165	5.59	44.00	65.38	0.89
EAST BRANCH	640	171.00	2758.40	2759.49	2759.34	2759.61	0.016513	2.73	62.57	120.34	0.67
EAST BRANCH	550	171.00	2755.82	2757.21	2757.21	2757.46	0.037285	3.98	42.96	86.62	1.00
EAST BRANCH	460	171.00	2754.19	2756.22	2755.69	2756.32	0.003140	3.01	73.83	90.65	0.44
EAST BRANCH	418	171.00	2753.67	2756.21	2754.85	2756.24	0.000599	1.43	119.57	73.67	0.20
EAST BRANCH	404	171.00	2752.10	2756.05	2753.90	2756.20	0.000340	3.16	65.74	47.84	0.28
EAST BRANCH	400	171.00	2752.04	2755.44	2754.45	2756.05	0.002577	6.29	27.20	8.00	0.60

Profile Output Table - Standard Table 2

Reach	River Sta	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
EAST BRANCH	1000	2769.79	2769.41	0.38	5.48	0.02		171.0		42.9
EAST BRANCH	810	2764.28	2763.97	0.32	3.22	0.06	58.3	88.5	24.2	65.4
EAST BRANCH	640	2759.61	2759.49	0.12	2.14	0.01		171.0		120.3
EAST BRANCH	550	2757.46	2757.21	0.25	0.62	0.04		171.0		86.6
EAST BRANCH	460	2756.32	2756.22	0.10	0.05	0.03	80.5	90.5		90.6
EAST BRANCH	418	2756.24	2756.21	0.03	0.01	0.03		171.0		73.7
EAST BRANCH	404	2756.20	2756.05	0.14	0.00	0.14	10.0	158.6	2.4	47.8
EAST BRANCH	400	2756.05	2755.44	0.61				171.0		8.0

PB Proj No. 11515
CRW East Tributary
Proposed Condition

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : CRW_ETRIBBBK

River: Coronado Ridge Reach: EAST BRANCH RS: 1000 Profile: TSMS100Yr
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

River: Coronado Ridge Reach: EAST BRANCH RS: 810 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Coronado Ridge Reach: EAST BRANCH RS: 640 Profile: TSMS100Yr
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

River: Coronado Ridge Reach: EAST BRANCH RS: 550 Profile: TSMS100Yr
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Coronado Ridge Reach: EAST BRANCH RS: 460 Profile: TSMS100Yr
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

River: Coronado Ridge Reach: EAST BRANCH RS: 418 Profile: TSMS100Yr
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

River: Coronado Ridge Reach: EAST BRANCH RS: 404 Profile: TSMS100Yr
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

River: Coronado Ridge Reach: EAST BRANCH RS: 400 Profile: TSMS100Yr
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

NEBRASKA DEPARTMENT OF ROADS
Broken-Back Culvert Analysis Program (BCAP)

PROJECT INFO	
Project:	HOUGHTON ROAD SW-OST
Station or Location:	CRW EAST TRIB rev
Date:	09/08/2008
CULVERT DATA	
Discharge:	171.0 cfs
Shape:	Box
Material:	Concrete
Size:	1-10.0 ft x 4.0 ft
Inlet Type:	Wingwall, Square Edge (0 deg. Flare)
WATER SURFACE PROFILE	
Inlet Depth:	2.09 ft
Inlet Velocity:	8.20 ft/s
Upper Break Depth:	2.09 ft
Upper Break Velocity:	8.20 ft/s
Lower Break Depth:	1.04 ft
Lower Break Velocity:	16.50 ft/s
Depth at End of Hydraulic Jump:	N/A ft
Velocity at End of Hydraulic Jump:	N/A ft/s
Depth at End of Hydraulic Jump:	6.21 ft
Velocity at End of Hydraulic Jump:	0.00 ft/s
OUTPUT DATA	
Head Water Depth:	3.44 ft
Inlet Control Elevation:	2755.44 ft
Break Control Elevation:	N/A ft
Critical Depth:	2.09 ft
Tailwater Depth:	6.21 ft
Hydraulic Jump?	NO
Outlet Depth:	1.04 ft
Outlet Velocity:	16.44 ft/s
Outlet Froude No.:	2.8

NEBRASKA DEPARTMENT OF ROADS
Broken-Back Culvert Analysis Program (BCAP)

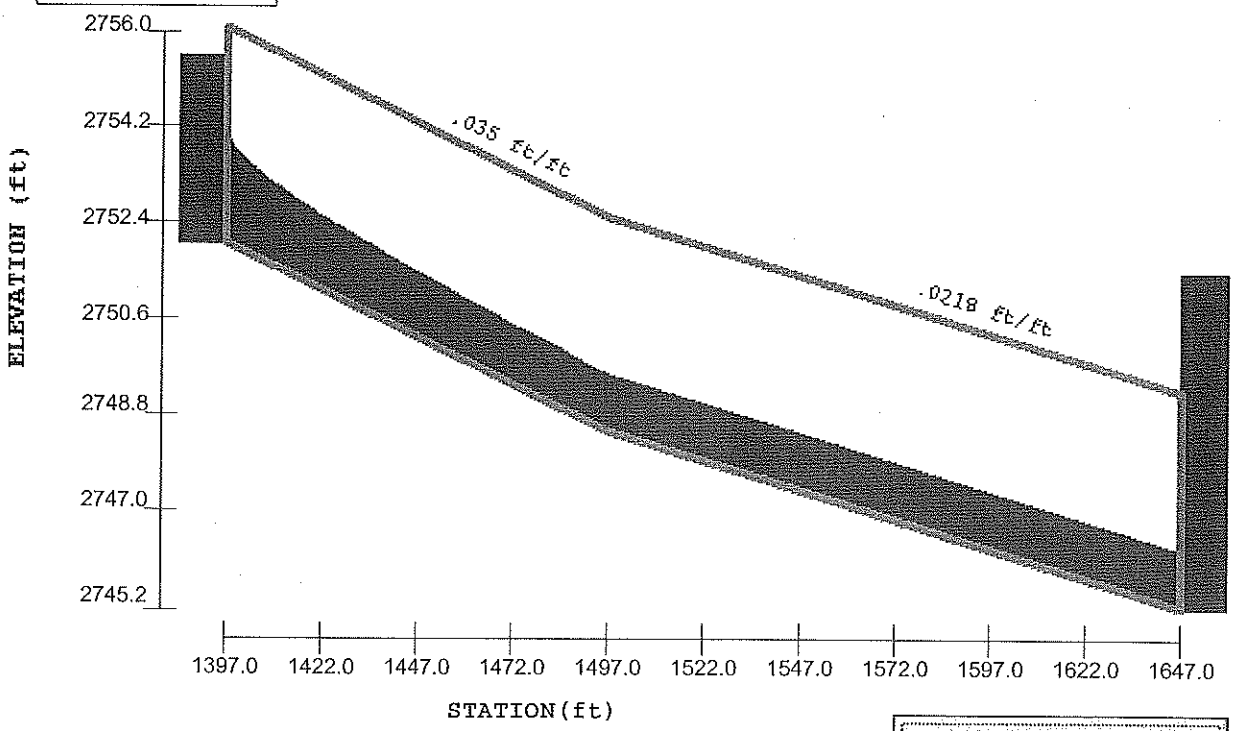
Project: HOUGHTON ROAD SW-OST
Station or Location: CRW EAST TRIB rev
Date: 09/08/2008

Discharge cfs	Headwater Depth ft	Inlet Control Elevation ft	Break Control Elevation ft	Critical Depth ft	Outlet Depth ft	Outlet Velocity ft/s	Outlet Froude Number	Tailwater Depth ft	Tailwater Velocity ft/s	Hydraulic Jump
110.0	2.54	2754.54	.00	1.55	.73	14.97	3.1	6.21	.00	YES
120.0	2.69	2754.69	.00	1.65	.80	15.05	3.0	6.21	.00	YES
130.0	2.84	2754.84	.00	1.74	.85	15.33	2.9	6.21	.00	YES
140.0	2.99	2754.99	.00	1.83	.90	15.63	2.9	6.21	.00	YES
150.0	3.13	2755.13	.00	1.91	.94	15.93	2.9	6.21	.00	YES
160.0	3.28	2755.28	.00	2.00	.99	16.23	2.9	6.21	.00	YES
170.0	3.43	2755.43	.00	2.08	1.04	16.38	2.8	6.21	.00	YES
171.0	3.44	2755.44	.00	2.09	1.04	16.44	2.8	6.21	.00	NO
190.0	3.72	2755.72	.00	2.24	1.11	17.15	2.9	6.21	.00	NO
200.0	3.87	2755.87	.00	2.32	1.16	17.30	2.8	6.21	.00	NO

Concrete Box Culvert
Span (per barrel)= 10 ft
Rise= 4 ft

Inlet Type
Wingwall, Square Edge (0 deg. Flare)
Rough. Coeff.= 0.012
Outlet Sec. Rough. Coeff.= 0.012

Q = 171 cfs

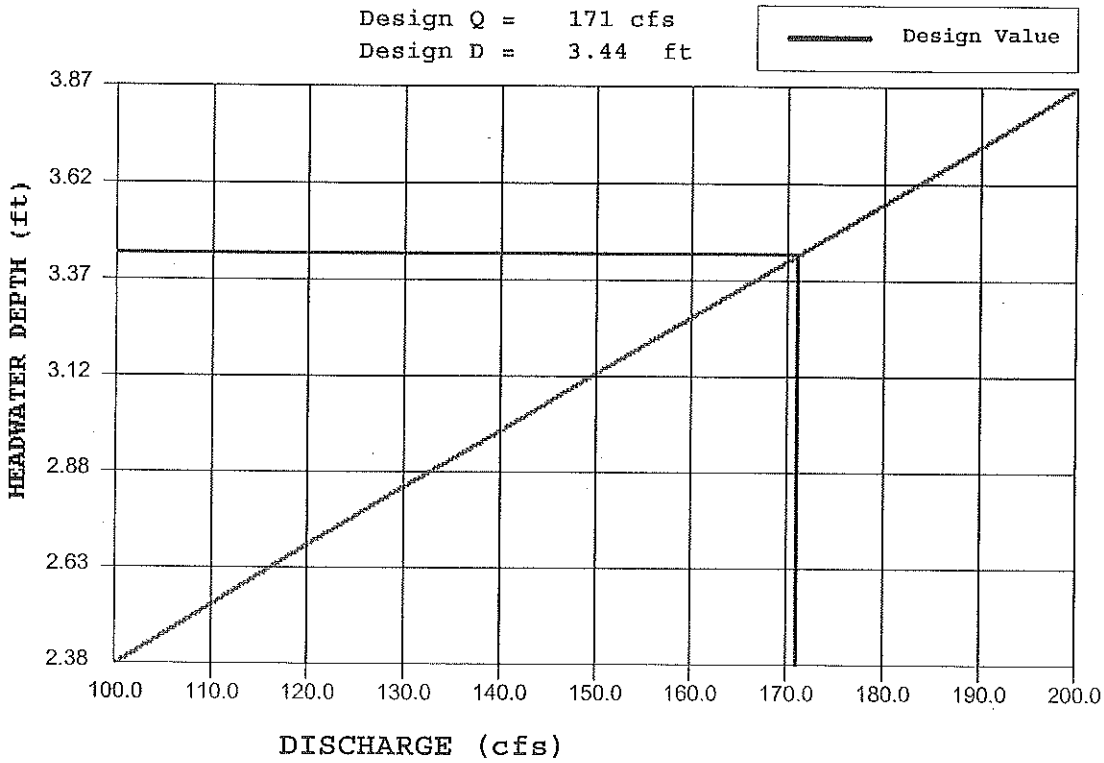


Source: L:\11515\Drainage\Hydraulics\Coronado Ridge Wash\ Press to Return to Output Form sep08.k

Project: HOUGHTON ROAD SW-OST Location: CRW EAST TRIB rev Date: 0!

DISCHARGE vs. HEADWATER DEPTH

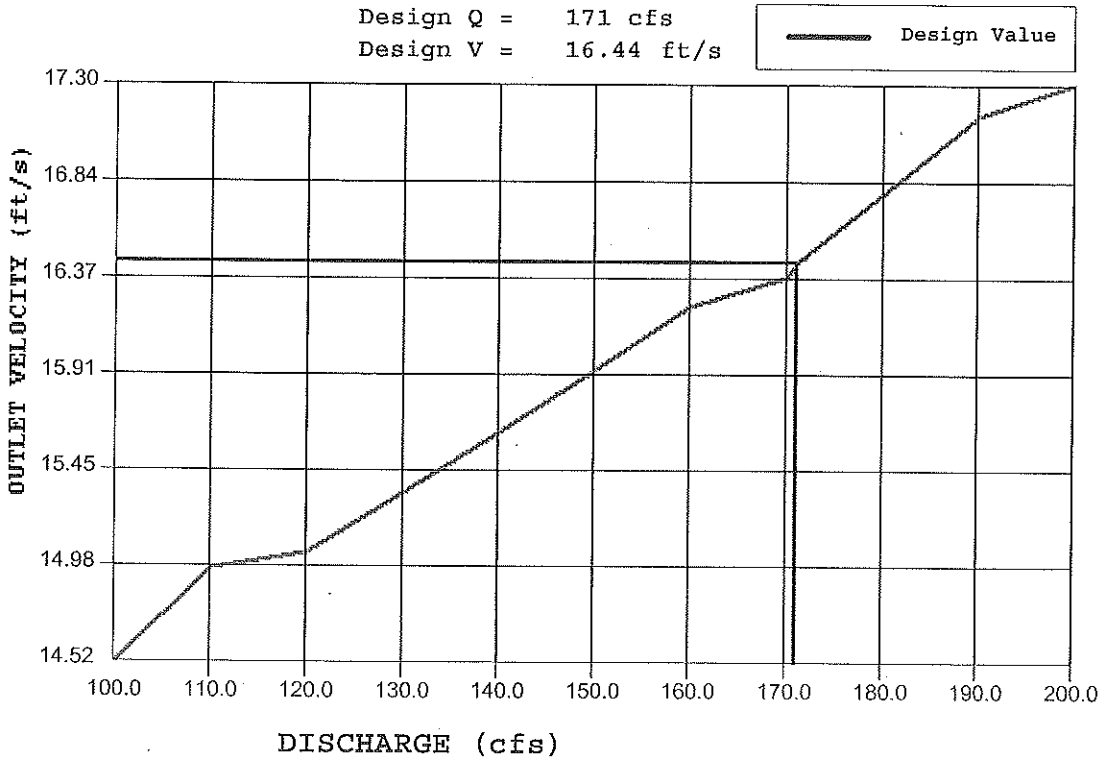
Design Q = 171 cfs
Design D = 3.44 ft



Source: L:\11515\Drainage\Hydraulics\Coronado Ridge Wash\BRDWY_CB Return to Output Table se

DISCHARGE vs. OUTLET VELOCITY

Design Q = 171 cfs
Design V = 16.44 ft/s



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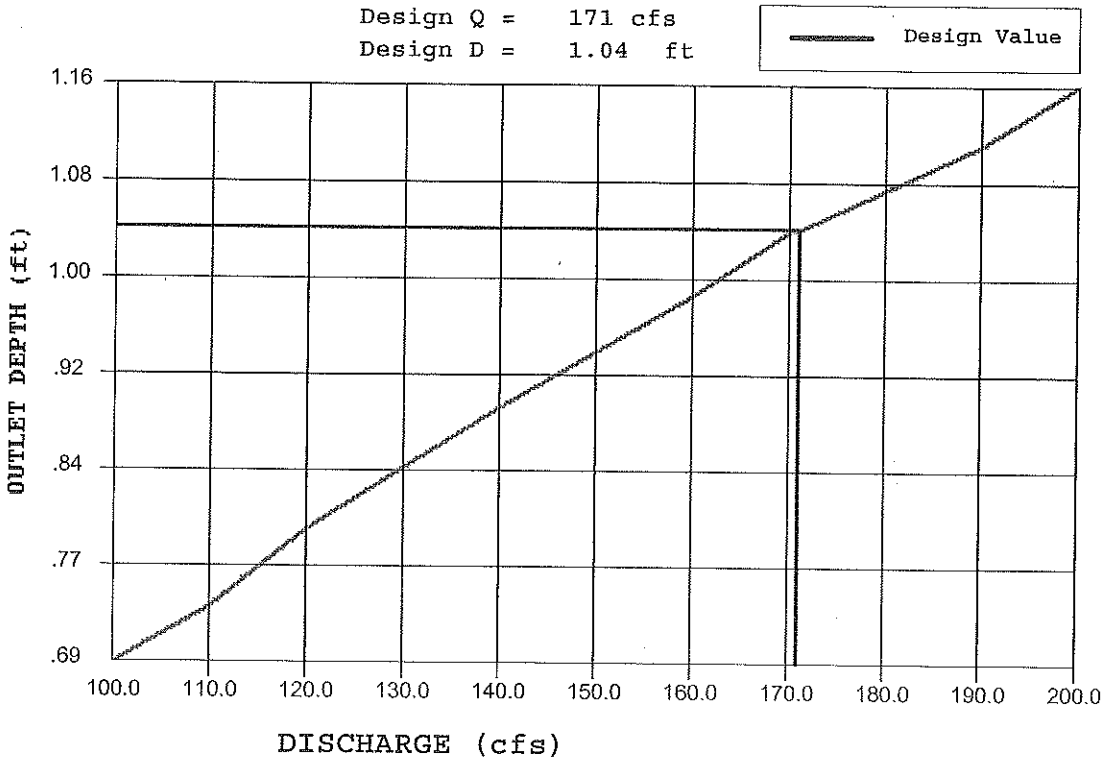
Project: HOUGHTON ROAD SW-OST Location: CRW EAST TRIB rev Date: 0!

DISCHARGE vs. OUTLET DEPTH

Design Q = 171 cfs
Design D = 1.04 ft



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FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Median Inlets
Date: 12/03/2007

Project No. :11515
Project Name.:HOUGHTON ROAD SW-OST
Computed by :BAMBAUER

Project Description

LOCAL DRAINAGE SWALE
PARKING LOT SAFEWAY TO ROADSIDE SWALE
INLET COMPUTATION

Median Inlet Design

Channel and Discharge Data

Channel Data

B	Channel Bottom Width (ft)	3.00
Z1	Left Side Slope (ft/ft)	3.0000
Z2	Right Side Slope (ft/ft)	4.0000
Q	Discharge (cfs)	11.000

Sump Condition

	Inlet Type	Parallel Bar P-1-7/8-4
L	Grate Length (ft)	3.00
W	Grate Width (ft)	2.00
D	Depth of Ponding (ft)	0.51

FHWA Urban Drainage Design Program, HY-22
HYDRAULIC PARAMETERS OF OPEN CHANNELS

Trapezoidal, Rectangular, or Triangular X-Section
Date: 12/03/2007

Project No. :11515
Project Name.:HOUGHTON ROAD SW-OST
Computed by :BAMBAUER

Project Description
PRELIMINARY CULVERT SIZING
CRW EAST TRIBUTARY
100-YEAR NORMAL DEPTH COMPUTATION

INPUT PARAMETERS

1.	Channel Slope (ft/ft)	0.0050
2.	Channel Bottom Width (ft)	8.00
3.	Left Side Slope (Horizontal to 1)	0.00
4.	Right Side Slope (Horizontal to 1)	0.00
5.	Manning's Coefficient	0.013
6.	Discharge (cfs)	171.00
7.	Depth of Flow (ft)	2.12

OUTPUT RESULTS

Cross Section Area (Sqft)	16.96
Average Velocity (ft/sec)	10.08
Top Width (ft)	8.00
Hydraulic Radius (ft)	1.39
Froude Number	1.22

CHECK INLET CONTROL:

$H = 4'$

$\frac{H_w}{D} = 1.0$

EXST WSE_{100} = 56.11
SET INV @ 52.11 or LOWER

$\frac{Q}{B}$ = 23-24 cfs/ft → B = 8' → Q_{max} = 176 cfs → 192 cfs

Q_{100} @ INLET = 165.3 cfs

TRIAL 1 → 1-8'x4' RCBC

FHWA Urban Drainage Design Program, HY-22
HYDRAULIC PARAMETERS OF OPEN CHANNELS

Trapezoidal, Rectangular, or Triangular X-Section
Date: 12/03/2007

Project No. :11515
Project Name.:HOUGHTON ROAD SW-OST
Computed by :BAMBAUER

Project Description

LOCAL DRAINAGE SWALE
PARKING LOT SAFEWAY TO ROADSIDE SWALE
NORMAL DEPTH COMPUTATION

INPUT PARAMETERS

1.	Channel Slope (ft/ft)	0.0050
2.	Channel Bottom Width (ft)	3.00
3.	Left Side Slope (Horizontal to 1)	3.00
4.	Right Side Slope (Horizontal to 1)	4.00
5.	Manning's Coefficient	0.025
6.	Discharge (cfs)	11.00
7.	Depth of Flow (ft)	0.74

OUTPUT RESULTS

Cross Section Area (Sqft)	4.14
Average Velocity (ft/sec)	2.66
Top Width (ft)	8.18
Hydraulic Radius (ft)	0.49
Froude Number	0.66

Slope Based on Flattest Slope From Roadway Profile
to Determine Maximum Flow Depth

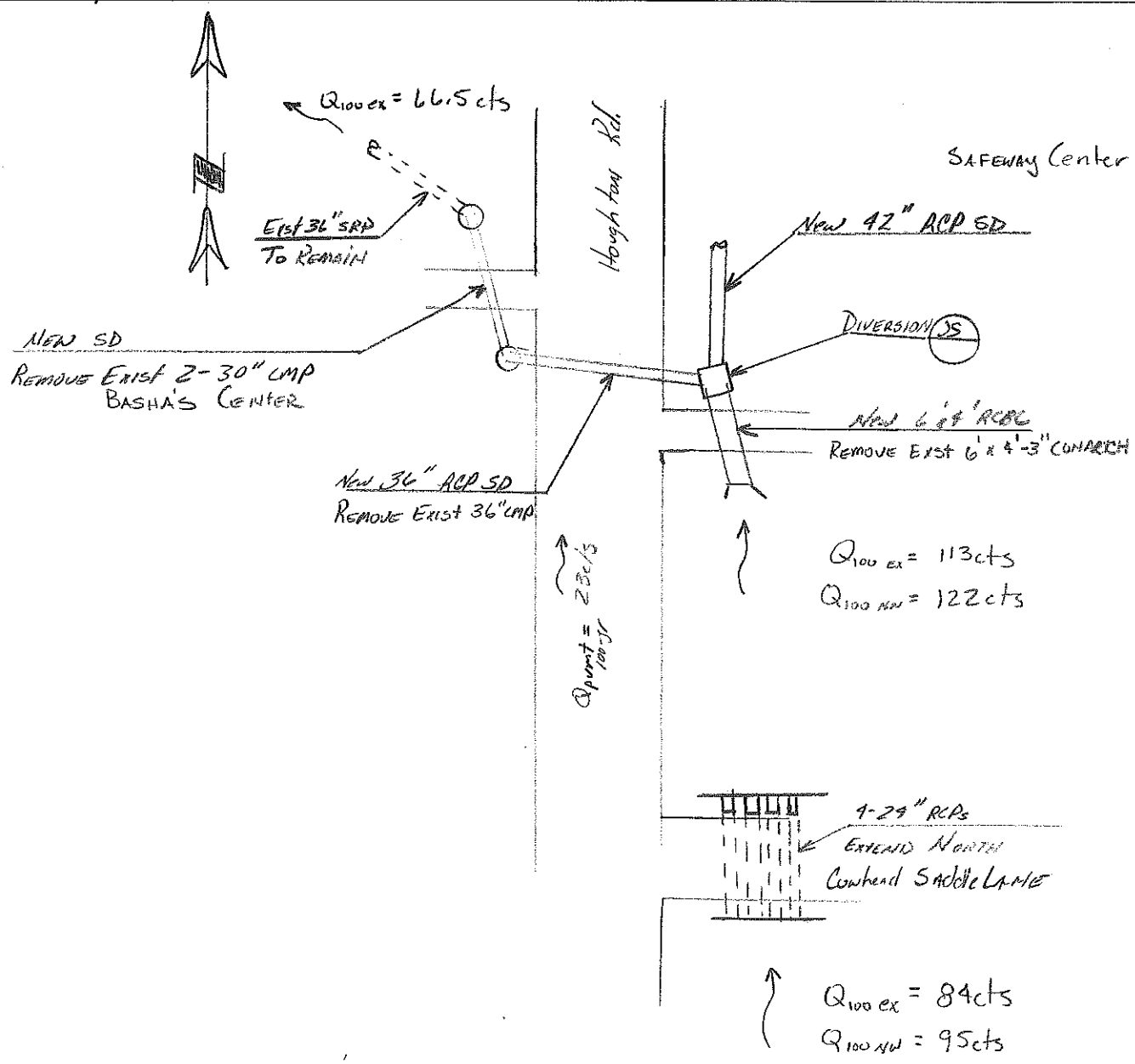
C-2

BASHAS' SHOPPING CENTER

PARSONS BRINCKERHOFF COMPUTATION SHEET

Made by G. Bamberger
Date 11/28/07
Checked by D. Ruwalcaba
Date 02/25/08

Subject Houghton Road 5th - OST
Basha's Stormdrain Hydraulic Analysis
Proposed Condition



1. Replace Existing 6'x4'-3" Conarch w/ New 6'x4' RCBC

2. Provide Junction Structure to Apply Diversion to match Existing Condition Flow Diversion

3. Approximate Pavement Run-off for Proposed Condition to Adjust Diversion → Existing 36" CMP (Basha's SD) will Receive Same Amount of R/O for Proposed Condition as in Existing Condition.

4. Preliminary Size New SD Pipes → Manning's

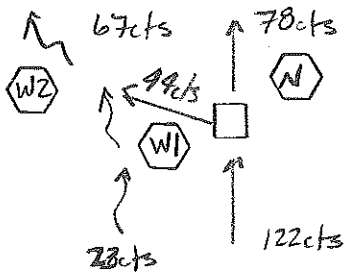
Subject Houghton Road 5th - OST
Basha's SD Hydraulic Analysis
Proposed Condition

PRELIMINARY Junction / DIVERSION DESIGN
CP GE1 - CP GE4

1. Compute Allowable Discharge to BASHA'S SD @ Junction

$Q_{100\ EXIST}$ = 66.5 cfs @ INLET to SD
$Q_{100\ PUMP\ NW}$ = 23 cfs

$Q_{100\ TOTAL\ NW}$ = 122 cfs



66.5 ~ 67cfs - 23cfs = 44cfs

122cfs - 44cfs = 78cfs

2. Preliminary Sizing SD pipes

N	S = 2.0% ±	Q = 78	y_n ~ 2.0'
W1	S ~ 2.8%	Q = 67	y_n ~ 1.8'
W2	S ~ 2.8%	Q = 67	y_n ~ 1.8'

3. Compare Inlet Control

FHWA Urban Drainage Design Program, HY-22
HYDRAULIC PARAMETERS OF OPEN CHANNELS

Circular X-Section
Date: 01/10/2008

Project No. :11515
Project Name.:Houghton Road 5th-OST
Computed by :G. Bambauer

Project Description

Basha's Storm Drain
Preliminary Analysis
Pipe to North N

INPUT PARAMETERS

1.	Pipe Slope (ft/ft)	0.0200
2.	Pipe Diameter (in)	42.0
3.	Manning's Coefficient	0.015
4.	Discharge (cfs)	78.000

OUTPUT RESULTS

Partial Flow Conditions

Depth of Flow (ft)	2.01
Velocity (ft/sec)	13.64

FHWA Urban Drainage Design Program, HY-22
HYDRAULIC PARAMETERS OF OPEN CHANNELS

Circular X-Section
Date: 01/10/2008

Project No. :11515
Project Name.:Houghton Road 5th-OST
Computed by :G. Bambauer

Project Description

Basha's Storm Drain
Preliminary Analysis
Pipe to West W

INPUT PARAMETERS

1.	Pipe Slope (ft/ft)	0.0280
2.	Pipe Diameter (in)	36.0
3.	Manning's Coefficient	0.015
4.	Discharge (cfs)	67.000

OUTPUT RESULTS

Partial Flow Conditions

Depth of Flow (ft)	1.83
Velocity (ft/sec)	14.81

Subject Houghton Road 5th - OST
Basha's SD Hydraulic Analysis
Proposed Condition

Preliminary SD Size @ Junction Con't

Size Based on Inlet Control

N - d/D = 1.5 for 78/80cfs → 5.25' HW (42" ϕ)

N1 - d/D = 1.25 for 44/45cfs → 3.75' HW (36" ϕ)

Set Pipe N Invert 1.5' Below Invert of Pipe N1

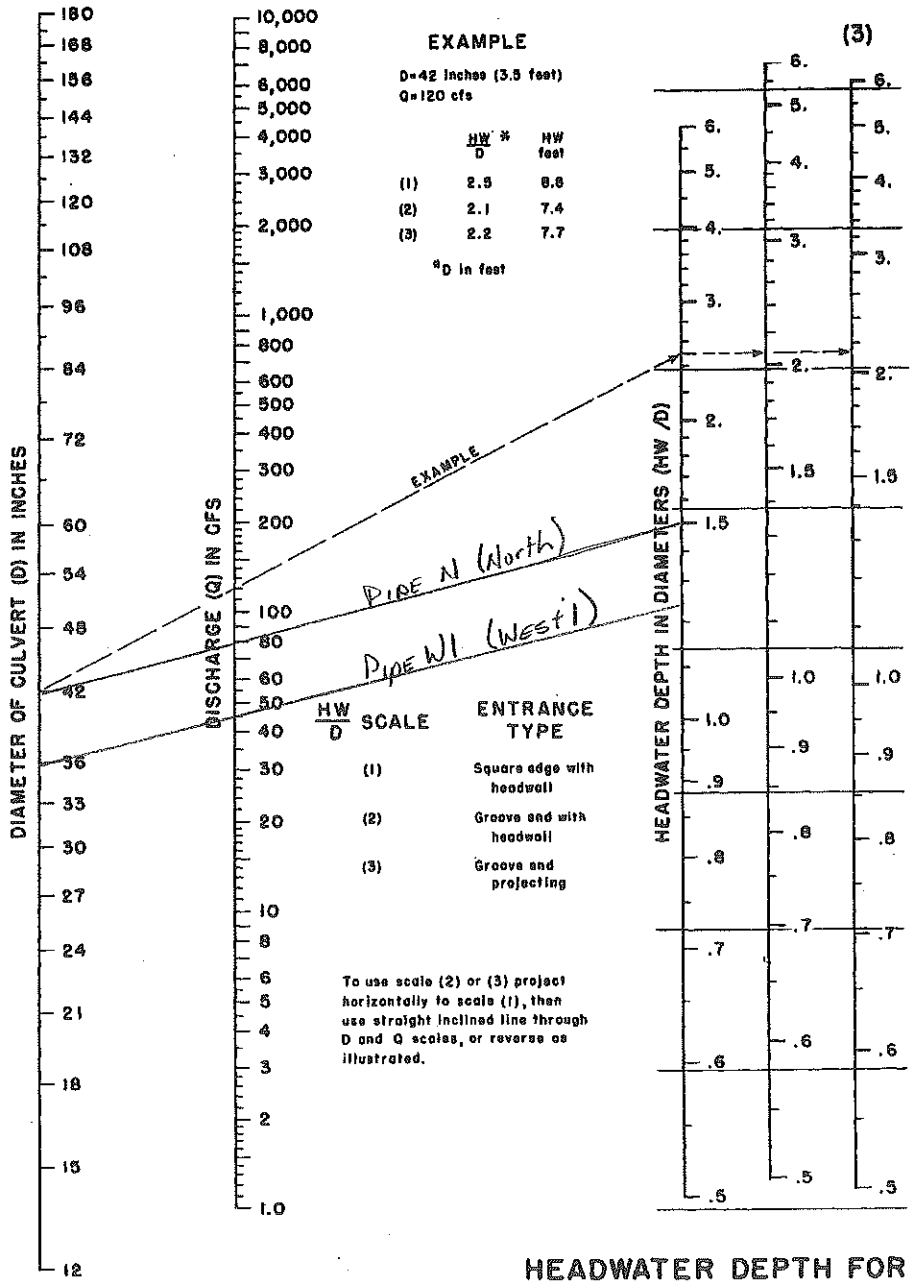
N Inv = 54.92 → HW_{INLET} = 60.17

N1 Inv = 56.42 → HW_{INLET} = 60.17

- See Nomograph next Page

Upstream Structures See HEC RAS

CHART 1B



HEADWATER SCALES 2&3
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

HOUGHTON ROAD SW-OST
PB PROJ NO 11515
CP GE1-GE4 PROPOSED CONDITION

HEC-RAS Version 3.1.3 May 2005
U.S. Army Corp 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: Bashas Stormdrain GS1-GE4
Project File : GS1_GS6.prj
Run Date and Time: 3/14/2008 7:56:44 AM

Project in English units

Project Description:
Existing Condition Analysis
CP GS3 to CP GS6
External Analysis Determined
Starting Condition For CP GS3 Headwater
Starting WSE-100 = 2762.34

PROPOSED
CONDITION --
PRELIMINARY ANALYSIS
CP GE1- CP GE4
EXTERNAL ANALYSIS FOR CP
GE1 HEADWATER
STARTING WSE-100 = 2760.17

PLAN DATA

Plan Title: PROP GE1-GE4
Plan File : 1:\11515\Drainage\HECRAS\Bashas SD GE1-GE4\Test\GS1_GS6.p02

Geometry Title: PROP GE1-GE4
Geometry File : 1:\11515\Drainage\HECRAS\Bashas SD GE1-GE4\Test\GS1_GS6.g02

Flow Title : PROP GE1-GE4
Flow File : 1:\11515\Drainage\HECRAS\Bashas SD GE1-GE4\Test\GS1_GS6.f02

Plan Description:
PROPOSED CONDITION
Tailwater Established from Rating Curve Computed

Externally from HECRAS.

Plan Summary Information:

Number of:	Cross Sections =	10	Multiple Openings =	0
	Culverts =	2	Inline Structures =	0
	Bridges =	0	Lateral Structures =	0

Computational Information

Water surface calculation tolerance	=	0.01
Critical depth calculation tolerance	=	0.01
Maximum number of iterations	=	40
Maximum difference tolerance	=	0.3
Flow tolerance factor	=	0.001

Computation Options

HOUGHTON ROAD SW-OST
PB PROJ NO 11515
CP GE1-GE4 PROPOSED CONDITION

Critical depth computed at all cross sections
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: PROP GE1-GE4
Flow File : l:\11515\Drainage\HECRAS\Bashas SD GE1-GE4\Test\GS1_GS6.f02

Flow Data (cfs)

River	Reach	RS	100-Year
Bashas SD	GS1-GE4	1695	95
Bashas SD	GS1-GE4	1267.95	122

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Bashas SD	GS1-GE4	100-Year	Critical	Known WS = 2760.17

GEOMETRY DATA

Geometry Title: PROP GE1-GE4
Geometry File : l:\11515\Drainage\HECRAS\Bashas SD GE1-GE4\Test\GS1_GS6.g02

CROSS SECTION

RIVER: Bashas SD
REACH: GS1-GE4 RS: 1695

INPUT
Description:
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2781.52	16.82	2781.31	26.84	2780.93	29.56	2780.71	35.44	2780.42
58.11	2779.05	66.09	2778.66	68.25	2778.41	77.16	2777.91	81.5	2777.47
88.35	2777.03	91.03	2776.75	95.78	2776.55	106.69	2775.9	113.82	2775.65
123.84	2774.78	132.61	2774.29	139.03	2773.54	145.14	2772.92	148.57	2772.43
154.94	2771.4	157.72	2772.02	159.58	2772.34	161.04	2772.4	174.72	2773.72
177.43	2774.11	181.44	2774.43	185.62	2774.88	192.1	2775.48	208.52	2776.07

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	113.82	.04	192.1	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
113.82	192.1	65	60	55	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	2773.51	Element			
Vel Head (ft)	0.38	Wt. n-Val.		0.040	
W.S. Elev (ft)	2773.13	Reach Len. (ft)	65.00	60.00	55.00
Crit W.S. (ft)	2773.13	Flow Area (sq ft)		19.13	
E.G. Slope (ft/ft)	0.026642	Area (sq ft)		19.13	
Q Total (cfs)	95.00	Flow (cfs)		95.00	
Top Width (ft)	25.56	Top Width (ft)		25.56	
Vel Total (ft/s)	4.97	Avg. Vel. (ft/s)		4.97	
Max Chl Dpth (ft)	1.73	Hydr. Depth (ft)		0.75	
Conv. Total (cfs)	582.0	Conv. (cfs)		582.0	
Length Wtd. (ft)	60.00	Wetted Per. (ft)		25.82	
Min Ch El (ft)	2771.40	Shear (lb/sq ft)		1.23	
Alpha	1.00	Stream Power (lb/ft s)		6.12	
Frctn Loss (ft)	1.50	Cum Volume (acre-ft)	0.00	0.72	
C & E Loss (ft)	0.00	Cum SA (acres)	0.01	0.58	

HOUGHTON ROAD SW-OST
PB PROJ NO 11515
CP GE1-GE4 PROPOSED CONDITION

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Bashas SD
REACH: GS1-GE4 RS: 1635

INPUT
Description:
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2777.06	6.56	2776.99	10.72	2776.61	13.23	2776.08	17.06	2775.66
23.65	2775.32	26.85	2775.23	29.04	2775.24	33.96	2774.99	39.57	2774.94
43.87	2774.61	45.86	2774.56	47.14	2774.68	49.24	2774.57	52.04	2774.5
52.82	2774.41	55.88	2774.24	59.66	2773.69	60.62	2773.61	64.22	2773.45
67.51	2773.25	78.85	2771.76	80.12	2771.53	88.49	2770.69	98	2770.04
98.74	2769.99	104.31	2770.62	110.05	2772.92	111.39	2773.8	115.2	2775.96

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	67.51	.04	115.2	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
67.51	115.2	140	135	130	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	2771.74	Element			
Vel Head (ft)	0.37	Wt. n-Val.		0.040	
W.S. Elev (ft)	2771.37	Reach Len. (ft)	140.00	135.00	130.00
Crit W.S. (ft)	2771.34	Flow Area (sq ft)		19.51	
E.G. Slope (ft/ft)	0.023538	Area (sq ft)		19.51	
Q Total (cfs)	95.00	Flow (cfs)		95.00	
Top Width (ft)	24.47	Top Width (ft)		24.47	
Vel Total (ft/s)	4.87	Avg. Vel. (ft/s)		4.87	
Max Chl Dpth (ft)	1.38	Hydr. Depth (ft)		0.80	
Conv. Total (cfs)	619.2	Conv. (cfs)		619.2	
Length Wtd. (ft)	135.00	Wetted Per. (ft)		24.71	
Min Ch El (ft)	2769.99	Shear (lb/sq ft)		1.16	
Alpha	1.00	Stream Power (lb/ft s)		5.65	
Frctn Loss (ft)	3.43	Cum Volume (acre-ft)	0.00	0.69	
C & E Loss (ft)	0.01	Cum SA (acres)	0.01	0.55	

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Bashas SD
REACH: GS1-GE4 RS: 1500

INPUT
Description:
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2773.62	5.2	2771.89	12.13	2771.78	14.02	2771.71	16.84	2771.54
18.91	2771.39	22.43	2771.15	27.28	2770.72	30.22	2770.48	33.8	2770.25
34.9	2770.19	35.46	2770.14	39.48	2769.87	40.21	2769.84	43.72	2769.41
44.49	2769.34	48.04	2769.12	49.01	2769.04	52.32	2768.78	57.76	2768.05
58.97	2767.93	68.73	2767.37	70.22	2767.28	70.62	2767.27	79.9	2766.41
85.16	2767.64	87.88	2767.84	99.81	2768.76	103.82	2770.6	112.68	2774.73
112.78	2774.73								

HOUGHTON ROAD SW-OST
PB PROJ NO 11515
CP GE1-GE4 PROPOSED CONDITION

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	12.13	.04	112.78	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
12.13	112.78	105	100	95	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	2768.30	Element			
Vel Head (ft)	0.34	Wt. n-Val.		0.040	
W.S. Elev (ft)	2767.97	Reach Len. (ft)	105.00	100.00	95.00
Crit W.S. (ft)	2767.97	Flow Area (sq ft)		20.43	
E.G. Slope (ft/ft)	0.027469	Area (sq ft)		20.43	
Q Total (cfs)	95.00	Flow (cfs)		95.00	
Top Width (ft)	30.90	Top Width (ft)		30.90	
Vel Total (ft/s)	4.65	Avg. Vel. (ft/s)		4.65	
Max Chl Dpth (ft)	1.56	Hydr. Depth (ft)		0.66	
Conv. Total (cfs)	573.2	Conv. (cfs)		573.2	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		31.11	
Min Ch El (ft)	2766.41	Shear (lb/sq ft)		1.13	
Alpha	1.00	Stream Power (lb/ft s)		5.24	
Frctn Loss (ft)	0.43	Cum Volume (acre-ft)	0.00	0.63	
C & E Loss (ft)	0.09	Cum SA (acres)	0.01	0.46	

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Bashas SD
REACH: GS1-GE4 RS: 1400

INPUT
Description:
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
3.4	2770.83	8.1	2769.25	9.51	2769.17	11.34	2769.08	12.7	2768.79
17.82	2767.68	18.37	2767.69	27.32	2767.02	30.92	2766.82	32.66	2766.68
34.54	2766.58	38.02	2766.49	41.58	2766.15	45.78	2765.79	48.19	2765.56
50.02	2765.39	53.32	2765.02	56.36	2764.65	61.19	2764.92	61.72	2764.95
62.55	2764.94	67.74	2764.9	68.53	2764.92	73.57	2765.5	75.39	2765.84
82.15	2766.37	82.75	2766.31	85.23	2766.41	100.22	2766.83	101.53	2767.32
115.5	2772.47								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
3.4	.05	18.37	.04	115.5	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
18.37	115.5	55	55	55	.3	.5

CROSS SECTION OUTPUT Profile #100-Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	2766.82	Element			
Vel Head (ft)	0.03	Wt. n-Val.		0.040	
W.S. Elev (ft)	2766.79	Reach Len. (ft)	55.00	55.00	55.00
Crit W.S. (ft)	2765.79	Flow Area (sq ft)		64.64	
E.G. Slope (ft/ft)	0.001666	Area (sq ft)		64.64	
Q Total (cfs)	95.00	Flow (cfs)		95.00	
Top Width (ft)	67.53	Top Width (ft)		67.53	
Vel Total (ft/s)	1.47	Avg. Vel. (ft/s)		1.47	
Max Chl Dpth (ft)	2.14	Hydr. Depth (ft)		0.96	
Conv. Total (cfs)	2327.1	Conv. (cfs)		2327.1	
Length Wtd. (ft)	55.00	Wetted Per. (ft)		67.74	
Min Ch El (ft)	2764.65	Shear (lb/sq ft)		0.10	

HOUGHTON ROAD SW-OST
PB PROJ NO 11515
CP GE1-GE4

PROPOSED CONDITION

Alpha	1.00	Stream Power (lb/ft s)		0.15
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	0.00	0.53
C & E Loss (ft)	0.00	Cum SA (acres)	0.01	0.35

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: Bashas SD
REACH: GS1-GE4 RS: 1345

INPUT
Description:
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
.7	2769.22	3.8	2768.2	12.03	2767.84	12.15	2767.8	13.27	2767.93
14.15	2767.91	23.14	2767.34	26.43	2767.23	29.79	2767.05	36	2766.42
38.11	2766.36	40.14	2765.94	42.6	2765.56	44.88	2765.36	51.01	2764.51
55.32	2763.5	59.39	2763.5	61.07	2763.47	71.55	2763.82	84.16	2764.59
88.06	2765.34	92.14	2766.03	92.89	2766.11	96.45	2766.84	99.31	2767.58
104.51	2768.77	109.57	2769.23	112.18	2769.14	112.3	2771.35	112.4	2772.18

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
.7	.05	13.27	.04	104.51	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
13.27	104.51	77	77	77	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
.7	48.8	2767	F
67.4	112.4	2767	F

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	2766.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.		0.040	
W.S. Elev (ft)	2766.73	Reach Len. (ft)	77.00	77.00	77.00
Crit W.S. (ft)	2764.69	Flow Area (sq ft)		54.81	
E.G. Slope (ft/ft)	0.000521	Area (sq ft)		125.54	
Q Total (cfs)	95.00	Flow (cfs)		95.00	
Top Width (ft)	62.91	Top Width (ft)		62.91	
Vel Total (ft/s)	1.73	Avg. Vel. (ft/s)		1.73	
Max Chl Dpth (ft)	3.26	Hydr. Depth (ft)		2.95	
Conv. Total (cfs)	4163.7	Conv. (cfs)		4163.7	
Length Wtd. (ft)	77.00	Wetted Per. (ft)		18.74	
Min Ch El (ft)	2763.47	Shear (lb/sq ft)		0.10	
Alpha	1.00	Stream Power (lb/ft s)		0.16	
Frctn Loss (ft)		Cum Volume (acre-ft)	0.00	0.41	
C & E Loss (ft)		Cum SA (acres)	0.01	0.27	

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid,
energy was used.

CULVERT

RIVER: Bashas SD
REACH: GS1-GE4 RS: 1340.5

INPUT
Description: COWHEAD SADDLE LANE
Distance from Upstream XS = 8
Deck/Roadway Width = 40
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 2

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2767		200	2767	

HOUGHTON ROAD SW-OST
PB PROJ NO 11515
CP GE1-GE4 PROPOSED CONDITION

Upstream Bridge Cross Section Data
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
.7	2769.22	3.8	2768.2	12.03	2767.84	12.15	2767.8	13.27	2767.93
14.15	2767.91	23.14	2767.34	26.43	2767.23	29.79	2767.05	36	2766.42
38.11	2766.36	40.14	2765.94	42.6	2765.56	44.88	2765.36	51.01	2764.51
55.32	2763.5	59.39	2763.5	61.07	2763.47	71.55	2763.82	84.16	2764.59
88.06	2765.34	92.14	2766.03	92.89	2766.11	96.45	2766.84	99.31	2767.58
104.51	2768.77	109.57	2769.23	112.18	2769.14	112.3	2771.35	112.4	2772.18

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
.7	.05	13.27	.04	104.51	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
13.27	104.51	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
.7	48.8	2767	F
67.4	112.4	2767	F

Downstream Deck/Roadway Coordinates
num= 2

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2766.4		200	2766.4	

Downstream Bridge Cross Section Data
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2765.63	3.4	2764.51	30.9	2764.02	38.2	2761.59	71.5	2761.59
81	2764.75	89.1	2766.75						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30.9	.04	89.1	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
30.9	89.1	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	50	2766.9	F
60.8	89.1	2766.9	F

Upstream Embankment side slope = 3 horiz. to 1.0 vertical
Downstream Embankment side slope = 3 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Circular	2	

FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 3 - Groove end entrance; pipe projecting from fill
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	4.5	65	.013	.013	0	.2	1

Number of Barrels = 4
Upstream Elevation = 2763.61
Centerline Stations

Sta.	Sta.	Sta.	Sta.
54.3	57.5	60.3	63.4

Downstream Elevation = 2761.76
Centerline Stations

Sta.	Sta.	Sta.	Sta.
50.9	53.7	56.8	59.8

CULVERT OUTPUT Profile #100-Year Culv Group: Culvert #1

Q Culv Group (cfs)	95.00	Culv Full Len (ft)	
# Barrels	4	Culv Vel US (ft/s)	7.56
Q Barrel (cfs)	23.75	Culv Vel DS (ft/s)	12.10

HOUGHTON ROAD SW-OST
PB PROJ NO 11515
CP GE1-GE4 PROPOSED CONDITION

E.G. US. (ft)	2766.77	Culv Inv El Up (ft)	2763.61
W.S. US. (ft)	2766.73	Culv Inv El Dn (ft)	2761.76
E.G. DS (ft)	2763.96	Culv Frctn Ls (ft)	1.37
W.S. DS (ft)	2763.18	Culv Exit Loss (ft)	1.27
Delta EG (ft)	2.81	Culv Entr Loss (ft)	0.18
Delta WS (ft)	3.55	Q Weir (cfs)	
E.G. IC (ft)	2766.77	Weir Sta Lft (ft)	
E.G. OC (ft)	2766.60	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	2765.61	Weir Max Depth (ft)	
Culv WS Outlet (ft)	2762.96	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	1.14	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	1.73	Min El Weir Flow (ft)	2767.01

Note: The flow in the culvert is entirely supercritical.

CROSS SECTION

RIVER: Bashas SD
REACH: GS1-GE4 RS: 1267.95

INPUT
Description:
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2765.63	3.4	2764.51	30.9	2764.02	38.2	2761.59	71.5	2761.59
81	2764.75	89.1	2766.75						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30.9	.04	89.1	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
30.9	89.1	68	68	68	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	50	2766.9	F
60.8	89.1	2766.9	F

CROSS SECTION OUTPUT Profile #100-Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	2763.96	Element			
Vel Head (ft)	0.78	Wt. n-Val.		0.040	
W.S. Elev (ft)	2763.18	Reach Len. (ft)	68.00	68.00	66.00
Crit W.S. (ft)	2763.18	Flow Area (sq ft)		17.17	
E.G. Slope (ft/ft)	0.019726	Area (sq ft)		60.53	
Q Total (cfs)	122.00	Flow (cfs)		122.00	
Top Width (ft)	42.85	Top Width (ft)		42.85	
Vel Total (ft/s)	7.11	Avg. Vel. (ft/s)		7.11	
Max Chl Dpth (ft)	1.59	Hydr. Depth (ft)		1.59	
Conv. Total (cfs)	868.6	Conv. (cfs)		868.6	
Length Wtd. (ft)	68.00	Wetted Per. (ft)		10.80	
Min Ch El (ft)	2761.59	Shear (lb/sq ft)		1.96	
Alpha	1.00	Stream Power (lb/ft s)		13.91	
Frctn Loss (ft)	0.37	Cum Volume (acre-ft)	0.00	0.25	
C & E Loss (ft)	0.37	Cum SA (acres)	0.01	0.17	

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid,
energy was used.

HOUGHTON ROAD SW-OST
PB PROJ NO 11515
CP GE1-GE4 PROPOSED CONDITION
CROSS SECTION

RIVER: Bashas SD
REACH: GS1-GE4 RS: 1200

INPUT
Description:
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9.2	2765.73	21.4	2761.75	25.76	2761.02	35.01	2760.98	35.6	2760.98
35.83	2760.97	46.49	2760.58	46.73	2760.58	51.45	2760.85	54.08	2761
54.72	2761.04	55.85	2761.1	57.77	2761.11	60.8	2761.13	60.92	2761.13
60.95	2761.13	61.02	2761.13	61.09	2761.13	70.31	2761.17	72.08	2761.25
74.96	2761.33	93.26	2761.96	107.28	2766.2	112.7	2767.83		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9.2	.05	9.2	.04	112.7	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9.2	112.7	40	40	40	.3	.5

CROSS SECTION OUTPUT Profile #100-Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	2762.18	Element			
Vel Head (ft)	0.05	Wt. n-Val.		0.040	
W.S. Elev (ft)	2762.13	Reach Len. (ft)	40.00	40.00	40.00
Crit W.S. (ft)	2761.56	Flow Area (sq ft)		68.72	
E.G. Slope (ft/ft)	0.002510	Area (sq ft)		68.72	
Q Total (cfs)	122.00	Flow (cfs)		122.00	
Top Width (ft)	73.58	Top Width (ft)		73.58	
Vel Total (ft/s)	1.78	Avg. Vel. (ft/s)		1.78	
Max Chl Dpth (ft)	1.55	Hydr. Depth (ft)		0.93	
Conv. Total (cfs)	2434.9	Conv. (cfs)		2434.9	
Length Wtd. (ft)	40.00	Wetted Per. (ft)		73.77	
Min Ch El (ft)	2760.58	Shear (lb/sq ft)		0.15	
Alpha	1.00	Stream Power (lb/ft s)		0.26	
Frctn Loss (ft)	0.06	Cum Volume (acre-ft)	0.00	0.15	
C & E Loss (ft)	0.00	Cum SA (acres)	0.01	0.08	

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: Bashas SD
REACH: GS1-GE4 RS: 1160

INPUT
Description: TOP OF NEW DROP
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
18.2	2764.74	31.4	2760.47	38.8	2760.48	51.5	2759.9	60	2759.89
63.9	2760.73	72.3	2761.38	80.7	2762.77				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
18.2	.05	18.2	.04	80.7	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
18.2	80.7	18	18	18	.3	.5

CROSS SECTION OUTPUT Profile #100-Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	2762.11	Element			
Vel Head (ft)	0.04	Wt. n-Val.		0.040	
W.S. Elev (ft)	2762.07	Reach Len. (ft)	18.00	18.00	18.00
Crit W.S. (ft)	2760.96	Flow Area (sq ft)		74.87	
E.G. Slope (ft/ft)	0.001136	Area (sq ft)		74.87	
Q Total (cfs)	122.00	Flow (cfs)		122.00	
Top Width (ft)	50.00	Top Width (ft)		50.00	
Vel Total (ft/s)	1.63	Avg. Vel. (ft/s)		1.63	

HOUGHTON ROAD SW-OST
PB PROJ NO 11515
CP GE1-GE4

PROPOSED CONDITION

Max Chl Dpth (ft)	2.18	Hydr. Depth (ft)		1.50
Conv. Total (cfs)	3619.4	Conv. (cfs)		3619.4
Length Wtd. (ft)	18.00	Wetted Per. (ft)		50.44
Min Ch El (ft)	2759.89	Shear (lb/sq ft)		0.11
Alpha	1.00	Stream Power (lb/ft s)		0.17
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	0.00	0.08
C & E Loss (ft)	0.02	Cum SA (acres)	0.01	0.03

CROSS SECTION

RIVER: Bashas SD
REACH: GS1-GE4 RS: 1142

INPUT
Description:
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
29.7	2764.05	33.8	2762.69	38.08	2762.22	43.24	2761.72	46.48	2761.17
49	2762.14	49	2758.14	60.3	2758.14	60.3	2762.14	67.642	762.107
75.99	2762.07	80.29	2762.26	81.67	2762.38	83.4	2762.48	87.69	2763.17
87.79	2762.77	88.08	2762.77						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
29.7	.05	49	.04	60.3	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
49	60.3	60	60	60	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
29.7	45.1	2764	F
65.3	88.08	2764	F

CROSS SECTION OUTPUT Profile #100-Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	2762.06	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.	0.050	0.040	
W.S. Elev (ft)	2761.94	Reach Len. (ft)	60.00	60.00	60.00
Crit W.S. (ft)	2759.69	Flow Area (sq ft)	1.66	42.91	
E.G. Slope (ft/ft)	0.001920	Area (sq ft)	2.60	42.91	
Q Total (cfs)	122.00	Flow (cfs)	1.31	120.69	
Top Width (ft)	18.78	Top Width (ft)	7.48	11.30	
Vel Total (ft/s)	2.74	Avg. Vel. (ft/s)	0.79	2.81	
Max Chl Dpth (ft)	3.80	Hydr. Depth (ft)	0.49	3.80	
Conv. Total (cfs)	2783.9	Conv. (cfs)	29.9	2754.1	
Length Wtd. (ft)	60.00	Wetted Per. (ft)	3.54	18.89	
Min Ch El (ft)	2758.14	Shear (lb/sq ft)	0.06	0.27	
Alpha	1.05	Stream Power (lb/ft s)	0.04	0.77	
Frctn Loss (ft)		Cum Volume (acre-ft)	0.00	0.05	
C & E Loss (ft)		Cum SA (acres)	0.01	0.01	

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CULVERT

RIVER: Bashas SD
REACH: GS1-GE4 RS: 1134.9

INPUT
Description: Southern enterance to Smiths Commercial Site
Distance from Upstream XS = 8
Deck/Roadway Width = 30
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2763		30	2763.7		100	2763.4	

Upstream Bridge Cross Section Data

HOUGHTON ROAD SW-OST
PB PROJ NO 11515
CP GE1-GE4 PROPOSED CONDITION

Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
29.7	2764.05	33.8	2762.69	38.08	2762.22	43.24	2761.72	46.48	2761.17
49	2762.14	49	2758.14	60.3	2758.14	60.3	2762.14	67.64	2762.107
75.99	2762.07	80.29	2762.26	81.67	2762.38	83.4	2762.48	87.69	2763.17
87.79	2762.77	88.08	2762.77						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
29.7	.05	49	.04	60.3	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
49	60.3	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
29.7	45.1	2764	F
65.3	88.08	2764	F

Downstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2763		30	2763.7		100	2763.4	

Downstream Bridge Cross Section Data
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
50	2762.46	50	2756.46	60	2756.49	60	2762.46

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
50	.013	50	.013	60	.013

Bank Sta: Left	Right	Coeff Contr.	Expan.
50	60	.3	.5

Upstream Embankment side slope = 3 horiz. to 1.0 vertical
Downstream Embankment side slope = 3 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Box	4	6

FHWA Chart # 11- Skewed headwall; Chamfered or beveled Inlet
FHWA Scale # 1 - Headwall skewed 45 deg.; inlet edges chamfered 3/4 inch
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	3	54	.013	.013	0	.2	1

Upstream Elevation = 2758
Centerline Station = 55.1
Downstream Elevation = 2756.42
Centerline Station = 55

CULVERT OUTPUT Profile #100-Year Culv Group: Culvert #1

Q Culv Group (cfs)	122.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	8.68
Q Barrel (cfs)	122.00	Culv Vel DS (ft/s)	14.01
E.G. US. (ft)	2762.06	Culv Inv El Up (ft)	2758.00
W.S. US. (ft)	2761.94	Culv Inv El Dn (ft)	2756.42
E.G. DS (ft)	2760.34	Culv Frctn Ls (ft)	0.59
W.S. DS (ft)	2760.17	Culv Exit Loss (ft)	0.58
Delta EG (ft)	1.72	Culv Entr Loss (ft)	0.55
Delta WS (ft)	1.77	Q Weir (cfs)	
E.G. IC (ft)	2762.06	Weir Sta Lft (ft)	
E.G. OC (ft)	2761.75	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	2760.34	Weir Max Depth (ft)	
Culv WS Outlet (ft)	2757.87	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	1.17	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	2.34	Min El Weir Flow (ft)	2763.58

HOUGHTON ROAD SW-OST
PB PROJ NO 11515
CP GE1-GE4 PROPOSED CONDITION

Note: The flow in the culvert is entirely supercritical.

CROSS SECTION

RIVER: Bashas SD
REACH: GS1-GE4 RS: 1082

INPUT
Description: DIVERSION JUNC STR
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
50	2762.46	50	2756.46	60	2756.49	60	2762.46

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
50	.013	50	.013	60	.013

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
50	60	0	0	0	.3	.5

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	2760.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.17	Wt. n-Val.		0.013	
W.S. Elev (ft)	2760.17	Reach Len. (ft)			
Crit W.S. (ft)	2758.14	Flow Area (sq ft)		36.95	
E.G. Slope (ft/ft)	0.000305	Area (sq ft)		36.95	
Q Total (cfs)	122.00	Flow (cfs)		122.00	
Top Width (ft)	10.00	Top Width (ft)		10.00	
Vel Total (ft/s)	3.30	Avg. Vel. (ft/s)		3.30	
Max Chl Dpth (ft)	3.71	Hydr. Depth (ft)		3.69	
Conv. Total (cfs)	6980.2	Conv. (cfs)		6980.2	
Length Wtd. (ft)		Wetted Per. (ft)		17.39	
Min Ch El (ft)	2756.46	Shear (lb/sq ft)		0.04	
Alpha	1.00	Stream Power (lb/ft s)		0.13	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

SUMMARY OF MANNING'S N VALUES

River:Bashas SD

Reach	River Sta.	n1	n2	n3
GS1-GE4	1695	.05	.04	.05
GS1-GE4	1635	.05	.04	.05
GS1-GE4	1500	.05	.04	.05
GS1-GE4	1400	.05	.04	.05
GS1-GE4	1345	.05	.04	.05
GS1-GE4	1340.5	Culvert		
GS1-GE4	1267.95	.05	.04	.05
GS1-GE4	1200	.05	.04	.05
GS1-GE4	1160	.05	.04	.05
GS1-GE4	1142	.05	.04	.05
GS1-GE4	1134.9	Culvert		
GS1-GE4	1082	.013	.013	.013

SUMMARY OF REACH LENGTHS

River: Bashas SD

Reach	River Sta.	Left	Channel	Right
GS1-GE4	1695	65	60	55
GS1-GE4	1635	140	135	130
GS1-GE4	1500	105	100	95

HOUGHTON ROAD SW-OST
PB PROJ NO 11515
CP GE1-GE4

PROPOSED CONDITION

GS1-GE4	1400	55	55	55
GS1-GE4	1345	77	77	77
GS1-GE4	1340.5	Culvert		
GS1-GE4	1267.95	68	68	68
GS1-GE4	1200	40	40	40
GS1-GE4	1160	18	18	18
GS1-GE4	1142	60	60	60
GS1-GE4	1134.9	Culvert		
GS1-GE4	1082	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Bashas SD

Reach	River Sta.	Contr.	Expan.
GS1-GE4	1695	.1	.3
GS1-GE4	1635	.1	.3
GS1-GE4	1500	.1	.3
GS1-GE4	1400	.3	.5
GS1-GE4	1345	.3	.5
GS1-GE4	1340.5	Culvert	
GS1-GE4	1267.95	.3	.5
GS1-GE4	1200	.3	.5
GS1-GE4	1160	.3	.5
GS1-GE4	1142	.3	.5
GS1-GE4	1134.9	Culvert	
GS1-GE4	1082	.3	.5

HOUGHTON ROAD SW-OST
PB PROJ NO 11515
CP GE1-GE4

PROPOSED CONDITION

Profile Output Table - Standard Table 1

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
GS1-GE4	1695	100-Year	95.00	2771.40	2773.13	2773.13	2773.51	0.026642	4.97	19.13	25.56	1.01
GS1-GE4	1635	100-Year	95.00	2769.99	2771.37	2771.34	2771.74	0.023538	4.87	19.51	24.47	0.96
GS1-GE4	1500	100-Year	95.00	2766.41	2767.97	2767.97	2768.30	0.027469	4.65	20.43	30.90	1.01
GS1-GE4	1400	100-Year	95.00	2764.65	2766.79	2765.79	2766.82	0.001666	1.47	64.64	67.53	0.26
GS1-GE4	1345	100-Year	95.00	2763.47	2766.73	2764.69	2766.77	0.000521	1.73	54.81	62.91	0.18
GS1-GE4	1340.5		Culvert									
GS1-GE4	1267.95	100-Year	122.00	2761.59	2763.18	2763.18	2763.96	0.019726	7.11	17.17	42.85	0.99
GS1-GE4	1200	100-Year	122.00	2760.58	2762.13	2761.56	2762.18	0.002510	1.78	68.72	73.58	0.32
GS1-GE4	1160	100-Year	122.00	2759.89	2762.07	2760.96	2762.11	0.001136	1.63	74.87	50.00	0.23
GS1-GE4	1142	100-Year	122.00	2758.14	2761.94	2759.69	2762.06	0.001920	2.81	44.57	18.78	0.25
GS1-GE4	1134.9		Culvert									
GS1-GE4	1082	100-Year	122.00	2756.46	2760.17	2758.14	2760.34	0.000305	3.30	36.95	10.00	0.30

Profile Output Table - Standard Table 2

Reach	River Sta	Profile	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
GS1-GE4	1695	100-Year	2773.51	2773.13	0.38	1.50	0.00		95.00		25.56
GS1-GE4	1635	100-Year	2771.74	2771.37	0.37	3.43	0.01		95.00		24.47
GS1-GE4	1500	100-Year	2768.30	2767.97	0.34	0.43	0.09		95.00		30.90
GS1-GE4	1400	100-Year	2766.82	2766.79	0.03	0.05	0.00		95.00		67.53
GS1-GE4	1345	100-Year	2766.77	2766.73	0.05				95.00		62.91
GS1-GE4	1340.5		Culvert								
GS1-GE4	1267.95	100-Year	2763.96	2763.18	0.78	0.37	0.37		122.00		42.85
GS1-GE4	1200	100-Year	2762.18	2762.13	0.05	0.06	0.00		122.00		73.58
GS1-GE4	1160	100-Year	2762.11	2762.07	0.04	0.03	0.02		122.00		50.00
GS1-GE4	1142	100-Year	2762.06	2761.94	0.12			1.31	120.69		18.78
GS1-GE4	1134.9		Culvert								
GS1-GE4	1082	100-Year	2760.34	2760.17	0.17				122.00		10.00

Profile Output Table - Culvert Only

Reach	River Sta		Profile	E.G. US. (ft)	W.S. US. (ft)	E.G. IC (ft)	E.G. OC (ft)	Min El Weir Flow (ft)	Q Culv Group (cfs)	Q Weir (cfs)	Delta WS (ft)	Culv Vel US (ft/s)	Culv Vel DS (ft/s)
GS1-GE4	1340.5	Culvert #1	100-Year	2766.77	2766.73	2766.77	2766.60	2767.01	95.00		3.55	7.56	12.10
GS1-GE4	1134.9	Culvert #1	100-Year	2762.06	2761.94	2762.06	2761.75	2763.58	122.00		1.77	8.68	14.01

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : PROPCOND

River: Bashas SD Reach: GS1-GE4 RS: 1695 Profile: 100-Year
Warning:The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.

HOUGHTON ROAD SW-OST
PB PROJ NO 11515
CP GE1-GE4

PROPOSED CONDITION

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: Bashas SD Reach: GS1-GE4 RS: 1635 Profile: 100-Year
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Bashas SD Reach: GS1-GE4 RS: 1500 Profile: 100-Year
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: Bashas SD Reach: GS1-GE4 RS: 1400 Profile: 100-Year
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.
River: Bashas SD Reach: GS1-GE4 RS: 1345 Profile: 100-Year
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Bashas SD Reach: GS1-GE4 RS: 1340.5 Profile: 100-Year Culv: Culvert #1
Note: The flow in the culvert is entirely supercritical.
River: Bashas SD Reach: GS1-GE4 RS: 1267.95 Profile: 100-Year
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Bashas SD Reach: GS1-GE4 RS: 1200 Profile: 100-Year
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.
River: Bashas SD Reach: GS1-GE4 RS: 1142 Profile: 100-Year
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Bashas SD Reach: GS1-GE4 RS: 1134.9 Profile: 100-Year Culv: Culvert #1
Note: The flow in the culvert is entirely supercritical.

C-3

KENSINGTON WASH

PARSONS BRINCKERHOFF COMPUTATION SHEET

Page 1 of 2

Made by [illegible]

Date 26 NOV 07

Checked by

Date

Subject Houghton Road
Proposed Hydraulic Analysis
CP H5

- DIVIDE DRAINAGE AREA INTO TWO AREAS.

CPH5a	CP H5b
Q_{100} = 45.2 cfs → 45 cfs	Q_{100} = 14.8 cfs → 15 cfs
*HW_{ALLOW} = 2792.72	*HW_{ALLOW} = 2799.23
STA 180+10, 75' LT ±	STA 183+15, 82.5' LT
GRATE ELEV = 2791.90	GRATE ELEV = 2798.00
HW ELEV = 2792.63	HW ELEV = 2799.02

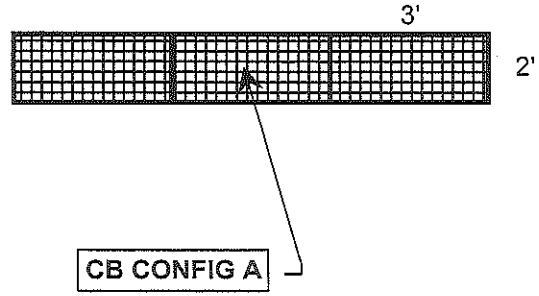
H6 13 cfs Bypass + 15 cfs = 28 cfs

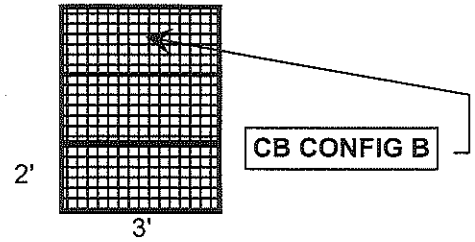
* HEADWATER ALLOWABLE BASED ON HEC RAS MODEL (EXIST. COND)

NOTE: Stormdrain Analysis will be Addressed IN 60% Submittal.

Project No.	PB No. 11513C
Project Name:	Houghton Road - SW-OST
Date:	November 26, 2007

OFF-ROADWAY GRATED CB DESIGN & ANALYSIS
PROPOSED CONDITION





CP (--)	CB No. (--)	Q_{DES} ft^3/sec	HW_{ALLOW} (ft)	$ELEV_{GRATE}$ (ft)	Grate Type (--)	No. Grates (--)	Open Area (ft^2)	CB Config (--)	Perimeter (ft)	HW_{WEIR} (ft)	$HW_{ORIFICE}$ (ft)	HW_{CNTRL} (ft)
H5a		45	2,792.72	2,791.40	EF1	4	18.64	B	22.0	2,792.63	2,792.21	W
H5b		28	2,799.23	2,798.00	EF1	3	13.98	B	18.0	2,799.02	2,798.56	W

Worksheet for South Section

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.02330	ft/ft
Discharge	28.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+65	2808.40
0+72	2805.98
0+83	2806.30
0+91	2806.22
1+01	2803.75
1+19	2802.89
1+22	2803.33
1+25	2803.11
1+32	2804.00
1+45	2803.46
1+50	2803.51
1+57	2803.29
1+76	2803.61
1+93	2804.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+65, 2808.40)	(1+93, 2804.22)	0.035

Results

Normal Depth	0.67	ft
Elevation Range	2802.89 to 2808.40 ft	
Flow Area	11.94	ft²
Wetted Perimeter	54.81	ft

Worksheet for South Section

Results

Top Width		54.71	ft
Normal Depth		0.67	ft
Critical Depth		0.65	ft
Critical Slope		0.03024	ft/ft
Velocity		2.35	ft/s
Velocity Head		0.09	ft
Specific Energy		0.76	ft
Froude Number		0.89	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.67	ft
Critical Depth	0.65	ft
Channel Slope	0.02330	ft/ft
Critical Slope	0.03024	ft/ft

Worksheet for North Section

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01500	ft/ft
Discharge	28.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+65	2805.04
0+76	2801.34
0+81	2800.96
0+86	2801.86
0+95	2800.04
1+05	2799.91
1+26	2801.47
1+28	2802.05
1+41	2802.97
1+78	2803.09

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+65, 2805.04)	(1+78, 2803.09)	0.035

Results

Normal Depth	0.64	ft
Elevation Range	2799.91 to 2805.04 ft	
Flow Area	9.38	ft²
Wetted Perimeter	21.56	ft
Top Width	21.48	ft
Normal Depth	0.64	ft
Critical Depth	0.57	ft
Critical Slope	0.02452	ft/ft

Worksheet for North Section

Results

Velocity	2.98	ft/s
Velocity Head	0.14	ft
Specific Energy	0.78	ft
Froude Number	0.80	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.64	ft
Critical Depth	0.57	ft
Channel Slope	0.01500	ft/ft
Critical Slope	0.02452	ft/ft

Worksheet for North Section

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01250	ft/ft
Discharge	45.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+65	2795.26
0+72	2793.02
0+75	2793.18
0+86	2793.19
0+94	2793.06
1+00	2792.76
1+09	2793.50
1+13	2793.32
1+16	2793.96
1+18	2794.12
1+18	2794.83
1+45	2794.98

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+65, 2795.26)	(1+45, 2794.98)	0.035

Results

Normal Depth	0.79	ft
Elevation Range	2792.76 to 2795.26 ft	
Flow Area	17.48	ft²
Wetted Perimeter	43.79	ft
Top Width	43.63	ft
Normal Depth	0.79	ft

Worksheet for North Section

Results

Critical Depth	0.70	ft
Critical Slope	0.02592	ft/ft
Velocity	2.57	ft/s
Velocity Head	0.10	ft
Specific Energy	0.89	ft
Froude Number	0.72	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.79	ft
Critical Depth	0.70	ft
Channel Slope	0.01250	ft/ft
Critical Slope	0.02592	ft/ft

Worksheet for South Section

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01960	ft/ft
Discharge	45.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+65	2798.31
0+74	2795.31
0+77	2795.62
0+88	2795.48
0+92	2795.30
0+99	2795.08
1+07	2796.16
1+22	2796.85
1+44	2798.28
1+47	2798.44

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+65, 2798.31)	(1+47, 2798.44)	0.035

Results

Normal Depth	0.77	ft
Elevation Range	2795.08 to 2798.44 ft	
Flow Area	13.56	ft²
Wetted Perimeter	32.49	ft
Top Width	32.33	ft
Normal Depth	0.77	ft
Critical Depth	0.75	ft
Critical Slope	0.02449	ft/ft

Worksheet for South Section

Results

Velocity	3.32	ft/s
Velocity Head	0.17	ft
Specific Energy	0.95	ft
Froude Number	0.90	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

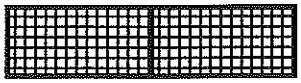
GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.77	ft
Critical Depth	0.75	ft
Channel Slope	0.01960	ft/ft
Critical Slope	0.02449	ft/ft

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Proposed Condition)
CP H6

CB Orientation A

OUTPUT FROM CULVERT MASTER



CB Open Area	9.32
CB Perimeter	16
Grate Elev=	2805

Total Discharge (cfs)	Weir Discharge (cfs)	Controlling CB Discharge (cfs)	HW ELEV (ft)	HW Depth	Qweir-cb (cfs)	Qorif-cb (cfs)	Control HW
0.0	0.0	-	2805.00		-	-	
24.0	0.0	24.0	2806.00	1.00	24.0	24.9	Weir
25.5	0.0	25.5	2806.05	1.05	25.8	25.5	Orifice
26.2	0.0	26.1	2806.10	1.10	27.7	26.1	Orifice
27.0	0.3	26.7	2806.15	1.15	29.6	26.7	Orifice
28.4	1.1	27.3	2806.20	1.20	31.5	27.3	Orifice
30.3	2.4	27.9	2806.25	1.25	33.5	27.9	Orifice
32.6	4.2	28.4	2806.30	1.30	35.6	28.4	Orifice
35.6	6.7	29.0	2806.35	1.35	37.6	29.0	Orifice
39.5	10.0	29.5	2806.40	1.40	39.8	29.5	Orifice
44.2	14.2	30.0	2806.45	1.45	41.9	30.0	Orifice
49.6	19.0	30.5	2806.50	1.50	44.1	30.5	Orifice

By Interpolation

Q_{100} = 42.3 cfs

Q_{weir} = 12.5 cfs ~ 13 cfs TO CP H50

Q_{CB} = 29.8 cfs ~ 30 cfs CAPTURED @ INLET

WSE_{100} = 2806.43

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Proposed Condition)
CP H6

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge 2.5
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Irregular Roadway Cross-Section:

	STA (ft)	ELEV (ft)	SEGMENT
1	0	2807.00	
			A
2	10.5	2806.52	
			B
3	17.6	2806.37	
			C
4	27.7	2806.31	
			D
5	39	2806.07	
			E
6	52.9	2806.17	
			F
7	65.3	2806.38	
			G
8	74.1	2806.79	
			H
9	85.0	2807.01	
			I
10			
			J
11			
			K
12			
			L
13			

Rating Table

WSE	Qweir
105.00	0.0
106.00	0.0
106.05	0.0
106.10	0.0
106.15	0.3
106.20	1.1
106.25	2.4
106.30	4.2
106.35	6.7
106.40	10.0
106.45	14.2
106.50	19.0

Base Elevation *2700 feet*

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 105.00 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 106.00 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 106.05 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	107.00														
	10.5	106.52	10.5	-0.0457	0.00			0.0	0.00			0.0	0.00			0.0
B	10.5	106.52														
	17.6	106.37	7.1	-0.0211	0.00			0.0	0.00			0.0	0.00			0.0
C	17.6	106.37														
	27.7	106.31	10.1	-0.0059	0.00			0.0	0.00			0.0	0.00			0.0
D	27.7	106.31														
	39.0	106.07	11.3	-0.0212	0.00			0.0	0.00			0.0	0.00			0.0
E	39.0	106.07														
	52.9	106.17	13.9	0.0072	0.00			0.0	0.00			0.0	0.00			0.0
F	52.9	106.17														
	65.3	106.38	12.4	0.0169	0.00			0.0	0.00			0.0	0.00			0.0
G	65.3	106.38														
	74.1	106.79	8.8	0.0466	0.00			0.0	0.00			0.0	0.00			0.0
H	74.1	106.79														
	85.0	107.01	10.9	0.0202	0.00			0.0	0.00			0.0	0.00			0.0
I	85.0	107.01														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								0.0				0.0				0.0

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Proposed Condition)
CP H6

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge 2.5
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation *2700 feet*

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 106.10 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 106.15 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 106.20 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	107.00														
	10.5	106.52	10.5	-0.0457	0.00			0.0	0.00			0.0	0.00			0.0
B	10.5	106.52														
	17.6	106.37	7.1	-0.0211	0.00			0.0	0.00			0.0	0.00			0.0
C	17.6	106.37														
	27.7	106.31	10.1	-0.0059	0.00			0.0	0.00			0.0	0.00			0.0
D	27.7	106.31														
	39.0	106.07	11.3	-0.0212	1.41	0.03	0.01	0.0	3.77	0.08	0.04	0.1	6.12	0.13	0.06	0.3
E	39.0	106.07				0.03				0.08				0.13		
	52.9	106.17	13.9	0.0072	4.17		0.01	0.0	11.12		0.04	0.2	13.90	0.03	0.08	0.8
F	52.9	106.17												0.03		
	65.3	106.38	12.4	0.0169	0.00			0.0	0.00			0.0	1.77		0.01	0.0
G	65.3	106.38														
	74.1	106.79	8.8	0.0466	0.00			0.0	0.00			0.0	0.00			0.0
H	74.1	106.79														
	85.0	107.01	10.9	0.0202	0.00			0.0	0.00			0.0	0.00			0.0
I	85.0	107.01														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								0.0				0.3				1.1

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Proposed Condition)
CP H6

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge 2.5
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation 2700 feet

Irregular Weir Analysis					WSE = 106.25				WSE = 106.30				WSE = 106.35			
Segmt	STA	ELEV	DL	So	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	107.00														
	10.5	106.52	10.5	-0.0457	0.00			0.0	0.00			0.0	0.00			0.0
B	10.5	106.52														
	17.6	106.37	7.1	-0.0211	0.00			0.0	0.00			0.0	0.00			0.0
C	17.6	106.37														
	27.7	106.31	10.1	-0.0059	0.00			0.0	0.00			0.0	6.73	0.04	0.02	0.0
D	27.7	106.31												0.04		
	39.0	106.07	11.3	-0.0212	8.48	0.18	0.09	0.6	10.83	0.23	0.12	1.1	11.30	0.28	0.16	1.9
E	39.0	106.07				0.18				0.23				0.28		
	52.9	106.17	13.9	0.0072	13.90	0.08	0.13	1.7	13.90	0.13	0.18	2.8	13.90	0.18	0.23	4.0
F	52.9	106.17				0.08				0.13				0.18		
	65.3	106.38	12.4	0.0169	4.72		0.04	0.1	7.68		0.07	0.3	10.63		0.09	0.7
G	65.3	106.38														
	74.1	106.79	8.8	0.0466	0.00			0.0	0.00			0.0	0.00			0.0
H	74.1	106.79														
	85.0	107.01	10.9	0.0202	0.00			0.0	0.00			0.0	0.00			0.0
I	85.0	107.01														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								2.4				4.2				6.7

Houghton Rd Speedway-Old Spanish Trail
PB Project No. 11515
Hydraulic Analysis (Proposed Condition)
CP H6

$Qw = Cw \times DL \times d^{3/2}$ Cw = 2.6

Qw : Weir Discharge 2.5
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation 2700 feet

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 106.40 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 106.45 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 106.50 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	107.00														
	10.5	106.52	10.5	-0.0457	0.00			0.0	0.00			0.0	0.00			0.0
B	10.5	106.52														
	17.6	106.37	7.1	-0.0211	1.42	0.03	0.02	0.0	3.79	0.08	0.04	0.1	6.15	0.13	0.07	0.3
C	17.6	106.37				0.03				0.08				0.13		
	27.7	106.31	10.1	-0.0059	10.10	0.09	0.06	0.4	10.10	0.14	0.11	1.0	10.10	0.19	0.16	1.7
D	27.7	106.31				0.09				0.14				0.19		
	39.0	106.07	11.3	-0.0212	11.30	0.33	0.21	2.8	11.30	0.38	0.26	3.9	11.30	0.43	0.31	5.1
E	39.0	106.07				0.33				0.38				0.43		
	52.9	106.17	13.9	0.0072	13.90	0.23	0.28	5.4	13.90	0.28	0.33	6.9	13.90	0.33	0.38	8.5
F	52.9	106.17				0.23				0.28				0.33		
	65.3	106.38	12.4	0.0169	12.40	0.02	0.13	1.4	12.40	0.07	0.17	2.4	12.40	0.12	0.22	3.4
G	65.3	106.38				0.02				0.07				0.12		
	74.1	106.79	8.8	0.0466	0.43		0.01	0.0	1.50		0.03	0.0	2.58		0.06	0.1
H	74.1	106.79														
	85.0	107.01	10.9	0.0202	0.00			0.0	0.00			0.0	0.00			0.0
I	85.0	107.01														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								10.0				14.2				19.0

PARSONS BRINCKERHOFF COMPUTATION SHEET

Page ____ of ____

Made by ____

Date ____

Checked by ____

Date ____

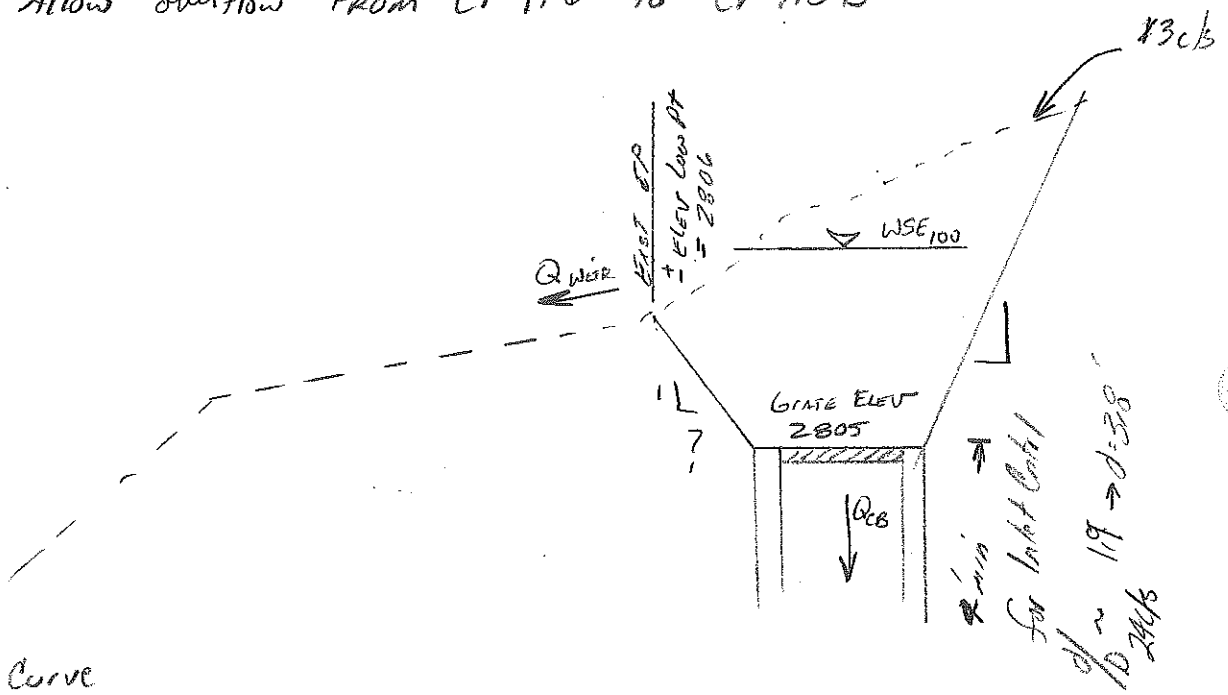
Subject CP H6 Proposed Condition

Capture ± ½ Q_{100} → Q_{100} = 43 cfs ~ 21.5 cfs
42.3 cfs

Try 2 grates @ elev = 2805.00

Create Rating Curve for CB, Roadway Weir & Stage

→ Allow overflow from CP H6 to CP H5B



Rating Curve

Elev	Q_{CB}	Q_{weir}

Weir Segment

Sta	Elev
0	2807
10.5	06.52
17.6	06.37
27.7	06.31
39	06.07
52.9	06.17
65.3	06.38
74.1	06.79
85.0	07.01

PARSONS BRINCKERHOFF COMPUTATION SHEET

Page ____ of ____ 1

Made by ____

Date ____

Checked by ____

Date ____

Subject CP H5 Proposed Condition

CP H5a

DA = 7.10 AC

L_c = 1026'

L_{CA} = 540'

$Q = C_f C_w L h^{3/2}$

$\left(\frac{Q}{C_f C_w L}\right)^{2/3} = \left(h^{3/2}\right)^{2/3}$

ΔL	ΔH	
828'	38	DF
198	45'	DF

$Q_o = C_f C_o A y^{1/2}$

$\left(\frac{Q_o}{C_f C_o A}\right)^2 = y$

Q_{100} = 45 cfs

I STA 180+15

EXST WSE_{100} = 2792.72

DESIGN INLET to HW Below on @ 2792.72

BASED ON Inlet Control & Weir

Exst Ground = 91.40

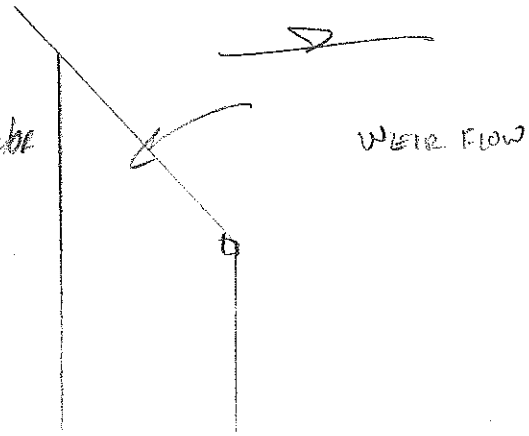
Grate @ 91.40

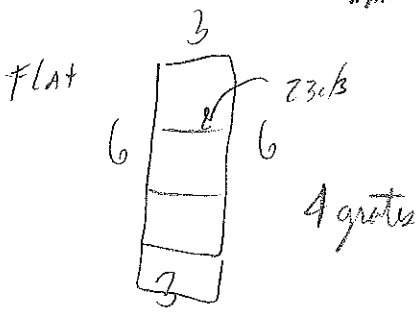
$Q = C_f C L H^{3/2}$; C = 3.0

L = 6' x 1.5 = 30

C_f = 0.5 Clogging factor

h_{max} = 1.3'





PARSONS BRINCKERHOFF COMPUTATION SHEET

Page ____ of ____

Made by ____

Date 26 NOV 07

Checked by ____

Date ____

Subject CP H5B Proposed Hydro

DA = 978041.11 ft² → 2.25 ac

L_c = 682'
L_{CA} = 332'

Slope --

ΔL	Δh
127	2.1
109	4
90	11
356	26
682 ✓	

Q_{100} = 19.8 cfs

H7 carryover = 13 cfs → 28 cfs Q_{100}

Grate Elev 2798.50

By Interpolation
Exst WSE = 2799.23 ±
RS 183+00 → 2798.90
183+50 ↑ 70% → 2800.01

Use 3-Grates in "B" Configuration

5' deep CB for Inlet Control

d_o = 4.3'
d_c = 4.6

PB PROJ No. 11515
Kensington Wash
Proposed Condition

```
                    HEC-RAS Version 3.1.3 May 2005
                     U.S. Army Corp 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: TSMS MG_N0080
Project File : MGN0080.prj
Run Date and Time: 1/14/2008 10:19:56 AM

Project in English units

Project Description:
Kensington Wash
Located southside of Kensington Drive

PLAN DATA

Plan Title: TSMS MG_N0080 PROPOSED
Plan File : l:\11515\Drainage\HECRAS\TSMS MG_N0080\MGN0080.p02

Geometry Title: TSMS MG_N0080 PROPOSED
Geometry File : l:\11515\Drainage\HECRAS\TSMS MG_N0080\MGN0080.g02

Flow Title : TSMS MG_N0080
Flow File : l:\11515\Drainage\HECRAS\TSMS MG_N0080\MGN0080.f01

Plan Description:
Proposed Condition Analysis

Plan Summary Information:

Number of:	Cross Sections	=	9	Multiple Openings	=	0
	Culverts	=	1	Inline Structures	=	0
	Bridges	=	0	Lateral Structures	=	0

Computational Information

Water surface calculation tolerance	=	0.01
Critical depth calculation tolerance	=	0.01
Maximum number of iterations	=	20
Maximum difference tolerance	=	0.3
Flow tolerance factor	=	0.001

Computation Options

Critical depth computed at all cross sections	
Conveyance Calculation Method:	At breaks in n values only
Friction Slope Method:	Average Conveyance
Computational Flow Regime:	Subcritical Flow

FLOW DATA

Flow Title: TSMS MG_N0080
Flow File : l:\11515\Drainage\HECRAS\TSMS MG_N0080\MGN0080.f01

Flow Data (cfs)

PB PROJ No. 11515
Kensington Wash
Proposed Condition

River	Reach	RS	TSMS 100YR	TSMS 10YR
MGN0080	Kennsington	1440	465	184

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
MGN0080	Kennsington	TSMS 100YR	Critical	Rating Curve #1
MGN0080	Kennsington	TSMS 10YR	Critical	Known WS = 2778.45

Rating Curve #1

Flow (cfs)	Elev (ft)
0	2772.68
50	2774.05
100	2774.86
150	2775.59
200	2776.26
250	2776.92
300	2777.6
350	2778.32
400	2779.11
450	2779.97
465	2780.06

GEOMETRY DATA

Geometry Title: TSMS MG_N0080 PROPOSED
Geometry File : 1:\11515\Drainage\HECRAS\TSMS MG_N0080\MGN0080.g02

CROSS SECTION

RIVER: MGN0080
REACH: Kennsington RS: 1440

INPUT
Description: uppermost xsec
Dense over bank brush
Main Channel Dense brush &
Braided condition
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2804	0	2794	17	2794	46	2792	60	2791.2
100	2791.8	142	2791.5	165	2792	188	2794	220	2794
220	2804								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	46	.06	165	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
46	165	120	150	165	.1	.3

CROSS SECTION OUTPUT Profile #TSMS 100YR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2793.04	Element			
Vel Head (ft)	0.13	Wt. n-Val.	0.080	0.060	0.080
W.S. Elev (ft)	2792.90	Reach Len. (ft)	120.00	150.00	165.00
Crit W.S. (ft)	2792.40	Flow Area (sq ft)	5.90	153.37	4.68
E.G. Slope (ft/ft)	0.010162	Area (sq ft)	5.90	153.37	4.68
Q Total (cfs)	465.00	Flow (cfs)	6.48	453.38	5.14
Top Width (ft)	142.45	Top Width (ft)	13.08	119.00	10.37
Vel Total (ft/s)	2.84	Avg. Vel. (ft/s)	1.10	2.96	1.10
Max Chl Dpth (ft)	1.70	Hydr. Depth (ft)	0.45	1.29	0.45
Conv. Total (cfs)	4612.7	Conv. (cfs)	64.3	4497.4	51.0
Length Wtd. (ft)	149.85	Wetted Per. (ft)	13.11	119.03	10.41

PB PROJ No. 11515
Kensington Wash
Proposed Condition

Min Ch El (ft)	2791.20	Shear (lb/sq ft)	0.29	0.82	0.29
Alpha	1.06	Stream Power (lb/ft s)	0.31	2.42	0.31
Frctn Loss (ft)	2.39	Cum Volume (acre-ft)	0.02	6.61	0.04
C & E Loss (ft)	0.01	Cum SA (acres)	0.05	2.35	0.07

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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: MGN0080
REACH: Kennsington RS: 1290

INPUT
Description: Dense Overbank Brush
Dense Main Channel Brush & Braided Condition
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2802	0	2792	8	2792	35	2790	62	2789.2
85	2789.5	160	2789.8	168	2789.2	183	2790	212	2792
234	2794	250	2794	250	2804				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	35	.06	183	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
35	183	75	125	140	.1	.3

CROSS SECTION OUTPUT Profile #TSMS 100YR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2790.63	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.	0.080	0.060	0.080
W.S. Elev (ft)	2790.42	Reach Len. (ft)	75.00	125.00	140.00
Crit W.S. (ft)	2790.26	Flow Area (sq ft)	1.19	124.08	1.28
E.G. Slope (ft/ft)	0.028646	Area (sq ft)	1.19	124.08	1.28
Q Total (cfs)	465.00	Flow (cfs)	1.32	462.27	1.41
Top Width (ft)	159.74	Top Width (ft)	5.66	148.00	6.08
Vel Total (ft/s)	3.67	Avg. Vel. (ft/s)	1.11	3.73	1.11
Max Chl Dpth (ft)	1.22	Hydr. Depth (ft)	0.21	0.84	0.21
Conv. Total (cfs)	2747.4	Conv. (cfs)	7.8	2731.3	8.3
Length Wtd. (ft)	124.86	Wetted Per. (ft)	5.68	148.06	6.10
Min Ch El (ft)	2789.20	Shear (lb/sq ft)	0.37	1.50	0.37
Alpha	1.02	Stream Power (lb/ft s)	0.41	5.58	0.41
Frctn Loss (ft)	1.98	Cum Volume (acre-ft)	0.01	6.14	0.03
C & E Loss (ft)	0.03	Cum SA (acres)	0.02	1.89	0.04

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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: MGN0080
REACH: Kennsington RS: 1165

INPUT
Description:
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2802	0	2792	29	2791	33	2789	55	2788
86	2787	130	2787.6	150	2787.8	174	2787	176	2786.9
178	2787	202	2787.5	216	2788	238	2790	260	2791
280	2791.5	280	2801.5						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	55	.06	216	.08

PB PROJ No. 11515
Kensington Wash
Proposed Condition

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
55	216	24	34	39	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
42	50	2790

CROSS SECTION OUTPUT Profile #TSMS 100YR

E.G. Elev (ft)	2788.62	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.	0.080	0.060	0.080
W.S. Elev (ft)	2788.52	Reach Len. (ft)	24.00	34.00	39.00
Crit W.S. (ft)	2788.06	Flow Area (sq ft)	2.01	175.49	1.47
E.G. Slope (ft/ft)	0.010075	Area (sq ft)	2.01	175.49	1.47
Q Total (cfs)	465.00	Flow (cfs)	1.97	461.93	1.10
Top Width (ft)	171.68	Top Width (ft)	5.00	161.00	5.68
Vel Total (ft/s)	2.60	Avg. Vel. (ft/s)	0.98	2.63	0.75
Max Chl Dpth (ft)	1.62	Hydr. Depth (ft)	0.40	1.09	0.26
Conv. Total (cfs)	4632.7	Conv. (cfs)	19.6	4602.1	11.0
Length Wtd. (ft)	33.98	Wetted Per. (ft)	5.29	161.05	5.70
Min Ch El (ft)	2786.90	Shear (lb/sq ft)	0.24	0.69	0.16
Alpha	1.02	Stream Power (lb/ft s)	0.23	1.80	0.12
Frctn Loss (ft)	0.68	Cum Volume (acre-ft)	0.00	5.71	0.03
C & E Loss (ft)	0.03	Cum SA (acres)	0.01	1.45	0.02

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: MGN0080
REACH: Kennsington RS: 1131

INPUT
Description: Top of Proposed Drop
Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2790.9	20.6	2789.88	30.1	2788.66	702787.029		84.9	2786.42
106.7	2786.78	111.6	2786.78	114.6	2786.65	131.8	2786.83	137.6	2786.68
141.6	2786.69	148.6	2786.77	157.4	2786.66	165.7	2786.94	168.9	2786.82
177.4	2786.94	195.9	2786.79	201.7	2786.6	220	2787.85	229.8	2788.52
258.5	2789.85	277.6	2790.39						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	70	.06	220	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
70	220	45	45	45	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	78.8	2788	F
196.6	277.6	2788	F

CROSS SECTION OUTPUT Profile #TSMS 100YR

E.G. Elev (ft)	2787.92	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.39	Wt. n-Val.		0.060	
W.S. Elev (ft)	2787.53	Reach Len. (ft)	45.00	45.00	45.00
Crit W.S. (ft)	2787.53	Flow Area (sq ft)		92.76	
E.G. Slope (ft/ft)	0.056354	Area (sq ft)	3.03	109.32	
Q Total (cfs)	465.00	Flow (cfs)		465.00	
Top Width (ft)	157.45	Top Width (ft)	12.18	145.27	
Vel Total (ft/s)	5.01	Avg. Vel. (ft/s)		5.01	
Max Chl Dpth (ft)	1.11	Hydr. Depth (ft)		0.79	
Conv. Total (cfs)	1958.8	Conv. (cfs)		1958.8	
Length Wtd. (ft)	45.00	Wetted Per. (ft)		117.82	
Min Ch El (ft)	2786.42	Shear (lb/sq ft)		2.77	
Alpha	1.00	Stream Power (lb/ft s)		13.88	
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)	0.00	5.60	0.03
C & E Loss (ft)	0.07	Cum SA (acres)	0.01	1.33	0.02

PB PROJ No. 11515
Kensington Wash
Proposed Condition

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid,
water surface was used.

CROSS SECTION

RIVER: MGN0080
REACH: Kennsington RS: 1106

INPUT
Description:
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2789.79	79.1	2786.05	85	2786.36	88.8	2786.26	90.6	2785.95
112.2	2786.1	135.5	2778.05	145.5	2778.05	168.6	2786.03	171.5	2786.06
176.4	2784.76	181.1	2785.83	199.9	2786.54	214.6	2786.41	227.7	2787.77
277.6	2789.52								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	112.2	.035	168.6	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
112.2	168.6	4	4	4	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	128.1	2800	F
152	277.6	2800	F

CROSS SECTION OUTPUT Profile #TSMS 100YR

E.G. Elev (ft)	2784.96	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.16	Wt. n-Val.		0.035	
W.S. Elev (ft)	2784.80	Reach Len. (ft)	4.00	4.00	4.00
Crit W.S. (ft)	2781.03	Flow Area (sq ft)		144.46	
E.G. Slope (ft/ft)	0.000546	Area (sq ft)		199.16	0.01
Q Total (cfs)	465.00	Flow (cfs)		465.00	
Top Width (ft)	49.34	Top Width (ft)		49.05	0.29
Vel Total (ft/s)	3.22	Avg. Vel. (ft/s)		3.22	
Max Chl Dpth (ft)	6.75	Hydr. Depth (ft)		6.04	
Conv. Total (cfs)	19904.7	Conv. (cfs)		19904.7	
Length Wtd. (ft)	4.00	Wetted Per. (ft)		24.71	
Min Ch El (ft)	2778.05	Shear (lb/sq ft)		0.20	
Alpha	1.00	Stream Power (lb/ft s)		0.64	
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	0.00	5.44	0.03
C & E Loss (ft)	0.06	Cum SA (acres)	0.00	1.23	0.02

Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid,
water surface was used.

CROSS SECTION

RIVER: MGN0080
REACH: Kennsington RS: 1102

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2790	61	2787	90	2786	109	2786	143	2777.97
155	2777.97	188	2785.9	195	2786	215	2786.4	231	2787

PB PROJ No. 11515
Kensington Wash
Proposed Condition

270	2789

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	109	.035	188	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
109	188	182	242	285	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	142	2800	F
157	270	2800	F

CROSS SECTION OUTPUT Profile #TSMS 100YR

E.G. Elev (ft)	2784.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.35	Wt. n-Val.		0.035	
W.S. Elev (ft)	2784.55	Reach Len. (ft)	182.00	242.00	285.00
Crit W.S. (ft)	2781.12	Flow Area (sq ft)		98.07	
E.G. Slope (ft/ft)	0.001028	Area (sq ft)		260.57	
Q Total (cfs)	465.00	Flow (cfs)		465.00	
Top Width (ft)	67.22	Top Width (ft)		67.22	
Vel Total (ft/s)	4.74	Avg. Vel. (ft/s)		4.74	
Max Chl Dpth (ft)	6.58	Hydr. Depth (ft)		6.54	
Conv. Total (cfs)	14503.2	Conv. (cfs)		14503.2	
Length Wtd. (ft)	242.00	Wetted Per. (ft)		15.08	
Min Ch El (ft)	2777.97	Shear (lb/sq ft)		0.42	
Alpha	1.00	Stream Power (lb/ft s)		1.98	
Frctn Loss (ft)		Cum Volume (acre-ft)	0.00	5.41	0.03
C & E Loss (ft)		Cum SA (acres)	0.00	1.22	0.02

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid,
energy was used.

CULVERT

RIVER: MGN0080
REACH: Kennsington RS: 1100

INPUT
Description: NEW RCBC 1-10' X 6' X 180' +-
Distance from Upstream XS = 10
Deck/Roadway Width = 158
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 2

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2789		400	2786	

Upstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2790	61	2787	90	2786	109	2786	143	2777.97
155	2777.97	188	2785.9	195	2786	215	2786.4	231	2787
270	2789								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	109	.035	188	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
109	188	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	142	2800	F
157	270	2800	F

Downstream Deck/Roadway Coordinates
num= 2

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2789		400	2786	

PB PROJ No. 11515
Kensington Wash
Proposed Condition

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2787	91	2783	100	2782	115.3	2779.88	115.3	2777.91
122.5	2775.74	133.5	2775.64	136.6	2776	138	2776	156	2775.2
188	2775.3	199	2775.4	203	2776	223	2780	230	2780.2

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	100	.04	223	.02

Bank Sta: Left	Right	Coeff Contr.	Expan.
100	223	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	113.5	2784	F
152.2	230	2784	F

Upstream Embankment side slope = 3 horiz. to 1.0 vertical
Downstream Embankment side slope = 3 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Box	6	10

FHWA Chart # 8 - flared wingwalls
FHWA Scale # 2 - Wingwall flared 90 or 15 deg.
Solution Criteria = Highest U.S. EG

Culvert Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
2	161	.012	.012	0	.2	1

Upstream Elevation = 2777.97
Centerline Station = 150
Downstream Elevation = 2775.92
Centerline Station = 128

CULVERT OUTPUT Profile #TSMS 100YR Culv Group: Culvert #1

Q Culv Group (cfs)	465.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	11.44
Q Barrel (cfs)	465.00	Culv Vel DS (ft/s)	16.70
E.G. US. (ft)	2784.90	Culv Inv El Up (ft)	2777.97
W.S. US. (ft)	2784.55	Culv Inv El Dn (ft)	2775.92
E.G. DS (ft)	2780.15	Culv Frctn Ls (ft)	1.03
W.S. DS (ft)	2780.00	Culv Exit Loss (ft)	2.89
Delta EG (ft)	4.75	Culv Entr Loss (ft)	0.83
Delta WS (ft)	4.55	Q Weir (cfs)	
E.G. IC (ft)	2784.90	Weir Sta Lft (ft)	
E.G. OC (ft)	2784.47	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	2782.04	Weir Max Depth (ft)	
Culv WS Outlet (ft)	2778.71	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.41	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	4.06	Min El Weir Flow (ft)	2787.95

Note: The flow in the culvert is entirely supercritical.

CROSS SECTION

RIVER: MGN0080
REACH: Kennsington RS: 865

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2787	91	2783	100	2782	115.3	2779.88	115.3	2777.91
122.5	2775.74	133.5	2775.64	136.6	2776	138	2776	156	2775.2
188	2775.3	199	2775.4	203	2776	223	2780	230	2780.2

PB PROJ No. 11515
Kensington Wash
Proposed Condition

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	100	.04	223	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
100	223	140	120	100	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	113.5	2784	F
152.2	230	2784	F

CROSS SECTION OUTPUT Profile #TSMS 100YR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2780.15	Element			
Vel Head (ft)	0.15	Wt. n-Val.		0.040	
W.S. Elev (ft)	2780.00	Reach Len. (ft)	140.00	120.00	100.00
Crit W.S. (ft)	2777.62	Flow Area (sq ft)		150.09	
E.G. Slope (ft/ft)	0.001196	Area (sq ft)		428.22	
Q Total (cfs)	465.00	Flow (cfs)		465.00	
Top Width (ft)	108.54	Top Width (ft)		108.54	
Vel Total (ft/s)	3.10	Avg. Vel. (ft/s)		3.10	
Max Chl Dpth (ft)	4.80	Hydr. Depth (ft)		3.98	
Conv. Total (cfs)	13443.7	Conv. (cfs)		13443.7	
Length Wtd. (ft)	119.96	Wetted Per. (ft)		40.09	
Min Ch El (ft)	2775.20	Shear (lb/sq ft)		0.28	
Alpha	1.00	Stream Power (lb/ft s)		0.87	
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	0.00	3.50	0.03
C & E Loss (ft)	0.07	Cum SA (acres)	0.00	0.73	0.02

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid,
energy was used.

CROSS SECTION

RIVER: MGN0080
REACH: Kennsington RS: 745

INPUT
Description: DS XSEC for Reach
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2782	25	2780	46	2775	80	2774.8	103	2774.6
140	2774.4	170	2774.3	180	2775	195	2778	202	2779

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	25	.03	195	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
25	195	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #TSMS 100YR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2780.07	Element			
Vel Head (ft)	0.00	Wt. n-Val.	0.040	0.030	0.040
W.S. Elev (ft)	2780.06	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	2775.33	Flow Area (sq ft)	0.03	837.71	10.95
E.G. Slope (ft/ft)	0.000015	Area (sq ft)	0.03	837.71	10.95
Q Total (cfs)	465.00	Flow (cfs)	0.00	463.08	1.92
Top Width (ft)	177.80	Top Width (ft)	0.80	170.00	7.00
Vel Total (ft/s)	0.55	Avg. Vel. (ft/s)	0.01	0.55	0.18
Max Chl Dpth (ft)	5.76	Hydr. Depth (ft)	0.03	4.93	1.56
Conv. Total (cfs)	120221.5	Conv. (cfs)	0.1	119725.6	495.8
Length Wtd. (ft)	100.00	Wetted Per. (ft)	0.81	170.91	8.14
Min Ch El (ft)	2774.30	Shear (lb/sq ft)	0.00	0.00	0.00
Alpha	1.01	Stream Power (lb/ft s)	0.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	0.00	1.76	0.01
C & E Loss (ft)	0.00	Cum SA (acres)	0.00	0.35	0.01

PB PROJ No. 11515
Kensington Wash
Proposed Condition

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

CROSS SECTION

RIVER: MGN0080
REACH: Kennsington RS: 640

INPUT
Description:
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2782	27	2780	42	2776	65	2773.2	118	2774
146	2776	162	2777.5						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	27	.03	162	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
27	162	0	0	0	.1	.3

CROSS SECTION OUTPUT Profile #TSMS 100YR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2780.07	Element			
Vel Head (ft)	0.01	Wt. n-Val.	0.040	0.030	
W.S. Elev (ft)	2780.06	Reach Len. (ft)			
Crit W.S. (ft)	2774.82	Flow Area (sq ft)	0.02	693.51	
E.G. Slope (ft/ft)	0.000021	Area (sq ft)	0.02	693.51	
Q Total (cfs)	465.00	Flow (cfs)	0.00	465.00	
Top Width (ft)	135.81	Top Width (ft)	0.81	135.00	
Vel Total (ft/s)	0.67	Avg. Vel. (ft/s)	0.02	0.67	
Max Chl Dpth (ft)	6.86	Hydr. Depth (ft)	0.03	5.14	
Conv. Total (cfs)	100585.3	Conv. (cfs)	0.1	100585.2	
Length Wtd. (ft)		Wetted Per. (ft)	0.81	138.40	
Min Ch El (ft)	2773.20	Shear (lb/sq ft)	0.00	0.01	
Alpha	1.00	Stream Power (lb/ft s)	0.00	0.00	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

PB PROJ No. 11515
Kensington Wash
Proposed Condition

SUMMARY OF MANNING'S N VALUES

River:MGN0080

Reach	River Sta.	n1	n2	n3
Kennsington	1440	.08	.06	.08
Kennsington	1290	.08	.06	.08
Kennsington	1165	.08	.06	.08
Kennsington	1131	.08	.06	.08
Kennsington	1106	.08	.035	.08
Kennsington	1102	.08	.035	.08
Kennsington	1100	Culvert		
Kennsington	865	.03	.04	.02
Kennsington	745	.04	.03	.04
Kennsington	640	.04	.03	.04

SUMMARY OF REACH LENGTHS

River: MGN0080

Reach	River Sta.	Left	Channel	Right
Kennsington	1440	120	150	165
Kennsington	1290	75	125	140
Kennsington	1165	24	34	39
Kennsington	1131	45	45	45
Kennsington	1106	4	4	4
Kennsington	1102	182	242	285
Kennsington	1100	Culvert		
Kennsington	865	140	120	100
Kennsington	745	100	100	100
Kennsington	640	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: MGN0080

Reach	River Sta.	Contr.	Expan.
Kennsington	1440	.1	.3
Kennsington	1290	.1	.3
Kennsington	1165	.1	.3
Kennsington	1131	.1	.3
Kennsington	1106	.3	.5
Kennsington	1102	.3	.5
Kennsington	1100	Culvert	
Kennsington	865	.3	.5
Kennsington	745	.1	.3
Kennsington	640	.1	.3

PB PROJ NO. 11515
Kensington Wash
Proposed Condition

Profile Output Table - Standard Table 1

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Kennsington	1440	TSMS 100YR	MGN0080NEW	465.00	2791.20	2792.90	2792.40	2793.04	0.010162	2.96	163.94	142.45	0.46
Kennsington	1440	TSMS 100YR	N0080_EXST	465.00	2791.20	2792.87	2792.40	2793.01	0.011057	3.03	159.50	141.64	0.48
Kennsington	1290	TSMS 100YR	MGN0080NEW	465.00	2789.20	2790.42	2790.26	2790.63	0.028646	3.73	126.54	159.74	0.72
Kennsington	1290	TSMS 100YR	N0080_EXST	465.00	2789.20	2790.46	2790.25	2790.66	0.024081	3.54	133.63	160.98	0.66
Kennsington	1165	TSMS 100YR	MGN0080NEW	465.00	2786.90	2788.52	2788.06	2788.62	0.010075	2.63	178.97	171.68	0.44
Kennsington	1165	TSMS 100YR	N0080_EXST	465.00	2786.90	2788.47	2788.06	2788.58	0.011853	2.76	170.18	171.11	0.48
Kennsington	1131	TSMS 100YR	MGN0080NEW	465.00	2786.42	2787.53	2787.53	2787.92	0.056354	5.01	92.76	157.45	1.00
Kennsington	1131	TSMS 100YR	N0080_EXST	465.00	2786.42	2787.45	2787.45	2787.79	0.059925	4.70	100.47	154.47	1.00
Kennsington	1106	TSMS 100YR	MGN0080NEW	465.00	2778.05	2784.80	2781.03	2784.96	0.000546	3.22	144.46	49.34	0.23
Kennsington	1102	TSMS 100YR	MGN0080NEW	465.00	2777.97	2784.55	2781.12	2784.90	0.001028	4.74	98.07	67.22	0.33
Kennsington	1100			Culvert									
Kennsington	1075	TSMS 100YR	N0080_EXST	465.00	2784.00	2786.52	2785.36	2786.62	0.000654	2.54	195.71	169.02	0.30
Kennsington	1030	TSMS 100YR	N0080_EXST	465.00	2783.80	2786.58	2785.70	2786.59	0.000027	0.93	597.34	308.70	0.10
Kennsington	945	TSMS 100YR	N0080_EXST	465.00	2781.00	2784.44	2784.44	2785.83	0.016558	9.46	49.18	114.10	0.99
Kennsington	865	TSMS 100YR	MGN0080NEW	465.00	2775.20	2780.00	2777.62	2780.15	0.001196	3.10	150.09	108.54	0.27
Kennsington	865	TSMS 100YR	N0080_EXST	465.00	2775.20	2780.06	2776.56	2780.08	0.000183	1.17	396.95	112.83	0.11
Kennsington	745	TSMS 100YR	MGN0080NEW	465.00	2774.30	2780.06	2775.33	2780.07	0.000015	0.55	848.69	177.80	0.04
Kennsington	745	TSMS 100YR	N0080_EXST	465.00	2774.30	2780.06	2775.33	2780.07	0.000015	0.55	848.69	177.80	0.04

PB PROJ No. 11515
Kensington Wash
Proposed Condition

Kennsington	640	TSMS 100YR	MGN0080NEW	465.00	2773.20	2780.06	2774.82	2780.07	0.000021	0.67	693.53	135.81
												0.05
Kennsington	640	TSMS 100YR	N0080_EXST	465.00	2773.20	2780.06	2774.82	2780.07	0.000021	0.67	693.53	135.81
												0.05

Profile Output Table - Standard Table 2

Reach	River Sta	Profile	Plan	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
Kennsington	1440	TSMS 100YR	MGN0080NEW	2793.04	2792.90	0.13	2.39	0.01	6.48	453.38	5.14	142.45
Kennsington	1440	TSMS 100YR	N0080_EXST	2793.01	2792.87	0.14	2.36	0.01	6.15	453.97	4.88	141.64
Kennsington	1290	TSMS 100YR	MGN0080NEW	2790.63	2790.42	0.21	1.98	0.03	1.32	462.27	1.41	159.74
Kennsington	1290	TSMS 100YR	N0080_EXST	2790.66	2790.46	0.19	2.04	0.02	1.58	461.73	1.69	160.98
Kennsington	1165	TSMS 100YR	MGN0080NEW	2788.62	2788.52	0.11	0.68	0.03	1.97	461.93	1.10	171.68
Kennsington	1165	TSMS 100YR	N0080_EXST	2788.58	2788.47	0.12	0.77	0.02	1.71	462.38	0.91	171.11
Kennsington	1131	TSMS 100YR	MGN0080NEW	2787.92	2787.53	0.39	0.08	0.07		465.00		157.45
Kennsington	1131	TSMS 100YR	N0080_EXST	2787.79	2787.45	0.34	0.12	0.07	3.50	461.50		154.47
Kennsington	1106	TSMS 100YR	MGN0080NEW	2784.96	2784.80	0.16	0.00	0.06		465.00		49.34
Kennsington	1102	TSMS 100YR	MGN0080NEW	2784.90	2784.55	0.35				465.00		67.22
Kennsington	1100			Culvert								
Kennsington	1075	TSMS 100YR	N0080_EXST	2786.62	2786.52	0.10	0.00	0.03		459.22	5.78	169.02
Kennsington	1030	TSMS 100YR	N0080_EXST	2786.59	2786.58	0.01			70.90	248.07	146.03	308.70
Kennsington	945	TSMS 100YR	N0080_EXST	2785.83	2784.44	1.39	0.05	0.68		465.00		114.10
Kennsington	865	TSMS 100YR	MGN0080NEW	2780.15	2780.00	0.15	0.01	0.07		465.00		108.54
Kennsington	865	TSMS 100YR	N0080_EXST	2780.08	2780.06	0.02	0.00	0.01		464.99	0.01	112.83

PB PROJ No. 11515
Kensington Wash
Proposed Condition

Kennsington	745	TSMS 100YR	MGN0080NEW	2780.07	2780.06	0.00	0.00	0.00	0.00	463.08	1.92
177.80											
Kennsington	745	TSMS 100YR	N0080_EXST	2780.07	2780.06	0.00	0.00	0.00	0.00	463.08	1.92
177.80											
Kennsington	640	TSMS 100YR	MGN0080NEW	2780.07	2780.06	0.01			0.00	465.00	
135.81											
Kennsington	640	TSMS 100YR	N0080_EXST	2780.07	2780.06	0.01			0.00	465.00	
135.81											

Profile Output Table - Culvert Only

Reach	River Sta	Profile	Plan	E.G. US.	W.S. US.	E.G. IC	E.G. OC	Min El Weir Flow	Q Culv Group	Q Weir	Delta WS	Culv Vel US	Culv Vel DS
				(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(ft)	(ft/s)	(ft/s)
Kennsington	1100	Culvert #1	TSMS 100YR	MGN0080NEW	2784.90	2784.55	2784.90	2784.47	2787.95	465.00	4.55	11.44	16.70
Kennsington	1020	Culvert #1	TSMS 100YR	N0080_EXST	2786.58	2786.58	2786.44	2786.58	2786.06	141.70	323.30	2.14	4.91

PB PROJ No. 11515
Kensington Wash
Proposed Condition

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : MGN0080NEW

River: MGN0080 Reach: Kennsington RS: 1440 Profile: TSMS 100YR
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: MGN0080 Reach: Kennsington RS: 1290 Profile: TSMS 100YR
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: MGN0080 Reach: Kennsington RS: 1165 Profile: TSMS 100YR
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.
River: MGN0080 Reach: Kennsington RS: 1131 Profile: TSMS 100YR
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
River: MGN0080 Reach: Kennsington RS: 1106 Profile: TSMS 100YR
Warning:Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
River: MGN0080 Reach: Kennsington RS: 1102 Profile: TSMS 100YR
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: MGN0080 Reach: Kennsington RS: 1100 Profile: TSMS 100YR Culv: Culvert #1
Note: The flow in the culvert is entirely supercritical.
River: MGN0080 Reach: Kennsington RS: 865 Profile: TSMS 100YR
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: MGN0080 Reach: Kennsington RS: 745 Profile: TSMS 100YR
Warning:The cross-section end points had to be extended vertically for the computed water surface.

C-4

CP-I

Culvert Designer/Analyzer Report
CP I US Pipes Proposed

Comments: HW Rating for DS Pipes 2-42"x29" CMPA ->
TW Rating for US Pipes 2-45"x29" HERCP

Analysis Component			
Storm Event	Design	Discharge	71.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	71.00 cfs	Check Discharge	50.00 cfs

Tailwater Conditions: Tailwater Rating

Discharge (cfs)	TW Elev. (ft)
0.00	17.74
5.00	18.29
10.00	18.55
15.00	18.77
20.00	18.96
25.00	19.13
30.00	19.29
35.00	19.45
40.00	19.60
45.00	19.74
50.00	19.89
55.00	20.04
60.00	20.19
65.00	20.35
70.00	20.56
75.00	22.30
80.00	23.68
85.00	24.98
90.00	26.32
95.00	27.71
100.00	29.16

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	2-29x45 inch Horiz Ellipse	71.00 cfs	26.54 ft	12.41 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
CP I US Pipes Proposed

BEVELED INLET

Component:Culvert-1

Culvert Summary					
Computed Headwater Elev	26.54	ft	Discharge	71.00	cfs
Inlet Control HW Elev.	26.44	ft	Tailwater Elevation	20.91	ft
Outlet Control HW Elev.	26.54	ft	Control Type	Entrance Control	
Headwater Depth/Height	1.02				

Grades					
Upstream Invert	24.11	ft	Downstream Invert	20.48	ft
Length	158.00	ft	Constructed Slope	0.022975	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	1.01	ft
Slope Type	Steep		Normal Depth	1.00	ft
Flow Regime	Supercritical		Critical Depth	1.57	ft
Velocity Downstream	12.41	ft/s	Critical Slope	0.003921	ft/ft

Section					
Section Shape	Horizontal Ellipse		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.79	ft
Section Size	29x45 inch		Rise	2.40	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	26.54	ft	Upstream Velocity Head	0.72	ft
Ke	0.20		Entrance Loss	0.14	ft

Inlet Control Properties					
Inlet Control HW Elev.	26.44	ft	Flow Control	Unsubmerged	
Inlet Type	Groove end with headwall (horizontal ellipse)		Area Full	14.8	ft^2
K	0.00180		HDS 5 Chart	29	
M	2.50000		HDS 5 Scale	2	
C	0.02920		Equation Form	1	
Y	0.74000				

Culvert Designer/Analyzer Report
CP I US Pipes Proposed

Comments: HW Rating for DS Pipes 2-42"x29" CMPA ->
TW Rating for US Pipes 2-45"x29" HERCP

Analysis Component			
Storm Event	Design	Discharge	71.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	71.00 cfs	Check Discharge	50.00 cfs

Tailwater Conditions: Tailwater Rating

Discharge (cfs)	TW Elev. (ft)
0.00	17.74
5.00	18.29
10.00	18.55
15.00	18.77
20.00	18.96
25.00	19.13
30.00	19.29
35.00	19.45
40.00	19.60
45.00	19.74
50.00	19.89
55.00	20.04
60.00	20.19
65.00	20.35
70.00	20.56
75.00	22.30
80.00	23.68
85.00	24.98
90.00	26.32
95.00	27.71
100.00	29.16

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	2-29x45 inch Horiz Ellipse	71.00 cfs	26.76 ft	12.41 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
CP I US Pipes Proposed

Square HW Inlet

Component:Culvert-1

Culvert Summary					
Computed Headwater Elev:	26.76	ft	Discharge	71.00	cfs
Inlet Control HW Elev.	26.60	ft	Tailwater Elevation	20.91	ft
Outlet Control HW Elev.	26.76	ft	Control Type	Entrance Control	
Headwater Depth/Height	1.11				

Grades					
Upstream Invert	24.11	ft	Downstream Invert	20.48	ft
Length	158.00	ft	Constructed Slope	0.022975	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	1.01	ft
Slope Type	Steep		Normal Depth	1.00	ft
Flow Regime	Supercritical		Critical Depth	1.57	ft
Velocity Downstream	12.41	ft/s	Critical Slope	0.003921	ft/ft

Section					
Section Shape	Horizontal Ellipse		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.79	ft
Section Size	29x45 inch		Rise	2.40	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	26.76	ft	Upstream Velocity Head	0.72	ft
Ke	0.50		Entrance Loss	0.36	ft

Inlet Control Properties					
Inlet Control HW Elev.	26.60	ft	Flow Control	Unsubmerged	
Inlet Type	Square edge with headwall (horizontal ellipse)		Area Full	14.8	ft^2
K	0.01000		HDS 5 Chart	29	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

PARSONS BRINCKERHOFF COMPUTATION SHEET

Page 1 of

Made by Bamhauer

Date 26 NOV 07

Checked by

Date

Subject Houghton Road
Hydraulic Analysis Preproposed Cond
Cy I 2

- Exist 2 - 29" x 45" x 150'± HERCPs

- Extend 8'± East

Q_{100} = 71 cfs

INV East = 24.01 North
INV East = 23.85 South
INV Avg = 23.93±

New INV = 24.19 North
New INV = 24.03 South
New INV Avg = 24.11

Design New Headwall & Sloping Drop Inlet

Trial 1 ± 20° skew LT

Use ADOT STD HW B-11.14
Modified for HERCPs

See next sheets

Trial 2

Use ADOT STD HW B-11.11
"L" HW w Conc Inlet
Modified per Special Detail

PARSONS BRINCKERHOFF COMPUTATION SHEET

Page 2 of

Made by Bambauer

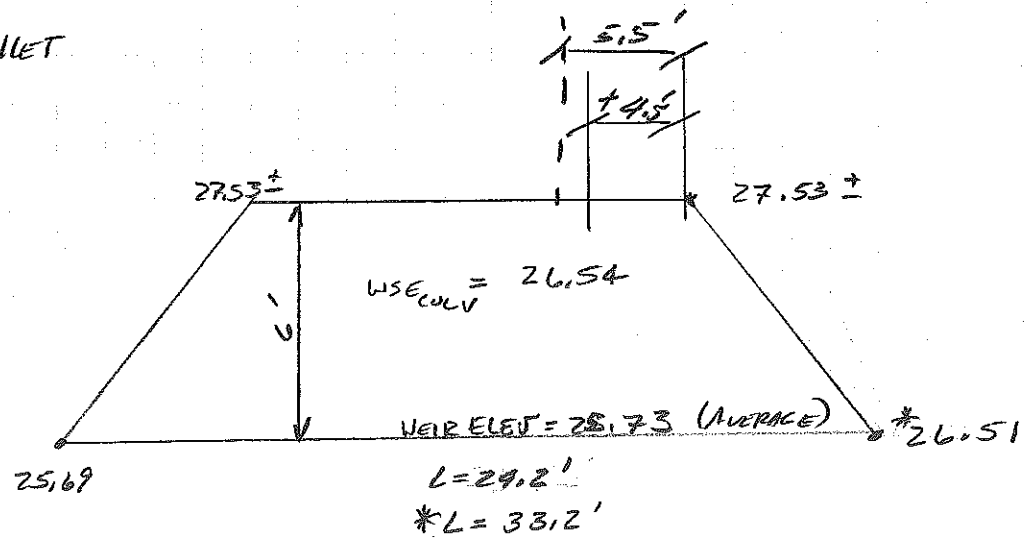
Date 26 NOV 07

Checked by

Date

Subject Houghton Road
Proposed Hydraulic Analysis
CPI 1

WEIR INLET



$Q_{WEIR} = CLh^{3/2}$; $C = 3.0$
$L = 24.2'$
$h = 26.54 - 25.73 = 0.81'$

$Q_{WEIR} = (3.0)(24.2)(0.81)^{3/2} = 52 c/s$

=

INCREASE L_{WEIR} → $Q_{WEIR} \leq HW_{CULV}$

$71 c/s = (3.0)(L)(.81)^{1.5}$

$L = 32.5'$ INCREASE HW width by 4.5' ON EACH END

Try $L = 33.2$ ELEV WEIR AVE = 26.1

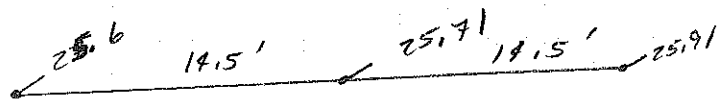
$h = .44$

NEED TO DESIGN WEIR SEGMENT & GRADE → Q_{WEIR} IS @ A LOWER OR EQUAL HW AS Q_{CULV}.

PARSONS BRINCKERHOFF COMPUTATION SHEET

Subject: Houghton Road
Proposed Hydraulic Analysis

Page 2 of 3
Made by Bambauer
Date 27 Nov 07
Checked by
Date



$HW_{CULV} = 26.54$

$y_1 = 26.54 - 25.60 = 0.94'$
$y_2 = 26.54 - 25.71 = 0.83'$
$y_3 = 26.54 - 25.91 = 0.63'$

$\bar{y}_{1-2} = \frac{.94 + 0.83}{2} = 0.89'$

$\bar{y}_{2-3} = \frac{0.83 + 0.63}{2} = 0.73'$

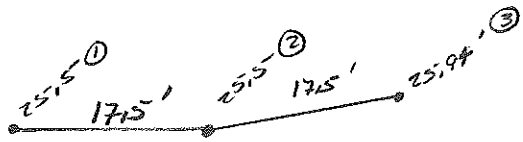
$Q_{1-2} = (2.6)(14.5)(.89)^{3/2} = 31.7\ cfs$

$Q_{2-3} = (2.6)(14.5)(.73)^{3/2} = 23.5$

> 55.2

Need to extend Weir ..

TRIAL - 2



← Use This Preliminary Geometry With Special "L" Headwall

$y_1 = 26.54 - 25.5 = 1.04'$
$y_2 = 26.54 - 25.5 = 1.04'$
$y_3 = 26.54 - 25.94 = 0.60'$

$\bar{y}_{1-2} = 1.04'$

$\bar{y}_{2-3} = (1.04 + 0.60)\,0.5 = 0.82$

$Q_{12} = (2.6)(17.5)(1.04)^{3/2} = 48.3\ cfs$

$Q_{2-3} = (2.6)(17.5)(.82)^{3/2} = 33.8\ cfs$

$> 82\ cfs > Cuvert.$

* Check Weir Submergence

Irregular Submerged Weir Computation

Houghton Road
Proposed Condition Hydraulics
CP I Drop Inlet Irregular Weir

$Qw = Cw \times DL \times d^{3/2}$ Cw = 3.0

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Irregular Weir Cross-Section:

SUBMERGED PORTION OF WEIR		STA (ft)	ELEV (ft)	SEGMENT	
	1	3.9	2826.54		
	2	8	2825.50	A	
	3	25.5	2825.50		B
	4	43	2825.94	C	
	5				D
	6			E	
	7				F
	8			G	
	9				H
	10			I	
	11				J
	12			K	
	13				L

$$Q_{SUB} = Q_{FREEFLOW}\left[1-\left(\frac{H_{DS}}{H_{US}}\right)^{1/2}\right]^{0.385}$$

Referenc Civil Engineering Reference Manual, 6th Edition, Lindeburg, Michael, 1997 Professional Publications, Inc.

Culvert Head Water = 26.54

Base Elevation *2800 feet*

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 26.54 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 26.70 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	f_{SUBMER} (--)	Q_{SUBMER}	WSE = 26.71 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	f_{SUBMER} (--)	
A	3.9	26.54				0.00				0.16						0.17				
	8.0	25.50	4.1	-0.2537	4.10	1.04	0.52	4.6	4.10	1.20	0.68	6.9	0.654	4.5	4.10	1.21	0.69	7.0	0.664	4.7
B	8.0	25.50				1.04				1.20						1.21				
	25.5	25.50	17.5	0.0000	17.50	1.04	1.04	55.7	17.50	1.20	1.20	69.0	0.531	36.6	17.50	1.21	1.21	69.9	0.541	37.8
C	25.5	25.50				1.04				1.20						1.21				
	43.0	25.94	17.5	0.0251	17.50	0.60	0.82	39.0	17.50	0.76	0.98	50.9	0.572	29.1	17.50	0.77	0.99	51.7	0.583	30.1
D	43.0	25.94																		
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0			0.00			0.0		
E	0.0	0.00																		
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0			0.00			0.0		
F	0.0	0.00																		
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0			0.00			0.0		
G	0.0	0.00																		
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0			0.00			0.0		
H	0.0	0.00																		
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0			0.00			0.0		
I	0.0	0.00																		
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0			0.00			0.0		
J	0.0	0.00																		
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0			0.00			0.0		
K	0.0	0.00																		
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0			0.00			0.0		
L	0.0	0.00																		
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0			0.00			0.0		
								99.3				126.8		70.3				128.6		72.7
												Q-Unsubmerged-->		0.0				Q-Unsubmerged-->		0.0
												Q-Total -->		70.3				Q-Total -->		72.7

UNSUBMERGED WEIR ANALYSIS

Houghton Road
Proposed Condition Hydraulics
CP I Drop Inlet Irregular Weir

$Qw = Cw \times DL \times d^{3/2}$ Cw = 3.0

Qw : Weir Discharge
DL : Incremental Weir Length
d : Average depth of flow over segment

Notes:
DL shown below are only applied if flow covers the entire segment.
Otherwise DL is prorated for amount of flow each weir segment.

Base Elevation 2800 feet

UNSUBMERGED PORTION OF WEIR

Irregular Weir Cross-Section:

	STA (ft)	ELEV (ft)	SEGMENT
1	0	2827.53	A
2	3.9	2826.54	B
3			C
4			D
5			E
6			F
7			G
8			H
9			I
10			J
11			K
12			L
13			

Irregular Weir Analysis

Segmt	STA	ELEV	DL	So	WSE = 26.54 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 26.70 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)	WSE = 26.71 Adj'd DL	Yi Yii	Yave	Qweir (ft³/sec)
A	0.0	27.53														
	3.9	26.54	3.9	-0.2538	0.00	0.00	0.00	0.0	0.63	0.16	0.08	0.0	0.67	0.17	0.09	0.0
B	3.9	26.54														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
C	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
D	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
E	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
F	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
G	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
H	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
I	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
J	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
K	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
L	0.0	0.00														
	0.0	0.00	0.0	0.0000	0.00			0.0	0.00			0.0	0.00			0.0
								0.0				0.0				0.0

C-5

TSMS NODE MG-N0040

Houghton Road SW-OST
PB Proj No. 11515
TSMS Node MG-N0040

Proposed Condition

```
                    HEC-RAS Version 3.1.3 May 2005
                     U.S. Army Corp 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: TSMS Node: MG N0040
Project File : N0040.prj
Run Date and Time: 9/2/2008 1:43:26 PM

Project in English units

Project Description:
TSMS NODE - MG N0040

EXISTING CONDITION --
NO CULVERT -- WEIR ONLY AT THIS
LOCATION
MODEL HYDRAULIC RESPONSE OF EXISTING DIP CROSSING
EXISTING DIP
CROSSING EVALUATED AS INLINE WEIR
--EXISTING DIP CROSSING IS NOT AT GRADE
WITH WASH
--MANNING'S ROUGHNESS ESTIMATE:
NCH = 0.06
NOB = 0.08
ONLY
DIFFERENCE BETWEEN MAIN CHANNEL AND OVERBANK
ROUGHNESS IS THAT THERE ARE
MINOR FLOW PATHS IN THE MAIN CHANNEL --> MINOR REDUCTION IN
ROUGHNESS.

PROPOSED CONDITION --
REPLACE EXISTING ELEVATED DIP WITH CULVERT
TO CONVEY
100-YEAR EVENT UNDER ROADWAY PROVIDING FOR ALL WEATHER ACCESS.

FLOW DATA

Flow Title: TSMS NODE MG N0040
Flow File : 1:\11515\Drainage\HECRAS\TSMS MG_N0040\N0040.f01

Flow Data (cfs)

River	Reach	RS	100-YR	10-YR
Stream	Reach	1250	243	71

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Stream	Reach	100-YR	Critical	Normal S = 0.023
Stream	Reach	10-YR	Critical	Normal S = 0.023

Houghton Road SW-OST
PB Proj No. 11515
TSMS Node MG-N0040 Proposed Condition

GEOMETRY DATA

Geometry Title: MG N0040 PROPOSED
Geometry File : l:\11515\Drainage\HECRAS\TSMS MG_N0040\N0040.g02

CROSS SECTION

RIVER: Stream
REACH: Reach RS: 1250

INPUT
Description:
Station Elevation Data num= 51

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2841.47	2.51	2841.36	7.03	2841.23	8.31	2841.14	10.07	2840.86
13.14	2840.63	14.56	2840.48	16.17	2840.44	22.47	2840.39	24.94	2840.22
26.76	2840	27.67	2840.13	40.06	2839.96	131.15	2835.68	139.2	2835.22
140.03	2835.23	149.74	2834.93	154.01	2834.85	160.2	2834.58	161.33	2834.62
167	2834.12	173.42	2834.39	185.06	2834.54	200.86	2834.46	200.87	2834.46
218.54	2834.36	223.18	2834.61	226.35	2834.7	234.7	2835.11	277.54	2837.43
329.35	2839.78	352.68	2841.16	354.21	2841.22	357.62	2841.48	363.91	2841.42
369.9	2841.45	370.79	2841.51	374.88	2841.95	378.02	2842.16	389.81	2842.3
393.09	2842.46	396.23	2842.5	403.96	2842.42	404.83	2842.38	405.97	2842.4
426.33	2843.26	431.63	2843.4	452.58	2844.15	454.8	2844.21	501.33	2845.92
504.92	2845.99								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	40.06	.06	352.68	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
40.06	352.68	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	2835.47	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.30	Wt. n-Val.		0.060	
W.S. Elev (ft)	2835.17	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	2835.17	Flow Area (sq ft)		54.91	
E.G. Slope (ft/ft)	0.065113	Area (sq ft)		54.91	
Q Total (cfs)	243.00	Flow (cfs)		243.00	
Top Width (ft)	93.63	Top Width (ft)		93.63	
Vel Total (ft/s)	4.43	Avg. Vel. (ft/s)		4.43	
Max Chl Dpth (ft)	1.05	Hydr. Depth (ft)		0.59	
Conv. Total (cfs)	952.3	Conv. (cfs)		952.3	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		93.69	
Min Ch El (ft)	2834.12	Shear (lb/sq ft)		2.38	
Alpha	1.00	Stream Power (lb/ft s)		10.54	
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)	0.18	1.85	0.32
C & E Loss (ft)	0.08	Cum SA (acres)	0.12	0.77	0.30

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Stream
REACH: Reach RS: 1150

INPUT
Description:

Houghton Road SW-OST
PB Proj No. 11515
TSMS Node MG-N0040 Proposed Condition

Station Elevation Data num= 51

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2841.67	8.21	2841.23	10.33	2841.05	13.35	2840.94	15.06	2840.78
19.02	2840.62	47.96	2838.77	51.02	2838.44	60.15	2837.72	76.63	2836.68
80.58	2836.35	98.51	2835.24	105.49	2835.08	110.27	2834.83	115.17	2834.87
118.56	2834.7	124.79	2833.85	137.16	2833	161.64	2832.32	171.47	2832.21
175.3	2831.88	189.48	2832.46	200	2832.43	200.02	2832.43	228.76	2832.71
236.99	2833.17	249.9	2834.64	260.56	2835.61	265.04	2835.81	269.95	2836.35
277.13	2836.79	282.3	2837.2	286.36	2837.42	299.55	2837.67	303.58	2837.28
309.59	2837.26	313.88	2837.65	329.9	2837.67	337.95	2837.92	345.84	2838.06
353.35	2838.43	368.65	2838.92	371.16	2838.92	393.68	2839.72	427.31	2841.18
439.38	2841.43	457.78	2841.98	462.98	2842.23	473.64	2842.06	499.02	2842.08
502.27	2842.16								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	118.56	.06	286.36	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
118.56	286.36	41	41	41	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	161	2837.5	F
239	502.27	2837	F

CROSS SECTION OUTPUT Profile #100-YR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2835.12	Element			
Vel Head (ft)	0.02	Wt. n-Val.		0.060	
W.S. Elev (ft)	2835.10	Reach Len. (ft)	41.00	41.00	41.00
Crit W.S. (ft)	2833.13	Flow Area (sq ft)		204.95	
E.G. Slope (ft/ft)	0.000633	Area (sq ft)	2.98	301.65	
Q Total (cfs)	243.00	Flow (cfs)		243.00	
Top Width (ft)	150.29	Top Width (ft)	13.90	136.39	
Vel Total (ft/s)	1.19	Avg. Vel. (ft/s)		1.19	
Max Chl Dpth (ft)	3.22	Hydr. Depth (ft)		2.63	
Conv. Total (cfs)	9660.2	Conv. (cfs)		9660.2	
Length Wtd. (ft)	41.00	Wetted Per. (ft)		78.05	
Min Ch El (ft)	2831.88	Shear (lb/sq ft)		0.10	
Alpha	1.00	Stream Power (lb/ft s)		0.12	
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	0.17	1.45	0.32
C & E Loss (ft)	0.00	Cum SA (acres)	0.10	0.51	0.30

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Stream
REACH: Reach RS: 1109

INPUT
Description:
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2834	11	2833	25	2832	62	2830.2	98	2830.2
104	2832	117	2833	130	2834	144	2835	160	2835.5

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	25	.036	104	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
25	104	223	223	223	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	63	2837.17	F
97	160	2837.32	F

CROSS SECTION OUTPUT Profile #100-YR

Houghton Road SW-OST
PB Proj No. 11515
TSMS Node MG-N0040

Proposed Condition

E.G. Elev (ft)	2835.11	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.		0.036	
W.S. Elev (ft)	2835.07	Reach Len. (ft)	223.00	223.00	223.00
Crit W.S. (ft)	2831.37	Flow Area (sq ft)		165.68	
E.G. Slope (ft/ft)	0.000153	Area (sq ft)	53.32	346.25	61.99
Q Total (cfs)	243.00	Flow (cfs)		243.00	
Top Width (ft)	146.33	Top Width (ft)	25.00	79.00	42.33
Vel Total (ft/s)	1.47	Avg. Vel. (ft/s)		1.47	
Max Chl Dpth (ft)	4.87	Hydr. Depth (ft)		4.87	
Conv. Total (cfs)	19654.9	Conv. (cfs)		19654.9	
Length Wtd. (ft)	223.00	Wetted Per. (ft)		34.00	
Min Ch El (ft)	2830.20	Shear (lb/sq ft)		0.05	
Alpha	1.00	Stream Power (lb/ft s)		0.07	
Frctn Loss (ft)		Cum Volume (acre-ft)	0.15	1.14	0.29
C & E Loss (ft)		Cum SA (acres)	0.08	0.41	0.28

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid,
energy was used.

CULVERT

RIVER: Stream
REACH: Reach RS: 1100

INPUT
Description:
Distance from Upstream XS = 14
Deck/Roadway Width = 175
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 2

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2839.4	0	400	2835.89	0

Upstream Bridge Cross Section Data
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2834	11	2833	25	2832	62	2830.2	98	2830.2
104	2832	117	2833	130	2834	144	2835	160	2835.5

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	25	.036	104	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
25	104	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	63	2837.17	F
97	160	2837.32	F

Downstream Deck/Roadway Coordinates
num= 2

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2839.4	0	400	2835.89	0

Downstream Bridge Cross Section Data
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2833	30	2827	30	2826.41	60	2826.41	60	2827
107	2827.5								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	30	.06	60	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
30	60	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	30	2830	F
60	107	2830	F

Left Levee Station= 0 Elevation= 2835

Houghton Road SW-OST
PB Proj No. 11515
TSMS Node MG-N0040

Proposed Condition

Upstream Embankment side slope = 4 horiz. to 1.0 vertical
Downstream Embankment side slope = 4 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Circular	4	

FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 2 - Groove end entrance with headwall
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	8	198	.012	.012	0	.2	1

Number of Barrels = 3
Upstream Elevation = 2830.87
Centerline Stations

Sta.	Sta.	Sta.
73	80	87

Downstream Elevation = 2827.07
Centerline Stations

Sta.	Sta.	Sta.
38	45	52

CULVERT OUTPUT Profile #100-YR Culv Group: Culvert #1

Q Culv Group (cfs)	243.00	Culv Full Len (ft)	
# Barrels	3	Culv Vel US (ft/s)	8.88
Q Barrel (cfs)	81.00	Culv Vel DS (ft/s)	15.04
E.G. US. (ft)	2835.11	Culv Inv El Up (ft)	2830.87
W.S. US. (ft)	2835.07	Culv Inv El Dn (ft)	2827.07
E.G. DS (ft)	2828.40	Culv Frctn Ls (ft)	2.46
W.S. DS (ft)	2828.00	Culv Exit Loss (ft)	3.95
Delta EG (ft)	6.70	Culv Entr Loss (ft)	0.29
Delta WS (ft)	7.07	Q Weir (cfs)	
E.G. IC (ft)	2835.11	Weir Sta Lft (ft)	
E.G. OC (ft)	2835.07	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	2833.60	Weir Max Depth (ft)	
Culv WS Outlet (ft)	2828.85	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	1.70	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	2.73	Min El Weir Flow (ft)	2838.47

Note: The flow in the culvert is entirely supercritical.

CROSS SECTION

RIVER: Stream
REACH: Reach RS: 886

INPUT
Description:
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2833	30	2827	30	2826.41	60	2826.41	60	2827
107	2827.5								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	30	.06	60	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
30	60	96	96	96	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	30	2830	F
60	107	2830	F

Left Levee Station= 0 Elevation= 2835

Houghton Road SW-OST
PB Proj No. 11515
TSMS Node MG-N0040 Proposed Condition
CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	2828.40	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.40	Wt. n-Val.		0.060	
W.S. Elev (ft)	2828.00	Reach Len. (ft)	96.00	96.00	96.00
Crit W.S. (ft)	2827.68	Flow Area (sq ft)		47.78	
E.G. Slope (ft/ft)	0.023878	Area (sq ft)	2.51	47.78	35.36
Q Total (cfs)	243.00	Flow (cfs)		243.00	
Top Width (ft)	82.01	Top Width (ft)	5.01	30.00	47.00
Vel Total (ft/s)	5.09	Avg. Vel. (ft/s)		5.09	
Max Chl Dpth (ft)	1.59	Hydr. Depth (ft)		1.59	
Conv. Total (cfs)	1572.6	Conv. (cfs)		1572.6	
Length Wtd. (ft)	96.00	Wetted Per. (ft)		31.18	
Min Ch El (ft)	2826.41	Shear (lb/sq ft)		2.28	
Alpha	1.00	Stream Power (lb/ft s)		11.62	
Frctn Loss (ft)	2.25	Cum Volume (acre-ft)	0.00	0.13	0.04
C & E Loss (ft)	0.11	Cum SA (acres)	0.01	0.13	0.05

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Stream
REACH: Reach RS: 790

INPUT
Description:
Station Elevation Data num= 50

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2828.27	10.23	2828.12	30.04	2827.43	32.85	2827.16	42.05	2825.86
45.51	2827.82	47.37	2829.1	61.57	2830.99	66.64	2831.3	79.68	2831.31
83.85	2831.15	87.35	2830.79	104.01	2829.54	125.42	2828.65	139.94	2827.8
144.18	2827.86	160.43	2827.4	166.26	2827.09	170.23	2826.68	180.04	2826.29
185.2	2825.94	211.25	2825.22	213.5	2825.08	217.47	2824.55	224.97	2824.07
231.34	2824.5	240.34	2824.61	249.84	2824.95	253.76	2824.98	264.53	2825.18
266.35	2825.41	290.24	2827.33	305.1	2828.11	323.02	2828.48	342.75	2829.2
353.72	2829.41	369.1	2829.93	375.99	2829.97	388.26	2830.45	405.32	2830.72
426.58	2831.72	434.73	2832.31	437.02	2832.16	448.12	2834.95	453.73	2835.8
454.99	2836.23	465.66	2836.29	477.92	2835.61	496.56	2835.9	503.96	2835.89

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	144.18	.06	305.1	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
144.18	305.1	0	0	0	.1	.3

Left Levee Station= 67 Elevation= 2834

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	2826.05	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.18	Wt. n-Val.		0.060	
W.S. Elev (ft)	2825.87	Reach Len. (ft)			
Crit W.S. (ft)	2825.57	Flow Area (sq ft)		71.99	
E.G. Slope (ft/ft)	0.023016	Area (sq ft)		71.99	
Q Total (cfs)	243.00	Flow (cfs)		243.00	
Top Width (ft)	84.42	Top Width (ft)		84.42	
Vel Total (ft/s)	3.38	Avg. Vel. (ft/s)		3.38	
Max Chl Dpth (ft)	1.80	Hydr. Depth (ft)		0.85	
Conv. Total (cfs)	1601.7	Conv. (cfs)		1601.7	
Length Wtd. (ft)		Wetted Per. (ft)		84.54	
Min Ch El (ft)	2824.07	Shear (lb/sq ft)		1.22	
Alpha	1.00	Stream Power (lb/ft s)		4.13	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Houghton Road SW-OST
PB Proj No. 11515
TSMS Node MG-N0040

Proposed Condition

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

SUMMARY OF MANNING'S N VALUES

River:Stream

Reach	River Sta.	n1	n2	n3
Reach	1250	.08	.06	.08
Reach	1150	.08	.06	.08
Reach	1109	.08	.036	.08
Reach	1100	Culvert		
Reach	886	.08	.06	.08
Reach	790	.08	.06	.08

SUMMARY OF REACH LENGTHS

River: Stream

Reach	River Sta.	Left	Channel	Right
Reach	1250	100	100	100
Reach	1150	41	41	41
Reach	1109	223	223	223
Reach	1100	Culvert		
Reach	886	96	96	96
Reach	790	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Stream

Reach	River Sta.	Contr.	Expan.
Reach	1250	.1	.3
Reach	1150	.3	.5
Reach	1109	.1	.3
Reach	1100	Culvert	
Reach	886	.3	.5
Reach	790	.1	.3

Houghton Road SW-OST
PB Proj No. 11515
TSMS Node MG-N0040

Proposed Condition

Profile Output Table - Standard Table 1

Reach	River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach	1250	243.00	2834.12	2835.17	2835.17	2835.47	0.065113	4.43	54.91	93.63	1.02
Reach	1150	243.00	2831.88	2835.10	2833.13	2835.12	0.000633	1.19	204.95	150.29	0.13
Reach	1109	243.00	2830.20	2835.07	2831.37	2835.11	0.000153	1.47	165.68	146.33	0.12
Reach	1100	Culvert									
Reach	886	243.00	2826.41	2828.00	2827.68	2828.40	0.023878	5.09	47.78	82.01	0.71
Reach	790	243.00	2824.07	2825.87	2825.57	2826.05	0.023016	3.38	71.99	84.42	0.64

Profile Output Table - Standard Table 2

Reach	River Sta	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
Reach	1250	2835.47	2835.17	0.30	0.21	0.08		243.00		93.63
Reach	1150	2835.12	2835.10	0.02	0.01	0.00		243.00		150.29
Reach	1109	2835.11	2835.07	0.03				243.00		146.33
Reach	1100	Culvert								
Reach	886	2828.40	2828.00	0.40	2.25	0.11		243.00		82.01
Reach	790	2826.05	2825.87	0.18				243.00		84.42

Profile Output Table - Culvert Only

Reach	River Sta		E.G. US. (ft)	W.S. US. (ft)	E.G. IC (ft)	E.G. OC (ft)	Min El Weir Flow (ft)	Q Culv Group (cfs)	Q Weir (cfs)	Delta WS (ft)	Culv Vel US (ft/s)	Culv Vel DS (ft/s)
Reach	1100	Culvert #1	2835.11	2835.07	2835.11	2835.07	2838.47	243.00		7.07	8.88	15.04

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : N0040PROP

River: Stream Reach: Reach RS: 1250 Profile: 100-YR
Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: Stream Reach: Reach RS: 1150 Profile: 100-YR

Houghton Road SW-OST
PB Proj No. 11515
TSMS Node MG-N0040

Proposed Condition

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.

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

River: Stream Reach: Reach RS: 1109 Profile: 100-YR

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

River: Stream Reach: Reach RS: 1100 Profile: 100-YR Culv: Culvert #1

Note: The flow in the culvert is entirely supercritical.

River: Stream Reach: Reach RS: 886 Profile: 100-YR

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

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

River: Stream Reach: Reach RS: 790 Profile: 100-YR

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

C-6

ESTE WASH

PB Proj. No. 11515
Este Wash
Prop 4-10'X6' RCBC's with FEMA Flow

HEC-RAS Version 3.1.3 May 2005
U.S. Army Corp 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: Este Wash New Topo HEC2
Project File : EWHEC2TSMS.prj
Run Date and Time: 9/2/2008 2:45:53 PM

Project in English units

Project Description:
88151-02-39
FIS City of Tucson
ESTE WASH
Imported FEMA
Geometry File: .g01
Imported FEMA Geometry File Adjusted Vertically by +2.23
ft to account for Vertical Datum Change: .g02

New Existing Conditions
Geometry File (Project 1' C.I. Topo with PAG 1999 2' C.I. Topo): .g06
Proposed
Conditions Geometry File (3-10'x6' RCBC's at Houghton Rd and 22nd St
crossings): ,g07
Proposed Conditions Geometry File (4-10'x6' RCBC's at
Houghton Rd and 22nd St crossings): ,g05

PLAN DATA

Plan Title: Prop 4 Barrel Boxes with FEMA Flow
Plan File : l:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2TSMS.p04

Geometry Title: Proposed Conditions 4-10'x6' RCBC's
Geometry File : l:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2TSMS.g05

Flow Title : FEMA Flow
Flow File : l:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2TSMS.f01

Plan Summary Information:

Number of:	Cross Sections =	22	Multiple Openings =	0
	Culverts =	2	Inline Structures =	0
	Bridges =	0	Lateral Structures =	0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed at all cross sections
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

PB Proj. No. 11515
Este Wash
Prop 4-10'X6' RCBC's with FEMA Flow

FLOW DATA

Flow Title: FEMA Flow
Flow File : l:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2TSMS.f01

Flow Data (cfs)

River	Reach	RS	PF 1
Este Wash	1	4085	1974

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Este Wash	1	PF 1	Normal S = 0.0133	Normal S = 0.0133

GEOMETRY DATA

Geometry Title: Proposed Conditions 4-10'x6' RCBC's
Geometry File : l:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2TSMS.g05

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 4085

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2862.5	9	2862	20	2860	30	2858	33	2856.4
50	2856.4	53	2857.7	80	2857.7	116	2858	127	2857.7
142	2858.1	159	2857.3	173	2857.7	209	2857.5	230	2858

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	33	.022	50	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
30	53	250	275	260	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2860.08	Element			
Vel Head (ft)	0.75	Wt. n-Val.	0.080	0.039	0.060
W.S. Elev (ft)	2859.33	Reach Len. (ft)	250.00	275.00	260.00
Crit W.S. (ft)	2859.33	Flow Area (sq ft)	4.41	63.01	283.57
E.G. Slope (ft/ft)	0.019136	Area (sq ft)	4.41	63.01	283.57
Q Total (cfs)	1974.00	Flow (cfs)	8.52	642.22	1323.26
Top Width (ft)	206.64	Top Width (ft)	6.64	23.00	177.00
Vel Total (ft/s)	5.62	Avg. Vel. (ft/s)	1.93	10.19	4.67
Max Chl Dpth (ft)	2.93	Hydr. Depth (ft)	0.66	2.74	1.60
Conv. Total (cfs)	14269.9	Conv. (cfs)	61.6	4642.6	9565.8
Length Wtd. (ft)	264.57	Wetted Per. (ft)	6.77	23.67	178.37
Min Ch El (ft)	2856.40	Shear (lb/sq ft)	0.78	3.18	1.90
Alpha	1.53	Stream Power (lb/ft s)	1.50	32.41	8.86
Frctn Loss (ft)	3.65	Cum Volume (acre-ft)	11.85	13.20	15.11
C & E Loss (ft)	0.01	Cum SA (acres)	9.16	4.89	11.76

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross

section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3810

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2856	8	2854.5	116	2854	150	2854	169	2853.8
183	2854.1	200	2852.7	220	2852.7	235	2854	250	2856
250.1	2862								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	200	.022	220	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
183	235	155	170	180	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2856.33	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.73	Wt. n-Val.	0.060	0.032	0.060
W.S. Elev (ft)	2855.60	Reach Len. (ft)	155.00	170.00	180.00
Crit W.S. (ft)	2855.60	Flow Area (sq ft)	259.20	129.26	9.62
E.G. Slope (ft/ft)	0.010423	Area (sq ft)	259.20	129.26	9.62
Q Total (cfs)	1974.00	Flow (cfs)	832.63	1120.51	20.87
Top Width (ft)	244.89	Top Width (ft)	180.88	52.00	12.02
Vel Total (ft/s)	4.96	Avg. Vel. (ft/s)	3.21	8.67	2.17
Max Chl Dpth (ft)	2.90	Hydr. Depth (ft)	1.43	2.49	0.80
Conv. Total (cfs)	19335.6	Conv. (cfs)	8155.7	10975.5	204.4
Length Wtd. (ft)	161.90	Wetted Per. (ft)	180.99	52.11	12.12
Min Ch El (ft)	2852.70	Shear (lb/sq ft)	0.93	1.61	0.52
Alpha	1.91	Stream Power (lb/ft s)	2.99	13.99	1.12
Frctn Loss (ft)	1.87	Cum Volume (acre-ft)	11.10	12.59	14.23
C & E Loss (ft)	0.08	Cum SA (acres)	8.62	4.65	11.20

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3640

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2854	15	2852	38	2851	126	2850.6	173	2851.2
205	2851.8	218	2850.8	238	2850.8	249	2851.8	270	2852
336	2854	360	2856	385	2858	410	2860	495	2862

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	218	.022	238	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
205	249	90	150	205	.1	.3

PB Proj. No. 11515
Este Wash
Prop 4-10'X6' RCBC's with FEMA Flow

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2853.23	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.46	Wt. n-Val.	0.060	0.031	0.080
W.S. Elev (ft)	2852.77	Reach Len. (ft)	90.00	150.00	205.00
Crit W.S. (ft)	2852.51	Flow Area (sq ft)	334.09	74.85	28.23
E.G. Slope (ft/ft)	0.012894	Area (sq ft)	334.09	74.85	28.23
Q Total (cfs)	1974.00	Flow (cfs)	1341.10	590.23	42.67
Top Width (ft)	286.34	Top Width (ft)	195.80	44.00	46.54
Vel Total (ft/s)	4.52	Avg. Vel. (ft/s)	4.01	7.89	1.51
Max Chl Dpth (ft)	2.17	Hydr. Depth (ft)	1.71	1.70	0.61
Conv. Total (cfs)	17384.3	Conv. (cfs)	11810.6	5198.0	375.8
Length Wtd. (ft)	113.62	Wetted Per. (ft)	195.89	44.08	46.55
Min Ch El (ft)	2850.80	Shear (lb/sq ft)	1.37	1.37	0.49
Alpha	1.45	Stream Power (lb/ft s)	5.51	10.78	0.74
Frctn Loss (ft)	2.23	Cum Volume (acre-ft)	10.04	12.20	14.16
C & E Loss (ft)	0.00	Cum SA (acres)	7.95	4.47	11.08

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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3490

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2854	13	2852	42	2850	116	2848.4	240	2849.9
258	2849.2	270	2849.2	280	2849.8	320	2850	350	2850
367	2849.6	388	2850	415	2850	460	2851	480	2851

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	116	.06	258	.022	270	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
240	280	90	140	190	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2851.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.47	Wt. n-Val.	0.066	0.035	0.060
W.S. Elev (ft)	2850.52	Reach Len. (ft)	90.00	140.00	190.00
Crit W.S. (ft)	2850.50	Flow Area (sq ft)	270.44	43.68	88.58
E.G. Slope (ft/ft)	0.033340	Area (sq ft)	270.44	43.68	88.58
Q Total (cfs)	1974.00	Flow (cfs)	1341.02	361.34	271.64
Top Width (ft)	404.20	Top Width (ft)	205.60	40.00	158.60
Vel Total (ft/s)	4.90	Avg. Vel. (ft/s)	4.96	8.27	3.07
Max Chl Dpth (ft)	2.12	Hydr. Depth (ft)	1.32	1.09	0.56
Conv. Total (cfs)	10811.0	Conv. (cfs)	7344.4	1978.9	1487.7
Length Wtd. (ft)	134.03	Wetted Per. (ft)	205.65	40.03	158.61
Min Ch El (ft)	2849.20	Shear (lb/sq ft)	2.74	2.27	1.16
Alpha	1.27	Stream Power (lb/ft s)	13.57	18.79	3.56
Frctn Loss (ft)	1.47	Cum Volume (acre-ft)	9.42	11.99	13.88
C & E Loss (ft)	0.09	Cum SA (acres)	7.53	4.32	10.60

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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Este Wash

PB Proj. No. 11515
Este Wash
Prop 4-10'X6' RCBC's with FEMA Flow
REACH: 1 RS: 3350

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2854	15	2852	35	2850	75	2848.1	90	2848.2
105	2848	128	2847.3	182	2848.1	198	2847.7	245	2847.6
250	2848	260	2847.9	297	2847.9	357	2846.9	430	2846.6
465	2848	495	2850	525	2850.5				

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	182	.06	245	.028	297	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
245	297	135	120	115	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
465	525		T

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2849.43	Element			
Vel Head (ft)	0.16	Wt. n-Val.	0.071	0.028	0.060
W.S. Elev (ft)	2849.27	Reach Len. (ft)	135.00	120.00	115.00
Crit W.S. (ft)	2848.46	Flow Area (sq ft)	268.57	71.17	364.87
E.G. Slope (ft/ft)	0.005413	Area (sq ft)	268.57	71.17	376.94
Q Total (cfs)	1974.00	Flow (cfs)	516.71	342.47	1114.82
Top Width (ft)	433.63	Top Width (ft)	194.60	52.00	187.03
Vel Total (ft/s)	2.80	Avg. Vel. (ft/s)	1.92	4.81	3.06
Max Chl Dpth (ft)	2.67	Hydr. Depth (ft)	1.38	1.37	2.17
Conv. Total (cfs)	26829.7	Conv. (cfs)	7022.9	4654.7	15152.1
Length Wtd. (ft)	121.38	Wetted Per. (ft)	194.65	52.02	168.04
Min Ch El (ft)	2847.60	Shear (lb/sq ft)	0.47	0.46	0.73
Alpha	1.31	Stream Power (lb/ft s)	0.90	2.23	2.24
Frctn Loss (ft)	1.34	Cum Volume (acre-ft)	8.86	11.81	12.87
C & E Loss (ft)	0.06	Cum SA (acres)	7.12	4.17	9.84

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3230

INPUT
Description:
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2852	23	2850	32	2848	58	2846	88	2846
100	2845.8	147	2846.1	162	2846	207	2846	210	2845.5
228	2845.5	248	2846	290	2845	305	2845.3	318	2844.9
335	2846	343	2847	365	2850	390	2853		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	210	.025	228	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
207	248	94	64	44	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	110		T
328	390		T

CROSS SECTION OUTPUT Profile #PF 1

PB Proj. No. 11515
Este Wash
Prop 4-10'X6' RCBC's with FEMA Flow

E.G. Elev (ft)	2848.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.76	Wt. n-Val.	0.080	0.038	0.080
W.S. Elev (ft)	2847.27	Reach Len. (ft)	94.00	64.00	44.00
Crit W.S. (ft)	2847.27	Flow Area (sq ft)	122.92	66.74	154.66
E.G. Slope (ft/ft)	0.033711	Area (sq ft)	202.19	66.74	171.53
Q Total (cfs)	1974.00	Flow (cfs)	490.88	664.88	818.23
Top Width (ft)	303.45	Top Width (ft)	165.48	41.00	96.97
Vel Total (ft/s)	5.73	Avg. Vel. (ft/s)	3.99	9.96	5.29
Max Chl Dpth (ft)	2.37	Hydr. Depth (ft)	1.27	1.63	1.93
Conv. Total (cfs)	10751.3	Conv. (cfs)	2673.6	3621.3	4456.5
Length Wtd. (ft)	63.59	Wetted Per. (ft)	97.00	41.05	80.04
Min Ch El (ft)	2845.50	Shear (lb/sq ft)	2.67	3.42	4.07
Alpha	1.49	Stream Power (lb/ft s)	10.65	34.09	21.51
Frctn Loss (ft)	0.30	Cum Volume (acre-ft)	8.13	11.62	12.14
C & E Loss (ft)	0.15	Cum SA (acres)	6.56	4.05	9.47

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3166

INPUT
Description:
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2844.5	20	2844	34	2839	89	2839	107	2845
117	2846								

Manning's n Values num= 1

Sta	n Val
0	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
34	89	6	6	6	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	34		T
89	117		T

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2846.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.47	Wt. n-Val.		0.040	
W.S. Elev (ft)	2845.54	Reach Len. (ft)	6.00	6.00	6.00
Crit W.S. (ft)	2842.41	Flow Area (sq ft)		359.59	
E.G. Slope (ft/ft)	0.001786	Area (sq ft)	82.29	359.59	65.13
Q Total (cfs)	1974.00	Flow (cfs)		1974.00	
Top Width (ft)	112.38	Top Width (ft)	34.00	55.00	23.38
Vel Total (ft/s)	5.49	Avg. Vel. (ft/s)		5.49	
Max Chl Dpth (ft)	6.54	Hydr. Depth (ft)		6.54	
Conv. Total (cfs)	46707.0	Conv. (cfs)		46707.0	
Length Wtd. (ft)	6.00	Wetted Per. (ft)		55.00	
Min Ch El (ft)	2839.00	Shear (lb/sq ft)		0.73	
Alpha	1.00	Stream Power (lb/ft s)		4.00	
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	7.82	11.30	12.02
C & E Loss (ft)	0.14	Cum SA (acres)	6.35	3.97	9.41

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.

PB Proj. No. 11515
Este Wash
Prop 4-10'X6' RCBC's with FEMA Flow

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3160

INPUT
Description:
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2848	10	2846	28	2845	60	2844	73	2844.5
113	2844.7	123	2843.9	140	2844.6	161	2844.6	177	2844
197	2839	240	2839	260	2844	266	2846	280	2847
290	2848	307	2850	322	2852	335	2853		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	177	.04	260	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
197	240	185	185	185	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	197		T
240	335		T

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2845.85	Element			
Vel Head (ft)	0.94	Wt. n-Val.		0.040	
W.S. Elev (ft)	2844.91	Reach Len. (ft)	185.00	185.00	185.00
Crit W.S. (ft)	2843.02	Flow Area (sq ft)		254.24	
E.G. Slope (ft/ft)	0.004086	Area (sq ft)	136.45	254.24	69.50
Q Total (cfs)	1974.00	Flow (cfs)		1974.00	
Top Width (ft)	231.94	Top Width (ft)	166.20	43.00	22.74
Vel Total (ft/s)	7.76	Avg. Vel. (ft/s)		7.76	
Max Chl Dpth (ft)	5.91	Hydr. Depth (ft)		5.91	
Conv. Total (cfs)	30881.7	Conv. (cfs)		30881.7	
Length Wtd. (ft)	185.00	Wetted Per. (ft)		43.00	
Min Ch El (ft)	2839.00	Shear (lb/sq ft)		1.51	
Alpha	1.00	Stream Power (lb/ft s)		11.71	
Frctn Loss (ft)		Cum Volume (acre-ft)	7.81	11.26	12.01
C & E Loss (ft)		Cum SA (acres)	6.33	3.97	9.40

CULVERT

RIVER: Este Wash
REACH: 1 RS: 3050

INPUT
Description: 4-10'x6' RCBC
Distance from Upstream XS = 7
Deck/Roadway Width = 175
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 2

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2849		460	2846	

Upstream Bridge Cross Section Data
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2848	10	2846	28	2845	60	2844	73	2844.5
113	2844.7	123	2843.9	140	2844.6	161	2844.6	177	2844
197	2839	240	2839	260	2844	266	2846	280	2847
290	2848	307	2850	322	2852	335	2853		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	177	.04	260	.08

PB Proj. No. 11515
Este Wash
Prop 4-10'X6' RCBC's with FEMA Flow

```
Bank Sta: Left   Right    Coeff Contr.   Expan.
          197     240            .3        .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     197               T
     240     335               T

Downstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0    2849             460    2846

Downstream Bridge Cross Section Data
Station Elevation Data    num=      23
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  2845.5       8    2845      25    2844      62    2843     100  2842.5
     108  2842.5     130  2842.7     150    2842     190    2841     210    2840
     220    2839     223    2838     240    2838     268    2838     275  2840.8
     305    2841     342    2842     356    2843     372    2844     390  2844.2
     405    2844     427    2845     460  2845.2

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .06     100    .025     108     .06     240     .04     268     .06

Bank Sta: Left   Right    Coeff Contr.   Expan.
          223     268            .3        .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     224               T
     267     460               T

Upstream Embankment side slope                =       0 horiz. to 1.0 vertical
Downstream Embankment side slope              =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =      .95
Elevation at which weir flow begins           =
Energy head used in spillway design           =
Spillway height used in design                =
Weir crest shape                              = Broad Crested

Number of Culverts =  1

Culvert Name      Shape      Rise    Span
Culvert #1          Box        6      10
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss Coef
                  1     184     .013      .013          0                  .2                 1
Number of Barrels =  4
Upstream   Elevation =  2839
Centerline Stations
    Sta.    Sta.    Sta.    Sta.
     202     213     224     235
Downstream Elevation =  2838
Centerline Stations
    Sta.    Sta.    Sta.    Sta.
     229     240     251     262

CULVERT OUTPUT  Profile #PF 1  Culv Group:  Culvert #1

  Q Culv Group (cfs)        1974.00    Culv Full Len (ft)
  # Barrels                       4    Culv Vel US (ft/s)          11.67
  Q Barrel (cfs)             493.50    Culv Vel DS (ft/s)          13.47
  E.G. US. (ft)             2845.85    Culv Inv El Up (ft)       2839.00
  W.S. US. (ft)             2844.91    Culv Inv El Dn (ft)       2838.00
  E.G. DS (ft)              2844.05    Culv Frctn Ls (ft)           0.86
  W.S. DS (ft)              2842.02    Culv Exit Loss (ft)          0.44
  Delta EG (ft)                1.81    Culv Entr Loss (ft)          0.51
  Delta WS (ft)                2.90    Q Weir (cfs)
  E.G. IC (ft)              2845.85    Weir Sta Lft (ft)
  E.G. OC (ft)              2845.77    Weir Sta Rgt (ft)
  Culvert Control             Inlet    Weir Submerg
  Culv WS Inlet (ft)        2843.23    Weir Max Depth (ft)
```

PB Proj. No. 11515
Este Wash
Prop 4-10'X6' RCBC's with FEMA Flow

Culv WS Outlet (ft)	2841.67	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	3.58	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	4.23	Min El Weir Flow (ft)	

Note: The flow in the culvert is entirely supercritical.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2975

INPUT
Description: AS
Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2845.5	8	2845	25	2844	62	2843	100	2842.5
108	2842.5	130	2842.7	150	2842	190	2841	210	2840
220	2839	223	2838	240	2838	268	2838	275	2840.8
305	2841	342	2842	356	2843	372	2844	390	2844.2
405	2844	427	2845	460	2845.2				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	100	.025	108	.06	240	.04	268	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
223	268	270	180	110	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	224		T
267	460		T

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2844.05	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.03	Wt. n-Val.		0.046	
W.S. Elev (ft)	2842.02	Reach Len. (ft)	270.00	180.00	110.00
Crit W.S. (ft)	2842.02	Flow Area (sq ft)		172.71	
E.G. Slope (ft/ft)	0.019322	Area (sq ft)	86.72	180.75	70.93
Q Total (cfs)	1974.00	Flow (cfs)		1974.00	
Top Width (ft)	192.71	Top Width (ft)	73.47	45.00	74.23
Vel Total (ft/s)	11.43	Avg. Vel. (ft/s)		11.43	
Max Chl Dpth (ft)	4.02	Hydr. Depth (ft)		4.02	
Conv. Total (cfs)	14201.2	Conv. (cfs)		14201.2	
Length Wtd. (ft)	176.00	Wetted Per. (ft)		43.00	
Min Ch El (ft)	2838.00	Shear (lb/sq ft)		4.85	
Alpha	1.00	Stream Power (lb/ft s)		55.38	
Frctn Loss (ft)	1.98	Cum Volume (acre-ft)	7.33	10.34	11.72
C & E Loss (ft)	0.56	Cum SA (acres)	5.83	3.78	9.20

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2795

INPUT
Description: AR
Station Elevation Data num= 20

PB Proj. No. 11515
Este Wash
Prop 4-10'X6' RCBC's with FEMA Flow

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2847	38	2846	72	2844	128	2842	160	2840
252	2838	260	2836.9	270	2837.8	283	2836.5	308	2836.5
320	2837.5	330	2837.2	343	2837.2	360	2838.5	380	2838.3
413	2839	440	2840	482	2842	510	2843	555	2844

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	252	.028	320	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
252	320	360	300	250	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
395	555		T

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2840.46	Element			
Vel Head (ft)	0.91	Wt. n-Val.	0.060	0.028	0.060
W.S. Elev (ft)	2839.55	Reach Len. (ft)	360.00	300.00	250.00
Crit W.S. (ft)	2839.55	Flow Area (sq ft)	55.33	176.92	120.89
E.G. Slope (ft/ft)	0.007371	Area (sq ft)	55.33	176.92	138.35
Q Total (cfs)	1974.00	Flow (cfs)	99.29	1521.53	353.18
Top Width (ft)	247.22	Top Width (ft)	71.35	68.00	107.88
Vel Total (ft/s)	5.59	Avg. Vel. (ft/s)	1.79	8.60	2.92
Max Chl Dpth (ft)	3.05	Hydr. Depth (ft)	0.78	2.60	1.61
Conv. Total (cfs)	22992.3	Conv. (cfs)	1156.5	17722.1	4113.7
Length Wtd. (ft)	295.90	Wetted Per. (ft)	71.36	68.22	75.06
Min Ch El (ft)	2836.50	Shear (lb/sq ft)	0.36	1.19	0.74
Alpha	1.88	Stream Power (lb/ft s)	0.64	10.26	2.17
Frctn Loss (ft)	1.95	Cum Volume (acre-ft)	6.89	9.60	11.45
C & E Loss (ft)	0.09	Cum SA (acres)	5.38	3.55	8.97

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2495

INPUT
Description: AQ
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2846	10	2842	15	2840.8	20	2841.3	48	2841.1
87	2840	120	2838	160	2836	198	2834	210	2833.4
237	2834.1	246	2832.5	280	2833	290	2833.8	310	2833.8
320	2833.2	326	2834	450	2836	496	2837	536	2838

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.04	10	.016	48	.06	246	.025	280	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
237	290	175	155	130	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
410	536		T

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2836.52	Element			
Vel Head (ft)	0.63	Wt. n-Val.	0.060	0.030	0.060
W.S. Elev (ft)	2835.89	Reach Len. (ft)	175.00	155.00	130.00
Crit W.S. (ft)	2835.72	Flow Area (sq ft)	118.04	155.00	181.38

PB Proj. No. 11515
Este Wash
Prop 4-10'X6' RCBC's with FEMA Flow

E.G. Slope (ft/ft)	0.005905	Area (sq ft)	118.04	155.00	190.28
Q Total (cfs)	1974.00	Flow (cfs)	303.97	1215.62	454.40
Top Width (ft)	281.14	Top Width (ft)	74.92	53.00	153.22
Vel Total (ft/s)	4.34	Avg. Vel. (ft/s)	2.58	7.84	2.51
Max Chl Dpth (ft)	3.39	Hydr. Depth (ft)	1.58	2.92	1.51
Conv. Total (cfs)	25687.8	Conv. (cfs)	3955.6	15819.0	5913.2
Length Wtd. (ft)	156.20	Wetted Per. (ft)	75.00	53.18	120.08
Min Ch El (ft)	2832.50	Shear (lb/sq ft)	0.58	1.07	0.56
Alpha	2.14	Stream Power (lb/ft s)	1.49	8.43	1.40
Frctn Loss (ft)	1.15	Cum Volume (acre-ft)	6.18	8.46	10.51
C & E Loss (ft)	0.06	Cum SA (acres)	4.77	3.13	8.22

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2340

INPUT
Description:
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2836	49	2837.7	62	2837	77	2836	84	2835
101	2832	115	2831.4	145	2831.1	165	2831	167	2830.8
183	2830.8	186	2831	193	2832	220	2832	258	2832.2
264	2833								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	165	.025	186	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
165	186	60	45	20	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	85		T
217	264		T

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2835.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.24	Wt. n-Val.	0.060	0.025	0.060
W.S. Elev (ft)	2834.07	Reach Len. (ft)	60.00	45.00	20.00
Crit W.S. (ft)	2834.07	Flow Area (sq ft)	190.36	68.18	67.69
E.G. Slope (ft/ft)	0.009365	Area (sq ft)	190.36	68.18	157.60
Q Total (cfs)	1974.00	Flow (cfs)	841.97	859.42	272.61
Top Width (ft)	174.73	Top Width (ft)	75.73	21.00	78.00
Vel Total (ft/s)	6.05	Avg. Vel. (ft/s)	4.42	12.61	4.03
Max Chl Dpth (ft)	3.27	Hydr. Depth (ft)	2.51	3.25	2.18
Conv. Total (cfs)	20398.2	Conv. (cfs)	8700.4	8880.8	2817.0
Length Wtd. (ft)	46.47	Wetted Per. (ft)	75.93	21.02	31.07
Min Ch El (ft)	2830.80	Shear (lb/sq ft)	1.47	1.90	1.27
Alpha	2.18	Stream Power (lb/ft s)	6.48	23.91	5.13
Frctn Loss (ft)	0.18	Cum Volume (acre-ft)	5.56	8.06	9.99
C & E Loss (ft)	0.37	Cum SA (acres)	4.47	3.00	7.87

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

PB Proj. No. 11515
Este Wash
Prop 4-10'X6' RCBC's with FEMA Flow

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2300

INPUT
Description:
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
2	2831	29	2830.6	45	2828	71	2828	103	2828
128	2832	164	2832.2						

Manning's n Values num= 1

Sta	n Val
2	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
45	103	6	6	6	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
2	45		T
103	164		T

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2834.53	Element			
Vel Head (ft)	0.49	Wt. n-Val.		0.040	
W.S. Elev (ft)	2834.04	Reach Len. (ft)	6.00	6.00	6.00
Crit W.S. (ft)	2831.29	Flow Area (sq ft)		350.35	
E.G. Slope (ft/ft)	0.002091	Area (sq ft)	163.34	350.35	170.87
Q Total (cfs)	1974.00	Flow (cfs)		1974.00	
Top Width (ft)	162.00	Top Width (ft)	43.00	58.00	61.00
Vel Total (ft/s)	5.63	Avg. Vel. (ft/s)		5.63	
Max Chl Dpth (ft)	6.04	Hydr. Depth (ft)		6.04	
Conv. Total (cfs)	43167.3	Conv. (cfs)		43167.3	
Length Wtd. (ft)	6.00	Wetted Per. (ft)		58.00	
Min Ch El (ft)	2828.00	Shear (lb/sq ft)		0.79	
Alpha	1.00	Stream Power (lb/ft s)		4.44	
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	5.31	7.84	9.91
C & E Loss (ft)	0.13	Cum SA (acres)	4.39	2.96	7.84

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: Este Wash
REACH: 1 RS: 2295

INPUT
Description: AP2
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2836.8	15	2836	40	2832	46	2831	65	2830.8
82	2831	99	2827.54	120	2827.54	142	2827.54	160	2831.5
165	2831.9	183	2831.8	215	2832	280	2833	340	2834
380	2835	410	2836	428	2836				

Manning's n Values num= 1

Sta	n Val
0	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
99	142	149	149	149	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	99		T
142	428		T

PB Proj. No. 11515
Este Wash
Prop 4-10'X6' RCBC's with FEMA Flow
CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2834.38	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.94	Wt. n-Val.		0.040	
W.S. Elev (ft)	2833.44	Reach Len. (ft)	149.00	149.00	149.00
Crit W.S. (ft)	2831.56	Flow Area (sq ft)		253.85	
E.G. Slope (ft/ft)	0.004107	Area (sq ft)	180.69	253.85	224.66
Q Total (cfs)	1974.00	Flow (cfs)		1974.00	
Top Width (ft)	275.64	Top Width (ft)	68.02	43.00	164.62
Vel Total (ft/s)	7.78	Avg. Vel. (ft/s)		7.78	
Max Chl Dpth (ft)	5.90	Hydr. Depth (ft)		5.90	
Conv. Total (cfs)	30803.1	Conv. (cfs)		30803.1	
Length Wtd. (ft)	149.00	Wetted Per. (ft)		43.00	
Min Ch El (ft)	2827.54	Shear (lb/sq ft)		1.51	
Alpha	1.00	Stream Power (lb/ft s)		11.77	
Frctn Loss (ft)		Cum Volume (acre-ft)	5.29	7.80	9.89
C & E Loss (ft)		Cum SA (acres)	4.38	2.95	7.83

CULVERT

RIVER: Este Wash
REACH: 1 RS: 2220

INPUT
Description: 4-10'x6' RCBC
Distance from Upstream XS = 10
Deck/Roadway Width = 100
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 2

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2836		270	2839	

Upstream Bridge Cross Section Data
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2836.8	15	2836	40	2832	46	2831	65	2830.8
82	2831	99	2827.54	120	2827.54	142	2827.54	160	2831.5
165	2831.9	183	2831.8	215	2832	280	2833	340	2834
380	2835	410	2836	428	2836				

Manning's n Values num= 1

Sta	n Val
0	.04

Bank Sta: Left	Right	Coeff Contr.	Expan.
99	142	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	99		T
142	428		T

Downstream Deck/Roadway Coordinates
num= 2

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2836		270	2839	

Downstream Bridge Cross Section Data
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2831	30	2831	45	2826.5	66	2826.5	88	2826.5
103	2831	120	2831						

Manning's n Values num= 1

Sta	n Val
0	.04

Bank Sta: Left	Right	Coeff Contr.	Expan.
45	88	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	45		T

PB Proj. No. 11515
Este Wash
Prop 4-10'X6' RCBC's with FEMA Flow

88	120	T

Upstream Embankment side slope = 4 horiz. to 1.0 vertical
Downstream Embankment side slope = 4 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Box	6	10

FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG

Culvert Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
5	140	.013	.013	0	.2	1

Number of Barrels = 4
Upstream Elevation = 2827.54
Centerline Stations

Sta.	Sta.	Sta.	Sta.
104	115	126	137

Downstream Elevation = 2826.5
Centerline Stations

Sta.	Sta.	Sta.	Sta.
50	61	72	83

CULVERT OUTPUT Profile #PF 1 Culv Group: Culvert #1

Q Culv Group (cfs)	1974.00	Culv Full Len (ft)	
# Barrels	4	Culv Vel US (ft/s)	11.67
Q Barrel (cfs)	493.50	Culv Vel DS (ft/s)	14.37
E.G. US. (ft)	2834.39	Culv Inv El Up (ft)	2827.54
W.S. US. (ft)	2833.44	Culv Inv El Dn (ft)	2826.50
E.G. DS (ft)	2832.55	Culv Frctn Ls (ft)	0.74
W.S. DS (ft)	2830.52	Culv Exit Loss (ft)	0.60
Delta EG (ft)	1.84	Culv Entr Loss (ft)	0.50
Delta WS (ft)	2.93	Q Weir (cfs)	
E.G. IC (ft)	2834.39	Weir Sta Lft (ft)	
E.G. OC (ft)	2834.31	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	2831.77	Weir Max Depth (ft)	
Culv WS Outlet (ft)	2829.93	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	3.21	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	4.23	Min El Weir Flow (ft)	

Note: The flow in the culvert is entirely supercritical.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2146

INPUT
Description:
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2831	30	2831	45	2826.5	66	2826.5	88	2826.5
103	2831	120	2831						

Manning's n Values num= 1

Sta	n Val
0	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
45	88	230	210	200	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	45		T
88	120		T

PB Proj. No. 11515
Este Wash
Prop 4-10'X6' RCBC's with FEMA Flow

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2832.55	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.03	Wt. n-Val.		0.040	
W.S. Elev (ft)	2830.52	Reach Len. (ft)	230.00	210.00	200.00
Crit W.S. (ft)	2830.52	Flow Area (sq ft)		172.71	
E.G. Slope (ft/ft)	0.014826	Area (sq ft)	26.89	172.71	26.89
Q Total (cfs)	1974.00	Flow (cfs)		1974.00	
Top Width (ft)	69.78	Top Width (ft)	13.39	43.00	13.39
Vel Total (ft/s)	11.43	Avg. Vel. (ft/s)		11.43	
Max Chl Dpth (ft)	4.02	Hydr. Depth (ft)		4.02	
Conv. Total (cfs)	16211.9	Conv. (cfs)		16211.9	
Length Wtd. (ft)	212.43	Wetted Per. (ft)		43.00	
Min Ch El (ft)	2826.50	Shear (lb/sq ft)		3.72	
Alpha	1.00	Stream Power (lb/ft s)		42.49	
Frctn Loss (ft)	2.41	Cum Volume (acre-ft)	4.94	7.07	9.46
C & E Loss (ft)	0.49	Cum SA (acres)	4.24	2.80	7.52

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2000

INPUT
Description:
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2835	.1	2831	50	2830	98	2828	170	2826
220	2824.5	225	2823.2	245	2823.2	248	2824	260	2826
295	2828	390	2830	420	2832				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	225	.025	245	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
220	248	100	135	150	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2828.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.05	Wt. n-Val.	0.060	0.037	0.060
W.S. Elev (ft)	2827.73	Reach Len. (ft)	100.00	135.00	150.00
Crit W.S. (ft)	2827.73	Flow Area (sq ft)	177.51	122.30	58.81
E.G. Slope (ft/ft)	0.008968	Area (sq ft)	177.51	122.30	58.81
Q Total (cfs)	1974.00	Flow (cfs)	565.22	1237.32	171.46
Top Width (ft)	182.38	Top Width (ft)	112.17	28.00	42.22
Vel Total (ft/s)	5.50	Avg. Vel. (ft/s)	3.18	10.12	2.92
Max Chl Dpth (ft)	4.53	Hydr. Depth (ft)	1.58	4.37	1.39
Conv. Total (cfs)	20845.1	Conv. (cfs)	5968.6	13065.9	1810.6
Length Wtd. (ft)	127.86	Wetted Per. (ft)	112.21	28.27	42.43
Min Ch El (ft)	2823.20	Shear (lb/sq ft)	0.89	2.42	0.78
Alpha	2.24	Stream Power (lb/ft s)	2.82	24.50	2.26
Frctn Loss (ft)	1.25	Cum Volume (acre-ft)	4.40	6.36	9.26
C & E Loss (ft)	0.01	Cum SA (acres)	3.91	2.63	7.39

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

PB Proj. No. 11515
Este Wash
Prop 4-10'X6' RCBC's with FEMA Flow

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 1865

INPUT
Description: AO
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2835	.1	2829	35	2828	105	2826	173	2824
203	2822	207	2821.5	222	2821.5	242	2822	252	2824
273	2826	292	2828	335	2830	360	2830.5		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	207	.025	222	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
203	242	375	400	440	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2826.70	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.19	Wt. n-Val.	0.060	0.038	0.060
W.S. Elev (ft)	2825.51	Reach Len. (ft)	375.00	400.00	440.00
Crit W.S. (ft)	2825.51	Flow Area (sq ft)	114.18	150.45	37.11
E.G. Slope (ft/ft)	0.010645	Area (sq ft)	114.18	150.45	37.11
Q Total (cfs)	1974.00	Flow (cfs)	365.35	1488.89	119.76
Top Width (ft)	146.26	Top Width (ft)	81.39	39.00	25.87
Vel Total (ft/s)	6.54	Avg. Vel. (ft/s)	3.20	9.90	3.23
Max Chl Dpth (ft)	4.01	Hydr. Depth (ft)	1.40	3.86	1.43
Conv. Total (cfs)	19133.0	Conv. (cfs)	3541.1	14431.1	1160.8
Length Wtd. (ft)	396.45	Wetted Per. (ft)	81.48	39.04	26.14
Min Ch El (ft)	2821.50	Shear (lb/sq ft)	0.93	2.56	0.94
Alpha	1.79	Stream Power (lb/ft s)	2.98	25.35	3.04
Frctn Loss (ft)	4.26	Cum Volume (acre-ft)	4.06	5.94	9.09
C & E Loss (ft)	0.11	Cum SA (acres)	3.69	2.53	7.28

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 1465

INPUT
Description: AN
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2827	.1	2821	15	2820	65	2818.2	95	2819
133	2819	180	2818	199	2816.3	240	2816.3	242	2818
248	2820	290	2822	290.1	2828				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	199	.028	240	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
180	242	280	290	320	.1	.3

Ineffective Flow num= 1

PB Proj. No. 11515
Este Wash
Prop 4-10'X6' RCBC's with FEMA Flow

Sta L	Sta R	Elev	Permanent
0	133	2819	F

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2820.56	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.80	Wt. n-Val.	0.060	0.042	0.080
W.S. Elev (ft)	2819.76	Reach Len. (ft)	280.00	290.00	320.00
Crit W.S. (ft)	2819.76	Flow Area (sq ft)	156.16	196.46	4.63
E.G. Slope (ft/ft)	0.010866	Area (sq ft)	156.16	196.46	4.63
Q Total (cfs)	1974.00	Flow (cfs)	399.52	1566.55	7.93
Top Width (ft)	225.51	Top Width (ft)	158.24	62.00	5.27
Vel Total (ft/s)	5.53	Avg. Vel. (ft/s)	2.56	7.97	1.71
Max Chl Dpth (ft)	3.46	Hydr. Depth (ft)	0.99	3.17	0.88
Conv. Total (cfs)	18937.2	Conv. (cfs)	3832.7	15028.4	76.1
Length Wtd. (ft)	291.97	Wetted Per. (ft)	158.29	62.70	5.55
Min Ch El (ft)	2816.30	Shear (lb/sq ft)	0.67	2.13	0.57
Alpha	1.70	Stream Power (lb/ft s)	1.71	16.95	0.97
Frctn Loss (ft)	3.72	Cum Volume (acre-ft)	2.90	4.34	8.88
C & E Loss (ft)	0.06	Cum SA (acres)	2.66	2.07	7.12

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 1175

INPUT
Description: AM
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2824	.1	2818	50	2814	60	2813	69	2814
90	2814.5	108	2814	170	2812.7	197	2812.7	222	2813.9
238	2813.9	288	2813.3	323	2814	410	2816	410.1	2822

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	170	.022	197	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
108	222	365	360	360	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2815.49	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.59	Wt. n-Val.	0.060	0.037	0.060
W.S. Elev (ft)	2814.90	Reach Len. (ft)	365.00	360.00	360.00
Crit W.S. (ft)	2814.90	Flow Area (sq ft)	56.62	194.88	141.60
E.G. Slope (ft/ft)	0.015158	Area (sq ft)	56.62	194.88	141.60
Q Total (cfs)	1974.00	Flow (cfs)	150.87	1387.95	435.18
Top Width (ft)	323.07	Top Width (ft)	69.16	114.00	139.91
Vel Total (ft/s)	5.02	Avg. Vel. (ft/s)	2.66	7.12	3.07
Max Chl Dpth (ft)	2.19	Hydr. Depth (ft)	0.82	1.71	1.01
Conv. Total (cfs)	16033.7	Conv. (cfs)	1225.5	11273.5	3534.7
Length Wtd. (ft)	360.25	Wetted Per. (ft)	69.31	114.04	139.93
Min Ch El (ft)	2812.70	Shear (lb/sq ft)	0.77	1.62	0.96
Alpha	1.52	Stream Power (lb/ft s)	2.06	11.52	2.94
Frctn Loss (ft)	5.20	Cum Volume (acre-ft)	2.21	3.04	8.35
C & E Loss (ft)	0.00	Cum SA (acres)	1.92	1.48	6.59

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross

section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 815

INPUT
Description: AL
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2816	.1	2810	92	2808	112	2807	140	2807
150	2808	212	2808	232	2807	262	2808	315	2806.8
365	2808	382	2814						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	112	.022	140	.06	315	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
92	150	390	390	420	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2809.64	Element			
Vel Head (ft)	0.63	Wt. n-Val.	0.060	0.029	0.065
W.S. Elev (ft)	2809.02	Reach Len. (ft)	390.00	390.00	420.00
Crit W.S. (ft)	2809.02	Flow Area (sq ft)	23.77	101.99	306.94
E.G. Slope (ft/ft)	0.013756	Area (sq ft)	23.77	101.99	306.94
Q Total (cfs)	1974.00	Flow (cfs)	43.98	888.51	1041.51
Top Width (ft)	322.62	Top Width (ft)	46.74	58.00	217.88
Vel Total (ft/s)	4.56	Avg. Vel. (ft/s)	1.85	8.71	3.39
Max Chl Dpth (ft)	2.22	Hydr. Depth (ft)	0.51	1.76	1.41
Conv. Total (cfs)	16830.6	Conv. (cfs)	374.9	7575.5	8880.1
Length Wtd. (ft)	404.90	Wetted Per. (ft)	46.75	58.07	218.13
Min Ch El (ft)	2807.00	Shear (lb/sq ft)	0.44	1.51	1.21
Alpha	1.94	Stream Power (lb/ft s)	0.81	13.14	4.10
Frctn Loss (ft)	3.55	Cum Volume (acre-ft)	1.88	1.81	6.49
C & E Loss (ft)	0.00	Cum SA (acres)	1.44	0.77	5.11

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 425

INPUT
Description: AK
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2803	10	2802	72	2800	73	2799.2	105	2799.2
115	2800	150	2801	180	2800	270	2800.5	350	2801.3
410	2799.9	425	2802	430	2802.2				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	72	.025	150	.08

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

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72	115	450	425	405	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2802.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.62	Wt. n-Val.	0.080	0.025	0.063
W.S. Elev (ft)	2801.90	Reach Len. (ft)	450.00	425.00	405.00
Crit W.S. (ft)	2801.90	Flow Area (sq ft)	56.09	111.80	412:51
E.G. Slope (ft/ft)	0.006085	Area (sq ft)	56.09	111.80	412.51
Q Total (cfs)	1974.00	Flow (cfs)	78.58	975.44	919.98
Top Width (ft)	411.28	Top Width (ft)	58.97	43.00	309.30
Vel Total (ft/s)	3.40	Avg. Vel. (ft/s)	1.40	8.72	2.23
Max Chl Dpth (ft)	2.70	Hydr. Depth (ft)	0.95	2.60	1.33
Conv. Total (cfs)	25305.2	Conv. (cfs)	1007.3	12504.5	11793.4
Length Wtd. (ft)	424.29	Wetted Per. (ft)	59.00	43.31	309.49
Min Ch El (ft)	2799.20	Shear (lb/sq ft)	0.36	0.98	0.51
Alpha	3.46	Stream Power (lb/ft s)	0.51	8.56	1.13
Frctn Loss (ft)	3.28	Cum Volume (acre-ft)	1.52	0.86	3.02
C & E Loss (ft)	0.00	Cum SA (acres)	0.97	0.32	2.57

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 0

INPUT
Description: AJ
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2798	21	2794	31	2793	144	2793	145	2792
165	2792	166	2793	197	2794	240	2794	276	2793.3
300	2794	332	2794.3	365	2794	420	2795.2		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	31	.06	145	.022	165	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
144	166	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2795.57	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.61	Wt. n-Val.	0.061	0.030	0.080
W.S. Elev (ft)	2794.96	Reach Len. (ft)			
Crit W.S. (ft)	2794.96	Flow Area (sq ft)	238.06	64.04	238.07
E.G. Slope (ft/ft)	0.010145	Area (sq ft)	238.06	64.04	238.07
Q Total (cfs)	1974.00	Flow (cfs)	896.93	637.60	439.47
Top Width (ft)	392.87	Top Width (ft)	128.02	22.00	242.84
Vel Total (ft/s)	3.65	Avg. Vel. (ft/s)	3.77	9.96	1.85
Max Chl Dpth (ft)	2.96	Hydr. Depth (ft)	1.86	2.91	0.98
Conv. Total (cfs)	19598.3	Conv. (cfs)	8904.9	6330.3	4363.2
Length Wtd. (ft)		Wetted Per. (ft)	128.16	22.83	242.89
Min Ch El (ft)	2792.00	Shear (lb/sq ft)	1.18	1.78	0.62
Alpha	2.94	Stream Power (lb/ft s)	4.43	17.69	1.15
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth). Water surface set to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

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SUMMARY OF MANNING'S N VALUES

River:Este Wash

Reach	River Sta.	n1	n2	n3	n4	n5
1	4085	.08	.022	.06		
1	3810	.06	.022	.06		
1	3640	.06	.022	.08		
1	3490	.08	.06	.022	.06	
1	3350	.08	.06	.028	.06	
1	3230	.08	.025	.08		
1	3166	.04				
1	3160	.08	.04	.08		
1	3050	Culvert				
1	2975	.06	.025	.06	.04	.06
1	2795	.06	.028	.06		
1	2495	.04	.016	.06	.025	.06
1	2340	.06	.025	.06		
1	2300	.04				
1	2295	.04				
1	2220	Culvert				
1	2146	.04				
1	2000	.06	.025	.06		
1	1865	.06	.025	.06		
1	1465	.06	.028	.08		
1	1175	.06	.022	.06		
1	815	.06	.022	.06	.08	
1	425	.08	.025	.08		
1	0	.08	.06	.022	.08	

SUMMARY OF REACH LENGTHS

River: Este Wash

Reach	River Sta.	Left	Channel	Right
1	4085	250	275	260
1	3810	155	170	180
1	3640	90	150	205
1	3490	90	140	190
1	3350	135	120	115
1	3230	94	64	44
1	3166	6	6	6
1	3160	185	185	185
1	3050	Culvert		
1	2975	270	180	110
1	2795	360	300	250
1	2495	175	155	130
1	2340	60	45	20
1	2300	6	6	6
1	2295	149	149	149
1	2220	Culvert		
1	2146	230	210	200
1	2000	100	135	150
1	1865	375	400	440
1	1465	280	290	320
1	1175	365	360	360
1	815	390	390	420
1	425	450	425	405
1	0			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Este Wash

Reach	River Sta.	Contr.	Expan.

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1	4085		.1	.3
1	3810		.1	.3
1	3640		.1	.3
1	3490		.1	.3
1	3350		.1	.3
1	3230		.3	.5
1	3166		.3	.5
1	3160		.3	.5
1	3050	Culvert		
1	2975		.3	.5
1	2795		.1	.3
1	2495		.1	.3
1	2340		.3	.5
1	2300		.3	.5
1	2295		.3	.5
1	2220	Culvert		
1	2146		.3	.5
1	2000		.1	.3
1	1865		.1	.3
1	1465		.1	.3
1	1175		.1	.3
1	815		.1	.3
1	425		.1	.3
1	0		.1	.3

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Prop 4-10'X6' RCBC's with FEMA Flow
Profile Output Table - Standard Table 1

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	4085	1974.00	2856.40	2859.33	2859.33	2860.08	0.019136	10.19	350.99	206.64	1.09
1	3810	1974.00	2852.70	2855.60	2855.60	2856.33	0.010423	8.67	398.08	244.89	0.97
1	3640	1974.00	2850.80	2852.77	2852.51	2853.23	0.012894	7.89	437.17	286.34	1.07
1	3490	1974.00	2849.20	2850.52	2850.50	2851.00	0.033340	8.27	402.70	404.20	1.40
1	3350	1974.00	2847.60	2849.27	2848.46	2849.43	0.005413	4.81	704.61	433.63	0.72
1	3230	1974.00	2845.50	2847.27	2847.27	2848.03	0.033711	9.96	344.32	303.45	1.38
1	3166	1974.00	2839.00	2845.54	2842.41	2846.01	0.001786	5.49	359.59	112.38	0.38
1	3160	1974.00	2839.00	2844.91	2843.02	2845.85	0.004086	7.76	254.24	231.94	0.56
1	3050	Culvert									
1	2975	1974.00	2838.00	2842.02	2842.02	2844.05	0.019322	11.43	172.71	192.71	1.00
1	2795	1974.00	2836.50	2839.55	2839.55	2840.46	0.007371	8.60	353.14	247.22	0.94
1	2495	1974.00	2832.50	2835.89	2835.72	2836.52	0.005905	7.84	454.42	281.14	0.81
1	2340	1974.00	2830.80	2834.07	2834.07	2835.31	0.009365	12.61	326.23	174.73	1.23
1	2300	1974.00	2828.00	2834.04	2831.29	2834.53	0.002091	5.63	350.35	162.00	0.40
1	2295	1974.00	2827.54	2833.44	2831.56	2834.38	0.004107	7.78	253.85	275.64	0.56
1	2220	Culvert									
1	2146	1974.00	2826.50	2830.52	2830.52	2832.55	0.014826	11.43	172.71	69.78	1.00
1	2000	1974.00	2823.20	2827.73	2827.73	2828.78	0.008968	10.12	358.63	182.38	0.85
1	1865	1974.00	2821.50	2825.51	2825.51	2826.70	0.010645	9.90	301.74	146.26	0.89
1	1465	1974.00	2816.30	2819.76	2819.76	2820.56	0.010866	7.97	357.25	225.51	0.79
1	1175	1974.00	2812.70	2814.90	2814.90	2815.49	0.015158	7.12	393.11	323.07	0.96
1	815	1974.00	2807.00	2809.02	2809.02	2809.64	0.013756	8.71	432.70	322.62	1.16
1	425	1974.00	2799.20	2801.90	2801.90	2802.52	0.006085	8.72	580.41	411.28	0.95
1	0	1974.00	2792.00	2794.96	2794.96	2795.57	0.010145	9.96	540.17	392.87	1.03

PB Proj. No. 11515
Este Wash
Prop 4-10'X6' RCBC's with FEMA Flow
Profile Output Table - Standard Table 2

Reach	River Sta	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
1	4085	2860.08	2859.33	0.75	3.65	0.01	8.52	642.22	1323.26	206.64
1	3810	2856.33	2855.60	0.73	1.87	0.08	832.63	1120.51	20.87	244.89
1	3640	2853.23	2852.77	0.46	2.23	0.00	1341.10	590.23	42.67	286.34
1	3490	2851.00	2850.52	0.47	1.47	0.09	1341.02	361.34	271.64	404.20
1	3350	2849.43	2849.27	0.16	1.34	0.06	516.71	342.47	1114.82	433.63
1	3230	2848.03	2847.27	0.76	0.30	0.15	490.88	664.88	818.23	303.45
1	3166	2846.01	2845.54	0.47	0.02	0.14		1974.00		112.38
1	3160	2845.85	2844.91	0.94				1974.00		231.94
1	3050	Culvert								
1	2975	2844.05	2842.02	2.03	1.98	0.56		1974.00		192.71
1	2795	2840.46	2839.55	0.91	1.95	0.09	99.29	1521.53	353.18	247.22
1	2495	2836.52	2835.89	0.63	1.15	0.06	303.97	1215.62	454.40	281.14
1	2340	2835.31	2834.07	1.24	0.18	0.37	841.97	859.42	272.61	174.73
1	2300	2834.53	2834.04	0.49	0.02	0.13		1974.00		162.00
1	2295	2834.38	2833.44	0.94				1974.00		275.64
1	2220	Culvert								
1	2146	2832.55	2830.52	2.03	2.41	0.49		1974.00		69.78
1	2000	2828.78	2827.73	1.05	1.25	0.01	565.22	1237.32	171.46	182.38
1	1865	2826.70	2825.51	1.19	4.26	0.11	365.35	1488.89	119.76	146.26
1	1465	2820.56	2819.76	0.80	3.72	0.06	399.52	1566.55	7.93	225.51
1	1175	2815.49	2814.90	0.59	5.20	0.00	150.87	1387.95	435.18	323.07
1	815	2809.64	2809.02	0.63	3.55	0.00	43.98	888.51	1041.51	322.62
1	425	2802.52	2801.90	0.62	3.28	0.00	78.58	975.44	919.98	411.28
1	0	2795.57	2794.96	0.61			896.93	637.60	439.47	392.87

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : Prop FEMA

River: Este Wash Reach: 1 RS: 4085 Profile: PF 1
Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.
River: Este Wash Reach: 1 RS: 3810 Profile: PF 1
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

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River: Este Wash Reach: 1 RS: 3640 Profile: PF 1
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

River: Este Wash Reach: 1 RS: 3490 Profile: PF 1
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

River: Este Wash Reach: 1 RS: 3350 Profile: PF 1
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

River: Este Wash Reach: 1 RS: 3230 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 3166 Profile: PF 1
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.

River: Este Wash Reach: 1 RS: 3050 Profile: PF 1 Culv: Culvert #1
Note: The flow in the culvert is entirely supercritical.

River: Este Wash Reach: 1 RS: 2975 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
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.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2795 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2495 Profile: PF 1
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate

the need for additional cross sections.

River: Este Wash Reach: 1 RS: 2340 Profile: PF 1

Warning:The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.

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

Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

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.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2300 Profile: PF 1

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.

River: Este Wash Reach: 1 RS: 2220 Profile: PF 1 Culv: Culvert #1

Note: The flow in the culvert is entirely supercritical.

River: Este Wash Reach: 1 RS: 2146 Profile: PF 1

Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2000 Profile: PF 1

Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

Note: Manning's n values were composited to a single value in the main channel.

River: Este Wash Reach: 1 RS: 1865 Profile: PF 1

Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 1465 Profile: PF 1

Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

Note: Manning's n values were composited to a single value in the main channel.

River: Este Wash Reach: 1 RS: 1175 Profile: PF 1

Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth

for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth.. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 815 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

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.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 425 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 0 Profile: PF 1

Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth). Water surface set to critical depth.

Note: Manning's n values were composited to a single value in the main channel.

PB Proj. No. 11515
Este Wash
Prop 3-10'X6' RCBC's with TSMS Future Flow

```
                    HEC-RAS Version 3.1.3 May 2005
                     U.S. Army Corp 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: Este Wash New Topo HEC2
Project File : EWHEC2TSMS.prj
Run Date and Time: 8/27/2008 2:53:15 PM

Project in English units

Project Description:
88151-02-39
FIS City of Tucson
ESTE WASH
Imported FEMA
Geometry File: .g01
Imported FEMA Geometry File Adjusted Vertically by +2.23
ft to account for Vertical Datum Change: .g02

New Existing Conditions
Geometry File (Project 1' C.I. Topo with PAG 1999 2' C.I. Topo): .g06
Proposed
Conditions Geometry File (3-10'x6' RCBC's at Houghton Rd and 22nd St
crossings): ,g07
Proposed Conditions Geometry File (4-10'x6' RCBC's at
Houghton Rd and 22nd St crossings): ,g05

PLAN DATA

Plan Title: Prop 3 Barrel Boxes wth TSMS Future Flow
Plan File : l:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2TSMS.p02

Geometry Title: Proposed Conditions 3-10'x6' RCBCs
Geometry File : l:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2TSMS.g07

Flow Title : TSMS Future Flow
Flow File : l:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2TSMS.f03

Plan Summary Information:

Number of:	Cross Sections =	22	Multiple Openings =	0
	Culverts =	2	Inline Structures =	0
	Bridges =	0	Lateral Structures =	0

Computational Information

Water surface calculation tolerance	=	0.01
Critical depth calculation tolerance	=	0.01
Maximum number of iterations	=	20
Maximum difference tolerance	=	0.3
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: Subcritical Flow

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Este Wash
Prop 3-10'X6' RCBC's with TSMS Future Flow

FLOW DATA

Flow Title: TSMS Future Flow
Flow File : 1:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2TSMS.f03

Flow Data (cfs)

River	Reach	RS	PF 1
Este Wash	1	4085	1208
Este Wash	1	1465	1256

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Este Wash	1	PF 1	Normal S = 0.0133	Normal S = 0.0133

GEOMETRY DATA

Geometry Title: Proposed Conditions 3-10'x6' RCBCs
Geometry File : 1:\11515\Drainage\HECRAS\ESTE WASH\EWHEC2TSMS.g07

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 4085

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2862.5	9	2862	20	2860	30	2858	33	2856.4
50	2856.4	53	2857.7	80	2857.7	116	2858	127	2857.7
142	2858.1	159	2857.3	173	2857.7	209	2857.5	230	2858

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	33	.022	50	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
30	53	250	275	260	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2859.46	Element			
Vel Head (ft)	0.55	Wt. n-Val.	0.080	0.039	0.060
W.S. Elev (ft)	2858.91	Reach Len. (ft)	250.00	275.00	260.00
Crit W.S. (ft)	2858.91	Flow Area (sq ft)	2.06	53.32	209.02
E.G. Slope (ft/ft)	0.016871	Area (sq ft)	2.06	53.32	209.02
Q Total (cfs)	1208.00	Flow (cfs)	2.89	456.58	748.53
Top Width (ft)	204.54	Top Width (ft)	4.54	23.00	177.00
Vel Total (ft/s)	4.57	Avg. Vel. (ft/s)	1.41	8.56	3.58
Max Chl Dpth (ft)	2.51	Hydr. Depth (ft)	0.45	2.32	1.18
Conv. Total (cfs)	9300.3	Conv. (cfs)	22.3	3515.1	5762.9
Length Wtd. (ft)	265.86	Wetted Per. (ft)	4.63	23.67	177.95
Min Ch El (ft)	2856.40	Shear (lb/sq ft)	0.47	2.37	1.24
Alpha	1.71	Stream Power (lb/ft s)	0.66	20.32	4.43
Frctn Loss (ft)	3.19	Cum Volume (acre-ft)	7.50	10.75	10.25
C & E Loss (ft)	0.00	Cum SA (acres)	7.69	4.89	10.78

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross

section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3810

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2856	8	2854.5	116	2854	150	2854	169	2853.8
183	2854.1	200	2852.7	220	2852.7	235	2854	250	2856
250.1	2862								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	200	.022	220	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
183	235	155	170	180	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2855.72	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.55	Wt. n-Val.	0.060	0.032	0.060
W.S. Elev (ft)	2855.16	Reach Len. (ft)	155.00	170.00	180.00
Crit W.S. (ft)	2855.16	Flow Area (sq ft)	180.49	106.48	5.08
E.G. Slope (ft/ft)	0.008987	Area (sq ft)	180.49	106.48	5.08
Q Total (cfs)	1208.00	Flow (cfs)	426.70	773.03	8.27
Top Width (ft)	239.27	Top Width (ft)	178.54	52.00	8.73
Vel Total (ft/s)	4.14	Avg. Vel. (ft/s)	2.36	7.26	1.63
Max Chl Dpth (ft)	2.46	Hydr. Depth (ft)	1.01	2.05	0.58
Conv. Total (cfs)	12742.5	Conv. (cfs)	4501.0	8154.2	87.2
Length Wtd. (ft)	162.32	Wetted Per. (ft)	178.61	52.11	8.81
Min Ch El (ft)	2852.70	Shear (lb/sq ft)	0.57	1.15	0.32
Alpha	2.09	Stream Power (lb/ft s)	1.34	8.32	0.53
Frctn Loss (ft)	1.66	Cum Volume (acre-ft)	6.97	10.24	9.61
C & E Loss (ft)	0.07	Cum SA (acres)	7.16	4.65	10.23

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3640

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2854	15	2852	38	2851	126	2850.6	173	2851.2
205	2851.8	218	2850.8	238	2850.8	249	2851.8	270	2852
336	2854	360	2856	385	2858	410	2860	495	2862

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	218	.022	238	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
205	249	90	150	205	.1	.3

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CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2852.68	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.32	Wt. n-Val.	0.060	0.030	0.080
W.S. Elev (ft)	2852.37	Reach Len. (ft)	90.00	150.00	205.00
Crit W.S. (ft)	2852.13	Flow Area (sq ft)	254.74	56.88	11.98
E.G. Slope (ft/ft)	0.011751	Area (sq ft)	254.74	56.88	11.98
Q Total (cfs)	1208.00	Flow (cfs)	823.44	372.31	12.26
Top Width (ft)	269.80	Top Width (ft)	192.74	44.00	33.06
Vel Total (ft/s)	3.73	Avg. Vel. (ft/s)	3.23	6.55	1.02
Max Chl Dpth (ft)	1.77	Hydr. Depth (ft)	1.32	1.29	0.36
Conv. Total (cfs)	11143.8	Conv. (cfs)	7596.2	3434.5	113.1
Length Wtd. (ft)	109.27	Wetted Per. (ft)	192.80	44.08	33.07
Min Ch El (ft)	2850.80	Shear (lb/sq ft)	0.97	0.95	0.27
Alpha	1.46	Stream Power (lb/ft s)	3.13	6.20	0.27
Frctn Loss (ft)	2.09	Cum Volume (acre-ft)	6.20	9.92	9.57
C & E Loss (ft)	0.01	Cum SA (acres)	6.50	4.47	10.14

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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3490

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2854	13	2852	42	2850	116	2848.4	240	2849.9
258	2849.2	270	2849.2	280	2849.8	320	2850	350	2850
367	2849.6	388	2850	415	2850	460	2851	480	2851

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	116	.06	258	.022	270	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
240	280	90	140	190	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2850.59	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.38	Wt. n-Val.	0.066	0.034	0.060
W.S. Elev (ft)	2850.20	Reach Len. (ft)	90.00	140.00	190.00
Crit W.S. (ft)	2850.20	Flow Area (sq ft)	205.38	30.88	40.12
E.G. Slope (ft/ft)	0.036653	Area (sq ft)	205.38	30.88	40.12
Q Total (cfs)	1208.00	Flow (cfs)	902.13	224.79	81.08
Top Width (ft)	385.16	Top Width (ft)	200.96	40.00	144.20
Vel Total (ft/s)	4.37	Avg. Vel. (ft/s)	4.39	7.28	2.02
Max Chl Dpth (ft)	1.80	Hydr. Depth (ft)	1.02	0.77	0.28
Conv. Total (cfs)	6309.7	Conv. (cfs)	4712.1	1174.1	423.5
Length Wtd. (ft)	132.94	Wetted Per. (ft)	201.00	40.03	144.21
Min Ch El (ft)	2849.20	Shear (lb/sq ft)	2.34	1.76	0.64
Alpha	1.28	Stream Power (lb/ft s)	10.27	12.85	1.29
Frctn Loss (ft)	1.57	Cum Volume (acre-ft)	5.72	9.77	9.45
C & E Loss (ft)	0.08	Cum SA (acres)	6.09	4.32	9.72

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there

PB Proj. No. 11515
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is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3350

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2854	15	2852	35	2850	75	2848.1	90	2848.2
105	2848	128	2847.3	182	2848.1	198	2847.7	245	2847.6
250	2848	260	2847.9	297	2847.9	357	2846.9	430	2846.6
465	2848	495	2850	525	2850.5				

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	182	.06	245	.028	297	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
245	297	135	120	115	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
465	525		T

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2848.90	Element			
Vel Head (ft)	0.11	Wt. n-Val.	0.070	0.028	0.060
W.S. Elev (ft)	2848.79	Reach Len. (ft)	135.00	120.00	115.00
Crit W.S. (ft)		Flow Area (sq ft)	177.55	46.20	284.19
E.G. Slope (ft/ft)	0.005756	Area (sq ft)	177.55	46.20	288.85
Q Total (cfs)	1208.00	Flow (cfs)	278.17	171.85	757.98
Top Width (ft)	416.31	Top Width (ft)	184.49	52.00	179.83
Vel Total (ft/s)	2.38	Avg. Vel. (ft/s)	1.57	3.72	2.67
Max Chl Dpth (ft)	2.19	Hydr. Depth (ft)	0.96	0.89	1.69
Conv. Total (cfs)	15922.4	Conv. (cfs)	3666.5	2265.2	9990.7
Length Wtd. (ft)	120.32	Wetted Per. (ft)	184.53	52.02	168.04
Min Ch El (ft)	2847.60	Shear (lb/sq ft)	0.35	0.32	0.61
Alpha	1.24	Stream Power (lb/ft s)	0.54	1.19	1.62
Frctn Loss (ft)	1.41	Cum Volume (acre-ft)	5.33	9.65	8.73
C & E Loss (ft)	0.05	Cum SA (acres)	5.69	4.17	9.02

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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3230

INPUT
Description:
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2852	23	2850	32	2848	58	2846	88	2846
100	2845.8	147	2846.1	162	2846	207	2846	210	2845.5
228	2845.5	248	2846	290	2845	305	2845.3	318	2844.9
335	2846	343	2847	365	2850	390	2853		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	210	.025	228	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
207	248	94	64	44	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent

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0	125	T
328	390	T

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2847.45	Element			
Vel Head (ft)	0.59	Wt. n-Val.	0.080	0.037	0.080
W.S. Elev (ft)	2846.86	Reach Len. (ft)	94.00	64.00	44.00
Crit W.S. (ft)	2846.86	Flow Area (sq ft)	68.82	49.86	121.73
E.G. Slope (ft/ft)	0.035508	Area (sq ft)	135.17	49.86	132.24
Q Total (cfs)	1208.00	Flow (cfs)	214.31	430.24	563.45
Top Width (ft)	294.99	Top Width (ft)	160.13	41.00	93.85
Vel Total (ft/s)	5.02	Avg. Vel. (ft/s)	3.11	8.63	4.63
Max Chl Dpth (ft)	1.96	Hydr. Depth (ft)	0.84	1.22	1.52
Conv. Total (cfs)	6410.7	Conv. (cfs)	1137.3	2283.2	2990.1
Length Wtd. (ft)	62.00	Wetted Per. (ft)	82.00	41.05	80.04
Min Ch El (ft)	2845.50	Shear (lb/sq ft)	1.86	2.69	3.37
Alpha	1.51	Stream Power (lb/ft s)	5.79	23.23	15.60
Frctn Loss (ft)	0.23	Cum Volume (acre-ft)	4.84	9.52	8.18
C & E Loss (ft)	0.15	Cum SA (acres)	5.16	4.05	8.65

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 3166

INPUT
Description:
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2844.5	20	2844	34	2839	89	2839	107	2845
117	2846								

Manning's n Values num= 1

Sta	n Val
0	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
34	89	6	6	6	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	42		T
89	117		T

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2845.13	Element			
Vel Head (ft)	0.30	Wt. n-Val.		0.040	
W.S. Elev (ft)	2844.83	Reach Len. (ft)	6.00	6.00	6.00
Crit W.S. (ft)		Flow Area (sq ft)		273.76	
E.G. Slope (ft/ft)	0.001346	Area (sq ft)	58.04	320.36	50.89
Q Total (cfs)	1208.00	Flow (cfs)		1208.00	
Top Width (ft)	106.47	Top Width (ft)	34.00	55.00	17.47
Vel Total (ft/s)	4.41	Avg. Vel. (ft/s)		4.41	
Max Chl Dpth (ft)	5.82	Hydr. Depth (ft)		5.82	
Conv. Total (cfs)	32922.3	Conv. (cfs)		32922.3	
Length Wtd. (ft)	6.00	Wetted Per. (ft)		47.00	
Min Ch El (ft)	2839.00	Shear (lb/sq ft)		0.49	
Alpha	1.00	Stream Power (lb/ft s)		2.16	
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4.64	9.24	8.08
C & E Loss (ft)	0.17	Cum SA (acres)	4.95	3.97	8.60

PB Proj. No. 11515
Este Wash
Prop 3-10'X6' RCBC's with TSMS Future Flow

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
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: Este Wash
REACH: 1 RS: 3160

INPUT
Description:
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2848	10	2846	28	2845	60	2844	73	2844.5
113	2844.7	123	2843.9	140	2844.6	161	2844.6	177	2844
197	2839	240	2839	260	2844	266	2846	280	2847
290	2848	307	2850	322	2852	335	2853		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	177	.04	260	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
197	240	185	185	185	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	208		T
240	335		T

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2844.95	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.85	Wt. n-Val.		0.040	
W.S. Elev (ft)	2844.10	Reach Len. (ft)	185.00	185.00	185.00
Crit W.S. (ft)	2842.53	Flow Area (sq ft)		163.05	
E.G. Slope (ft/ft)	0.004537	Area (sq ft)	52.99	219.09	51.92
Q Total (cfs)	1208.00	Flow (cfs)		1208.00	
Top Width (ft)	98.53	Top Width (ft)	35.24	43.00	20.29
Vel Total (ft/s)	7.41	Avg. Vel. (ft/s)		7.41	
Max Chl Dpth (ft)	5.10	Hydr. Depth (ft)		5.10	
Conv. Total (cfs)	17934.5	Conv. (cfs)		17934.5	
Length Wtd. (ft)	185.00	Wetted Per. (ft)		32.00	
Min Ch El (ft)	2839.00	Shear (lb/sq ft)		1.44	
Alpha	1.00	Stream Power (lb/ft s)		10.69	
Frctn Loss (ft)		Cum Volume (acre-ft)	4.63	9.21	8.08
C & E Loss (ft)		Cum SA (acres)	4.95	3.97	8.60

CULVERT

RIVER: Este Wash
REACH: 1 RS: 3050

INPUT
Description: 3-10'x6' RCBC
Distance from Upstream XS = 7
Deck/Roadway Width = 175
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 2

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2849		460	2846	

Upstream Bridge Cross Section Data
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2848	10	2846	28	2845	60	2844	73	2844.5
113	2844.7	123	2843.9	140	2844.6	161	2844.6	177	2844
197	2839	240	2839	260	2844	266	2846	280	2847

PB Proj. No. 11515
Este Wash
Prop 3-10'X6' RCBC's with TSMS Future Flow

290	2848	307	2850	322	2852	335	2853

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	177	.04	260	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
197	240	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	208		T
240	335		T

Downstream Deck/Roadway Coordinates
num= 2

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2849		460	2846	

Downstream Bridge Cross Section Data
Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2845.5	8	2845	25	2844	62	2843	100	2842.5
108	2842.5	130	2842.7	150	2842	190	2841	210	2840
220	2839	223	2838	240	2838	268	2838	275	2840.8
305	2841	342	2842	356	2843	372	2844	390	2844.2
405	2844	427	2845	460	2845.2				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	100	.025	108	.06	240	.04	268	.06

Bank Sta: Left	Right	Coeff Contr.	Expan.
223	268	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235		T
267	460		T

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Box	6	10

FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	1	184	.013	.013	0	.2	1

Number of Barrels = 3
Upstream Elevation = 2839
Centerline Stations

Sta.	Sta.	Sta.
213	224	235

Downstream Elevation = 2838
Centerline Stations

Sta.	Sta.	Sta.
240	251	262

CULVERT OUTPUT Profile #PF 1 Culv Group: Culvert #1

Q Culv Group (cfs)	1208.00	Culv Full Len (ft)	
# Barrels	3	Culv Vel US (ft/s)	10.90
Q Barrel (cfs)	402.67	Culv Vel DS (ft/s)	12.72
E.G. US. (ft)	2844.95	Culv Inv El Up (ft)	2839.00
W.S. US. (ft)	2844.10	Culv Inv El Dn (ft)	2838.00
E.G. DS (ft)	2843.31	Culv Frctn Ls (ft)	0.86
W.S. DS (ft)	2841.53	Culv Exit Loss (ft)	0.37

PB Proj. No. 11515
Este Wash
Prop 3-10'X6' RCBC's with TSMS Future Flow

Delta EG (ft)	1.64	Culv Entr Loss (ft)	0.41
Delta WS (ft)	2.57	Q Weir (cfs)	
E.G. IC (ft)	2844.95	Weir Sta Lft (ft)	
E.G. OC (ft)	2844.91	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	2842.69	Weir Max Depth (ft)	
Culv WS Outlet (ft)	2841.17	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	3.10	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	3.69	Min El Weir Flow (ft)	2847.65

Note: The flow in the culvert is entirely supercritical.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2975

INPUT
Description: AS
Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2845.5	8	2845	25	2844	62	2843	100	2842.5
108	2842.5	130	2842.7	150	2842	190	2841	210	2840
220	2839	223	2838	240	2838	268	2838	275	2840.8
305	2841	342	2842	356	2843	372	2844	390	2844.2
405	2844	427	2845	460	2845.2				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	100	.025	108	.06	240	.04	268	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
223	268	270	180	110	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235		T
267	460		T

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2843.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.78	Wt. n-Val.		0.042	
W.S. Elev (ft)	2841.53	Reach Len. (ft)	270.00	180.00	110.00
Crit W.S. (ft)	2841.53	Flow Area (sq ft)		112.85	
E.G. Slope (ft/ft)	0.017215	Area (sq ft)	55.42	158.70	38.81
Q Total (cfs)	1208.00	Flow (cfs)		1208.00	
Top Width (ft)	155.55	Top Width (ft)	54.06	45.00	56.48
Vel Total (ft/s)	10.70	Avg. Vel. (ft/s)		10.70	
Max Chl Dpth (ft)	3.53	Hydr. Depth (ft)		3.53	
Conv. Total (cfs)	9207.0	Conv. (cfs)		9207.0	
Length Wtd. (ft)	176.15	Wetted Per. (ft)		32.00	
Min Ch El (ft)	2838.00	Shear (lb/sq ft)		3.79	
Alpha	1.00	Stream Power (lb/ft s)		40.57	
Frctn Loss (ft)	1.92	Cum Volume (acre-ft)	4.40	8.40	7.88
C & E Loss (ft)	0.53	Cum SA (acres)	4.76	3.78	8.43

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

PB Proj. No. 11515
Este Wash
Prop 3-10'X6' RCBC's with TSMS Future Flow

RIVER: Este Wash
REACH: 1 RS: 2795

INPUT
Description: AR
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2847	38	2846	72	2844	128	2842	160	2840
252	2838	260	2836.9	270	2837.8	283	2836.5	308	2836.5
320	2837.5	330	2837.2	343	2837.2	360	2838.5	380	2838.3
413	2839	440	2840	482	2842	510	2843	555	2844

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	252	.028	320	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
252	320	360	300	250	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
395	555		T

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2839.68	Element			
Vel Head (ft)	0.71	Wt. n-Val.	0.060	0.028	0.060
W.S. Elev (ft)	2838.97	Reach Len. (ft)	360.00	300.00	250.00
Crit W.S. (ft)	2838.97	Flow Area (sq ft)	21.76	137.59	77.51
E.G. Slope (ft/ft)	0.007499	Area (sq ft)	21.76	137.59	80.48
Q Total (cfs)	1208.00	Flow (cfs)	28.85	1009.31	169.84
Top Width (ft)	204.45	Top Width (ft)	44.74	68.00	91.71
Vel Total (ft/s)	5.10	Avg. Vel. (ft/s)	1.33	7.34	2.19
Max Chl Dpth (ft)	2.47	Hydr. Depth (ft)	0.49	2.02	1.03
Conv. Total (cfs)	13950.1	Conv. (cfs)	333.2	11655.7	1961.3
Length Wtd. (ft)	297.30	Wetted Per. (ft)	44.75	68.22	75.06
Min Ch El (ft)	2836.50	Shear (lb/sq ft)	0.23	0.94	0.48
Alpha	1.76	Stream Power (lb/ft s)	0.30	6.93	1.06
Frctn Loss (ft)	2.31	Cum Volume (acre-ft)	4.16	7.79	7.73
C & E Loss (ft)	0.01	Cum SA (acres)	4.45	3.55	8.25

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2495

INPUT
Description: AQ
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2846	10	2842	15	2840.8	20	2841.3	48	2841.1
87	2840	120	2838	160	2836	198	2834	210	2833.4
237	2834.1	246	2832.5	280	2833	290	2833.8	310	2833.8
320	2833.2	326	2834	450	2836	496	2837	536	2838

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.04	10	.016	48	.06	246	.025	280	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
237	290	175	155	130	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
410	536		T

PB Proj. No. 11515
Este Wash
Prop 3-10'X6' RCBC's with TSMS Future Flow
CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2835.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.68	Wt. n-Val.	0.060	0.029	0.060
W.S. Elev (ft)	2835.12	Reach Len. (ft)	175.00	155.00	130.00
Crit W.S. (ft)	2835.12	Flow Area (sq ft)	65.72	113.96	90.21
E.G. Slope (ft/ft)	0.008085	Area (sq ft)	65.72	113.96	90.21
Q Total (cfs)	1208.00	Flow (cfs)	155.06	871.73	181.21
Top Width (ft)	218.41	Top Width (ft)	60.21	53.00	105.21
Vel Total (ft/s)	4.48	Avg. Vel. (ft/s)	2.36	7.65	2.01
Max Chl Dpth (ft)	2.62	Hydr. Depth (ft)	1.09	2.15	0.86
Conv. Total (cfs)	13434.3	Conv. (cfs)	1724.4	9694.6	2015.2
Length Wtd. (ft)		Wetted Per. (ft)	60.26	53.18	105.29
Min Ch El (ft)	2832.50	Shear (lb/sq ft)	0.55	1.08	0.43
Alpha	2.17	Stream Power (lb/ft s)	1.30	8.27	0.87
Frctn Loss (ft)		Cum Volume (acre-ft)	3.80	6.93	7.24
C & E Loss (ft)		Cum SA (acres)	4.02	3.13	7.68

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2340

INPUT
Description:
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2836	49	2837.7	62	2837	77	2836	84	2835
101	2832	115	2831.4	145	2831.1	165	2831	167	2830.8
183	2830.8	186	2831	193	2832	220	2832	258	2832.2
264	2833								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	165	.025	186	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
165	186	60	45	20	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	100		T
217	264		T

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2834.26	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.92	Wt. n-Val.	0.060	0.025	0.060
W.S. Elev (ft)	2833.35	Reach Len. (ft)	60.00	45.00	20.00
Crit W.S. (ft)	2833.35	Flow Area (sq ft)	133.08	52.96	45.22
E.G. Slope (ft/ft)	0.009222	Area (sq ft)	136.96	52.96	101.07
Q Total (cfs)	1208.00	Flow (cfs)	510.16	559.74	138.10
Top Width (ft)	170.63	Top Width (ft)	71.63	21.00	78.00
Vel Total (ft/s)	5.22	Avg. Vel. (ft/s)	3.83	10.57	3.05
Max Chl Dpth (ft)	2.55	Hydr. Depth (ft)	2.05	2.52	1.46
Conv. Total (cfs)	12579.4	Conv. (cfs)	5312.5	5828.8	1438.0
Length Wtd. (ft)	46.74	Wetted Per. (ft)	65.03	21.02	31.07
Min Ch El (ft)	2830.80	Shear (lb/sq ft)	1.18	1.45	0.84
Alpha	2.16	Stream Power (lb/ft s)	4.52	15.33	2.56
Frctn Loss (ft)	0.17	Cum Volume (acre-ft)	3.39	6.63	6.96
C & E Loss (ft)	0.26	Cum SA (acres)	3.75	3.00	7.41

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for

additional cross sections.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2300

INPUT
Description:
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
2	2831	29	2830.6	45	2828	71	2828	103	2828
128	2832	164	2832.2						

Manning's n Values num= 1

Sta	n Val
2	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
45	103	6	6	6	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
2	57		T
103	164		T

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2833.64	Element			
Vel Head (ft)	0.39	Wt. n-Val.		0.040	
W.S. Elev (ft)	2833.25	Reach Len. (ft)	6.00	6.00	6.00
Crit W.S. (ft)		Flow Area (sq ft)		241.52	
E.G. Slope (ft/ft)	0.001986	Area (sq ft)	129.37	304.53	122.68
Q Total (cfs)	1208.00	Flow (cfs)		1208.00	
Top Width (ft)	162.00	Top Width (ft)	43.00	58.00	61.00
Vel Total (ft/s)	5.00	Avg. Vel. (ft/s)		5.00	
Max Chl Dpth (ft)	5.25	Hydr. Depth (ft)		5.25	
Conv. Total (cfs)	27103.5	Conv. (cfs)		27103.5	
Length Wtd. (ft)	6.00	Wetted Per. (ft)		46.00	
Min Ch El (ft)	2828.00	Shear (lb/sq ft)		0.65	
Alpha	1.00	Stream Power (lb/ft s)		3.26	
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	3.21	6.44	6.91
C & E Loss (ft)	0.14	Cum SA (acres)	3.67	2.96	7.38

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: Este Wash
REACH: 1 RS: 2295

INPUT
Description: AP2
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2836.8	15	2836	40	2832	46	2831	65	2830.8
82	2831	99	2827.54	120	2827.54	142	2827.54	160	2831.5
165	2831.9	183	2831.8	215	2832	280	2833	340	2834
380	2835	410	2836	428	2836				

Manning's n Values num= 1

Sta	n Val
0	.04

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

PB Proj. No. 11515
Este Wash
Prop 3-10'X6' RCBC's with TSMS Future Flow

99	142	149	149	149	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	110		T
142	428		T

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2833.48	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.86	Wt. n-Val.		0.040	
W.S. Elev (ft)	2832.63	Reach Len. (ft)	149.00	149.00	149.00
Crit W.S. (ft)	2831.07	Flow Area (sq ft)		162.75	
E.G. Slope (ft/ft)	0.004565	Area (sq ft)	127.17	218.70	110.47
Q Total (cfs)	1208.00	Flow (cfs)		1208.00	
Top Width (ft)	219.60	Top Width (ft)	62.91	43.00	113.69
Vel Total (ft/s)	7.42	Avg. Vel. (ft/s)		7.42	
Max Chl Dpth (ft)	5.09	Hydr. Depth (ft)		5.09	
Conv. Total (cfs)	17880.1	Conv. (cfs)		17880.1	
Length Wtd. (ft)	149.00	Wetted Per. (ft)		32.00	
Min Ch El (ft)	2827.54	Shear (lb/sq ft)		1.45	
Alpha	1.00	Stream Power (lb/ft s)		10.76	
Frctn Loss (ft)		Cum Volume (acre-ft)	3.19	6.41	6.89
C & E Loss (ft)		Cum SA (acres)	3.67	2.95	7.36

CULVERT

RIVER: Este Wash
REACH: 1 RS: 2220

INPUT
Description: 3-10'x6' RCBC
Distance from Upstream XS = 10
Deck/Roadway Width = 100
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 2

Sta Hi	Cord Lo	Cord	Sta Hi	Cord Lo	Cord
0	2836		270	2839	

Upstream Bridge Cross Section Data
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2836.8	15	2836	40	2832	46	2831	65	2830.8
82	2831	99	2827.54	120	2827.54	142	2827.54	160	2831.5
165	2831.9	183	2831.8	215	2832	280	2833	340	2834
380	2835	410	2836	428	2836				

Manning's n Values num= 1

Sta	n Val
0	.04

Bank Sta: Left Right Coeff Contr. Expan.

99	142	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	110		T
142	428		T

Downstream Deck/Roadway Coordinates
num= 2

Sta Hi	Cord Lo	Cord	Sta Hi	Cord Lo	Cord
0	2836		270	2839	

Downstream Bridge Cross Section Data
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2831	30	2831	45	2826.5	66	2826.5	88	2826.5
103	2831	120	2831						

Manning's n Values num= 1

Sta	n Val
0	.04

PB Proj. No. 11515
Este Wash
Prop 3-10'X6' RCBC's with TSMS Future Flow

Bank Sta: Left	Right	Coeff Contr.	Expan.
45	88	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	56		T
88	120		T

Upstream Embankment side slope = 4 horiz. to 1.0 vertical
Downstream Embankment side slope = 4 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Box	6	10

FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	5	140	.013	.013	0	.2	1

Number of Barrels = 3
Upstream Elevation = 2827.54
Centerline Stations

Sta.	Sta.	Sta.
115	126	137

Downstream Elevation = 2826.5
Centerline Stations

Sta.	Sta.	Sta.
61	72	83

CULVERT OUTPUT Profile #PF 1 Culv Group: Culvert #1

Q Culv Group (cfs)	1208.00	Culv Full Len (ft)	
# Barrels	3	Culv Vel US (ft/s)	10.90
Q Barrel (cfs)	402.67	Culv Vel DS (ft/s)	13.60
E.G. US. (ft)	2833.48	Culv Inv El Up (ft)	2827.54
W.S. US. (ft)	2832.63	Culv Inv El Dn (ft)	2826.50
E.G. DS (ft)	2831.81	Culv Frctn Ls (ft)	0.75
W.S. DS (ft)	2830.03	Culv Exit Loss (ft)	0.53
Delta EG (ft)	1.68	Culv Entr Loss (ft)	0.41
Delta WS (ft)	2.60	Q Weir (cfs)	
E.G. IC (ft)	2833.48	Weir Sta Lft (ft)	
E.G. OC (ft)	2833.45	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	2831.23	Weir Max Depth (ft)	
Culv WS Outlet (ft)	2829.46	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.78	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	3.69	Min El Weir Flow (ft)	2837.23

Note: The flow in the culvert is entirely supercritical.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2146

INPUT
Description:
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2831	30	2831	45	2826.5	66	2826.5	88	2826.5
103	2831	120	2831						

Manning's n Values num= 1

Sta	n Val
0	.04

PB Proj. No. 11515
Este Wash
Prop 3-10'X6' RCBC's with TSMS Future Flow

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
45	88	230	210	200	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	56		T
88	120		T

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2831.81	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.78	Wt. n-Val.		0.040	
W.S. Elev (ft)	2830.03	Reach Len. (ft)	230.00	210.00	200.00
Crit W.S. (ft)	2830.03	Flow Area (sq ft)		112.85	
E.G. Slope (ft/ft)	0.015468	Area (sq ft)	20.73	151.64	20.73
Q Total (cfs)	1208.00	Flow (cfs)		1208.00	
Top Width (ft)	66.51	Top Width (ft)	11.76	43.00	11.76
Vel Total (ft/s)	10.70	Avg. Vel. (ft/s)		10.70	
Max Chl Dpth (ft)	3.53	Hydr. Depth (ft)		3.53	
Conv. Total (cfs)	9712.9	Conv. (cfs)		9712.9	
Length Wtd. (ft)	211.80	Wetted Per. (ft)		32.00	
Min Ch El (ft)	2826.50	Shear (lb/sq ft)		3.41	
Alpha	1.00	Stream Power (lb/ft s)		36.45	
Frctn Loss (ft)	2.50	Cum Volume (acre-ft)	2.94	5.78	6.67
C & E Loss (ft)	0.42	Cum SA (acres)	3.54	2.80	7.15

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 2000

INPUT
Description:
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2835	.1	2831	50	2830	98	2828	170	2826
220	2824.5	225	2823.2	245	2823.2	248	2824	260	2826
295	2828	390	2830	420	2832				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	225	.025	245	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
220	248	100	135	150	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2827.82	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.93	Wt. n-Val.	0.060	0.037	0.060
W.S. Elev (ft)	2826.89	Reach Len. (ft)	100.00	135.00	150.00
Crit W.S. (ft)	2826.89	Flow Area (sq ft)	95.87	98.74	29.48
E.G. Slope (ft/ft)	0.009274	Area (sq ft)	95.87	98.74	29.48
Q Total (cfs)	1208.00	Flow (cfs)	253.94	880.74	73.32
Top Width (ft)	137.36	Top Width (ft)	81.87	28.00	27.49
Vel Total (ft/s)	5.39	Avg. Vel. (ft/s)	2.65	8.92	2.49
Max Chl Dpth (ft)	3.69	Hydr. Depth (ft)	1.17	3.53	1.07
Conv. Total (cfs)	12544.2	Conv. (cfs)	2637.0	9145.9	761.4
Length Wtd. (ft)	129.93	Wetted Per. (ft)	81.90	28.27	27.68
Min Ch El (ft)	2823.20	Shear (lb/sq ft)	0.68	2.02	0.62
Alpha	2.06	Stream Power (lb/ft s)	1.79	18.04	1.53
Frctn Loss (ft)	1.40	Cum Volume (acre-ft)	2.63	5.17	6.55
C & E Loss (ft)	0.01	Cum SA (acres)	3.29	2.63	7.06

PB Proj. No. 11515
Este Wash
Prop 3-10'X6' RCBC's with TSMS Future Flow

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 1865

INPUT
Description: AO
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2835	.1	2829	35	2828	105	2826	173	2824
203	2822	207	2821.5	222	2821.5	242	2822	252	2824
273	2826	292	2828	335	2830	360	2830.5		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	207	.025	222	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
203	242	375	400	440	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2825.61	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.06	Wt. n-Val.	0.060	0.038	0.060
W.S. Elev (ft)	2824.55	Reach Len. (ft)	375.00	400.00	440.00
Crit W.S. (ft)	2824.55	Flow Area (sq ft)	51.43	112.78	17.02
E.G. Slope (ft/ft)	0.012600	Area (sq ft)	51.43	112.78	17.02
Q Total (cfs)	1208.00	Flow (cfs)	148.42	1010.18	49.40
Top Width (ft)	103.28	Top Width (ft)	48.55	39.00	15.73
Vel Total (ft/s)	6.67	Avg. Vel. (ft/s)	2.89	8.96	2.90
Max Chl Dpth (ft)	3.05	Hydr. Depth (ft)	1.06	2.89	1.08
Conv. Total (cfs)	10761.8	Conv. (cfs)	1322.2	8999.5	440.1
Length Wtd. (ft)	398.11	Wetted Per. (ft)	48.63	39.04	15.95
Min Ch El (ft)	2821.50	Shear (lb/sq ft)	0.83	2.27	0.84
Alpha	1.54	Stream Power (lb/ft s)	2.40	20.36	2.44
Frctn Loss (ft)	4.59	Cum Volume (acre-ft)	2.46	4.84	6.47
C & E Loss (ft)	0.11	Cum SA (acres)	3.14	2.53	6.98

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 1465

INPUT
Description: AN
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2827	.1	2821	15	2820	65	2818.2	95	2819
133	2819	180	2818	199	2816.3	240	2816.3	242	2818
248	2820	290	2822	290.1	2828				

PB Proj. No. 11515
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Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	199	.028	240	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
180	242	280	290	320	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	133	2819	F

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2819.89	Element			
Vel Head (ft)	0.68	Wt. n-Val.	0.060	0.042	0.080
W.S. Elev (ft)	2819.21	Reach Len. (ft)	280.00	290.00	320.00
Crit W.S. (ft)	2819.21	Flow Area (sq ft)	74.09	162.69	2.20
E.G. Slope (ft/ft)	0.010624	Area (sq ft)	74.09	162.69	2.20
Q Total (cfs)	1256.00	Flow (cfs)	121.92	1131.16	2.92
Top Width (ft)	208.75	Top Width (ft)	143.11	62.00	3.64
Vel Total (ft/s)	5.26	Avg. Vel. (ft/s)	1.65	6.95	1.32
Max Chl Dpth (ft)	2.91	Hydr. Depth (ft)	0.52	2.62	0.61
Conv. Total (cfs)	12185.8	Conv. (cfs)	1182.9	10974.6	28.3
Length Wtd. (ft)	292.12	Wetted Per. (ft)	143.15	62.70	3.83
Min Ch El (ft)	2816.30	Shear (lb/sq ft)	0.34	1.72	0.38
Alpha	1.59	Stream Power (lb/ft s)	0.56	11.97	0.50
Frctn Loss (ft)	3.55	Cum Volume (acre-ft)	1.92	3.58	6.37
C & E Loss (ft)	0.06	Cum SA (acres)	2.32	2.07	6.89

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 1175

INPUT
Description: AM
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2824	.1	2818	50	2814	60	2813	69	2814
90	2814.5	108	2814	170	2812.7	197	2812.7	222	2813.9
238	2813.9	288	2813.3	323	2814	410	2816	410.1	2822

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	170	.022	197	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
108	222	365	360	360	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2815.02	Element			
Vel Head (ft)	0.47	Wt. n-Val.	0.060	0.036	0.060
W.S. Elev (ft)	2814.55	Reach Len. (ft)	365.00	360.00	360.00
Crit W.S. (ft)	2814.55	Flow Area (sq ft)	33.65	155.81	96.20
E.G. Slope (ft/ft)	0.013999	Area (sq ft)	33.65	155.81	96.20
Q Total (cfs)	1256.00	Flow (cfs)	63.56	955.73	236.71
Top Width (ft)	303.88	Top Width (ft)	64.88	114.00	125.00
Vel Total (ft/s)	4.40	Avg. Vel. (ft/s)	1.89	6.13	2.46
Max Chl Dpth (ft)	1.85	Hydr. Depth (ft)	0.52	1.37	0.77
Conv. Total (cfs)	10615.3	Conv. (cfs)	537.2	8077.6	2000.6
Length Wtd. (ft)	360.15	Wetted Per. (ft)	65.02	114.04	125.02
Min Ch El (ft)	2812.70	Shear (lb/sq ft)	0.45	1.19	0.67
Alpha	1.55	Stream Power (lb/ft s)	0.85	7.32	1.65

Frctn Loss (ft)	4.85	Cum Volume (acre-ft)	1.57	2.52	6.01
C & E Loss (ft)	0.00	Cum SA (acres)	1.65	1.48	6.41

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 815

INPUT
Description: AL
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2816	.1	2810	92	2808	112	2807	140	2807
150	2808	212	2808	232	2807	262	2808	315	2806.8
365	2808	382	2814						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	112	.022	140	.06	315	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
92	150	390	390	420	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2809.15	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.49	Wt. n-Val.	0.060	0.029	0.065
W.S. Elev (ft)	2808.67	Reach Len. (ft)	390.00	390.00	420.00
Crit W.S. (ft)	2808.67	Flow Area (sq ft)	10.20	81.64	230.67
E.G. Slope (ft/ft)	0.012970	Area (sq ft)	10.20	81.64	230.67
Q Total (cfs)	1256.00	Flow (cfs)	13.82	613.55	628.63
Top Width (ft)	305.50	Top Width (ft)	30.61	58.00	216.89
Vel Total (ft/s)	3.89	Avg. Vel. (ft/s)	1.36	7.51	2.73
Max Chl Dpth (ft)	1.87	Hydr. Depth (ft)	0.33	1.41	1.06
Conv. Total (cfs)	11028.7	Conv. (cfs)	121.4	5387.4	5519.9
Length Wtd. (ft)	403.59	Wetted Per. (ft)	30.62	58.07	217.07
Min Ch El (ft)	2807.00	Shear (lb/sq ft)	0.27	1.14	0.86
Alpha	2.07	Stream Power (lb/ft s)	0.37	8.55	2.34
Frctn Loss (ft)	3.18	Cum Volume (acre-ft)	1.39	1.54	4.66
C & E Loss (ft)	0.00	Cum SA (acres)	1.25	0.77	5.00

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 425

INPUT
Description: AK
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2803	10	2802	72	2800	73	2799.2	105	2799.2
115	2800	150	2801	180	2800	270	2800.5	350	2801.3

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410	2799.9	425	2802	430	2802.2

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	72	.025	150	.08

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
72	115	450	425	405	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2802.03	Element			
Vel Head (ft)	0.49	Wt. n-Val.	0.080	0.025	0.063
W.S. Elev (ft)	2801.54	Reach Len. (ft)	450.00	425.00	405.00
Crit W.S. (ft)	2801.54	Flow Area (sq ft)	36.61	96.09	299.94
E.G. Slope (ft/ft)	0.005276	Area (sq ft)	36.61	96.09	299.94
Q Total (cfs)	1256.00	Flow (cfs)	41.42	705.61	508.97
Top Width (ft)	397.33	Top Width (ft)	47.64	43.00	306.69
Vel Total (ft/s)	2.90	Avg. Vel. (ft/s)	1.13	7.34	1.70
Max Chl Dpth (ft)	2.34	Hydr. Depth (ft)	0.77	2.23	0.98
Conv. Total (cfs)	17292.1	Conv. (cfs)	570.3	9714.5	7007.3
Length Wtd. (ft)	425.55	Wetted Per. (ft)	47.67	43.31	306.86
Min Ch El (ft)	2799.20	Shear (lb/sq ft)	0.25	0.73	0.32
Alpha	3.74	Stream Power (lb/ft s)	0.29	5.37	0.55
Frctn Loss (ft)	2.83	Cum Volume (acre-ft)	1.18	0.74	2.10
C & E Loss (ft)	0.00	Cum SA (acres)	0.90	0.32	2.48

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Este Wash
REACH: 1 RS: 0

INPUT
Description: AJ
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2798	21	2794	31	2793	144	2793	145	2792
165	2792	166	2793	197	2794	240	2794	276	2793.3
300	2794	332	2794.3	365	2794	420	2795.2		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	31	.06	145	.022	165	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
144	166	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	2795.07	Element			
Vel Head (ft)	0.48	Wt. n-Val.	0.061	0.030	0.080
W.S. Elev (ft)	2794.59	Reach Len. (ft)			
Crit W.S. (ft)	2794.59	Flow Area (sq ft)	191.68	56.01	152.49
E.G. Slope (ft/ft)	0.008634	Area (sq ft)	191.68	56.01	152.49
Q Total (cfs)	1256.00	Flow (cfs)	583.14	470.50	202.36
Top Width (ft)	374.22	Top Width (ft)	126.11	22.00	226.11
Vel Total (ft/s)	3.14	Avg. Vel. (ft/s)	3.04	8.40	1.33
Max Chl Dpth (ft)	2.59	Hydr. Depth (ft)	1.52	2.55	0.67
Conv. Total (cfs)	13517.0	Conv. (cfs)	6275.7	5063.5	2177.8
Length Wtd. (ft)		Wetted Per. (ft)	126.21	22.83	226.16
Min Ch El (ft)	2792.00	Shear (lb/sq ft)	0.82	1.32	0.36
Alpha	3.15	Stream Power (lb/ft s)	2.49	11.11	0.48
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

PB Proj. No. 11515
Este Wash
Prop 3-10'X6' RCBC's with TSMS Future Flow

Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth). Water surface set to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

SUMMARY OF MANNING'S N VALUES

River:Este Wash

Reach	River Sta.	n1	n2	n3	n4	n5
1	4085	.08	.022	.06		
1	3810	.06	.022	.06		
1	3640	.06	.022	.08		
1	3490	.08	.06	.022	.06	
1	3350	.08	.06	.028	.06	
1	3230	.08	.025	.08		
1	3166	.04				
1	3160	.08	.04	.08		
1	3050	Culvert				
1	2975	.06	.025	.06	.04	.06
1	2795	.06	.028	.06		
1	2495	.04	.016	.06	.025	.06
1	2340	.06	.025	.06		
1	2300	.04				
1	2295	.04				
1	2220	Culvert				
1	2146	.04				
1	2000	.06	.025	.06		
1	1865	.06	.025	.06		
1	1465	.06	.028	.08		
1	1175	.06	.022	.06		
1	815	.06	.022	.06	.08	
1	425	.08	.025	.08		
1	0	.08	.06	.022	.08	

SUMMARY OF REACH LENGTHS

River: Este Wash

Reach	River Sta.	Left	Channel	Right
1	4085	250	275	260
1	3810	155	170	180
1	3640	90	150	205
1	3490	90	140	190
1	3350	135	120	115
1	3230	94	64	44
1	3166	6	6	6
1	3160	185	185	185
1	3050	Culvert		
1	2975	270	180	110
1	2795	360	300	250
1	2495	175	155	130
1	2340	60	45	20
1	2300	6	6	6
1	2295	149	149	149
1	2220	Culvert		
1	2146	230	210	200
1	2000	100	135	150
1	1865	375	400	440
1	1465	280	290	320
1	1175	365	360	360
1	815	390	390	420
1	425	450	425	405
1	0			

PB Proj. No. 11515
Este Wash
Prop 3-10'X6' RCBC's with TSMS Future Flow

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Este Wash

Reach	River Sta.	Contr.	Expan.
1	4085	.1	.3
1	3810	.1	.3
1	3640	.1	.3
1	3490	.1	.3
1	3350	.1	.3
1	3230	.3	.5
1	3166	.3	.5
1	3160	.3	.5
1	3050	Culvert	
1	2975	.3	.5
1	2795	.1	.3
1	2495	.1	.3
1	2340	.3	.5
1	2300	.3	.5
1	2295	.3	.5
1	2220	Culvert	
1	2146	.3	.5
1	2000	.1	.3
1	1865	.1	.3
1	1465	.1	.3
1	1175	.1	.3
1	815	.1	.3
1	425	.1	.3
1	0	.1	.3

PB Proj. No. 11515
Este Wash
Prop 3-10'X6' RCBC's with TSMS Future Flow
Profile Output Table - Standard Table 1

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	4085	1208.00	2856.40	2858.91	2858.91	2859.46	0.016871	8.56	264.41	204.54	0.99
1	3810	1208.00	2852.70	2855.16	2855.16	2855.72	0.008987	7.26	292.05	239.27	0.89
1	3640	1208.00	2850.80	2852.37	2852.13	2852.68	0.011751	6.55	323.59	269.80	1.01
1	3490	1208.00	2849.20	2850.20	2850.20	2850.59	0.036653	7.28	276.38	385.16	1.46
1	3350	1208.00	2847.60	2848.79		2848.90	0.005756	3.72	507.94	416.31	0.70
1	3230	1208.00	2845.50	2846.86	2846.86	2847.45	0.035508	8.63	240.41	294.99	1.38
1	3166	1208.00	2839.00	2844.83		2845.13	0.001346	4.41	273.76	106.47	0.32
1	3160	1208.00	2839.00	2844.10	2842.53	2844.95	0.004537	7.41	163.05	98.53	0.58
1	3050	Culvert									
1	2975	1208.00	2838.00	2841.53	2841.53	2843.31	0.017215	10.70	112.85	155.55	1.00
1	2795	1208.00	2836.50	2838.97	2838.97	2839.68	0.007499	7.34	236.86	204.45	0.91
1	2495	1208.00	2832.50	2835.12	2835.12	2835.79	0.008085	7.65	269.88	218.41	0.92
1	2340	1208.00	2830.80	2833.35	2833.35	2834.26	0.009222	10.57	231.26	170.63	1.17
1	2300	1208.00	2828.00	2833.25		2833.64	0.001986	5.00	241.52	162.00	0.38
1	2295	1208.00	2827.54	2832.63	2831.07	2833.48	0.004565	7.42	162.75	219.60	0.58
1	2220	Culvert									
1	2146	1208.00	2826.50	2830.03	2830.03	2831.81	0.015468	10.70	112.85	66.51	1.00
1	2000	1208.00	2823.20	2826.89	2826.89	2827.82	0.009274	8.92	224.09	137.36	0.84
1	1865	1208.00	2821.50	2824.55	2824.55	2825.61	0.012600	8.96	181.23	103.28	0.93
1	1465	1256.00	2816.30	2819.21	2819.21	2819.89	0.010624	6.95	238.98	208.75	0.76
1	1175	1256.00	2812.70	2814.55	2814.55	2815.02	0.013999	6.13	285.66	303.88	0.92
1	815	1256.00	2807.00	2808.67	2808.67	2809.15	0.012970	7.51	322.51	305.50	1.12
1	425	1256.00	2799.20	2801.54	2801.54	2802.03	0.005276	7.34	432.64	397.33	0.87
1	0	1256.00	2792.00	2794.59	2794.59	2795.07	0.008634	8.40	400.18	374.22	0.93

PB Proj. No. 11515
Este Wash
Prop 3-10'X6' RCBC's with TSMS Future Flow
Profile Output Table - Standard Table 2

Reach	River Sta	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
1	4085	2859.46	2858.91	0.55	3.19	0.00	2.89	456.58	748.53	204.54
1	3810	2855.72	2855.16	0.55	1.66	0.07	426.70	773.03	8.27	239.27
1	3640	2852.68	2852.37	0.32	2.09	0.01	823.44	372.31	12.26	269.80
1	3490	2850.59	2850.20	0.38	1.57	0.08	902.13	224.79	81.08	385.16
1	3350	2848.90	2848.79	0.11	1.41	0.05	278.17	171.85	757.98	416.31
1	3230	2847.45	2846.86	0.59	0.23	0.15	214.31	430.24	563.45	294.99
1	3166	2845.13	2844.83	0.30	0.01	0.17		1208.00		106.47
1	3160	2844.95	2844.10	0.85				1208.00		98.53
1	3050	Culvert								
1	2975	2843.31	2841.53	1.78	1.92	0.53		1208.00		155.55
1	2795	2839.68	2838.97	0.71	2.31	0.01	28.85	1009.31	169.84	204.45
1	2495	2835.79	2835.12	0.68			155.06	871.73	181.21	218.41
1	2340	2834.26	2833.35	0.92	0.17	0.26	510.16	559.74	138.10	170.63
1	2300	2833.64	2833.25	0.39	0.02	0.14		1208.00		162.00
1	2295	2833.48	2832.63	0.86				1208.00		219.60
1	2220	Culvert								
1	2146	2831.81	2830.03	1.78	2.50	0.42		1208.00		66.51
1	2000	2827.82	2826.89	0.93	1.40	0.01	253.94	880.74	73.32	137.36
1	1865	2825.61	2824.55	1.06	4.59	0.11	148.42	1010.18	49.40	103.28
1	1465	2819.89	2819.21	0.68	3.55	0.06	121.92	1131.16	2.92	208.75
1	1175	2815.02	2814.55	0.47	4.85	0.00	63.56	955.73	236.71	303.88
1	815	2809.15	2808.67	0.49	3.18	0.00	13.82	613.55	628.63	305.50
1	425	2802.03	2801.54	0.49	2.83	0.00	41.42	705.61	508.97	397.33
1	0	2795.07	2794.59	0.48			583.14	470.50	202.36	374.22

Profile Output Table - Lateral Structures

Reach	River Sta	Q US	Q Leaving Total	Q DS	Q Weir	Q Gates	Wr Top Wdth	Weir Max Depth	Weir Avg Depth	Min El Weir Flow	E.G. US.	W.S. US.	E.G. DS	W.S. DS
		(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : Prop TSMS

River: Este Wash Reach: 1 RS: 4085 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The cross-section end points had to be extended vertically for the computed water surface.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The

program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.
River: Este Wash Reach: 1 RS: 3810 Profile: PF 1
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: Este Wash Reach: 1 RS: 3640 Profile: PF 1
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Este Wash Reach: 1 RS: 3490 Profile: PF 1
Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: Este Wash Reach: 1 RS: 3350 Profile: PF 1
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Este Wash Reach: 1 RS: 3230 Profile: PF 1
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: Este Wash Reach: 1 RS: 3166 Profile: PF 1
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
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.
River: Este Wash Reach: 1 RS: 3050 Profile: PF 1 Culv: Culvert #1
Note: The flow in the culvert is entirely supercritical.
River: Este Wash Reach: 1 RS: 2975 Profile: PF 1
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
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.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate

the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2795 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2495 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

River: Este Wash Reach: 1 RS: 2340 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning:The cross-section end points had to be extended vertically for the computed water surface.
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
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.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2300 Profile: PF 1
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.

River: Este Wash Reach: 1 RS: 2220 Profile: PF 1 Culv: Culvert #1
Note: The flow in the culvert is entirely supercritical.

River: Este Wash Reach: 1 RS: 2146 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 2000 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

River: Este Wash Reach: 1 RS: 1865 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

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Este Wash
Prop 3-10'X6' RCBC's with TSMS Future Flow

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 1465 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

Note: Manning's n values were composited to a single value in the main channel.

River: Este Wash Reach: 1 RS: 1175 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 815 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

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.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 425 Profile: PF 1

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

River: Este Wash Reach: 1 RS: 0 Profile: PF 1

Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth). Water surface set to critical depth.

Note: Manning's n values were composited to a single value in the main channel.