July 14, 2016

PORTAGE PARKWAY EA

Conceptual Stormwater Report

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REPORT

Report Number: 1522372

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Golder Associates

Table of Contents

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by CIMA+ to prepare the following conceptual stormwater report related to the Environmental Assessment for the Portage Parkway Widening and Extension. The project limits are from Applewood Crescent to Creditstone Road.

The proposed works involve the widening of Portage Parkway from Applewood Crescent to Jane Street to increase the existing road width to 4 lanes, plus a center turning lane, and the extension of Portage Parkway from Jane Street to Creditstone Road.

The preferred alternative for the proposed Portage Parkway alignment includes a crossing of Black Creek. As part of the stormwater management plan for the project, several options for conveying Black Creek under the proposed crossing were considered. Hydraulic models for each option were created based on existing Toronto Region Conservation Authority (TRCA) hydraulic models, and the resulting water levels were evaluated. The results were used to make a recommendation as to the most cost-effective option that met the conveyance requirements.

The preferred alternative also includes a new local storm sewer system along Portage Parkway. The new storm sewer system is proposed to alleviate capacity concerns and resultant surface ponding, identified by the City of Vaughan, along Millway Avenue, south of Portage Parkway. The new local storm sewer system is also proposed to provide a drainage outlet for the new section of Portage Parkway extending from Jane Street to Creditstone Road.

This report has been revised to include additional information for the existing infrastructure in Jane Street.

2.0 BLACK CREEK CROSSING

2.1 Background

The proposed Portage Parkway alignment includes the construction of a new section of 4-lane road between Jane Street and Creditstone Road, crossing Black Creek approximately 500 m downstream of existing Jane Street crossing and 350 m upstream of the online Jane/7 stormwater pond north of Highway 7.

At the crossing location, Black Creek is largely confined to an engineered stream valley 80 m wide and 6 m deep, with a low flow channel 3-5 m wide and 0.6 m deep. The channel margins include a dense network of grasses, shrubs, and trees. Substrate at the bed was dominated by medium sand with silt and clay, while substrate at the banks was characterized by mostly fines (clay and silt with some fine sand) (Golder 2015). A photograph taken at the proposed crossing location is shown in Figure 1 below.

Figure 1: Photograph at Proposed Crossing Location

The proposed alignment includes a 25.7 m wide crossing of the stream valley. A total of five (5) alternatives were proposed for the crossing, including two bridge options and three culvert options. The options are designed to provide conveyance of the Regional Storm (i.e., Hurricane Hazel) flow without overtopping the roadway, as per the preferred Alternative 4 presented in the Black Creek Stormwater Optimization Study (AECOM, 2012), while also minimizing any increases in water level upstream of the proposed crossing.

2.2 Methodology

2.2.1 Hydraulic Model

In order to evaluate the proposed bridge options, the updated 1D HECRAS hydraulic model for Black Creek was obtained from the City of Vaughn. This model was originally developed by the TRCA, and was thereafter updated by the City of Vaughn as part of the Black Creek Optimization study; changes included revisions to the geometry and steady-state peak flows. The model extends from upstream of Creditview Road (4 km upstream of the proposed Portage Parkway crossing) to a point just north of Steeles Avenue West (3km downstream of the proposed Portage Parkway crossing).

There are no cross sections in the model located at the crossing location. The nearest sections are 46.24 (located 51 m upstream of the proposed crossing) and 46.23 (located 95 m downstream of the proposed crossing). Channel roughness values for these sections were 0.035 in the model, with bank roughness values as 0.08 and roughness of 0.05 beyond the valley section; these values are generally consistent with the conditions observed in the field at the crossing location.

The peak steady-flow rates in the City of Vaughn HECRAS model were not reviewed or changed as part of this project.

2.2.2 Field Survey Sections

A field survey of the proposed crossing location was conducted on July 8, 2015. The survey included a photographic survey and a topographic survey of the crossing, including the low flow channel. This survey was combined with the topographic survey from CIMA+ to produce cross sections immediately upstream and downstream of the proposed road crossing. The sections are shown on Figures 2 and 3 below.

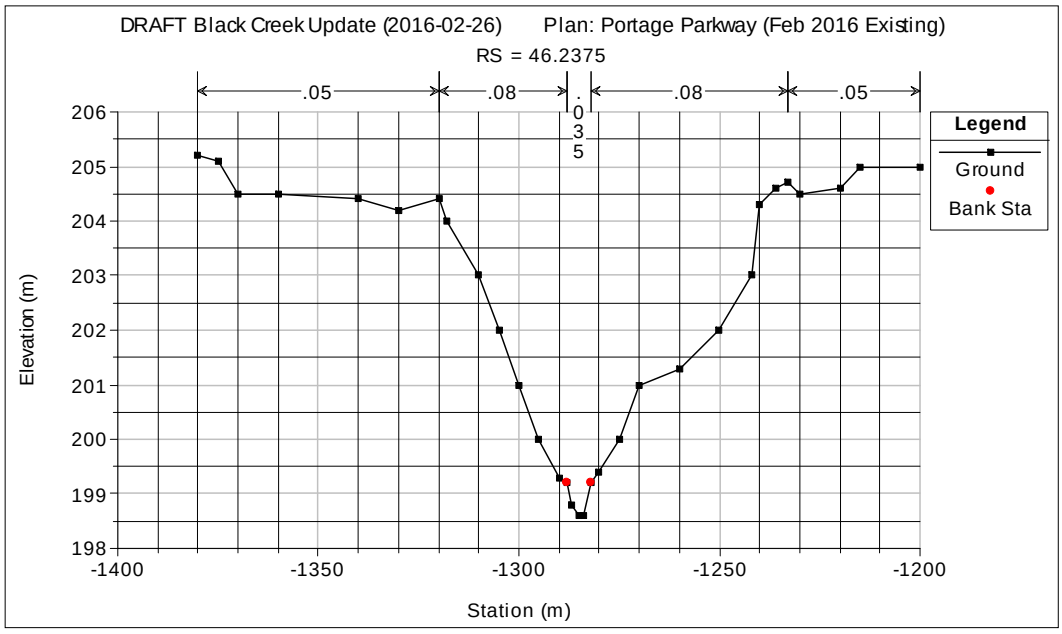

Figure 2: Added Cross Section Upstream of Proposed Crossing

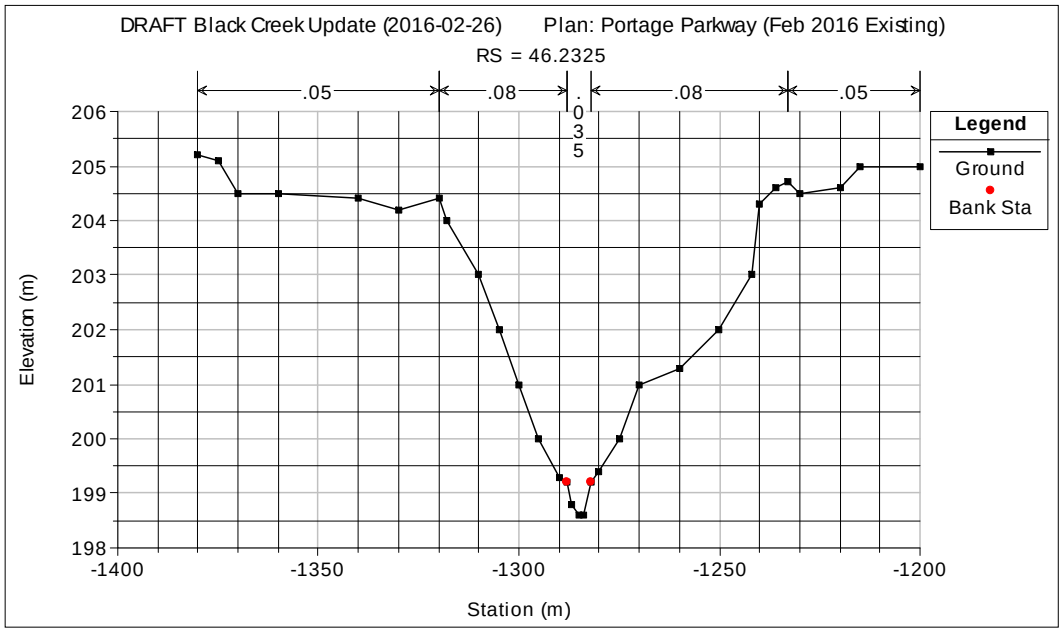

Figure 3: Added Section Downstream of Proposed Crossing

The two cross sections were added to the HECRAS hydraulic model, assigned Manning's roughness values matching those in the existing model (0.035, 0.08, and 0.05 for the channel, overbank, and remaining areas, respectively), and the revised model was run (with these new sections) in order to produce a set of Existing Condition model results against which to compare results from the analysis of the proposed crossing options.

2.2.3 Crossing Conveyance Options

A total of five (5) conveyance options were proposed for the crossing. These options included:

- **Option 1:** Twin 4.5 m wide by 5.0 m tall opened-bottom concrete box culverts centered on the low flow channel. Two additional 4.5 m wide by 2.0 m tall culverts were also proposed (one to either side of the of the main culverts) for pedestrian access for the proposed trails along Black Creek;
- **Option 2:** A 60 m wide single span bridge structure spanning the entire valley;
- **Option 3:** Two 30 m span bridges joined at the middle with a pier;
- **Option 4:** Two 15 m span bridges linked by a third 30 m span bridge, supported by piers 25% and 75% across the section; and,
- **Option 5:** A single 12 m wide by 5.0 m tall open-bottom concrete arch culvert centered on the low flow channel. Two additional 4.5 m wide by 2.0 m tall culverts were also proposed (one to either side of the main culverts) for pedestrian access for the proposed trails along Black Creek.

The five proposed crossing options were added as scenarios to HECRAS, with the crossing information entered in the bridge editor between the two new cross sections (46.2375 and 46.2325). Cross sections for the five options are shown in Figures 4 through 8 below. The crossing conveyance options were coded into the model between the added cross sections. In the case of Option 1 and Option 5, the design included retaining walls on the upstream and downstream face of the road. Both culvert options were modeled without wingwalls (i.e., entrance loss of 0.5).

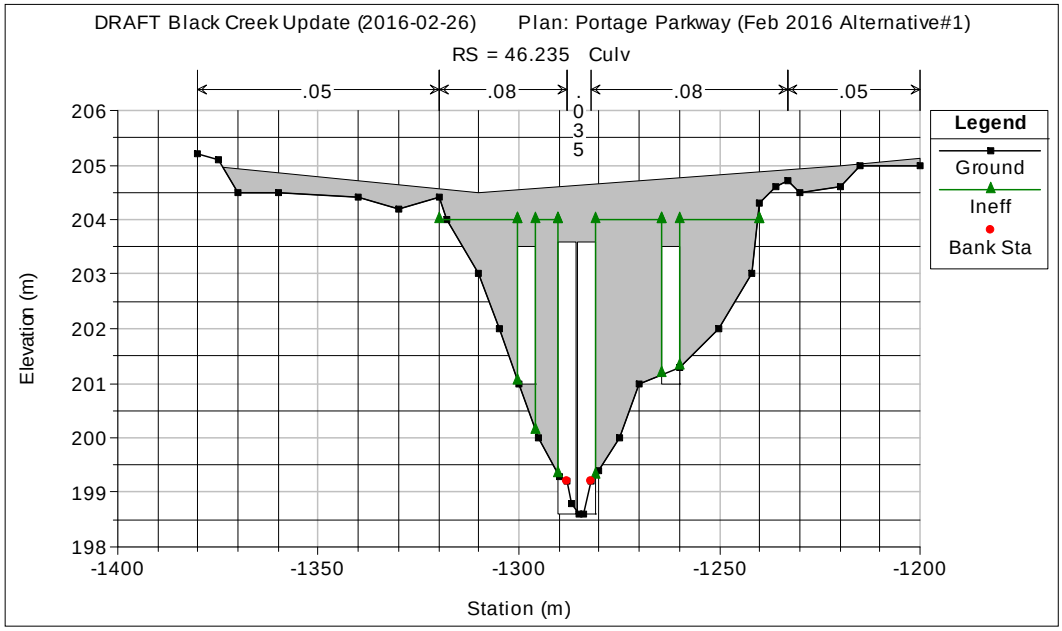

Figure 4: Option 1: Twin 4.5 m Concrete Box Culverts

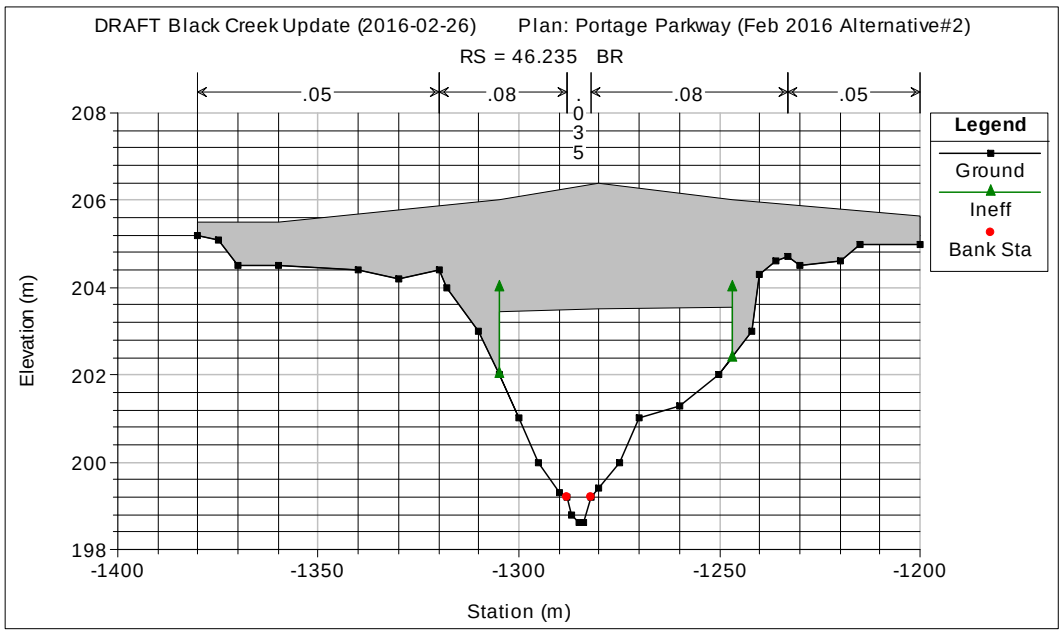

Figure 5: Single Span Bridge

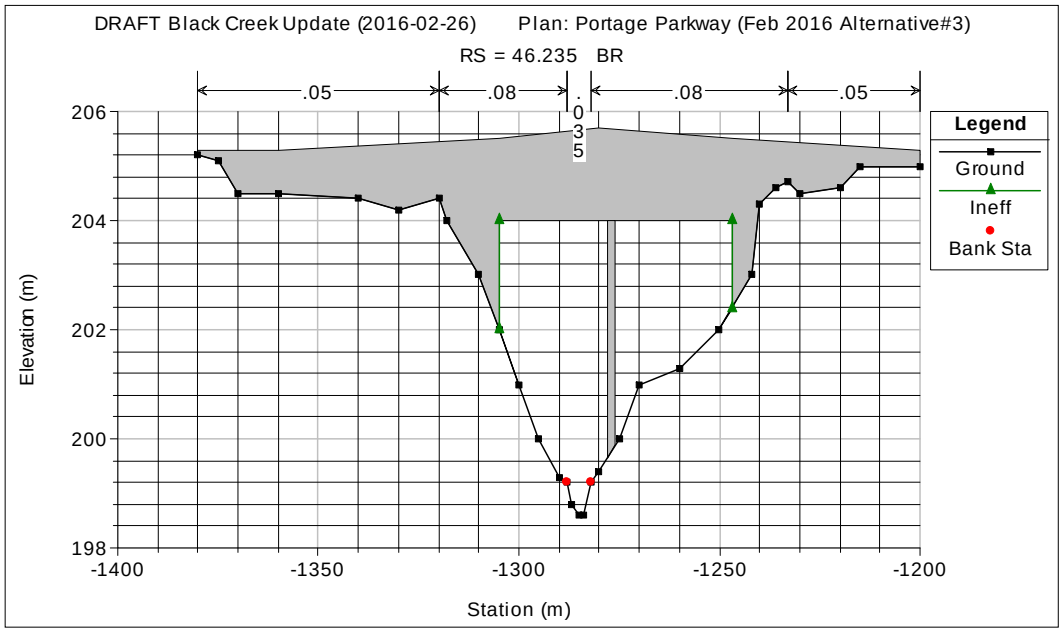

Figure 6: Option 3: Two-Span Bridge with Pier

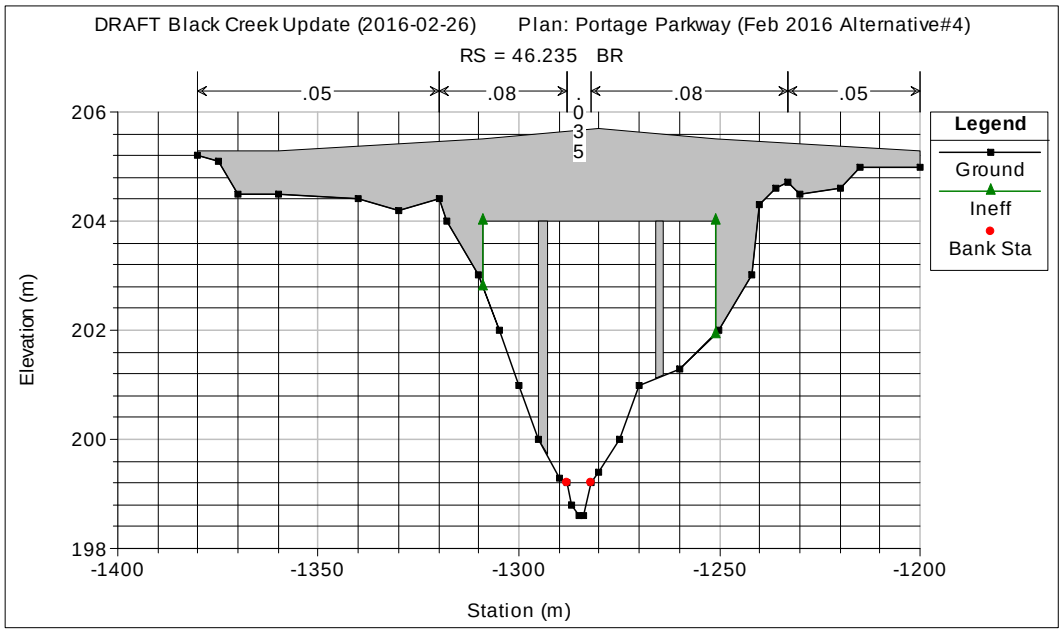

Figure 7: Option 4: Three-Span Bridge with Piers

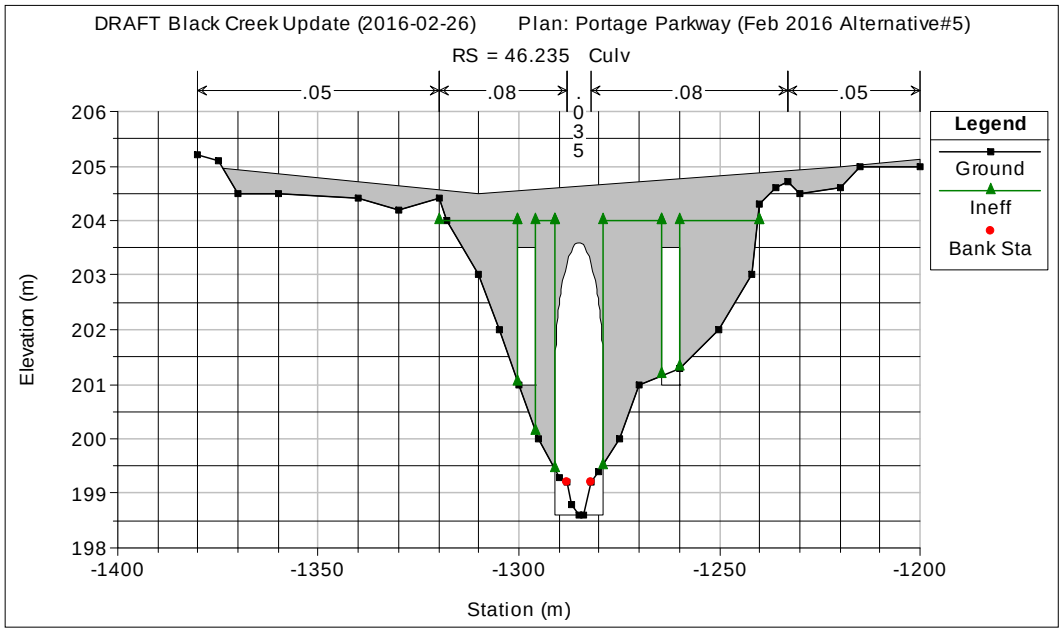

Figure 8: Option 5: 12 m Concrete Arch Culvert

The road profile over the crossings were taken from CIMA+ designs. The low point of the road centerline (which are important in determining whether the road overtops) varied between the designs (based on the required depth for the bridge decks). The road low points for each option are shown in Table 1 below.

Table 1: Road Low Point Elevations

Option	Road Low Point Elevation (masl)
Option 1: Twin Box Culverts	204.50
Option 2: Single Span Bridge	205.60
Option 3: 2-Span Bridge with Pier	205.20
Option 4: 3-Span Bridge with Piers	205.20
Option 5: Concrete Arch Culvert	204.50

2.3 Results

Profile results for the Existing scenario (with the added cross sections) and the five options are shown in Figures 9 through 14 below, while complete tabular results from the HECRAS model are shown in Appendix A. In general, the results show that the water levels through the proposed crossing location (between cross sections 46.2325 and 46.2375) is controlled by the outlet of the Jane/7 online stormwater pond upstream of Highway 7. The model results do not show any overtopping of the proposed road options resulting from the Regional Storm flow.

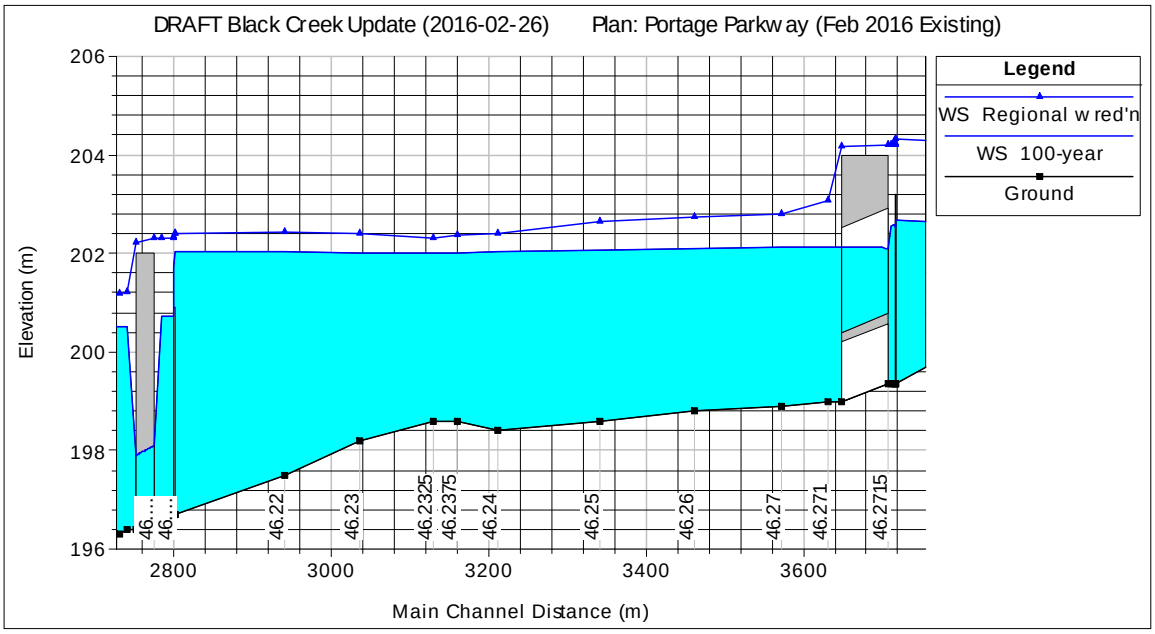

Figure 9: Existing Condition Scenario Profile

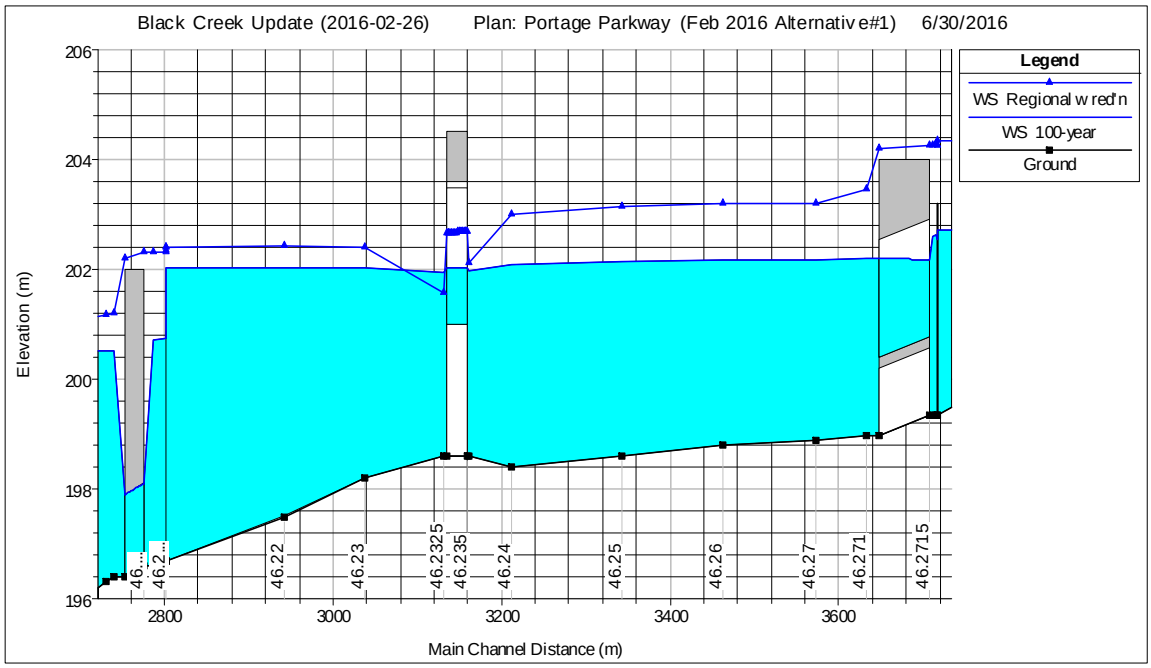

Figure 10: Option 1: Twin 4.5 m Box Culvert Profile

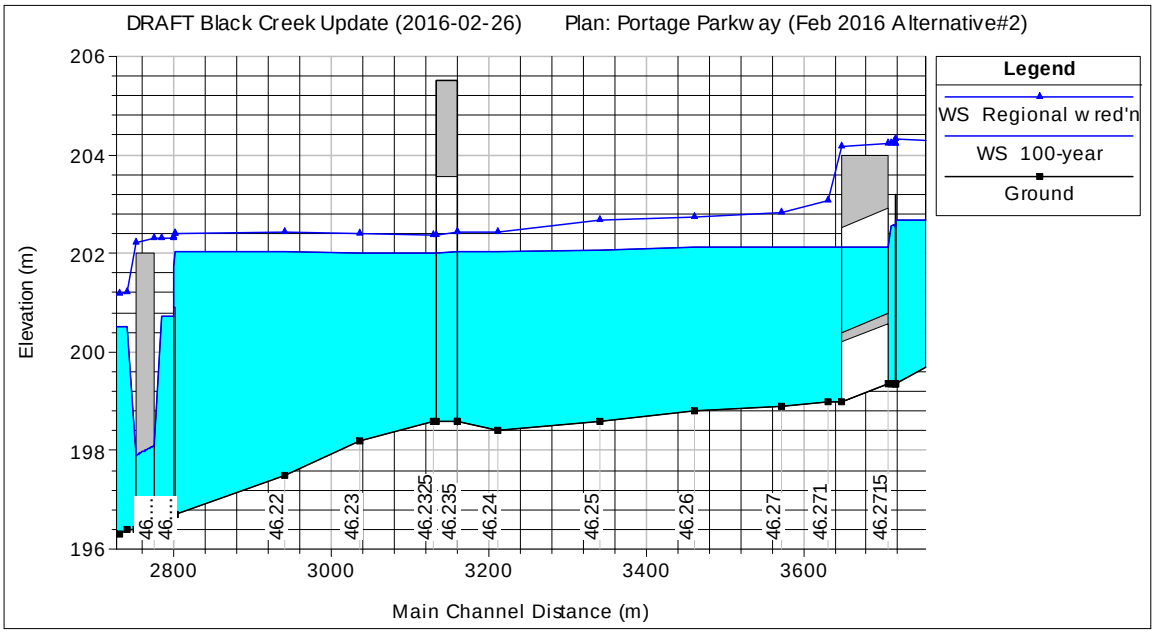

Figure 11: Option 2: Single Span Bridge Profile

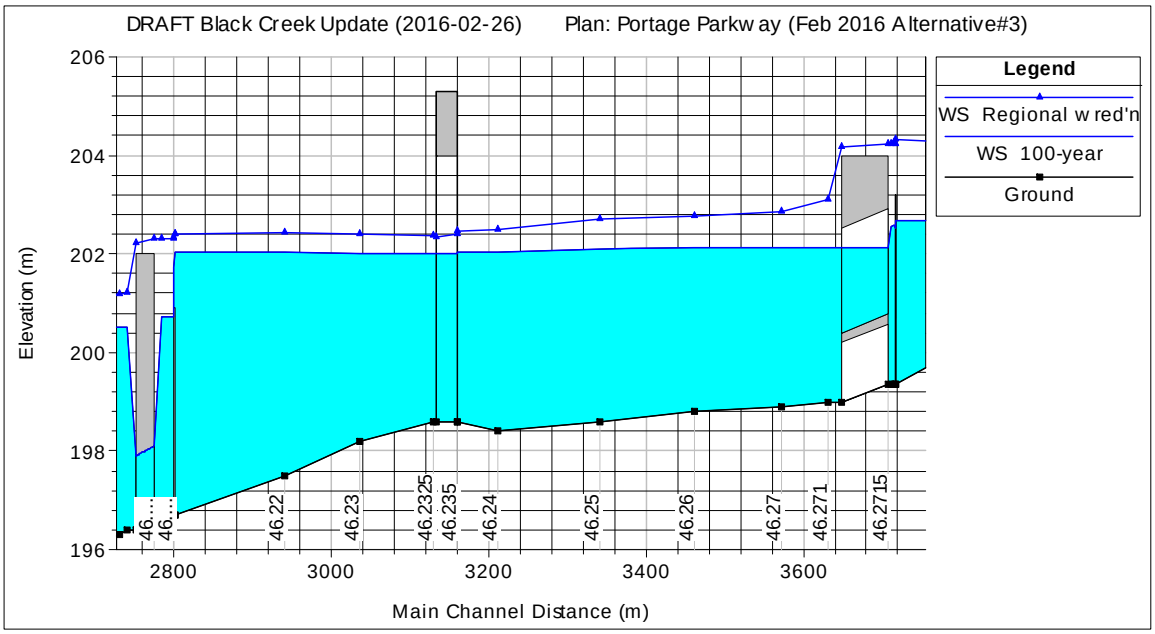

Figure 12: Option 3: 2-Span Bridge with Pier Profile

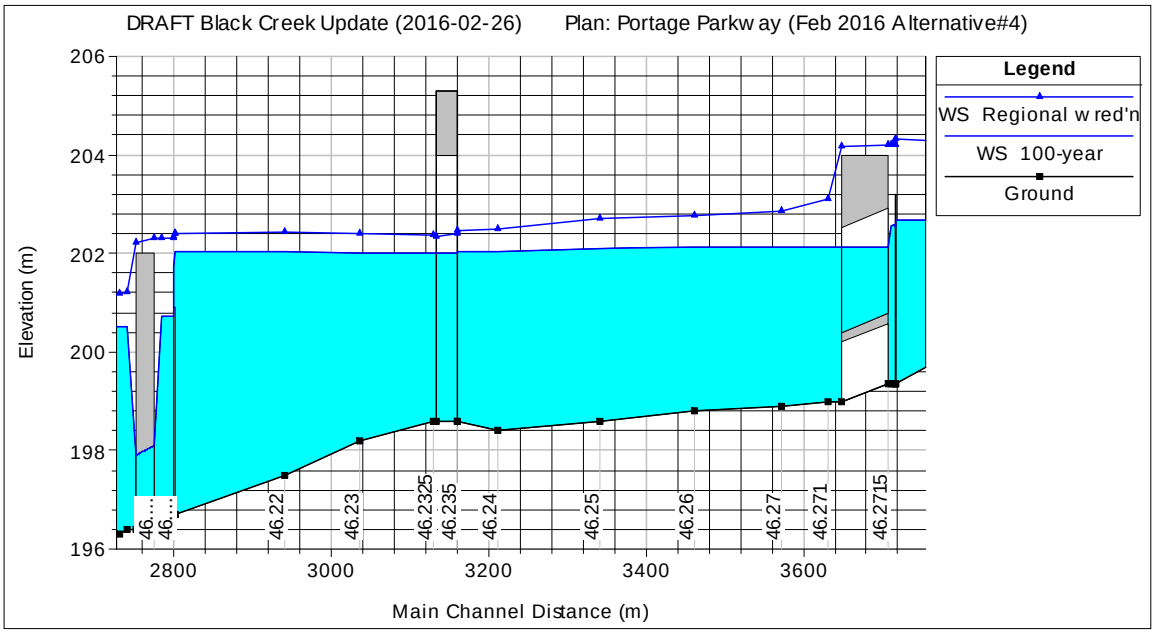

Figure 13: Option 4: 3-Span Bridge with Piers

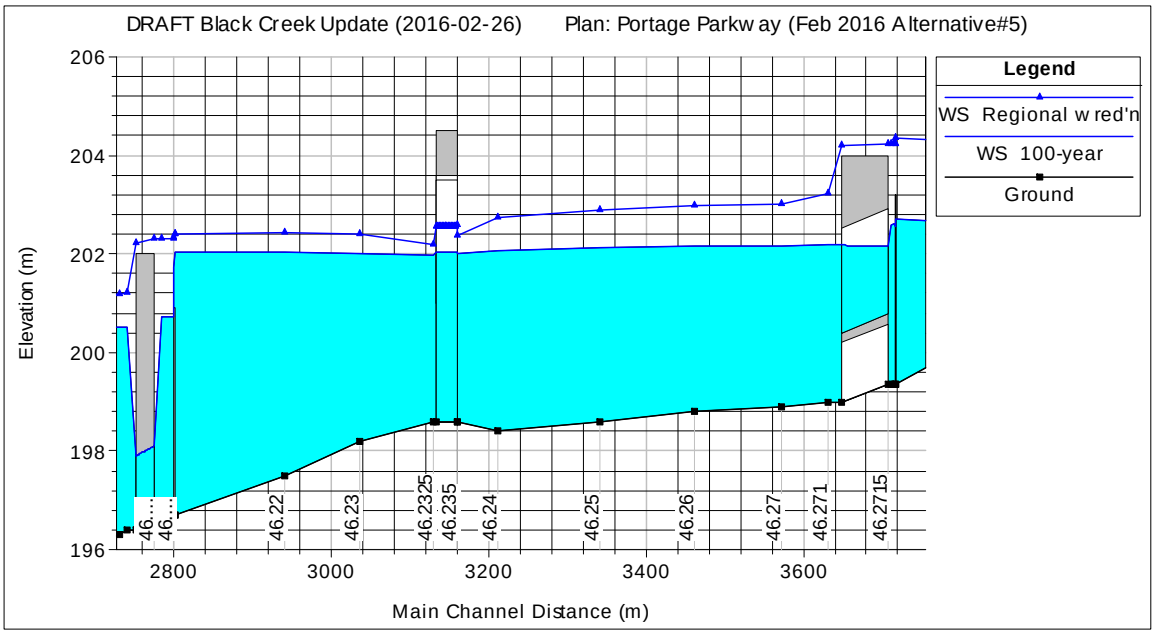

Figure 14: Option 5: 12 m Concrete Arch Culvert Profile

Water level results at the upstream and downstream ends of the proposed structure for the Existing scenario and proposed options are shown in Table 2 and Table 3 below. In the existing condition, the model results suggest a 0.01 m to 0.06 m increase in water level between the new sections upstream and downstream of proposed crossing for the 1:100yr and Regional Storm flow, respectively. Of the proposed options, Option 1 (the twin 4.5 m wide box culverts) results in the greatest increase in water level between the upstream and downstream sections (0.04 m and 0.52 m for the 1:100yr and Regional flows, respectively), with the other options resulting in increases between 0.01 m and 0.02 m for the 1:100yr flow and between 0.06 m and 0.17 m for the Regional Storm flow.

Table 2: Water Levels at Downstream End of Proposed Crossing

Profile	Downstream End of Proposed Structure – Internal Water Level (masl)					
	Existing (at Cross Section 46.2375)	Option 1 (Twin 4.5m Box Culverts)	Option 2 (Single Span Bridge)	Option 3 (2-Span Bridge w/ Pier)	Option 4 (3-Span Bridge w/ Piers)	Option 5 (12m Concrete Arch Culvert)
1:100yr Flow	*202.00*	202.02	202.01	202.01	202.01	202.04
Regional Storm Flow	*202.33*	202.66	202.37	202.35	202.35	202.53

Table 3: Water Levels at Upstream End of Proposed Crossing

Profile	Upstream End of Proposed Structure - Internal Water Level (masl)					
	Existing (at Cross Section 46.2325)	Option 1 (Twin 4.5m Box Culverts)	Option 2 (Single Span Bridge)	Option 3 (2-Span Bridge w/ Pier)	Option 4 (3-Span Bridge w/ Piers)	Option 5 (12m Concrete Arch Culvert)
1:100yr Flow	*202.02*	202.03	202.02	202.02	202.02	202.05
Regional Storm Flow	*202.39*	202.69	202.42	202.41	202.41	202.55

Model result water levels at the downstream face of the Jane Street culvert (500 m upstream of the proposed crossing) are shown in Table 4 below. The results show a small increase in water level at Jane Street between the Existing scenario and the various options for the 1:100yr flow of between 0.01 m and 0.06 m. For the Regional Storm flow, Option 1 produces the greatest increase in water level at Jane Street (0.38 m), while the remaining options result in an increase of between 0.01 m and 0.17 m. As shown in Figures 9 through 14, the Regional Storm flow is shown to overtop Jane Street in the existing condition scenario, as well as in each of the five options.

Table 4: Water Levels at Jane Street Crossing

Profile	D/S of Jane St. (46.271) Water Level (masl)					
	Existing	Option 1 (Twin 4.5m Box Culverts)	Option 2 (Single Span Bridge)	Option 3 (2-Span Bridge w/ Pier)	Option 4 (3-Span Bridge w/ Piers)	Option 5 (12m Concrete Arch Culvert)
1:100yr Flow	202.13	202.19	202.14	202.14	202.14	202.17
Regional Storm Flow	203.07	203.45	203.08	203.10	203.10	203.24

We understand that the preferred option for the crossing of Black Creek is Option 5.

3.0 PROPOSED STORM SEWERS

3.1 Background

The existing storm sewer system in the area was initially constructed between 1987 and 1989 and includes the following:

- A stormwater management (SWM) pond located southeast of the Portage Parkway bridge over Highway 400, which collects stormwater runoff from the following:
  - 1,095 mm diameter storm sewer flowing south along Applewood Crescent; and,
  - 900 mm diameter storm sewer flowing west along Portage Parkway, collecting stormwater runoff from the majority of Portage Parkway between Edgeley Boulevard and Applewood Crescent.
- A SWM pond (Jane/7) south of Portage Parkway, located southeast of the intersection with Jane Street, which collects stormwater runoff from the following:
  - 1,350 mm diameter storm sewer flowing south along Edgeley Boulevard, crossing Portage Parkway;
  - 1,200 mm diameter storm sewer flowing south along Buttermill Avenue. This storm sewer continues along Portage Parkway as a 1,350 mm diameter storm sewer from Buttermill Avenue to Millway Avenue;
  - 1,350 mm diameter storm sewer flowing south along Millway Avenue, crossing Portage Parkway and collects stormwater runoff from the 1,350 mm and 600 mm diameter storm sewers along Portage Parkway. This storm sewer continues south of Portage Parkway along Millway Avenue as a 1,800 mm diameter storm sewer; and,
  - Storm sewers located in Creditstone Road. The elevation, size and type of material for these storm sewers was not provided with the as-built information or ArcReader GIS information from the City of Vaughan.
- Storm sewers located in Jane Street. The elevation, size, type of material for these storm sewers was not provided with the as-built information or ArcReader GIS information from the City of Vaughan or the Regional Municipality of York.

3.2 Methodology

Since detailed topographical information was not provided, it was assumed that the drainage area boundary for Portage Parkway would follow the edge of the road allowance and known high points on the adjacent streets, based on the provided as-built and GIS information. The actual drainage area boundaries will need to be confirmed as part of the detailed design. The Drainage Area Plans are included in Appendix E.

The stormwater runoff peak flow rates were calculated using the Rational Method, as per the City of Vaughan standards, as the drainage area is less than 40 ha and runoff control facilities are not included prior to the outlet into Black Creek. The following City of Vaughan standards were used in the design of the storm sewer system:

- The minor system (new local storm sewers) has been designed to convey the 1:5 year storm event.
- Rainfall intensity as per Table 1-7 of the Engineering Design Criteria & Standard Drawings.
- The first leg of the storm sewer system has been designed using an initial inlet time of 7 minutes.
- Runoff coefficients were selected based on the weighted average of paved and sodded areas from Table 1-8 of the Engineering Design Criteria & Standard Drawings. Based on the road cross-section provided by CIMA+, the average runoff coefficient has been calculated to be 0.75. This is also consistent with the runoff coefficient used for the roads in the previous design of the storm sewers by Ander Engineering & Associates Limited.
- Minimum storm sewer velocity of 0.75 m/s.
- Minimum storm sewer size is 200 mm and minimum depth of cover is 1.2 m.
- Manning's equation was used to size the storm sewer system, based on the above criteria. A Manning's roughness coefficient of 0.013 was used for concrete and PVC pipes.

It is noted that not all of the City of Vaughan standards were addressed in the conceptual design, as the design details have not been developed to a stage where all standards could be met. The detailed design should incorporate all applicable standards.

3.3 Results

3.3.1 SWM pond at Portage Parkway Bridge over Highway 400

Portage Parkway is currently a 4 lane road from Edgeley Boulevard to Applewood Crescent; therefore, the widening for this section of Portage Parkway will consist of only one center turning lane. It is anticipated that the proposed widening will have a negligible effect on the rate of stormwater runoff for this area and a new storm sewer system or enlargement of the existing storm sewers west of Edgeley Boulevard will not be required as part of this project. Revisions to the location of catchbasin structures will be required during the detailed design to line up with the edge of the road and the revised profile. These structures have been identified on Drawing 1.

The City of Vaughan has not provided the level of treatment provided by the existing SWM pond located southeast of the Portage Parkway bridge over Highway 400. Therefore, we cannot comment on the level of quality control of stormwater runoff for this section of Portage Parkway. However, based on the negligible increase in stormwater peak flow rates, we expect that the level of treatment will be consistent with the existing conditions.

3.3.2 Jane/7 Stormwater Management Facility

A new local storm sewer system is proposed east of Edgeley Boulevard extending up to, and outletting directly into, Black Creek, by-passing the forebay of the Jane/7 stormwater management facility, located east of Jane Street and south of Portage Parkway. The new local storm sewer system is proposed to help alleviate ponding concerns that the City of Vaughan has noticed on the existing storm sewer system along Millway Avenue, south

of Portage Parkway. The conceptual design for this new storm sewer system consists of 450 mm to 675 mm diameter storm sewers installed along the south edge of Portage Parkway. The sewers will be installed at grades of 0.2 to 0.4% in order to maintain the minimum cover of 1.2 m at Edgeley Boulevard. The storm sewers will outlet into Black Creek at an invert elevation of 199.20 m. Refer to Drawings 2 to 4 for details.

Potential conflicts with the existing service connections on the south side of Portage Parkway between Millway Avenue and Edgeley Boulevard could not be determined at this time. The as-built information or ArcReader GIS information from the City of Vaughan did not include sufficient information to determine if conflicts exist. Based on the proposed conceptual design, there should be sufficient vertical space to accommodate revisions to the service connections, should conflicts exist. This should be confirmed as part of the detailed design.

Potential conflicts with the existing storm sewers located in Jane Street could not be determined at this time, as no as-built information has been provided. The ArcReader GIS information from the City of Vaughan did not include the elevations, size or type of materials for the existing storm sewers. Based on the GIS information provided, it appears that the storm sewers in the vicinity of the intersection of Jane Street and Portage Parkway connect to the existing 525 mm diameter concrete storm sewer flowing west along Portage Parkway. Assuming this is correct, there would not be a conflict with the new storm sewer system. This should be confirmed as part of the detailed design.

A conflict exists with the existing 600 mm watermain located in Jane Street. The approximate location and elevation of the existing 600 mm diameter watermain is shown on Drawing 3. The City of Vaughan has confirmed that they will consider deflecting the existing watermain to avoid the conflict, subject to the detailed design. The existing watermain is shown to be raised to provide a minimum 500 mm vertical clearance to the new storm sewer system. This should be confirmed as part of the detailed design.

The catchbasins on Portage Parkway, at the intersections of Edgeley Boulevard and Millway Avenue, will need to be relocated to low points created on the adjacent streets, as Portage Parkway will become the major road at both of these intersections. Refer to Drawings 1 and 3 for details.

New catchbasins and maintenance holes are proposed on the east side of Black Creek to intercept stormwater runoff from a portion of the proposed extension of Portage Parkway. 300 mm to 450 mm diameter storm sewers are proposed at 1.5%, outletting into Black Creek at an invert elevation of 199.20 m. Refer to Drawing 4 for details.

The City of Vaughan does not require quantity control of stormwater runoff from Portage Parkway prior to discharge to Black Creek, as Black Creek has an existing online SWM facility. This online SWM facility will be upgraded as part of a separate project. Quality control of stormwater runoff will be managed through the use of oil/grit separators prior to discharge into Black Creek. Two Stormceptor units are proposed, one for each outlet into Black Creek. The 675 mm diameter storm sewer on the west side of Black Creek will be serviced by a Stormceptor STC 9000, which will provide 80% removal of Total Suspended Solids (TSS). The 450 mm diameter storm sewer on the east side of Black Creek will be serviced by a Stormceptor STC 4000, which will provide 80% removal of TSS. Copies of the Stormceptor Sizing Reports are included in Appendix C.

3.3.3 Creditstone Road

The eastern portion of the extension of Portage Parkway, approximately 100 m in length, is proposed to drain to the existing storm sewer system on Creditstone Road. Additional catchbasins connecting to the storm sewers in Creditstone Road will be required west of the intersection. The connection point and elevation will need to be confirmed during the detailed design. The storm sewer is proposed as a 300 mm diameter sewer at a grade of 1.5%. Refer to Drawing 5 for details. It is assumed that this section of road would represent only a minor increase to the existing drainage area for Creditstone Road. Information regarding the existing storm sewer network in Creditstone Road has not been provided for our review. Therefore, we cannot comment on the existing level of treatment, or the impacts that Portage Parkway will have on the existing system.

Additional catchbasins may be required between the high points and initial inlet structures, or in between structures, in order to meet maximum spacing requirements or provide improved collection of stormwater runoff, as per City of Vaughan standards. These should be included in the detailed design.

The actual velocity from the 1:5 year storm event for each storm sewer section has been calculated based on the percent full flow and Figure 9.4 - Hydraulics in PVC Sewer Pipe at Varying Depths from the Handbook of PVC Pipe. This chart is also applicable to concrete pipe, as the Manning's coefficient is the same as PVC. The actual velocities from the 1:5 year storm event range from 0.79 to 2.13 m/s. The storm sewer design sheets are included in Appendix B.

4.0 COST ESTIMATE

The approximate Class C (+/- 30%) capital costs for the new local storm sewer systems and revisions to the existing storm sewers system is $1,500,000. This cost estimate is based on PVC storm sewer system for diameters 450 mm and smaller and concrete storm sewers for sizes larger than 450 mm diameter. The estimate does not include any general construction costs or costs for other items, including surface removals and reinstatement, as these costs should be included as part of the Portage Parkway widening and extension. The estimate includes the revisions proposed to the existing watermain in Jane Street, but does not include costs for temporary water supply, as this has not been determined to be required at this time.

5.0 REFERENCES

1) AECOM “Black Creek Stormwater Optimization Study Municipal Class Environmental Assessment Master Plan Report (Phase 1 & 2)”, February 2012.

2) Golder Associates LTD., “DRAFT Fluvial Geomorphic Assessment in Support of the Portage Parkway Municipal Class Environmental Assessment Study, City of Vaughan”, August 2015.

3) Plan and Profile of Applewood Crescent, Drawing 85-102-10, Sheet 1 of 3, prepared by Ander Engineering & Associates Limited, As Constructed Dec. 1989.

4) Plan and Profile of Applewood Crescent, Drawing 85-102-10, Sheet 2 of 3, prepared by Ander Engineering & Associates Limited, As Constructed Dec. 1989.

5) Plan and Profile of Applewood Crescent, Drawing 85-102-10, Sheet 3 of 3, prepared by Ander Engineering & Associates Limited, As Constructed Dec. 1989.

6) Tributary Areas of Storm Sewer Design, Drawing 85-102-4, Sheet 1 of 3, prepared by Ander Engineering & Associates Limited, dated August 1992.

7) Storm Connection Data, Drawing 85-102-4, Sheet 2 of 3, prepared by Ander Engineering & Associates Limited, As Constructed Dec. 1989.

8) Storm Connection Data, Drawing 85-102-4, Sheet 3 of 3, prepared by Ander Engineering & Associates Limited, As Constructed Dec. 1989.

9) Jane Street (Y.R.55) New Construction, Drawing P-1046-24, Sheet No. 9, The Regional Municipality of York Engineering, dated 11/8/89.

10) Highway 400 & 7 – Phase II, Applewood Crescent (East), Drawing 403, prepared by Stantec Consulting Ltd., dated May 3, 2002.

11) City of Vaughan ArcReader GIS information, received on March 10, 2016, May 17, 2016 and July 11, 2016.

12) Handbook of PVC Pipe, Uni-Bell PVC Pipe Association, dated December 1993.

Report Signature Page

GOLDER ASSOCIATES LTD.

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Civil Engineer

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Senior Civil Engineer

SWT/DVK/md
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APPENDIX A

HECRAS Modelling

HEC-RAS HEC-RAS 5.0.0 February 2016
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

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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
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PROJECT DATA
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Project File : BlackCreekUpdate.prj
Run Date and Time: 6/30/2016 3:26:59 PM

Project in SI units

Project Description:
Main Humber River and Tributaries Digital Flood Plain Mapping
Hec-Ras File:
Black Creek Geometry.gxx covers Sheets HUM 13 (Converted Hec-2 file 46f1tbc.dat using new mapping), HUM 13A, HUM 13B & HUM 13C (New HEC-RAS based on new mapping)

PLAN DATA

Plan Title: Portage Parkway (Feb 2016 Existing)
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Geometry Title: BlackCreek-Portage Existing -Feb2016
Geometry File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.g07

Flow Title : Black Creek EXISTING Flows - April '10
Flow File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.f04

Plan Summary Information:

Number of: Cross Sections	= 86	Multiple Openings	= 1
Culverts	= 19	Inline Structures	= 2
Bridges	= 1	Lateral Structures	= 0

Computational Information
Water surface calculation tolerance = 0.003
Critical depth calculation tolerance = 0.003
Maximum number of iterations = 20

Maximum difference tolerance = 0.1
Flow tolerance factor = 0.001

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

FLOW DATA

Flow Title: Black Creek EXISTING Flows - April '10
Flow File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.f04

Flow Data (m3/s)

River	Reach	RS	2-year	5-year	10-year	25-year	50-year	100-year	Aug. 19thRegional w red'n
RIVER-1	Reach-1	46.45	3.729	4.826	5.609	6.57	7.342	7.79	16.701 42.698
RIVER-1	Reach-1	46.413	1.611	2.011	2.244	2.66	3.591	4.753	10.797 42.698
RIVER-1	Reach-1	46.41	3.066	4.074	4.85	5.926	6.831	7.624	17.745 47.801
RIVER-1	Reach-1	46.36	6.209	8.542	10.169	12.321	14.297	16.307	41.071 66.485
RIVER-1	Reach-1	46.33	8.661	12.09	14.453	17.546	20.243	22.971	57.024 74.783
RIVER-1	Reach-1	46.30	10.769	15.139	18.134	22.036	25.353	28.697	70.731 81.913
RIVER-1	Reach-1	46.274	8.055	11.399	13.737	17.024	19.57	22.105	52.858 81.913
RIVER-1	Reach-1	46.25	15.029	21.487	25.936	31.807	36.287	40.806	96.524 108.096
RIVER-1	Reach-1	46.214	3.775	6.823	9.185	12.675	15.796	19.055	49.3 108.096
RIVER-1	Reach-1	46.21	7.789	11.08	13.186	15.823	17.823	20.589	50.389 122.563
RIVER-1	Reach-1	46.09	8.997	12.899	15.58	19.072	21.783	24.795	62.776 133.764
RIVER-1	Reach-1	46.032	19.481	29.214	36.46	51.57	58.851	66.972	191.204 200.643

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
RIVER-1	Reach-1	2-year		
Known WS = 181.99				
RIVER-1	Reach-1	5-year		
Known WS = 182.42				
RIVER-1	Reach-1	10-year		
Known WS = 182.66				
RIVER-1	Reach-1	25-year		
Known WS = 182.73				
RIVER-1	Reach-1	50-year		
Known WS = 182.89				
RIVER-1	Reach-1	100-year		
Known WS = 183.04				
RIVER-1	Reach-1	Aug. 19th		
Known WS = 184.54				
RIVER-1	Reach-1	Regional w red'n		
Known WS = 184.54				

GEOMETRY DATA

Geometry Title: BlackCreek-Portage Existing -Feb2016
Geometry File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.g07

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.45

INPUT
Description: Section 46.45 - J.D. Barnes 2003 topo mapping - U/S Study Limit
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	209	30	208	75	207.5	84	206.5	85	206.5
90	207.5	130	208	136	209				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	75	.035	90	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
75	90	180	180	170	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	207.38	Element	Left OB	Channel	Right OB
Vel Head (m)	0.19	Wt. n-Val.		0.035	

W.S. Elev (m)	207.19	Reach Len. (m)	180.00	180.00
170.00				
Crit W.S. (m)	207.19	Flow Area (m2)		4.02
E.G. Slope (m/m)	0.017095	Area (m2)		4.02
Q Total (m3/s)	7.79	Flow (m3/s)		7.79
Top Width (m)	10.66	Top Width (m)		10.66
Vel Total (m/s)	1.94	Avg. Vel. (m/s)		1.94
Max Chl Dpth (m)	0.69	Hydr. Depth (m)		0.38
Conv. Total (m3/s)	59.6	Conv. (m3/s)		59.6
Length Wtd. (m)	179.49	Wetted Per. (m)		10.76
Min Ch El (m)	206.50	Shear (N/m2)		62.62
Alpha	1.00	Stream Power (N/m s)		121.33
Frctn Loss (m)	0.16	Cum Volume (1000 m3)	119.99	215.16
77.63				
C & E Loss (m)	0.05	Cum SA (1000 m2)	121.50	84.02
93.40				

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 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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	208.17	Element	Left OB	Channel	Right OB
Vel Head (m)	0.22	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	207.95	Reach Len. (m)	180.00	180.00	170.00
Crit W.S. (m)	207.95	Flow Area (m2)	8.94	14.69	7.94
E.G. Slope (m/m)	0.006925	Area (m2)	8.94	14.69	7.94
Q Total (m3/s)	42.70	Flow (m3/s)	5.47	34.19	3.04
Top Width (m)	90.74	Top Width (m)	40.10	15.00	

35.64					
Vel Total (m/s)	1.35	Avg. Vel. (m/s)	0.61	2.33	
0.38					
Max Chl Dpth (m)	1.45	Hydr. Depth (m)	0.22	0.98	
0.22					
Conv. Total (m3/s)	513.1	Conv. (m3/s)	65.7	410.9	
36.5					
Length Wtd. (m)	177.73	Wetted Per. (m)	40.10	15.15	
35.65					
Min Ch El (m)	206.50	Shear (N/m2)	15.13	65.81	
15.13					
Alpha	2.40	Stream Power (N/m s)	9.26	153.23	
5.79					
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	450.51	441.94	
387.15					
C & E Loss (m)	0.07	Cum SA (1000 m2)	335.08	84.42	
330.62					

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 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: RIVER-1
REACH: Reach-1 RS: 46.44

INPUT
Description: Section 46.44 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	209	84	208	118	205	126	204	129	203.7
131	203.7	132	204	136	205	139	206	216	207
224	208	300	209						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	126	.035	132	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
126	132	130	130	125	.1 .3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	205.29	Element	Left OB	Channel

Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	205.28	Reach Len. (m)	130.00	130.00	125.00
Crit W.S. (m)		Flow Area (m2)	6.69	8.88	3.24
E.G. Slope (m/m)	0.000274	Area (m2)	6.69	8.88	3.24
Q Total (m3/s)	7.79	Flow (m3/s)	1.57	5.42	0.80
Top Width (m)	22.02	Top Width (m)	11.18	6.00	4.84
Vel Total (m/s)	0.41	Avg. Vel. (m/s)	0.23	0.61	0.25
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.60	1.48	0.67
Conv. Total (m3/s)	470.5	Conv. (m3/s)	94.6	327.5	48.4
Length Wtd. (m)	129.13	Wetted Per. (m)	11.25	6.06	5.01
Min Ch El (m)	203.70	Shear (N/m2)	1.60	3.94	1.74
Alpha	1.61	Stream Power (N/m s)	0.37	2.41	0.43
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	119.39	214.00	77.36
C & E Loss (m)	0.00	Cum SA (1000 m2)	120.50	82.52	92.99

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.46	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	207.46	Reach Len. (m)	130.00	130.00	125.00
Crit W.S. (m)		Flow Area (m2)	57.86	21.94	92.20
E.G. Slope (m/m)	0.000074	Area (m2)	57.86	21.94	92.20
Q Total (m3/s)	42.70	Flow (m3/s)	13.64	12.70	16.35
Top Width (m)	129.50	Top Width (m)	35.84	6.00	87.65
Vel Total (m/s)	0.25	Avg. Vel. (m/s)	0.24	0.58	0.18
Max Chl Dpth (m)	3.76	Hydr. Depth (m)	1.61	3.66	1.05
Conv. Total (m3/s)	4968.4	Conv. (m3/s)	1587.3	1478.3	1902.8
Length Wtd. (m)	128.13	Wetted Per. (m)	36.01	6.06	87.97
Min Ch El (m)	203.70	Shear (N/m2)	1.16	2.62	0.76

Alpha	2.10	Stream Power (N/m s)	0.27	1.52
0.13				
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	444.50	438.65
378.64				
C & E Loss (m)	0.00	Cum SA (1000 m2)	328.24	82.53
320.14				

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.43

INPUT
Description: Section 46.43 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	95	210	95	208.3	105	208	116	205
143	204	145	203.5	149	203.5	150	204	177	205
180	206	187	207	231	208	310	208.6		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	105	.08	143	.035	150	.08	177	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
143	150	100	100	95	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	205.27	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035
0.080				
W.S. Elev (m)	205.27	Reach Len. (m)	100.00	100.00
95.00				
Crit W.S. (m)		Flow Area (m2)	20.95	11.65
20.93				
E.G. Slope (m/m)	0.000076	Area (m2)	20.95	11.65
20.93				
Q Total (m3/s)	7.79	Flow (m3/s)	1.88	4.00
1.91				
Top Width (m)	62.81	Top Width (m)	27.99	7.00
27.81				
Vel Total (m/s)	0.15	Avg. Vel. (m/s)	0.09	0.34
0.09				
Max Chl Dpth (m)	1.77	Hydr. Depth (m)	0.75	1.66
0.75				
Conv. Total (m3/s)	894.4	Conv. (m3/s)	215.7	459.5
219.3				
Length Wtd. (m)	99.26	Wetted Per. (m)	28.05	7.18
27.88				
Min Ch El (m)	203.50	Shear (N/m2)	0.56	1.21
0.56				
Alpha	3.05	Stream Power (N/m s)	0.05	0.41
0.05				
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	117.59	212.67
75.85				
C & E Loss (m)	0.00	Cum SA (1000 m2)	117.95	81.68
90.95				

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.46	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035	0.077
W.S. Elev (m)	207.45	Reach Len. (m)	100.00	100.00	95.00
Crit W.S. (m)		Flow Area (m2)	90.69	26.91	96.66
E.G. Slope (m/m)	0.000047	Area (m2)	90.69	26.91	96.66
Q Total (m3/s)	42.70	Flow (m3/s)	14.32	12.73	15.65
Top Width (m)	99.83	Top Width (m)	35.99	7.00	56.84
Vel Total (m/s)	0.20	Avg. Vel. (m/s)	0.16	0.47	0.16
Max Chl Dpth (m)	3.95	Hydr. Depth (m)	2.52	3.84	1.70
Conv. Total (m3/s)	6221.0	Conv. (m3/s)	2086.0	1854.8	2280.2
Length Wtd. (m)	98.70	Wetted Per. (m)	36.33	7.18	57.10
Min Ch El (m)	203.50	Shear (N/m2)	1.15	1.73	0.78
Alpha	2.13	Stream Power (N/m s)	0.18	0.82	0.13
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	434.85	435.47	366.83
C & E Loss (m)	0.00	Cum SA (1000 m2)	323.58	81.69	311.11

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.42

INPUT
Description: Section 46.42 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208.5	13	208	29	207	31	206	52	205
64	204	66	203.3	70	203.3	74	204	80	205
84	206	105	207	215	208	231	208.3		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	29	.08	64	.035	74	.08	105	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
64	74	295	240	190	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	205.27	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	205.26	Reach Len. (m)	295.00	240.00	190.00
Crit W.S. (m)		Flow Area (m2)	9.83	17.50	4.69
E.G. Slope (m/m)	0.000085	Area (m2)	9.83	17.50	4.69
Q Total (m3/s)	7.79	Flow (m3/s)	0.77	6.61	0.41
Top Width (m)	34.50	Top Width (m)	17.46	10.00	7.04
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.08	0.38	0.09
Max Chl Dpth (m)	1.96	Hydr. Depth (m)	0.56	1.75	0.67
Conv. Total (m3/s)	845.3	Conv. (m3/s)	83.6	717.4	44.3
Length Wtd. (m)	241.75	Wetted Per. (m)	17.51	10.18	7.15
Min Ch El (m)	203.30	Shear (N/m2)	0.47	1.43	0.55
Alpha	2.06	Stream Power (N/m s)	0.04	0.54	0.05
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	116.06	211.21	74.63
C & E Loss (m)	0.00	Cum SA (1000 m2)	115.68	80.83	89.29

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.077
W.S. Elev (m)	207.44	Reach Len. (m)	295.00	240.00	190.00
Crit W.S. (m)		Flow Area (m2)	79.44	39.30	55.77
E.G. Slope (m/m)	0.000067	Area (m2)	79.44	39.30	55.77
Q Total (m3/s)	42.70	Flow (m3/s)	13.58	22.59	6.53
Top Width (m)	131.40	Top Width (m)	42.04	10.00	79.37
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.17	0.57	0.12
Max Chl Dpth (m)	4.14	Hydr. Depth (m)	1.89	3.93	0.70
Conv. Total (m3/s)	5223.1	Conv. (m3/s)	1661.5	2763.0	798.6
Length Wtd. (m)	248.69	Wetted Per. (m)	42.35	10.18	79.60
Min Ch El (m)	203.30	Shear (N/m2)	1.23	2.53	

0.46				
Alpha	3.11	Stream Power (N/m s)	0.21	1.45
0.05				
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	426.34	432.16
359.59				
C & E Loss (m)	0.00	Cum SA (1000 m2)	319.67	80.84
304.64				

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: RIVER-1
REACH: Reach-1 RS: 46.413

INPUT
Description: Section 46.413 - Creditview Road - Inline Weir Section
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	203.05	144.7	203.05	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
128	146	5	5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	129.7	207.11	F
144.7	352	207.4	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	205.26	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.00	Wt. n-Val.		0.035
W.S. Elev (m)	205.26	Reach Len. (m)	5.00	5.00
5.00				
Crit W.S. (m)	203.27	Flow Area (m2)		33.11
E.G. Slope (m/m)	0.000009	Area (m2)	29.76	39.05
14.63				
Q Total (m3/s)	4.75	Flow (m3/s)		4.75
Top Width (m)	52.28	Top Width (m)	22.19	18.00
12.09				
Vel Total (m/s)	0.14	Avg. Vel. (m/s)		0.14
Max Chl Dpth (m)	2.21	Hydr. Depth (m)		2.21
Conv. Total (m3/s)	1603.4	Conv. (m3/s)		1603.4
Length Wtd. (m)	5.00	Wetted Per. (m)		15.00

Min Ch El (m)	203.05	Shear (N/m2)		0.19
Alpha	1.00	Stream Power (N/m s)		0.03
Frctn Loss (m)		Cum Volume (1000 m3)	110.22	204.43
72.79				
C & E Loss (m)		Cum SA (1000 m2)	109.83	77.47
87.48				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.44	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.00	Wt. n-Val.	0.079	0.035	
0.080					
W.S. Elev (m)	207.44	Reach Len. (m)	5.00	5.00	
5.00					
Crit W.S. (m)	203.99	Flow Area (m2)	93.25	78.25	
48.65					
E.G. Slope (m/m)	0.000021	Area (m2)	93.25	78.25	
48.65					
Q Total (m3/s)	42.70	Flow (m3/s)	10.48	27.13	
5.09					
Top Width (m)	99.97	Top Width (m)	62.80	18.00	
19.16					
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.11	0.35	
0.10					
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.48	4.35	
2.54					
Conv. Total (m3/s)	9325.7	Conv. (m3/s)	2288.4	5926.0	
1111.3					
Length Wtd. (m)	5.00	Wetted Per. (m)	63.25	18.13	
19.70					
Min Ch El (m)	203.05	Shear (N/m2)	0.30	0.89	
0.51					
Alpha	2.15	Stream Power (N/m s)	0.03	0.31	
0.05					
Frctn Loss (m)		Cum Volume (1000 m3)	400.87	418.05	
349.67					
C & E Loss (m)		Cum SA (1000 m2)	304.21	77.48	
295.28					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

INLINE STRUCTURE

RIVER: RIVER-1
REACH: Reach-1 RS: 46.4125

INPUT
Description: Hum 13B-4R. Creditview Road - 4 Cell - 3.0 m W x 1.5 m H x 41 m L Concrete Box Culverts and 6.5 m W Weir with Drop Inlet Structure.

Drawings by Urban Ecosystems Ltd. (DT-2 & G-4), 1999.

New
HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 1
Deck/Roadway Width = .5
Weir Coefficient = 1.75
Weir Embankment Coordinates num = 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	129.75	207.11	129.75	207	133.95	207
133.95	204.7	137.2	204.7	140.45	204.7	140.45	207	144.65	207
144.65	207.4	205	207.79	305	208.3	352	208.6		

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 =
Weir crest shape = Broad Crested

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.412

INPUT
Description: Section 46.412 - Creditview Road - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	203.05	144.7	203.05	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
128	146	45	45	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	129.7	207.11	F
144.7	352	207.4	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.91	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.035	
W.S. Elev (m)	203.91	Reach Len. (m)	45.00	45.00	45.00
Crit W.S. (m)	203.27	Flow Area (m2)		12.84	
E.G. Slope (m/m)	0.000206	Area (m2)	2.97	14.73	1.32
Q Total (m3/s)	4.75	Flow (m3/s)		4.75	

Top Width (m)	39.13	Top Width (m)	14.63	18.00	6.50
Vel Total (m/s)	0.37	Avg. Vel. (m/s)		0.37	
Max Chl Dpth (m)	0.86	Hydr. Depth (m)		0.86	
Conv. Total (m3/s)	330.8	Conv. (m3/s)		330.8	
Length Wtd. (m)	45.00	Wetted Per. (m)		15.00	
Min Ch El (m)	203.05	Shear (N/m2)		1.73	
Alpha	1.00	Stream Power (N/m s)		0.64	
Frctn Loss (m)		Cum Volume (1000 m3)	110.22	204.23	72.79
C & E Loss (m)		Cum SA (1000 m2)	109.74	77.38	87.43

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.37	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	
W.S. Elev (m)	207.37	Reach Len. (m)	45.00	45.00	45.00
Crit W.S. (m)	203.99	Flow Area (m2)	89.20	71.72	
E.G. Slope (m/m)	0.000032	Area (m2)	89.20	77.04	47.37
Q Total (m3/s)	42.70	Flow (m3/s)	12.31	30.39	
Top Width (m)	94.35	Top Width (m)	57.41	18.00	18.94
Vel Total (m/s)	0.27	Avg. Vel. (m/s)	0.14	0.42	
Max Chl Dpth (m)	4.32	Hydr. Depth (m)	1.55	4.29	
Conv. Total (m3/s)	7588.4	Conv. (m3/s)	2187.2	5401.2	
Length Wtd. (m)	45.00	Wetted Per. (m)	57.86	16.76	
Min Ch El (m)	203.05	Shear (N/m2)	0.48	1.33	
Alpha	1.89	Stream Power (N/m s)	0.07	0.56	
Frctn Loss (m)		Cum Volume (1000 m3)	400.87	417.47	349.67
C & E Loss (m)		Cum SA (1000 m2)	303.91	77.39	295.19

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.4115

INPUT
Description: Hum 13B-4R. Creditview Road - 4 Cell - 3.0 m W x 1.5 m H x 45 m L
Concrete Box Culverts and 6.5 m W Weir with Drop Inlet Structure.
Drawings by Urban Ecosystems Ltd. (DT-2 & G-4), 1999.

New
HEC-RAS coding January 2004 by Acres included coding of culvert
in HEC-RAS, including adjustments to roadway coding and hydraulic
loss coefficients.

Distance from Upstream XS = 10
Deck/Roadway Width = 25
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 11

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	208		60	207.5		129.7	207.11	
129.7	208.5		137.2	208.5		144.7	208.5	
144.7	207.4		205	207.79		265	208	
305	208.3		352	208.6				

Upstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	203.05	144.7	203.05	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
128	146	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	129.7	207.11	F
144.7	352	207.4	F

Downstream Deck/Roadway Coordinates
num= 11

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	208		60	207.5		129.7	207.11	
129.7	208.5		137.2	208.5		144.7	208.5	
144.7	207.4		205	207.79		265	208	
305	208.3		352	208.6				

Downstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	202.96	144.7	202.96	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

```
Bank Sta: Left   Right    Coeff Contr.   Expan.
          128     146            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   129.7   206.8       F
   144.7     352   206.8       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           Box     1.5       3
FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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      41     .015     .015        0                   .5
      1
Number of Barrels =  4
Upstream   Elevation =  203.05
Centerline Stations
    Sta.    Sta.    Sta.    Sta.
   132.1   135.5   138.9   142.3
Downstream Elevation =  202.96
Centerline Stations
    Sta.    Sta.    Sta.    Sta.
   132.1   135.5   138.9   142.3

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       4.75    Culv Full Len (m)
  # Barrels                    4    Culv Vel US (m/s)         0.47
  Q Barrel (m3/s)           1.19    Culv Vel DS (m/s)         0.42
  E.G. US. (m)            203.91    Culv Inv El Up (m)      203.05
  W.S. US. (m)            203.91    Culv Inv El Dn (m)      202.96
  E.G. DS (m)             203.90    Culv Frctn Ls (m)         0.01
  W.S. DS (m)             203.89    Culv Exit Loss (m)        0.00
  Delta EG (m)              0.01    Culv Entr Loss (m)        0.01
  Delta WS (m)              0.01    Q Weir (m3/s)
  E.G. IC (m)             203.46    Weir Sta Lft (m)
  E.G. OC (m)             203.91    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
  Culv WS Inlet (m)       203.90    Weir Max Depth (m)
  Culv WS Outlet (m)      203.89    Weir Avg Depth (m)
  Culv Nml Depth (m)        0.31    Weir Flow Area (m2)
  Culv Crt Depth (m)        0.25    Min El Weir Flow (m)    207.11


CULVERT OUTPUT  Profile #Regional w red'n  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      39.14    Culv Full Len (m)        41.00
  # Barrels                   4     Culv Vel US (m/s)         2.17
  Q Barrel (m3/s)           9.79    Culv Vel DS (m/s)         2.17
  E.G. US. (m)            207.37    Culv Inv El Up (m)      203.05
  W.S. US. (m)            207.37    Culv Inv El Dn (m)      202.96
```

E.G. DS (m)	206.91	Culv Frctn Ls (m)	0.11
W.S. DS (m)	206.90	Culv Exit Loss (m)	0.24
Delta EG (m)	0.47	Culv Entr Loss (m)	0.12
Delta WS (m)	0.46	Q Weir (m3/s)	3.55
E.G. IC (m)	204.84	Weir Sta Lft (m)	82.57
E.G. OC (m)	207.37	Weir Sta Rgt (m)	129.70
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	204.55	Weir Max Depth (m)	0.26
Culv WS Outlet (m)	204.46	Weir Avg Depth (m)	0.13
Culv Nml Depth (m)		Weir Flow Area (m2)	6.21
Culv Crt Depth (m)	1.03	Min El Weir Flow (m)	207.11

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.411

INPUT
Description: Section 46.411 - Creditview Road - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	202.96	144.7	202.96	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
128	146	80	80	90	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	129.7	206.8	F
144.7	352	206.8	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.90	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.035	
W.S. Elev (m)	203.89	Reach Len. (m)	80.00	80.00	90.00
Crit W.S. (m)	203.18	Flow Area (m2)		14.02	
E.G. Slope (m/m)	0.000154	Area (m2)	2.80	16.01	1.24
Q Total (m3/s)	4.75	Flow (m3/s)		4.75	
Top Width (m)	38.52	Top Width (m)	14.20	18.00	6.31
Vel Total (m/s)	0.34	Avg. Vel. (m/s)		0.34	
Max Chl Dpth (m)	0.93	Hydr. Depth (m)		0.93	

Conv. Total (m3/s)	382.8	Conv. (m3/s)		382.8
Length Wtd. (m)	80.76	Wetted Per. (m)		15.00
Min Ch El (m)	202.96	Shear (N/m2)		1.41
Alpha	1.00	Stream Power (N/m s)		0.48
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	110.22	204.05
72.79				
C & E Loss (m)	0.00	Cum SA (1000 m2)	109.09	76.57
87.14				

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.91	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	
0.080					
W.S. Elev (m)	206.90	Reach Len. (m)	80.00	80.00	
90.00					
Crit W.S. (m)	203.90	Flow Area (m2)	70.79	70.16	
38.91					
E.G. Slope (m/m)	0.000033	Area (m2)	70.79	70.16	
38.91					
Q Total (m3/s)	42.70	Flow (m3/s)	9.47	28.50	
4.72					
Top Width (m)	63.11	Top Width (m)	27.68	18.00	
17.43					
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.13	0.41	
0.12					
Max Chl Dpth (m)	3.94	Hydr. Depth (m)	2.56	3.90	
2.23					
Conv. Total (m3/s)	7384.3	Conv. (m3/s)	1638.0	4929.7	
816.7					
Length Wtd. (m)	81.46	Wetted Per. (m)	28.11	18.19	
17.89					
Min Ch El (m)	202.96	Shear (N/m2)	0.83	1.26	
0.71					
Alpha	2.05	Stream Power (N/m s)	0.11	0.51	
0.09					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	400.87	416.36	
349.67					
C & E Loss (m)	0.00	Cum SA (1000 m2)	302.00	76.58	
294.37					

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: RIVER-1
REACH: Reach-1 RS: 46.41

INPUT
Description: Section 46.41 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207.5	71	207	83	204	84	203.56	123	203.56
126	205	136	205	140	204	156	203.1	161	202.5
164	202.5	166	203	195	204	206	208	234	208.2

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	71	.08	83	.035	126	.08	156	.035
166	.08	195	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
156	166	140	140	120	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.89	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.043	0.035	0.080
W.S. Elev (m)	203.88	Reach Len. (m)	140.00	140.00	120.00
Crit W.S. (m)		Flow Area (m2)	18.33	11.84	11.34
E.G. Slope (m/m)	0.000131	Area (m2)	18.33	11.84	11.34
Q Total (m3/s)	7.62	Flow (m3/s)	2.38	4.31	0.94
Top Width (m)	89.99	Top Width (m)	54.35	10.00	25.64
Vel Total (m/s)	0.18	Avg. Vel. (m/s)	0.13	0.36	0.08
Max Chl Dpth (m)	1.38	Hydr. Depth (m)	0.34	1.18	0.44
Conv. Total (m3/s)	665.9	Conv. (m3/s)	207.5	376.2	82.2
Length Wtd. (m)	138.77	Wetted Per. (m)	54.52	10.10	25.66
Min Ch El (m)	202.50	Shear (N/m2)	0.43	1.51	0.57
Alpha	2.40	Stream Power (N/m s)	0.06	0.55	0.05
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	109.37	202.94	72.23
C & E Loss (m)	0.00	Cum SA (1000 m2)	106.35	75.45	85.70

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.91	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.044	0.035	0.077
W.S. Elev (m)	206.90	Reach Len. (m)	140.00	140.00	120.00
Crit W.S. (m)		Flow Area (m2)	240.59	42.04	110.32
E.G. Slope (m/m)	0.000008	Area (m2)	240.59	42.04	110.32
Q Total (m3/s)	47.80	Flow (m3/s)	30.75	8.57	8.48
Top Width (m)	131.60	Top Width (m)	84.62	10.00	36.99
Vel Total (m/s)	0.12	Avg. Vel. (m/s)	0.13	0.20	0.08
Max Chl Dpth (m)	4.40	Hydr. Depth (m)	2.84	4.20	2.98
Conv. Total (m3/s)	17337.3	Conv. (m3/s)	11152.1	3108.5	3076.7
Length Wtd. (m)	135.44	Wetted Per. (m)	85.54	10.10	37.51
Min Ch El (m)	202.50	Shear (N/m2)	0.21	0.31	0.22
Alpha	1.28	Stream Power (N/m s)	0.03	0.06	0.02
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	388.41	411.87	342.96
C & E Loss (m)	0.00	Cum SA (1000 m2)	297.50	75.46	291.92

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: RIVER-1
REACH: Reach-1 RS: 46.402

INPUT
Description: Section 46.402 - Highway 400 - U/S Bounding Section - J.D. Barnes
2003 topo mapping

Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	212	21	206	97	205	104	203	105	202.4
115	202.4	116	203	125	205	136	206	187	206
250	206	270	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	97	.08	104	.035	116	.08	136	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
104	116	100	100	100	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	106	206.7	F
114.5	270	206.7	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.86	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.84	Reach Len. (m)	100.00	100.00	100.00
Crit W.S. (m)	202.83	Flow Area (m2)		12.25	
E.G. Slope (m/m)	0.000292	Area (m2)	1.24	16.69	1.59
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	18.73	Top Width (m)	2.94	12.00	3.78
Vel Total (m/s)	0.62	Avg. Vel. (m/s)		0.62	
Max Chl Dpth (m)	1.44	Hydr. Depth (m)		1.44	
Conv. Total (m3/s)	446.4	Conv. (m3/s)		446.4	
Length Wtd. (m)	100.00	Wetted Per. (m)		8.50	
Min Ch El (m)	202.40	Shear (N/m2)		4.12	
Alpha	1.00	Stream Power (N/m s)		2.57	
Frctn Loss (m)		Cum Volume (1000 m3)	108.00	200.94	71.45
C & E Loss (m)		Cum SA (1000 m2)	102.34	73.91	83.94

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.90	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.055	0.035	0.059
W.S. Elev (m)	206.90	Reach Len. (m)	100.00	100.00	100.00
Crit W.S. (m)	203.88	Flow Area (m2)	128.12	53.40	148.15
E.G. Slope (m/m)	0.000023	Area (m2)	128.12	53.40	148.15
Q Total (m3/s)	47.80	Flow (m3/s)	15.09	19.42	13.30
Top Width (m)	241.15	Top Width (m)	86.15	12.00	143.00
Vel Total (m/s)	0.14	Avg. Vel. (m/s)	0.12	0.36	0.09
Max Chl Dpth (m)	4.50	Hydr. Depth (m)	1.49	4.45	

1.04					
Conv. Total (m3/s)	9978.6	Conv. (m3/s)	3149.6	4053.3	2775.7
Length Wtd. (m)	100.00	Wetted Per. (m)	86.56	12.33	143.31
Min Ch El (m)	202.40	Shear (N/m2)	0.33	0.97	0.23
Alpha	2.87	Stream Power (N/m s)	0.04	0.35	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	362.60	405.19	327.45
C & E Loss (m)		Cum SA (1000 m2)	285.55	73.92	281.12

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.4015

INPUT
Description: Hum 13B-3R. Highway 400 - 3 Cell - 2.4 m W x 2.4 m H x 80 m L Concrete Box Culverts. Drawings by McCormick Rankin (Sheet 40 & 47, no date) used to code culvert in HEC-RAS format.

New
HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 14
Deck/Roadway Width = 80
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	206.5		189	207		270	207.8	

Upstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	212	21	206	97	205	104	203	105	202.4
115	202.4	116	203	125	205	136	206	187	206
250	206	270	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	97	.08	104	.035	116	.08	136	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
104	116	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	106	206.7	F
114.5	270	206.7	F

Downstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord

0	206.5	189	207	270	207.8		

Downstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	212	21	206	97	205	104	203	105	202.4
115	202.4	116	203	125	205	136	206	187	206
270	206.5								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	21	.08	104	.035	116	.08	136	.05

Bank Sta: Left Right Coeff Contr. Expan.
104 116 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	106	206	F
114.5	270	206	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	Box	2.4	2.4

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
	14	80	.015	.015	0	.4	1

Number of Barrels = 3
Upstream Elevation = 202.4
Centerline Stations

Sta.	Sta.	Sta.
107.5	110.2	112.9

Downstream Elevation = 202.4
Centerline Stations

Sta.	Sta.	Sta.
107.5	110.2	112.9

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	7.62	Culv Full Len (m)	
# Barrels	3	Culv Vel US (m/s)	0.75
Q Barrel (m3/s)	2.54	Culv Vel DS (m/s)	0.76
E.G. US. (m)	203.86	Culv Inv El Up (m)	202.40
W.S. US. (m)	203.84	Culv Inv El Dn (m)	202.40
E.G. DS (m)	203.82	Culv Frctn Ls (m)	0.01
W.S. DS (m)	203.80	Culv Exit Loss (m)	0.01
Delta EG (m)	0.04	Culv Entr Loss (m)	0.01
Delta WS (m)	0.04	Q Weir (m3/s)	
E.G. IC (m)	203.16	Weir Sta Lft (m)	
E.G. OC (m)	203.86	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	

Culv WS Inlet (m)	203.82	Weir Max Depth (m)	
Culv WS Outlet (m)	203.80	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.49	Min El Weir Flow (m)	206.70

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	31.75	Culv Full Len (m)	80.00
# Barrels	3	Culv Vel US (m/s)	1.84
Q Barrel (m3/s)	10.58	Culv Vel DS (m/s)	1.84
E.G. US. (m)	206.90	Culv Inv El Up (m)	202.40
W.S. US. (m)	206.90	Culv Inv El Dn (m)	202.40
E.G. DS (m)	206.55	Culv Frctn Ls (m)	0.12
W.S. DS (m)	206.54	Culv Exit Loss (m)	0.16
Delta EG (m)	0.35	Culv Entr Loss (m)	0.07
Delta WS (m)	0.36	Q Weir (m3/s)	16.05
E.G. IC (m)	205.08	Weir Sta Lft (m)	17.83
E.G. OC (m)	206.90	Weir Sta Rgt (m)	153.02
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	204.80	Weir Max Depth (m)	0.35
Culv WS Outlet (m)	204.80	Weir Avg Depth (m)	0.18
Culv Nml Depth (m)		Weir Flow Area (m2)	23.96
Culv Crt Depth (m)	1.26	Min El Weir Flow (m)	206.70

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.401

INPUT
Description: Section 46.401 - Highway 400 - D/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	212	21	206	97	205	104	203	105	202.4
115	202.4	116	203	125	205	136	206	187	206
270	206.5								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	21	.08	104	.035	116	.08	136	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
104	116	80	95	100	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	106	206	F
114.5	270	206	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.82	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	

W.S. Elev (m)	203.80	Reach Len. (m)	80.00	95.00	100.00
Crit W.S. (m)	202.83	Flow Area (m2)		11.92	
E.G. Slope (m/m)	0.000319	Area (m2)	1.13	16.23	1.45
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	18.42	Top Width (m)	2.81	12.00	3.61
Vel Total (m/s)	0.64	Avg. Vel. (m/s)		0.64	
Max Chl Dpth (m)	1.40	Hydr. Depth (m)		1.40	
Conv. Total (m3/s)	426.6	Conv. (m3/s)		426.6	
Length Wtd. (m)	95.00	Wetted Per. (m)		8.50	
Min Ch El (m)	202.40	Shear (N/m2)		4.39	
Alpha	1.00	Stream Power (N/m s)		2.81	
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	108.00	200.35	71.45
C & E Loss (m)	0.00	Cum SA (1000 m2)	102.05	72.71	83.57

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.55	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.066
W.S. Elev (m)	206.54	Reach Len. (m)	80.00	95.00	100.00
Crit W.S. (m)	203.88	Flow Area (m2)	97.50	49.10	86.23
E.G. Slope (m/m)	0.000063	Area (m2)	97.50	49.10	86.23
Q Total (m3/s)	47.80	Flow (m3/s)	10.67	27.93	9.20
Top Width (m)	250.90	Top Width (m)	84.90	12.00	154.00
Vel Total (m/s)	0.21	Avg. Vel. (m/s)	0.11	0.57	0.11
Max Chl Dpth (m)	4.14	Hydr. Depth (m)	1.15	4.09	0.56
Conv. Total (m3/s)	6032.0	Conv. (m3/s)	1346.1	3524.6	1161.3
Length Wtd. (m)	90.36	Wetted Per. (m)	85.26	12.33	154.31
Min Ch El (m)	202.40	Shear (N/m2)	0.70	2.45	0.34
Alpha	4.60	Stream Power (N/m s)	0.08	1.39	0.04
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	362.60	397.78	327.45

C & E Loss (m)	0.00	Cum SA (1000 m2)	277.00	72.72
266.27				

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: RIVER-1
REACH: Reach-1 RS: 46.392

INPUT
Description: Section 46.392 - Langstaff Road - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	15	206	30	206	103	206	106	205
130	205	135	203	136	202.5	145	202.5	147	203
153	205	175	205	191	210	203	210		

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.025	103	.05	130	.08	135	.035
147	.08	153	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
135	147	70	70	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	136.4	206.2	F
145	203	212.9	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.79	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.03	Wt. n-Val.		0.035
W.S. Elev (m)	203.76	Reach Len. (m)	70.00	70.00
70.00				
Crit W.S. (m)	202.93	Flow Area (m2)		10.85
E.G. Slope (m/m)	0.000444	Area (m2)	0.72	14.38
0.87				
Q Total (m3/s)	7.62	Flow (m3/s)		7.62
Top Width (m)	16.19	Top Width (m)	1.90	12.00
2.28				
Vel Total (m/s)	0.70	Avg. Vel. (m/s)		0.70
Max Chl Dpth (m)	1.26	Hydr. Depth (m)		1.26
Conv. Total (m3/s)	361.7	Conv. (m3/s)		361.7
Length Wtd. (m)	70.00	Wetted Per. (m)		8.60
Min Ch El (m)	202.50	Shear (N/m2)		5.50

Alpha	1.00	Stream Power (N/m s)		3.86
Frctn Loss (m)		Cum Volume (1000 m3)	107.93	198.90
71.33				
C & E Loss (m)		Cum SA (1000 m2)	101.86	71.57
83.27				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.54	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.01	Wt. n-Val.	0.043	0.035
W.S. Elev (m)	206.53	Reach Len. (m)	70.00	70.00
70.00				
Crit W.S. (m)	203.97	Flow Area (m2)	99.88	40.07
E.G. Slope (m/m)	0.000081	Area (m2)	99.88	47.64
52.66				
Q Total (m3/s)	47.80	Flow (m3/s)	21.97	25.83
Top Width (m)	166.90	Top Width (m)	122.00	12.00
32.90				
Vel Total (m/s)	0.34	Avg. Vel. (m/s)	0.22	0.64
Max Chl Dpth (m)	4.03	Hydr. Depth (m)	0.82	4.01
Conv. Total (m3/s)	5302.7	Conv. (m3/s)	2436.8	2865.9
Length Wtd. (m)	70.00	Wetted Per. (m)	122.61	10.12
Min Ch El (m)	202.50	Shear (N/m2)	0.65	3.16
Alpha	2.12	Stream Power (N/m s)	0.14	2.03
Frctn Loss (m)		Cum Volume (1000 m3)	354.71	393.19
320.50				
C & E Loss (m)		Cum SA (1000 m2)	268.72	71.58
256.93				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

MULTIPLE OPENING

RIVER: RIVER-1
REACH: Reach-1 RS: 46.3915

INPUT
Description: Hum 13B-2R. Langstaff Road - 3 Cell - 2.4 m W x 2.4 m H x 60 m L Concrete Box Culverts. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004 by Acres
included coding of culvert in HEC-RAS, including adjustments to
roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 60
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 9

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	212.8		8	213	212	28	213.2	212.3
73	213.82	212.82	103	213.4	212.4	103	213.4	206
142	213		182	212		203	211.5	

Upstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	15	206	30	206	103	206	106	205
130	205	135	203	136	202.5	145	202.5	147	203
153	205	175	205	191	210	203	210		

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.025	103	.05	130	.08	135	.035
147	.08	153	.05						

Bank Sta: Left	Right	Coeff Contr.	Expan.
135	147	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	136.4	206.2	F
145	203	212.9	F

Downstream Deck/Roadway Coordinates
num= 9

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	212.8		8	213	212	28	213.2	212.3
73	213.82	212.82	103	213.4	212.4	103	213.4	206
142	213		182	212		203	211.5	

Downstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	15	206	30	206	103	206	106	205
130	205	135	203	136	202.4	145	202.4	147	203
153	205	175	205	191	210	203	210		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.025	103	.05	130	.08	153	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
135	147	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	136.4	206	F
145	203	211	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 Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Box	2.4	2.4

FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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
	5	60	.015	.015	0	.5	1

Number of Barrels = 3
Upstream Elevation = 202.5
Centerline Stations

Sta.	Sta.	Sta.
138	140.7	143.4

Downstream Elevation = 202.4
Centerline Stations

Sta.	Sta.	Sta.
138	140.7	143.4

Multiple Opening Stagnation Limits

	Upstream		Downstream	
Opening Type	Sta. Left	Sta. Right	Sta. Left	Sta. Right
Bridge	0	120	0	120
Culvert Group	120	203	120	203

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.391

INPUT
Description: Section 46.391 - Langstaff Road - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	15	206	30	206	103	206	106	205
130	205	135	203	136	202.4	145	202.4	147	203
153	205	175	205	191	210	203	210		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.025	103	.05	130	.08	153	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
135	147	45	35	25	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	136.4	206	F
145	203	211	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.74	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.080	
W.S. Elev (m)	203.72	Reach Len. (m)	45.00	35.00	25.00
Crit W.S. (m)	202.83	Flow Area (m2)		11.32	
E.G. Slope (m/m)	0.002010	Area (m2)	0.64	14.90	0.77
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	15.94	Top Width (m)	1.79	12.00	2.15
Vel Total (m/s)	0.67	Avg. Vel. (m/s)		0.67	
Max Chl Dpth (m)	1.32	Hydr. Depth (m)		1.32	
Conv. Total (m3/s)	170.1	Conv. (m3/s)		170.1	
Length Wtd. (m)	35.03	Wetted Per. (m)		8.60	
Min Ch El (m)	202.40	Shear (N/m2)		25.95	
Alpha	1.00	Stream Power (N/m s)		17.47	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	107.93	198.90	71.33
C & E Loss (m)	0.01	Cum SA (1000 m2)	101.73	70.73	83.12

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.045	0.080	
W.S. Elev (m)	206.45	Reach Len. (m)	45.00	35.00	25.00

Crit W.S. (m)	203.87	Flow Area (m2)	89.27	40.15	
E.G. Slope (m/m)	0.000212	Area (m2)	89.27	47.64	49.80
Q Total (m3/s)	47.80	Flow (m3/s)	29.55	18.25	
Top Width (m)	166.29	Top Width (m)	121.67	12.00	32.62
Vel Total (m/s)	0.37	Avg. Vel. (m/s)	0.33	0.45	
Max Chl Dpth (m)	4.05	Hydr. Depth (m)	0.73	4.02	
Conv. Total (m3/s)	3285.2	Conv. (m3/s)	2031.2	1254.0	
Length Wtd. (m)	38.91	Wetted Per. (m)	122.27	10.17	
Min Ch El (m)	202.40	Shear (N/m2)	1.52	8.20	
Alpha	1.07	Stream Power (N/m s)	0.50	3.73	
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	354.71	393.19	320.50
C & E Loss (m)	0.00	Cum SA (1000 m2)	260.19	70.74	254.63

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: RIVER-1
REACH: Reach-1 RS: 46.39

INPUT
Description: Section 46.39 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	20	205	45	205	51	206.5	133	206.3
142	206	152	205	161	204	185	204	193	203
195	202.4	204	202.4	206	203	212	204	236	205
268	210								

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	51	.025	142	.05	185	.08	193	.035
206	.08	212	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
193	206	50	35	25	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	51	206.6	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.72	Element	Left OB	Channel

Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.71	Reach Len. (m)	50.00	35.00	25.00
Crit W.S. (m)	202.80	Flow Area (m2)	2.00	15.79	1.50
E.G. Slope (m/m)	0.000207	Area (m2)	2.00	15.79	1.50
Q Total (m3/s)	7.62	Flow (m3/s)	0.18	7.31	0.13
Top Width (m)	22.89	Top Width (m)	5.65	13.00	4.24
Vel Total (m/s)	0.40	Avg. Vel. (m/s)	0.09	0.46	0.09
Max Chl Dpth (m)	1.31	Hydr. Depth (m)	0.35	1.21	0.35
Conv. Total (m3/s)	530.4	Conv. (m3/s)	12.4	508.7	9.3
Length Wtd. (m)	35.09	Wetted Per. (m)	5.70	13.18	4.30
Min Ch El (m)	202.40	Shear (N/m2)	0.71	2.43	0.71
Alpha	1.32	Stream Power (N/m s)	0.06	1.12	0.06
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	107.87	198.36	71.31
C & E Loss (m)	0.00	Cum SA (1000 m2)	101.56	70.29	83.04

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.055	0.035	0.057
W.S. Elev (m)	206.44	Reach Len. (m)	50.00	35.00	25.00
Crit W.S. (m)	203.62	Flow Area (m2)	116.11	51.38	71.02
E.G. Slope (m/m)	0.000029	Area (m2)	166.83	51.38	71.02
Q Total (m3/s)	47.80	Flow (m3/s)	18.06	19.50	10.23
Top Width (m)	216.77	Top Width (m)	164.53	13.00	39.25
Vel Total (m/s)	0.20	Avg. Vel. (m/s)	0.16	0.38	0.14
Max Chl Dpth (m)	4.04	Hydr. Depth (m)	0.97	3.95	1.81
Conv. Total (m3/s)	8912.9	Conv. (m3/s)	3368.0	3636.8	1908.1
Length Wtd. (m)	40.73	Wetted Per. (m)	119.48	13.18	39.46

Min Ch El (m)	202.40	Shear (N/m2)	0.27	1.10	0.51
Alpha	1.80	Stream Power (N/m s)	0.04	0.42	0.07
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	348.94	391.45	318.99
C & E Loss (m)	0.00	Cum SA (1000 m2)	253.75	70.30	253.73

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: RIVER-1
REACH: Reach-1 RS: 46.382

INPUT
Description: Section 46.382 - Hwy 400 / Langstaff Rd Ramp - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	50	206.5	95	205	220	204	227	203
235	202.4	244	202.4	247	203	252	204	257	205
269	206	300	206	300	209.5				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	50	.08	227	.035	247	.08	257	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
227	247	45	45	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235.2	206.38	F
243.8	300	207.55	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.71	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.68	Reach Len. (m)	45.00	45.00	45.00
Crit W.S. (m)	202.83	Flow Area (m2)		11.02	
E.G. Slope (m/m)	0.000421	Area (m2)	1.62	22.32	1.16
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	28.18	Top Width (m)	4.77	20.00	3.41
Vel Total (m/s)	0.69	Avg. Vel. (m/s)		0.69	
Max Chl Dpth (m)	1.28	Hydr. Depth (m)		1.28	
Conv. Total (m3/s)	371.4	Conv. (m3/s)		371.4	

Length Wtd. (m)	45.00	Wetted Per. (m)		8.60
Min Ch El (m)	202.40	Shear (N/m2)		5.30
Alpha	1.00	Stream Power (N/m s)		3.66
Frctn Loss (m)		Cum Volume (1000 m3)	107.78	197.69
71.27				
C & E Loss (m)		Cum SA (1000 m2)	101.30	69.71
82.94				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.45	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035
W.S. Elev (m)	206.44	Reach Len. (m)	45.00	45.00
45.00				
Crit W.S. (m)	203.86	Flow Area (m2)	294.89	65.54
E.G. Slope (m/m)	0.000024	Area (m2)	294.89	77.58
49.53				
Q Total (m3/s)	47.80	Flow (m3/s)	25.30	22.50
Top Width (m)	248.32	Top Width (m)	175.32	20.00
53.00				
Vel Total (m/s)	0.13	Avg. Vel. (m/s)	0.09	0.34
Max Chl Dpth (m)	4.04	Hydr. Depth (m)	1.68	3.90
Conv. Total (m3/s)	9847.5	Conv. (m3/s)	5211.3	4636.2
Length Wtd. (m)	45.00	Wetted Per. (m)	175.42	16.82
Min Ch El (m)	202.40	Shear (N/m2)	0.39	0.90
Alpha	3.38	Stream Power (N/m s)	0.03	0.31
Frctn Loss (m)		Cum Volume (1000 m3)	337.40	389.20
317.49				
C & E Loss (m)		Cum SA (1000 m2)	245.26	69.72
252.58				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.3815

INPUT

Description: Hum 13B-1R. Hwy 400 / Langstaff Rd Ramp - 3 Cell - 2.4 m W x 2.4 m H x 38 m L Concrete Box Culverts. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004
by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 2
Deck/Roadway Width = 38
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	207		130	206.38		200	206	
230	207		260	208		285	209	
300	209.5							

Upstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	50	206.5	95	205	220	204	227	203
235	202.4	244	202.4	247	203	252	204	257	205
269	206	300	206	300	209.5				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	50	.08	227	.035	247	.08	257	.05

Bank Sta: Left Right Coeff Contr. Expan.
227 247 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235.2	206.38	F
243.8	300	207.55	F

Downstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	207		130	206.38		200	206	
230	207		260	208		285	209	
300	209.5							

Downstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	50	206.5	95	205	220	204	227	203
235	202.3	244	202.3	247	203	252	204	257	205
269	206	300	206	300	209.5				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	50	.05	220	.08	227	.035	247	.08
257	.05								

Bank Sta: Left Right Coeff Contr. Expan.
227 247 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235.2	205.5	F
243.8	300	205.5	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           Box     2.4     2.4
FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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
                 2      38     .015     .015        0                    .7
      1
Number of Barrels =  3
Upstream   Elevation =  202.4
Centerline Stations
    Sta.    Sta.    Sta.
   236.9   239.5   242.1
Downstream Elevation =  202.3
Centerline Stations
    Sta.    Sta.    Sta.
   236.9   239.5   242.1

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       7.62    Culv Full Len (m)
  # Barrels                    3    Culv Vel US (m/s)         0.85
  Q Barrel (m3/s)           2.54    Culv Vel DS (m/s)         0.79
  E.G. US. (m)            203.71    Culv Inv El Up (m)      202.40
  W.S. US. (m)            203.68    Culv Inv El Dn (m)      202.30
  E.G. DS (m)             203.66    Culv Frctn Ls (m)         0.01
  W.S. DS (m)             203.64    Culv Exit Loss (m)        0.01
  Delta EG (m)              0.05    Culv Entr Loss (m)        0.03
  Delta WS (m)              0.04    Q Weir (m3/s)
  E.G. IC (m)             203.19    Weir Sta Lft (m)
  E.G. OC (m)             203.71    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
  Culv WS Inlet (m)       203.64    Weir Max Depth (m)
  Culv WS Outlet (m)      203.64    Weir Avg Depth (m)
  Culv Nml Depth (m)        0.58    Weir Flow Area (m2)
  Culv Crt Depth (m)        0.49    Min El Weir Flow (m)    206.38


CULVERT OUTPUT  Profile #Regional w red'n  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      32.68    Culv Full Len (m)        38.00
  # Barrels                   3     Culv Vel US (m/s)         1.89
  Q Barrel (m3/s)          10.89    Culv Vel DS (m/s)         1.89
  E.G. US. (m)            206.45    Culv Inv El Up (m)      202.40
  W.S. US. (m)            206.44    Culv Inv El Dn (m)      202.30
  E.G. DS (m)             206.08    Culv Frctn Ls (m)         0.06
  W.S. DS (m)             206.08    Culv Exit Loss (m)        0.18
  Delta EG (m)              0.37    Culv Entr Loss (m)        0.13
  Delta WS (m)              0.37    Q Weir (m3/s)            15.12
  E.G. IC (m)             205.10    Weir Sta Lft (m)        116.39
  E.G. OC (m)             206.45    Weir Sta Rgt (m)        213.35
  Culvert Control         Outlet    Weir Submerg              0.00
  Culv WS Inlet (m)       204.80    Weir Max Depth (m)        0.44
  Culv WS Outlet (m)      204.70    Weir Avg Depth (m)        0.22
```

Culv Nml Depth (m)		Weir Flow Area (m2)	21.26
Culv Crt Depth (m)	1.28	Min El Weir Flow (m)	206.38

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.381

INPUT
Description: Section 46.381 - Hwy 400 / Langstaff Rd Ramp - D/S Bounding
Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	50	206.5	95	205	220	204	227	203
235	202.3	244	202.3	247	203	252	204	257	205
269	206	300	206	300	209.5				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	50	.05	220	.08	227	.035	247	.08
257	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
227	247	260	275	290	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235.2	205.5	F
243.8	300	205.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.66	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.64	Reach Len. (m)	260.00	275.00	290.00
Crit W.S. (m)	202.73	Flow Area (m2)		11.50	
E.G. Slope (m/m)	0.000366	Area (m2)	1.42	22.89	1.02
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	27.65	Top Width (m)	4.46	20.00	3.19
Vel Total (m/s)	0.66	Avg. Vel. (m/s)		0.66	
Max Chl Dpth (m)	1.34	Hydr. Depth (m)		1.34	
Conv. Total (m3/s)	398.7	Conv. (m3/s)		398.7	
Length Wtd. (m)	275.05	Wetted Per. (m)		8.60	
Min Ch El (m)	202.30	Shear (N/m2)		4.79	
Alpha	1.00	Stream Power (N/m s)		3.18	

Frctn Loss (m)	0.11	Cum Volume (1000 m3)	107.78	197.52	71.27
C & E Loss (m)	0.00	Cum SA (1000 m2)	101.10	68.81	82.80

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.052	0.035	0.076
W.S. Elev (m)	206.08	Reach Len. (m)	260.00	275.00	290.00
Crit W.S. (m)	203.77	Flow Area (m2)	232.29	71.65	29.99
E.G. Slope (m/m)	0.000019	Area (m2)	232.29	71.65	29.99
Q Total (m3/s)	47.80	Flow (m3/s)	24.83	20.86	2.11
Top Width (m)	237.26	Top Width (m)	164.26	20.00	53.00
Vel Total (m/s)	0.14	Avg. Vel. (m/s)	0.11	0.29	0.07
Max Chl Dpth (m)	3.78	Hydr. Depth (m)	1.41	3.58	0.57
Conv. Total (m3/s)	10945.2	Conv. (m3/s)	5686.6	4775.9	482.7
Length Wtd. (m)	272.95	Wetted Per. (m)	164.35	20.11	53.32
Min Ch El (m)	202.30	Shear (N/m2)	0.26	0.67	0.11
Alpha	2.10	Stream Power (N/m s)	0.03	0.19	0.01
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	337.40	387.27	317.49
C & E Loss (m)	0.01	Cum SA (1000 m2)	237.62	68.82	250.20

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: RIVER-1
REACH: Reach-1 RS: 46.36

INPUT

Description: Section 46.36 - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207.4	29	207	39	205	50	202	52	201.6
57	201.6	59	202	71	205	130	205.8		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	29	.05	39	.08	50	.035	59	.08
71	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
50	59	150	150	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
110	130	208	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.54	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.51	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)		Flow Area (m2)	4.16	16.36	4.54
E.G. Slope (m/m)	0.000437	Area (m2)	4.16	16.36	4.54
Q Total (m3/s)	16.31	Flow (m3/s)	0.88	14.47	0.96
Top Width (m)	20.55	Top Width (m)	5.52	9.00	6.03
Vel Total (m/s)	0.65	Avg. Vel. (m/s)	0.21	0.88	0.21
Max Chl Dpth (m)	1.91	Hydr. Depth (m)	0.75	1.82	0.75
Conv. Total (m3/s)	780.1	Conv. (m3/s)	42.0	692.1	46.0
Length Wtd. (m)	150.00	Wetted Per. (m)	5.73	9.08	6.21
Min Ch El (m)	201.60	Shear (N/m2)	3.11	7.72	3.13
Alpha	1.65	Stream Power (N/m s)	0.66	6.83	0.66
Frctn Loss (m)	0.06	Cum Volume (1000 m3)	107.05	192.12	70.47
C & E Loss (m)	0.00	Cum SA (1000 m2)	99.80	64.83	81.46

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.05	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.079	0.035	0.068
W.S. Elev (m)	206.02	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)		Flow Area (m2)	30.26	38.95	

59.52					
E.G. Slope (m/m)	0.000195	Area (m2)	30.26	38.95	
66.56					
Q Total (m3/s)	66.49	Flow (m3/s)	9.17	41.00	
16.32					
Top Width (m)	96.08	Top Width (m)	16.08	9.00	
71.00					
Vel Total (m/s)	0.52	Avg. Vel. (m/s)	0.30	1.05	
0.27					
Max Chl Dpth (m)	4.42	Hydr. Depth (m)	1.88	4.33	
1.17					
Conv. Total (m3/s)	4764.5	Conv. (m3/s)	657.4	2937.9	
1169.2					
Length Wtd. (m)	150.00	Wetted Per. (m)	16.58	9.08	
51.37					
Min Ch El (m)	201.60	Shear (N/m2)	3.48	8.19	
2.21					
Alpha	2.68	Stream Power (N/m s)	1.06	8.62	
0.61					
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	303.27	372.07	
303.49					
C & E Loss (m)	0.00	Cum SA (1000 m2)	214.17	64.83	
232.22					

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.35

INPUT
Description: Section 46.35 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	206.8	29	206.5	35	206	49	202	52	201.4
56	201.4	59	202	79	205	100	205.5	100	208
139	208								

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	29	.05	35	.08	49	.035	59	.08
79	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
49	59	120	120	120	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.48	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	
0.080					
W.S. Elev (m)	203.46	Reach Len. (m)	120.00	120.00	
120.00					
Crit W.S. (m)		Flow Area (m2)	3.72	18.77	
7.08					
E.G. Slope (m/m)	0.000316	Area (m2)	3.72	18.77	

Q Total (m3/s)	16.31	Flow (m3/s)	0.65	14.39	7.08
Top Width (m)	24.82	Top Width (m)	5.10	10.00	1.26
Vel Total (m/s)	0.55	Avg. Vel. (m/s)	0.18	0.77	9.72
Max Chl Dpth (m)	2.06	Hydr. Depth (m)	0.73	1.88	0.18
Conv. Total (m3/s)	917.7	Conv. (m3/s)	36.7	810.0	0.73
Length Wtd. (m)	120.00	Wetted Per. (m)	5.30	10.12	71.1
Min Ch El (m)	201.40	Shear (N/m2)	2.17	5.74	9.82
Alpha	1.72	Stream Power (N/m s)	0.38	4.40	2.23
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	106.46	189.49	0.40
C & E Loss (m)	0.00	Cum SA (1000 m2)	99.00	63.40	69.60
					80.28

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.02	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	0.075
W.S. Elev (m)	205.99	Reach Len. (m)	120.00	120.00	120.00
Crit W.S. (m)		Flow Area (m2)	27.91	44.14	65.50
E.G. Slope (m/m)	0.000158	Area (m2)	27.91	44.14	65.50
Q Total (m3/s)	66.49	Flow (m3/s)	6.77	42.26	17.46
Top Width (m)	64.98	Top Width (m)	13.98	10.00	41.00
Vel Total (m/s)	0.48	Avg. Vel. (m/s)	0.24	0.96	0.27
Max Chl Dpth (m)	4.59	Hydr. Depth (m)	2.00	4.41	1.60
Conv. Total (m3/s)	5296.5	Conv. (m3/s)	539.0	3366.8	1390.6
Length Wtd. (m)	120.00	Wetted Per. (m)	14.54	10.12	41.72
Min Ch El (m)	201.40	Shear (N/m2)	2.97	6.74	2.43
Alpha	2.60	Stream Power (N/m s)	0.72	6.45	0.65
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	298.91	365.83	293.58
C & E Loss (m)	0.00	Cum SA (1000 m2)	211.92	63.41	223.82

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.34

INPUT
Description: Section 46.34 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	206.4	30	206.4	36	206	46	202	51	201.2
53	201.2	58	202	68	205	144	205.4		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	30	.05	36	.08	46	.035	58	.08
68	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
46	58	225	205	190	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
100	144	208	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.43	Reach Len. (m)	225.00	205.00	190.00
Crit W.S. (m)		Flow Area (m2)	2.55	22.73	3.40
E.G. Slope (m/m)	0.000244	Area (m2)	2.55	22.73	3.40
Q Total (m3/s)	16.31	Flow (m3/s)	0.38	15.41	0.51
Top Width (m)	20.33	Top Width (m)	3.57	12.00	4.76
Vel Total (m/s)	0.57	Avg. Vel. (m/s)	0.15	0.68	0.15
Max Chl Dpth (m)	2.23	Hydr. Depth (m)	0.71	1.89	0.71
Conv. Total (m3/s)	1044.2	Conv. (m3/s)	24.2	987.1	32.9
Length Wtd. (m)	204.98	Wetted Per. (m)	3.84	12.13	4.97
Min Ch El (m)	201.20	Shear (N/m2)	1.58	4.48	1.63
Alpha	1.35	Stream Power (N/m s)	0.24	3.04	0.25
Frctn Loss (m)	0.07	Cum Volume (1000 m3)	106.08	187.00	68.97
C & E Loss (m)	0.00	Cum SA (1000 m2)	98.48	62.08	79.41

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.01	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	

0.065					
W.S. Elev (m)	205.97	Reach Len. (m)	225.00	205.00	190.00
Crit W.S. (m)		Flow Area (m2)	19.74	53.29	53.21
E.G. Slope (m/m)	0.000144	Area (m2)	19.74	53.29	83.55
Q Total (m3/s)	66.49	Flow (m3/s)	4.46	49.09	12.94
Top Width (m)	107.93	Top Width (m)	9.93	12.00	86.00
Vel Total (m/s)	0.53	Avg. Vel. (m/s)	0.23	0.92	0.24
Max Chl Dpth (m)	4.77	Hydr. Depth (m)	1.99	4.44	1.27
Conv. Total (m3/s)	5531.7	Conv. (m3/s)	371.1	4084.3	1076.3
Length Wtd. (m)	205.80	Wetted Per. (m)	10.70	12.13	42.44
Min Ch El (m)	201.20	Shear (N/m2)	2.61	6.22	1.78
Alpha	2.31	Stream Power (N/m s)	0.59	5.73	0.43
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	296.05	359.99	284.64
C & E Loss (m)	0.00	Cum SA (1000 m2)	210.48	62.09	216.20

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.33

INPUT
Description: Section 46.33 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	67	205	75	202	78	201	83	201
86	202	97	205	115	205	115	208	180	208

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	67	.08	75	.035	86	.08	97	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
75	86	130	130	130	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.38	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.33	Reach Len. (m)	130.00	130.00	130.00
Crit W.S. (m)		Flow Area (m2)	2.36	22.65	

3.25					
E.G. Slope (m/m)	0.000453	Area (m2)	2.36	22.65	
3.25					
Q Total (m3/s)	22.97	Flow (m3/s)	0.46	21.87	
0.64					
Top Width (m)	19.43	Top Width (m)	3.55	11.00	
4.88					
Vel Total (m/s)	0.81	Avg. Vel. (m/s)	0.19	0.97	
0.20					
Max Chl Dpth (m)	2.33	Hydr. Depth (m)	0.67	2.06	
0.67					
Conv. Total (m3/s)	1079.1	Conv. (m3/s)	21.6	1027.2	
30.3					
Length Wtd. (m)	130.00	Wetted Per. (m)	3.79	11.32	
5.06					
Min Ch El (m)	201.00	Shear (N/m2)	2.77	8.89	
2.85					
Alpha	1.35	Stream Power (N/m s)	0.54	8.58	
0.57					
Frctn Loss (m)	0.05	Cum Volume (1000 m3)	105.53	182.35	
68.34					
C & E Loss (m)	0.00	Cum SA (1000 m2)	97.68	59.72	
78.49					

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.98	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.03	Wt. n-Val.	0.058	0.035	
0.070					
W.S. Elev (m)	205.95	Reach Len. (m)	130.00	130.00	
130.00					
Crit W.S. (m)		Flow Area (m2)	83.32	51.46	
44.08					
E.G. Slope (m/m)	0.000128	Area (m2)	83.32	51.46	
44.08					
Q Total (m3/s)	74.78	Flow (m3/s)	18.67	45.71	
10.40					
Top Width (m)	115.00	Top Width (m)	75.00	11.00	
29.00					
Vel Total (m/s)	0.42	Avg. Vel. (m/s)	0.22	0.89	
0.24					
Max Chl Dpth (m)	4.95	Hydr. Depth (m)	1.11	4.68	
1.52					
Conv. Total (m3/s)	6598.8	Conv. (m3/s)	1647.2	4033.6	
918.0					
Length Wtd. (m)	130.00	Wetted Per. (m)	76.49	11.32	
30.35					
Min Ch El (m)	201.00	Shear (N/m2)	1.37	5.72	
1.83					
Alpha	2.88	Stream Power (N/m s)	0.31	5.08	
0.43					
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	284.45	349.25	
272.52					
C & E Loss (m)	0.00	Cum SA (1000 m2)	200.93	59.73	
205.27					

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

water surface.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.322

INPUT
Description: Section 46.322 - Applewod Crescent - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	58	208	58	205.5	66	205.5	78.5	201.8
79.15	201	91	201	91.5	201.8	100.5	205.7	115	205.7
115	208	175	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	66	.08	78.5	.035	91.5	.08	100.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
78.5	91.5	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	78.5	205.6	F
91.5	175	205.6	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.035	
W.S. Elev (m)	203.30	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	201.71	Flow Area (m2)		29.40	
E.G. Slope (m/m)	0.000274	Area (m2)	3.78	29.40	2.58
Q Total (m3/s)	22.97	Flow (m3/s)		22.97	
Top Width (m)	21.51	Top Width (m)	5.06	13.00	3.45
Vel Total (m/s)	0.78	Avg. Vel. (m/s)		0.78	
Max Chl Dpth (m)	2.30	Hydr. Depth (m)		2.26	
Conv. Total (m3/s)	1388.9	Conv. (m3/s)		1388.9	
Length Wtd. (m)	50.00	Wetted Per. (m)		13.82	
Min Ch El (m)	201.00	Shear (N/m2)		5.70	
Alpha	1.00	Stream Power (N/m s)		4.46	
Frctn Loss (m)		Cum Volume (1000 m3)	105.13	178.96	67.96
C & E Loss (m)		Cum SA (1000 m2)	97.12	58.16	77.95

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.96	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.078	0.035	0.078
W.S. Elev (m)	205.92	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	202.54	Flow Area (m2)	31.65	63.45	22.63
E.G. Slope (m/m)	0.000153	Area (m2)	31.65	63.45	22.63
Q Total (m3/s)	74.78	Flow (m3/s)	7.79	61.95	5.04
Top Width (m)	57.00	Top Width (m)	20.50	13.00	23.50
Vel Total (m/s)	0.64	Avg. Vel. (m/s)	0.25	0.98	0.22
Max Chl Dpth (m)	4.92	Hydr. Depth (m)	1.54	4.88	0.96
Conv. Total (m3/s)	6044.1	Conv. (m3/s)	629.9	5006.7	407.6
Length Wtd. (m)	50.00	Wetted Per. (m)	21.45	13.82	24.52
Min Ch El (m)	201.00	Shear (N/m2)	2.22	6.89	1.39
Alpha	1.98	Stream Power (N/m s)	0.55	6.73	0.31
Frctn Loss (m)		Cum Volume (1000 m3)	276.98	341.78	268.18
C & E Loss (m)		Cum SA (1000 m2)	194.72	58.17	201.86

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.3215

INPUT
Description: Hum 13A-4R. Applewood Crescent - Twin Cell - 4.3 m W x 2.4 m H x 30 m L Concrete Box Culverts. Based on Drawings - July 2010

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.
Distance from Upstream XS = 10
Deck/Roadway Width = 30
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 2
Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord

58	205.6		115	205.6					

Upstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	58	208	58	205.5	66	205.5	78.5	201.8
79.15	201	91	201	91.5	201.8	100.5	205.7	115	205.7
115	208	175	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	66	.08	78.5	.035	91.5	.08	100.5	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
78.5	91.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	78.5	205.6	F
91.5	175	205.6	F

Downstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
58	205.6	115	205.6

Downstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	58	208	58	205.5	66	205.5	78.5	201.8
79.15	200.6	91	200.6	91.5	201.8	100.5	205.7	115	205.7
115	208	175	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	66	.08	78.5	.035	91.5	.08	100.5	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
78.5	91.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	78.5	205	F
91.5	175	205	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	Box	2.44	4.27

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
10	30	.015	.015	0	.4	1

Number of Barrels = 2

Upstream Elevation = 201
Centerline Stations
Sta. Sta.
82.5 87.5
Downstream Elevation = 200.6
Centerline Stations
Sta. Sta.
82.5 87.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	22.97	Culv Full Len (m)	14.42
# Barrels	2	Culv Vel US (m/s)	1.21
Q Barrel (m3/s)	11.49	Culv Vel DS (m/s)	1.10
E.G. US. (m)	203.33	Culv Inv El Up (m)	201.00
W.S. US. (m)	203.30	Culv Inv El Dn (m)	200.60
E.G. DS (m)	203.25	Culv Frctn Ls (m)	0.01
W.S. DS (m)	203.23	Culv Exit Loss (m)	0.04
Delta EG (m)	0.08	Culv Entr Loss (m)	0.03
Delta WS (m)	0.07	Q Weir (m3/s)	
E.G. IC (m)	202.42	Weir Sta Lft (m)	
E.G. OC (m)	203.33	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	203.22	Weir Max Depth (m)	
Culv WS Outlet (m)	203.04	Weir Avg Depth (m)	
Culv Nml Depth (m)	0.59	Weir Flow Area (m2)	
Culv Crt Depth (m)	0.90	Min El Weir Flow (m)	205.60

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	58.92	Culv Full Len (m)	30.00
# Barrels	2	Culv Vel US (m/s)	2.83
Q Barrel (m3/s)	29.46	Culv Vel DS (m/s)	2.83
E.G. US. (m)	205.96	Culv Inv El Up (m)	201.00
W.S. US. (m)	205.92	Culv Inv El Dn (m)	200.60
E.G. DS (m)	205.36	Culv Frctn Ls (m)	0.08
W.S. DS (m)	205.31	Culv Exit Loss (m)	0.35
Delta EG (m)	0.59	Culv Entr Loss (m)	0.16
Delta WS (m)	0.61	Q Weir (m3/s)	15.87
E.G. IC (m)	204.55	Weir Sta Lft (m)	58.00
E.G. OC (m)	205.96	Weir Sta Rgt (m)	115.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	203.44	Weir Max Depth (m)	0.36
Culv WS Outlet (m)	203.04	Weir Avg Depth (m)	0.33
Culv Nml Depth (m)		Weir Flow Area (m2)	18.96
Culv Crt Depth (m)	1.69	Min El Weir Flow (m)	205.60

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.321

INPUT
Description: Section 46.322 - Applewod Crescent - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	58	208	58	205.5	66	205.5	78.5	201.8
79.15	200.6	91	200.6	91.5	201.8	100.5	205.7	115	205.7
115	208	175	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	66	.08	78.5	.035	91.5	.08	100.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
78.5	91.5	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	78.5	205	F
91.5	175	205	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.25	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.23	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	201.32	Flow Area (m2)		33.46	
E.G. Slope (m/m)	0.000190	Area (m2)	3.44	33.46	2.35
Q Total (m3/s)	22.97	Flow (m3/s)		22.97	
Top Width (m)	21.11	Top Width (m)	4.82	13.00	3.29
Vel Total (m/s)	0.69	Avg. Vel. (m/s)		0.69	
Max Chl Dpth (m)	2.63	Hydr. Depth (m)		2.57	
Conv. Total (m3/s)	1668.1	Conv. (m3/s)		1668.1	
Length Wtd. (m)	50.00	Wetted Per. (m)		14.51	
Min Ch El (m)	200.60	Shear (N/m2)		4.29	
Alpha	1.00	Stream Power (N/m s)		2.94	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	105.13	178.20	67.96
C & E Loss (m)	0.02	Cum SA (1000 m2)	96.87	57.51	77.78

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.36	Element	Left OB	Channel	Right OB

Vel Head (m)	0.05	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	205.31	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	202.15	Flow Area (m2)	20.82	60.55	14.22
E.G. Slope (m/m)	0.000215	Area (m2)	20.82	60.55	14.22
Q Total (m3/s)	74.78	Flow (m3/s)	5.40	65.79	3.58
Top Width (m)	32.96	Top Width (m)	11.86	13.00	8.10
Vel Total (m/s)	0.78	Avg. Vel. (m/s)	0.26	1.09	0.25
Max Chl Dpth (m)	4.71	Hydr. Depth (m)	1.76	4.66	1.76
Conv. Total (m3/s)	5095.9	Conv. (m3/s)	368.3	4483.3	244.3
Length Wtd. (m)	50.00	Wetted Per. (m)	12.37	14.51	8.83
Min Ch El (m)	200.60	Shear (N/m2)	3.55	8.81	3.40
Alpha	1.71	Stream Power (N/m s)	0.92	9.57	0.86
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	276.98	339.43	268.18
C & E Loss (m)	0.02	Cum SA (1000 m2)	193.91	57.52	201.07

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.32

INPUT
Description: Section 46.32 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	45	208	45	205.5	52	205	66	201
68	200.6	69	200.6	71	201	84	205	102	206
102	208	152	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	52	.08	66	.035	71	.08	84	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
66	71	110	110	110	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.22	Element	Left OB	Channel	Right OB

Vel Head (m)	0.08	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.13	Reach Len. (m)	110.00	110.00	110.00
Crit W.S. (m)		Flow Area (m2)	7.95	11.86	7.38
E.G. Slope (m/m)	0.000844	Area (m2)	7.95	11.86	7.38
Q Total (m3/s)	22.97	Flow (m3/s)	2.93	17.32	2.71
Top Width (m)	19.39	Top Width (m)	7.46	5.00	6.93
Vel Total (m/s)	0.84	Avg. Vel. (m/s)	0.37	1.46	0.37
Max Chl Dpth (m)	2.53	Hydr. Depth (m)	1.07	2.37	1.07
Conv. Total (m3/s)	790.7	Conv. (m3/s)	101.0	596.3	93.4
Length Wtd. (m)	110.00	Wetted Per. (m)	7.76	5.08	7.25
Min Ch El (m)	200.60	Shear (N/m2)	8.48	19.32	8.43
Alpha	2.30	Stream Power (N/m s)	3.13	28.23	3.10
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	104.85	177.07	67.71
C & E Loss (m)	0.02	Cum SA (1000 m2)	96.57	57.06	77.53

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.12	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	205.21	Reach Len. (m)	110.00	110.00	110.00
Crit W.S. (m)		Flow Area (m2)	31.23	22.25	29.11
E.G. Slope (m/m)	0.000650	Area (m2)	31.23	22.25	29.11
Q Total (m3/s)	74.78	Flow (m3/s)	16.32	43.36	15.10
Top Width (m)	38.69	Top Width (m)	16.93	5.00	16.77
Vel Total (m/s)	0.91	Avg. Vel. (m/s)	0.52	1.95	0.52
Max Chl Dpth (m)	4.61	Hydr. Depth (m)	1.85	4.45	1.74
Conv. Total (m3/s)	2934.3	Conv. (m3/s)	640.2	1701.6	592.6
Length Wtd. (m)	110.00	Wetted Per. (m)	17.50	5.08	17.37
Min Ch El (m)	200.60	Shear (N/m2)	11.37	27.90	10.67
Alpha	2.83	Stream Power (N/m s)	5.94	54.38	

5.54					
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	275.68	337.36	267.10
C & E Loss (m)	0.02	Cum SA (1000 m2)	193.19	57.07	200.45

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: RIVER-1
REACH: Reach-1 RS: 46.312

INPUT
Description: Section 46.312 - Edgeley Blvd - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	43	207	43	204.6	49	204.6	52	204.1
60.5	201.1	61.15	200.6	72.85	200.6	73.5	201.1	82	204.1
84	204.7	90	204.7	90	207	150	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	49	.08	60.5	.035	73.5	.08	84	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
60.5	73.5	60	60	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	60.5	204.7	F
73.5	150	204.7	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.16	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.035	
W.S. Elev (m)	203.13	Reach Len. (m)	60.00	60.00	60.00
Crit W.S. (m)	201.31	Flow Area (m2)		32.63	
E.G. Slope (m/m)	0.000184	Area (m2)	5.87	32.63	5.87
Q Total (m3/s)	22.97	Flow (m3/s)		22.97	
Top Width (m)	24.53	Top Width (m)	5.77	13.00	5.77
Vel Total (m/s)	0.70	Avg. Vel. (m/s)		0.70	
Max Chl Dpth (m)	2.53	Hydr. Depth (m)		2.51	
Conv. Total (m3/s)	1692.4	Conv. (m3/s)		1692.4	
Length Wtd. (m)	60.00	Wetted Per. (m)		13.34	

Min Ch El (m)	200.60	Shear (N/m2)			4.42
Alpha	1.00	Stream Power (N/m s)			3.11
Frctn Loss (m)		Cum Volume (1000 m3)	104.09	174.63	66.99
C & E Loss (m)		Cum SA (1000 m2)	95.84	56.07	76.83

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.27	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.077	0.035	0.078
W.S. Elev (m)	205.23	Reach Len. (m)	60.00	60.00	60.00
Crit W.S. (m)	202.13	Flow Area (m2)	28.76	59.86	27.18
E.G. Slope (m/m)	0.000169	Area (m2)	28.76	59.86	27.18
Q Total (m3/s)	74.78	Flow (m3/s)	7.27	60.47	7.03
Top Width (m)	47.00	Top Width (m)	17.50	13.00	16.50
Vel Total (m/s)	0.65	Avg. Vel. (m/s)	0.25	1.01	0.26
Max Chl Dpth (m)	4.63	Hydr. Depth (m)	1.64	4.60	1.65
Conv. Total (m3/s)	5753.4	Conv. (m3/s)	559.7	4652.6	541.2
Length Wtd. (m)	60.00	Wetted Per. (m)	18.68	13.34	17.63
Min Ch El (m)	200.60	Shear (N/m2)	2.55	7.43	2.55
Alpha	2.01	Stream Power (N/m s)	0.65	7.51	0.66
Frctn Loss (m)		Cum Volume (1000 m3)	272.38	332.84	264.00
C & E Loss (m)		Cum SA (1000 m2)	191.30	56.08	198.62

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.3115

INPUT
Description: Hum 13A-3R. Edgeley Blvd - Twin Cell - 4.3 m W x 2.4 m H x 35 m L Concrete Box Culverts. July 2010

Drawing by Ander Engineering Ltd. (Dwg No. 88-150-7, October 1989) used to recode culvert in HEC-RAS format.

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 10
Deck/Roadway Width = 35
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
43	204.7	90	204.7

Upstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	43	207	43	204.6	49	204.6	52	204.1
60.5	201.1	61.15	200.6	72.85	200.6	73.5	201.1	82	204.1
84	204.7	90	204.7	90	207	150	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	49	.08	60.5	.035	73.5	.08	84	.05

Bank Sta: Left Right Coeff Contr. Expan.
60.5 73.5 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	60.5	204.7	F
73.5	150	204.7	F

Downstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
43	204.7	90	204.7

Downstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	43	207	43	204.6	49	204.6	52	204.1
60.5	201.1	61.15	200.5	72.85	200.5	73.5	201.1	82	204.1
84	204.7	90	204.7	90	207	150	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	49	.08	60.5	.035	73.5	.08	84	.05

Bank Sta: Left Right Coeff Contr. Expan.
60.5 73.5 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	60.5	203.5	F
73.5	150	203.5	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	Box	2.44	4.27

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
	10	35	.015	.015	0	.4	1

Number of Barrels = 2
Upstream Elevation = 200.6
Centerline Stations

Sta.	Sta.
64.5	69.5

Downstream Elevation = 200.5
Centerline Stations

Sta.	Sta.
64.5	69.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	22.97	Culv Full Len (m)	35.00
# Barrels	2	Culv Vel US (m/s)	1.10
Q Barrel (m3/s)	11.49	Culv Vel DS (m/s)	1.10
E.G. US. (m)	203.16	Culv Inv El Up (m)	200.60
W.S. US. (m)	203.13	Culv Inv El Dn (m)	200.50
E.G. DS (m)	203.08	Culv Frctn Ls (m)	0.01
W.S. DS (m)	203.06	Culv Exit Loss (m)	0.04
Delta EG (m)	0.08	Culv Entr Loss (m)	0.02
Delta WS (m)	0.07	Q Weir (m3/s)	
E.G. IC (m)	202.03	Weir Sta Lft (m)	
E.G. OC (m)	203.16	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	203.04	Weir Max Depth (m)	
Culv WS Outlet (m)	202.94	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.90	Min El Weir Flow (m)	204.70

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	45.54	Culv Full Len (m)	35.00
# Barrels	2	Culv Vel US (m/s)	2.19
Q Barrel (m3/s)	22.77	Culv Vel DS (m/s)	2.19
E.G. US. (m)	205.27	Culv Inv El Up (m)	200.60
W.S. US. (m)	205.23	Culv Inv El Dn (m)	200.50
E.G. DS (m)	204.93	Culv Frctn Ls (m)	0.05
W.S. DS (m)	204.88	Culv Exit Loss (m)	0.19
Delta EG (m)	0.34	Culv Entr Loss (m)	0.10
Delta WS (m)	0.35	Q Weir (m3/s)	29.24
E.G. IC (m)	204.16	Weir Sta Lft (m)	43.00
E.G. OC (m)	205.27	Weir Sta Rgt (m)	90.00
Culvert Control	Outlet	Weir Submerg	0.31
Culv WS Inlet (m)	203.04	Weir Max Depth (m)	0.57
Culv WS Outlet (m)	202.94	Weir Avg Depth (m)	0.57
Culv Nml Depth (m)		Weir Flow Area (m2)	26.85
Culv Crt Depth (m)	1.43	Min El Weir Flow (m)	204.70

Warning: During the culvert inlet control computations, the program could not

balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.311

INPUT
Description: Section 46.311 - Edgeley Blvd - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	43	207	43	204.6	49	204.6	52	204.1
60.5	201.1	61.15	200.5	72.85	200.5	73.5	201.1	82	204.1
84	204.7	90	204.7	90	207	150	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	49	.08	60.5	.035	73.5	.08	84	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
60.5	73.5	150	150	150	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	60.5	203.5	F
73.5	150	203.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.06	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)	201.21	Flow Area (m2)		32.89	
E.G. Slope (m/m)	0.000182	Area (m2)	5.44	32.89	5.44
Q Total (m3/s)	22.97	Flow (m3/s)		22.97	
Top Width (m)	24.11	Top Width (m)	5.55	13.00	5.55
Vel Total (m/s)	0.70	Avg. Vel. (m/s)		0.70	
Max Chl Dpth (m)	2.56	Hydr. Depth (m)		2.53	
Conv. Total (m3/s)	1704.1	Conv. (m3/s)		1704.1	
Length Wtd. (m)	150.00	Wetted Per. (m)		13.47	
Min Ch El (m)	200.50	Shear (N/m2)		4.35	
Alpha	1.00	Stream Power (N/m s)		3.04	
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	104.09	173.71	66.99
C & E Loss (m)	0.00	Cum SA (1000 m2)	95.50	55.29	76.49

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.93	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.079	0.035	0.079
W.S. Elev (m)	204.88	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)	202.03	Flow Area (m2)	22.63	56.53	21.40
E.G. Slope (m/m)	0.000225	Area (m2)	22.63	56.53	21.40
Q Total (m3/s)	74.78	Flow (m3/s)	5.89	63.08	5.81
Top Width (m)	47.00	Top Width (m)	17.50	13.00	16.50
Vel Total (m/s)	0.74	Avg. Vel. (m/s)	0.26	1.12	0.27
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.29	4.35	1.30
Conv. Total (m3/s)	4982.5	Conv. (m3/s)	392.5	4203.0	386.9
Length Wtd. (m)	150.00	Wetted Per. (m)	18.33	13.47	17.28
Min Ch El (m)	200.50	Shear (N/m2)	2.73	9.27	2.74
Alpha	1.92	Stream Power (N/m s)	0.71	10.35	0.74
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	272.38	330.01	264.00
C & E Loss (m)	0.00	Cum SA (1000 m2)	190.25	55.30	197.63

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.31

INPUT
Description: Section 46.31 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	40	207	40	204.5	46	204.5	49	204
58	201	61	200.4	67	200.4	70	201	81	204
85	204.6	107	204.6	107	207	148	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	46	.08	58	.035	70	.08	85	.05

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

58 70 150 150 150 .1 .3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.06	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.03	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)		Flow Area (m2)	6.21	29.81	7.59
E.G. Slope (m/m)	0.000178	Area (m2)	6.21	29.81	7.59
Q Total (m3/s)	22.97	Flow (m3/s)	1.01	20.71	1.25
Top Width (m)	25.56	Top Width (m)	6.10	12.00	7.46
Vel Total (m/s)	0.53	Avg. Vel. (m/s)	0.16	0.69	0.16
Max Chl Dpth (m)	2.63	Hydr. Depth (m)	1.02	2.48	1.02
Conv. Total (m3/s)	1721.6	Conv. (m3/s)	75.8	1552.2	93.6
Length Wtd. (m)	150.00	Wetted Per. (m)	6.43	12.12	7.73
Min Ch El (m)	200.40	Shear (N/m2)	1.68	4.29	1.71
Alpha	1.58	Stream Power (N/m s)	0.27	2.98	0.28
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	103.21	169.01	66.01
C & E Loss (m)	0.00	Cum SA (1000 m2)	94.63	53.42	75.52

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.90	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.079	0.035	0.078
W.S. Elev (m)	204.84	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)		Flow Area (m2)	24.94	51.53	33.32
E.G. Slope (m/m)	0.000236	Area (m2)	24.94	51.53	33.32
Q Total (m3/s)	74.78	Flow (m3/s)	6.86	59.32	8.61
Top Width (m)	67.00	Top Width (m)	18.00	12.00	37.00
Vel Total (m/s)	0.68	Avg. Vel. (m/s)	0.27	1.15	0.26
Max Chl Dpth (m)	4.44	Hydr. Depth (m)	1.39	4.29	0.90
Conv. Total (m3/s)	4871.1	Conv. (m3/s)	446.7	3863.8	560.6
Length Wtd. (m)	150.00	Wetted Per. (m)	18.87	12.12	37.69

Min Ch El (m)	200.40	Shear (N/m2)	3.05	9.83	2.04
Alpha	2.30	Stream Power (N/m s)	0.84	11.31	0.53
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	268.81	321.90	259.90
C & E Loss (m)	0.00	Cum SA (1000 m2)	187.59	53.43	193.61

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.30

INPUT
Description: Section 46.30 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	20	207	20	205	46	205	56	201
59	200.3	65	200.3	68	201	80	204	83	204.7
119	205	119	207	146	207				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	46	.08	56	.035	68	.08	83	.025
119	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
56	68	110	110	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.02	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.99	Reach Len. (m)	110.00	110.00	110.00
Crit W.S. (m)		Flow Area (m2)	4.93	30.14	7.89
E.G. Slope (m/m)	0.000275	Area (m2)	4.93	30.14	7.89
Q Total (m3/s)	28.70	Flow (m3/s)	0.97	26.13	1.60
Top Width (m)	24.91	Top Width (m)	4.97	12.00	7.95
Vel Total (m/s)	0.67	Avg. Vel. (m/s)	0.20	0.87	0.20
Max Chl Dpth (m)	2.69	Hydr. Depth (m)	0.99	2.51	0.99
Conv. Total (m3/s)	1731.8	Conv. (m3/s)	58.4	1577.1	96.3
Length Wtd. (m)	110.00	Wetted Per. (m)	5.35	12.16	8.19
Min Ch El (m)	200.30	Shear (N/m2)	2.48	6.67	2.59
Alpha	1.54	Stream Power (N/m s)	0.49	5.79	0.52
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	102.38	164.51	

64.85					
C & E Loss (m)	0.00	Cum SA (1000 m2)	93.79	51.62	
74.36					

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.86	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	204.79	Reach Len. (m)	110.00	110.00	110.00
Crit W.S. (m)		Flow Area (m2)	17.92	51.74	29.19
E.G. Slope (m/m)	0.000297	Area (m2)	17.92	51.74	29.19
Q Total (m3/s)	81.91	Flow (m3/s)	5.62	66.89	9.41
Top Width (m)	46.82	Top Width (m)	9.47	12.00	25.35
Vel Total (m/s)	0.83	Avg. Vel. (m/s)	0.31	1.29	0.32
Max Chl Dpth (m)	4.49	Hydr. Depth (m)	1.89	4.31	1.15
Conv. Total (m3/s)	4752.9	Conv. (m3/s)	326.2	3880.9	545.7
Length Wtd. (m)	110.00	Wetted Per. (m)	10.19	12.16	25.80
Min Ch El (m)	200.30	Shear (N/m2)	5.12	12.39	3.30
Alpha	2.01	Stream Power (N/m s)	1.61	16.02	1.06
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	265.60	314.16	255.21
C & E Loss (m)	0.01	Cum SA (1000 m2)	185.53	51.63	188.94

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.292

INPUT
Description: Section 46.292 - Millway Avenue - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	25	207	25	204	40	204	50	201
50.5	200.3	63	200.3	64	201	72	204	75	204.5
85	204.7	85	207	142	207				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	40	.08	50	.035	64	.08	72	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
50	64	55	55	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	50.5	204.1	F
63	142	204.1	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.99	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.		0.035	
W.S. Elev (m)	202.95	Reach Len. (m)	55.00	55.00	55.00
Crit W.S. (m)	201.11	Flow Area (m2)		33.18	
E.G. Slope (m/m)	0.000249	Area (m2)	6.37	36.64	5.09
Q Total (m3/s)	28.70	Flow (m3/s)		28.70	
Top Width (m)	25.73	Top Width (m)	6.52	14.00	5.21
Vel Total (m/s)	0.86	Avg. Vel. (m/s)		0.86	
Max Chl Dpth (m)	2.65	Hydr. Depth (m)		2.65	
Conv. Total (m3/s)	1817.7	Conv. (m3/s)		1817.7	
Length Wtd. (m)	55.00	Wetted Per. (m)		12.50	
Min Ch El (m)	200.30	Shear (N/m2)		6.49	
Alpha	1.00	Stream Power (N/m s)		5.61	
Frctn Loss (m)		Cum Volume (1000 m3)	101.76	160.84	64.13
C & E Loss (m)		Cum SA (1000 m2)	93.16	50.19	73.64

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.82	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.071	0.035	0.078
W.S. Elev (m)	204.77	Reach Len. (m)	55.00	55.00	55.00
Crit W.S. (m)	201.94	Flow Area (m2)	34.37	62.13	21.52
E.G. Slope (m/m)	0.000204	Area (m2)	34.37	62.13	21.52
Q Total (m3/s)	81.91	Flow (m3/s)	9.53	66.62	5.76
Top Width (m)	60.00	Top Width (m)	25.00	14.00	21.00
Vel Total (m/s)	0.69	Avg. Vel. (m/s)	0.28	1.07	0.27

Max Chl Dpth (m)	4.48	Hydr. Depth (m)	1.37	4.44	1.02
Conv. Total (m3/s)	5735.9	Conv. (m3/s)	667.6	4665.0	403.2
Length Wtd. (m)	55.00	Wetted Per. (m)	26.22	14.58	21.66
Min Ch El (m)	200.30	Shear (N/m2)	2.62	8.52	1.99
Alpha	1.97	Stream Power (N/m s)	0.73	9.14	0.53
Frctn Loss (m)		Cum Volume (1000 m3)	262.72	307.90	252.42
C & E Loss (m)		Cum SA (1000 m2)	183.63	50.20	186.39

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2915

INPUT
Description: Hum 13A-2RR. Millway Avenue Culvert - Twin Cell - 4.3 m W x 2.4 m H x 30 m L Concrete Box Culverts. Based on drawings - July 2010

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 15
Deck/Roadway Width = 30
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
25	204.1		75	204.1		85	204.7	

Upstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	25	207	25	204	40	204	50	201
50.5	200.3	63	200.3	64	201	72	204	75	204.5
85	204.7	85	207	142	207				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	40	.08	50	.035	64	.08	72	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
50	64	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	50.5	204.1	F
63	142	204.1	F

Downstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord

25	204.1	75	204.1	85	204.7

Downstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	25	207	25	204	40	204	50	201
50.5	200.2	63	200.2	64	201	72	204	75	204.5
85	204.7	85	207	142	207				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	40	.08	50	.035	64	.08	72	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
50	64	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	50.5	203.4	F
63	142	203.4	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	Box	2.44	4.27

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
	15	30	.015	.015	0	.4	1

Number of Barrels = 2
Upstream Elevation = 200.3
Centerline Stations

Sta.	Sta.
54.3	59.3

Downstream Elevation = 200.2
Centerline Stations

Sta.	Sta.
54.3	59.3

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	28.70	Culv Full Len (m)	30.00
# Barrels	2	Culv Vel US (m/s)	1.38
Q Barrel (m3/s)	14.35	Culv Vel DS (m/s)	1.38
E.G. US. (m)	202.99	Culv Inv El Up (m)	200.30
W.S. US. (m)	202.95	Culv Inv El Dn (m)	200.20
E.G. DS (m)	202.88	Culv Frctn Ls (m)	0.02
W.S. DS (m)	202.84	Culv Exit Loss (m)	0.06
Delta EG (m)	0.11	Culv Entr Loss (m)	0.04
Delta WS (m)	0.11	Q Weir (m3/s)	
E.G. IC (m)	201.97	Weir Sta Lft (m)	
E.G. OC (m)	202.99	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	

Culv WS Inlet (m)	202.74	Weir Max Depth (m)	
Culv WS Outlet (m)	202.64	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	1.05	Min El Weir Flow (m)	204.10

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	36.77	Culv Full Len (m)	30.00
# Barrels	2	Culv Vel US (m/s)	1.76
Q Barrel (m3/s)	18.38	Culv Vel DS (m/s)	1.76
E.G. US. (m)	204.82	Culv Inv El Up (m)	200.30
W.S. US. (m)	204.77	Culv Inv El Dn (m)	200.20
E.G. DS (m)	204.63	Culv Frctn Ls (m)	0.03
W.S. DS (m)	204.57	Culv Exit Loss (m)	0.10
Delta EG (m)	0.20	Culv Entr Loss (m)	0.06
Delta WS (m)	0.20	Q Weir (m3/s)	45.15
E.G. IC (m)	204.15	Weir Sta Lft (m)	25.00
E.G. OC (m)	204.82	Weir Sta Rgt (m)	85.00
Culvert Control	Outlet	Weir Submerg	0.63
Culv WS Inlet (m)	202.74	Weir Max Depth (m)	0.72
Culv WS Outlet (m)	202.64	Weir Avg Depth (m)	0.63
Culv Nml Depth (m)		Weir Flow Area (m2)	37.99
Culv Crt Depth (m)	1.24	Min El Weir Flow (m)	204.10

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.291

INPUT
Description: Section 46.291 - Millway Avenue - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	25	207	25	204	40	204	50	201
50.5	200.2	63	200.2	64	201	72	204	75	204.5
85	204.7	85	207	142	207				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	40	.08	50	.035	64	.08	72	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
50	64	145	150	155	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	50.5	203.4	F
63	142	203.4	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.88	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.		0.035	

W.S. Elev (m)	202.84	Reach Len. (m)	145.00	150.00	155.00
Crit W.S. (m)	201.01	Flow Area (m2)		33.00	
E.G. Slope (m/m)	0.000254	Area (m2)	5.64	36.35	4.51
Q Total (m3/s)	28.70	Flow (m3/s)		28.70	
Top Width (m)	25.04	Top Width (m)	6.13	14.00	4.91
Vel Total (m/s)	0.87	Avg. Vel. (m/s)		0.87	
Max Chl Dpth (m)	2.64	Hydr. Depth (m)		2.64	
Conv. Total (m3/s)	1800.6	Conv. (m3/s)		1800.6	
Length Wtd. (m)	149.98	Wetted Per. (m)		12.50	
Min Ch El (m)	200.20	Shear (N/m2)		6.58	
Alpha	1.00	Stream Power (N/m s)		5.72	
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	101.76	159.65	64.13
C & E Loss (m)	0.00	Cum SA (1000 m2)	92.82	49.42	73.36

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.63	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.073	0.035	0.079
W.S. Elev (m)	204.57	Reach Len. (m)	145.00	150.00	155.00
Crit W.S. (m)	201.84	Flow Area (m2)	29.31	60.61	17.67
E.G. Slope (m/m)	0.000239	Area (m2)	29.31	60.61	17.67
Q Total (m3/s)	81.91	Flow (m3/s)	8.10	68.73	5.08
Top Width (m)	53.61	Top Width (m)	25.00	14.00	14.61
Vel Total (m/s)	0.76	Avg. Vel. (m/s)	0.28	1.13	0.29
Max Chl Dpth (m)	4.37	Hydr. Depth (m)	1.17	4.33	1.21
Conv. Total (m3/s)	5301.5	Conv. (m3/s)	524.5	4448.0	328.9
Length Wtd. (m)	149.85	Wetted Per. (m)	26.01	14.72	15.19
Min Ch El (m)	200.20	Shear (N/m2)	2.64	9.64	2.72
Alpha	1.88	Stream Power (N/m s)	0.73	10.93	0.78
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	262.72	303.95	252.42

C & E Loss (m)	0.00	Cum SA (1000 m2)	182.26	49.43
185.41				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.29

INPUT
Description: Section 46.29 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	30	207	30	204.5	54	204	64	201
71	200.2	78	201	86	204	110	205	156	205

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	54	.08	64	.035	78	.08	86	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
64	78	135	145	150	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.83	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035
0.080				
W.S. Elev (m)	202.80	Reach Len. (m)	135.00	145.00
150.00				
Crit W.S. (m)		Flow Area (m2)	5.39	30.77
4.31				
E.G. Slope (m/m)	0.000326	Area (m2)	5.39	30.77
4.31				
Q Total (m3/s)	28.70	Flow (m3/s)	1.10	26.73
0.87				
Top Width (m)	24.79	Top Width (m)	5.99	14.00
4.79				
Vel Total (m/s)	0.71	Avg. Vel. (m/s)	0.20	0.87
0.20				
Max Chl Dpth (m)	2.60	Hydr. Depth (m)	0.90	2.20
0.90				
Conv. Total (m3/s)	1588.7	Conv. (m3/s)	60.9	1479.7
48.0				
Length Wtd. (m)	144.88	Wetted Per. (m)	6.26	14.09
5.12				
Min Ch El (m)	200.20	Shear (N/m2)	2.75	6.99
2.69				
Alpha	1.40	Stream Power (N/m s)	0.56	6.07
0.54				
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	100.96	154.62
63.45				
C & E Loss (m)	0.00	Cum SA (1000 m2)	91.94	47.32
72.61				

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.58	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.076	0.035	0.078
W.S. Elev (m)	204.52	Reach Len. (m)	135.00	145.00	150.00
Crit W.S. (m)		Flow Area (m2)	26.60	54.85	19.36
E.G. Slope (m/m)	0.000309	Area (m2)	26.60	54.85	19.36
Q Total (m3/s)	81.91	Flow (m3/s)	7.82	68.21	5.88
Top Width (m)	68.42	Top Width (m)	34.00	14.00	20.42
Vel Total (m/s)	0.81	Avg. Vel. (m/s)	0.29	1.24	0.30
Max Chl Dpth (m)	4.32	Hydr. Depth (m)	0.78	3.92	0.95
Conv. Total (m3/s)	4656.6	Conv. (m3/s)	444.6	3877.5	334.4
Length Wtd. (m)	144.53	Wetted Per. (m)	34.46	14.09	20.98
Min Ch El (m)	200.20	Shear (N/m2)	2.34	11.81	2.80
Alpha	1.97	Stream Power (N/m s)	0.69	14.69	0.85
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	258.67	295.29	249.55
C & E Loss (m)	0.01	Cum SA (1000 m2)	177.98	47.33	182.70

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.282

INPUT
Description: Section 46.282 - Pennsylvania Avenue - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	60	207	60	204	73	204	81	201
83	200.4	84	199.9	96	199.9	97	200.4	99	202
101	203	103	204	118	204	145	204	180	204.64
225	204.64								

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	83	.035	97	.08	103	.05
118	.025	145	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
83	97	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	83.5	204.1	F

```
    96.5     225  204.05        F
Right Levee     Station=     180      Elevation=     207

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           202.80    Element                Left OB    Channel
Right OB
  Vel Head (m)              0.03    Wt. n-Val.                         0.035

  W.S. Elev (m)           202.77    Reach Len. (m)          50.00      50.00
50.00
  Crit W.S. (m)           200.70    Flow Area (m2)                     37.15

  E.G. Slope (m/m)      0.000182    Area (m2)                8.30      39.64
3.72
  Q Total (m3/s)            28.70   Flow (m3/s)                        28.70

  Top Width (m)             24.25   Top Width (m)            6.71      14.00
3.53
  Vel Total (m/s)           0.77    Avg. Vel. (m/s)                    0.77

  Max Chl Dpth (m)          2.87    Hydr. Depth (m)                    2.86

  Conv. Total (m3/s)      2124.3    Conv. (m3/s)                     2124.3

  Length Wtd. (m)           50.00   Wetted Per. (m)                    13.12

  Min Ch El (m)           199.90    Shear (N/m2)                       5.07

  Alpha                     1.00    Stream Power (N/m s)               3.91

  Frctn Loss (m)                    Cum Volume (1000 m3)   100.03     149.51
62.85
  C & E Loss (m)                    Cum SA (1000 m2)        91.08      45.29
71.98


Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #Regional w red'n


  E.G. Elev (m)           204.54    Element                Left OB    Channel
Right OB
  Vel Head (m)              0.04    Wt. n-Val.              0.076      0.035
0.048
  W.S. Elev (m)           204.50    Reach Len. (m)          50.00      50.00
50.00
  Crit W.S. (m)           201.50    Flow Area (m2)          30.15      63.93
40.61
  E.G. Slope (m/m)      0.000170    Area (m2)               30.15      63.93
40.61
  Q Total (m3/s)            81.91   Flow (m3/s)              7.61      64.84
9.46
  Top Width (m)            112.47   Top Width (m)           23.00      14.00
75.47
  Vel Total (m/s)           0.61    Avg. Vel. (m/s)          0.25       1.01
0.23
  Max Chl Dpth (m)          4.60    Hydr. Depth (m)          1.31       4.57
0.54
```

Conv. Total (m3/s)	6280.6	Conv. (m3/s)	583.2	4971.8	725.6
Length Wtd. (m)	50.00	Wetted Per. (m)	24.13	14.24	76.50
Min Ch El (m)	199.90	Shear (N/m2)	2.08	7.49	0.89
Alpha	2.23	Stream Power (N/m s)	0.53	7.60	0.21
Frctn Loss (m)		Cum Volume (1000 m3)	254.84	286.68	245.05
C & E Loss (m)		Cum SA (1000 m2)	174.13	45.30	175.50

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2815

INPUT
Description: Hum 13A-2R. Pennsylvania Avenue Culvert - Twin Cell - 5.7 m W x 2.4 m H x 40 m L Concrete Box Culverts. Drawing by Ander Engineering Ltd. (Dwg No. 85-102-9, December 1989) shows 4 Cell Culvert, but only two cells observed in field.

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 40
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 6

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	205	103	204	133	203.53
145	204	180	204	225	204

Upstream Bridge Cross Section Data
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	60	207	60	204	73	204	81	201
83	200.4	84	199.9	96	199.9	97	200.4	99	202
101	203	103	204	118	204	145	204	180	204.64
225	204.64								

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	83	.035	97	.08	103	.05
118	.025	145	.05						

Bank Sta: Left	Right	Coeff Contr.	Expan.
83	97	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	83.5	204.1	F
96.5	225	204.05	F

Right Levee Station= 180 Elevation= 207

```
Downstream  Deck/Roadway Coordinates
    num=       5
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0     205             103     204             133  203.53
     160     204             200     204

Downstream Bridge Cross Section Data
Station Elevation Data    num=      15
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0     205      73     204      81     201      83   200.4      84   199.8
      96   199.8      97   200.4      99     202     101     203     103     204
     118     204     145     204     160     204     200     204     200     206

Manning's n Values        num=       7
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05      73     .08      83    .035      97     .08     103     .05
     118    .025     145     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
            83      97             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    83.5   203.4       F
    96.5     200   203.4       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           Box    3.05    4.57
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      40     .015     .015        0                  .4
      1
Number of Barrels =  2
Upstream   Elevation =  199.3
Centerline Stations
    Sta.    Sta.
    87.5    92.5
Downstream Elevation =  199.2
Centerline Stations
    Sta.    Sta.
    87.5    92.5

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      28.70    Culv Full Len (m)        40.00
  # Barrels                   2     Culv Vel US (m/s)         1.03
  Q Barrel (m3/s)          14.35    Culv Vel DS (m/s)         1.03
  E.G. US. (m)            202.80    Culv Inv El Up (m)      199.30
  W.S. US. (m)            202.77    Culv Inv El Dn (m)      199.20
  E.G. DS (m)             202.74    Culv Frctn Ls (m)         0.01
```

W.S. DS (m)	202.71	Culv Exit Loss (m)	0.02
Delta EG (m)	0.06	Culv Entr Loss (m)	0.02
Delta WS (m)	0.06	Q Weir (m3/s)	
E.G. IC (m)	200.88	Weir Sta Lft (m)	
E.G. OC (m)	202.80	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	202.35	Weir Max Depth (m)	
Culv WS Outlet (m)	202.25	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	1.00	Min El Weir Flow (m)	204.05

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	39.78	Culv Full Len (m)	40.00
# Barrels	2	Culv Vel US (m/s)	1.43
Q Barrel (m3/s)	19.89	Culv Vel DS (m/s)	1.43
E.G. US. (m)	204.54	Culv Inv El Up (m)	199.30
W.S. US. (m)	204.50	Culv Inv El Dn (m)	199.20
E.G. DS (m)	204.42	Culv Frctn Ls (m)	0.02
W.S. DS (m)	204.38	Culv Exit Loss (m)	0.06
Delta EG (m)	0.12	Culv Entr Loss (m)	0.04
Delta WS (m)	0.13	Q Weir (m3/s)	42.13
E.G. IC (m)	202.56	Weir Sta Lft (m)	60.00
E.G. OC (m)	204.54	Weir Sta Rgt (m)	174.51
Culvert Control	Outlet	Weir Submerg	0.61
Culv WS Inlet (m)	202.35	Weir Max Depth (m)	0.54
Culv WS Outlet (m)	202.25	Weir Avg Depth (m)	0.39
Culv Nml Depth (m)		Weir Flow Area (m2)	44.85
Culv Crt Depth (m)	1.25	Min El Weir Flow (m)	204.05

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.281

INPUT
Description: Section 46.281 - Pennsylvania Avenue - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	73	204	81	201	83	200.4	84	199.8
96	199.8	97	200.4	99	202	101	203	103	204
118	204	145	204	160	204	200	204	200	206

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	83	.035	97	.08	103	.05
118	.025	145	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
83	97	40	40	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	83.5	203.4	F
96.5	200	203.4	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.74	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.035	
W.S. Elev (m)	202.71	Reach Len. (m)	40.00	40.00	40.00
Crit W.S. (m)	200.60	Flow Area (m2)		37.70	
E.G. Slope (m/m)	0.000175	Area (m2)	7.93	40.16	3.53
Q Total (m3/s)	28.70	Flow (m3/s)		28.70	
Top Width (m)	23.99	Top Width (m)	6.56	14.00	3.42
Vel Total (m/s)	0.76	Avg. Vel. (m/s)		0.76	
Max Chl Dpth (m)	2.91	Hydr. Depth (m)		2.90	
Conv. Total (m3/s)	2171.6	Conv. (m3/s)		2171.6	
Length Wtd. (m)	40.00	Wetted Per. (m)		13.17	
Min Ch El (m)	199.80	Shear (N/m2)		4.90	
Alpha	1.00	Stream Power (N/m s)		3.73	
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	100.03	148.63	62.85
C & E Loss (m)	0.01	Cum SA (1000 m2)	90.75	44.59	71.81

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.078	0.035	0.051
W.S. Elev (m)	204.38	Reach Len. (m)	40.00	40.00	40.00
Crit W.S. (m)	201.40	Flow Area (m2)	27.54	63.47	48.38
E.G. Slope (m/m)	0.000182	Area (m2)	27.54	63.47	48.38
Q Total (m3/s)	81.91	Flow (m3/s)	6.64	65.89	9.38
Top Width (m)	154.48	Top Width (m)	37.48	14.00	103.00
Vel Total (m/s)	0.59	Avg. Vel. (m/s)	0.24	1.04	0.19
Max Chl Dpth (m)	4.58	Hydr. Depth (m)	0.73	4.53	0.47

Conv. Total (m3/s)	6079.0	Conv. (m3/s)	492.9	4890.1	695.9
Length Wtd. (m)	40.00	Wetted Per. (m)	38.12	14.33	104.41
Min Ch El (m)	199.80	Shear (N/m2)	1.29	7.89	0.83
Alpha	2.54	Stream Power (N/m s)	0.31	8.19	0.16
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	254.84	283.36	245.05
C & E Loss (m)	0.02	Cum SA (1000 m2)	172.62	44.60	171.04

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.28

INPUT
Description: Section 46.28 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	73	204	83	201	87	200	89	199.8
91	199.8	93	200	95	201	98	202	101	203
103	204	117	204	142	204	173	204	173	206

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	87	.035	93	.08	103	.05
117	.025	142	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
87	93	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.72	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.65	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)		Flow Area (m2)	13.18	16.72	8.41
E.G. Slope (m/m)	0.000521	Area (m2)	13.18	16.72	8.41
Q Total (m3/s)	28.70	Flow (m3/s)	4.55	21.55	2.60
Top Width (m)	22.48	Top Width (m)	9.51	6.00	6.96
Vel Total (m/s)	0.75	Avg. Vel. (m/s)	0.35	1.29	0.31
Max Chl Dpth (m)	2.85	Hydr. Depth (m)	1.38	2.79	

1.21					
Conv. Total (m3/s)	1257.7	Conv. (m3/s)	199.5	944.3	
113.8					
Length Wtd. (m)	50.00	Wetted Per. (m)	9.88	6.02	
7.47					
Min Ch El (m)	199.80	Shear (N/m2)	6.81	14.18	
5.75					
Alpha	2.27	Stream Power (N/m s)	2.35	18.27	
1.78					
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	99.61	147.49	
62.61					
C & E Loss (m)	0.02	Cum SA (1000 m2)	90.43	44.19	
71.60					

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.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.39	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.10	Wt. n-Val.	0.079	0.035	
0.065					
W.S. Elev (m)	204.29	Reach Len. (m)	50.00	50.00	
50.00					
Crit W.S. (m)		Flow Area (m2)	36.18	26.55	
43.31					
E.G. Slope (m/m)	0.000552	Area (m2)	36.18	26.55	
43.31					
Q Total (m3/s)	81.91	Flow (m3/s)	17.19	47.91	
16.81					
Top Width (m)	121.27	Top Width (m)	35.27	6.00	
80.00					
Vel Total (m/s)	0.77	Avg. Vel. (m/s)	0.48	1.80	
0.39					
Max Chl Dpth (m)	4.49	Hydr. Depth (m)	1.03	4.42	
0.54					
Conv. Total (m3/s)	3487.1	Conv. (m3/s)	731.6	2039.7	
715.8					
Length Wtd. (m)	50.00	Wetted Per. (m)	35.83	6.02	
81.09					
Min Ch El (m)	199.80	Shear (N/m2)	5.46	23.86	
2.89					
Alpha	3.32	Stream Power (N/m s)	2.60	43.07	
1.12					
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	253.56	281.56	
243.22					
C & E Loss (m)	0.02	Cum SA (1000 m2)	171.16	44.20	
167.38					

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: RIVER-1
REACH: Reach-1 RS: 46.274

INPUT
Description: Section 46.274 - Jane Street - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	76	204	83	201	90	200
94	199.34	98	199.34	102	200	106	201	116	204
130	204	205	204	205	206				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	76	.08	90	.035	106	.08	116	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	102	1	1	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	89	203.21	F
103	205	203.21	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.69	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.035
W.S. Elev (m)	202.68	Reach Len. (m)	0.50	0.50	0.50
Crit W.S. (m)	200.27	Flow Area (m2)	2.61	37.44	2.56
E.G. Slope (m/m)	0.000080	Area (m2)	18.55	37.44	13.42
Q Total (m3/s)	22.11	Flow (m3/s)	0.55	20.36	1.20
Top Width (m)	32.52	Top Width (m)	10.92	12.00	9.60
Vel Total (m/s)	0.52	Avg. Vel. (m/s)	0.21	0.54	0.47
Max Chl Dpth (m)	3.34	Hydr. Depth (m)	2.61	3.12	2.55
Conv. Total (m3/s)	2465.3	Conv. (m3/s)	61.4	2270.3	133.7
Length Wtd. (m)	0.50	Wetted Per. (m)	1.01	12.11	1.03
Min Ch El (m)	199.34	Shear (N/m2)	2.04	2.44	1.95
Alpha	1.06	Stream Power (N/m s)	0.43	1.33	0.92
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	98.82	146.13	62.06
C & E Loss (m)	0.04	Cum SA (1000 m2)	89.91	43.74	71.19

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.
Note: Multiple critical depths were found at this location. The critical depth

with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.36	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.076	0.035	0.047
W.S. Elev (m)	204.33	Reach Len. (m)	0.50	0.50	0.50
Crit W.S. (m)	201.18	Flow Area (m2)	55.19	57.26	63.19
E.G. Slope (m/m)	0.000123	Area (m2)	55.19	57.26	63.19
Q Total (m3/s)	81.91	Flow (m3/s)	12.20	51.20	18.51
Top Width (m)	181.62	Top Width (m)	66.62	12.00	103.00
Vel Total (m/s)	0.47	Avg. Vel. (m/s)	0.22	0.89	0.29
Max Chl Dpth (m)	4.99	Hydr. Depth (m)	0.83	4.77	0.61
Conv. Total (m3/s)	7374.7	Conv. (m3/s)	1098.6	4609.5	1666.6
Length Wtd. (m)	0.50	Wetted Per. (m)	67.31	12.11	103.90
Min Ch El (m)	199.34	Shear (N/m2)	0.99	5.72	0.74
Alpha	2.42	Stream Power (N/m s)	0.22	5.12	0.22
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	251.28	279.46	240.56
C & E Loss (m)	0.03	Cum SA (1000 m2)	168.62	43.75	162.81

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.

BRIDGE

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2735

INPUT
Description: Hum 13A-1R. Jane Street Culverts - Upstream In-Line Weir Coded as Bridge. Weir is 25 m L. Drawings by Ander Engineering Ltd. (85-101-7 & 85-101-1) 1985.

New HEC-RAS coding January 2004 by
Acres included coding of in-line weir (as a bridge) and culverts in HEC-RAS.
Distance from Upstream XS = .5
Deck/Roadway Width = .25
Weir Coefficient = 1.72
Upstream Deck/Roadway Coordinates
num= 8

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
76	204	204	83.5	204		83.5	203.21	
90	203.21	200.7	102	203.21	200.7	108.5	203.21	
108.5	204		116	204				

Upstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	76	204	83	201	90	200
94	199.34	98	199.34	102	200	106	201	116	204
130	204	205	204	205	206				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	76	.08	90	.035	106	.08	116	.05

Bank Sta: Left Right Coeff Contr. Expan.
90 102 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	89	203.21	F
103	205	203.21	F

Downstream Deck/Roadway Coordinates
num= 8

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
76	204	204	83.5	204		83.5	203.21	
90	203.21	200.7	102	203.21	200.7	108.5	203.21	
108.5	204		116	204				

Downstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	76	204	83	201	90	200
94	199.34	98	199.34	102	200	106	201	116	204
130	204	205	204	205	206				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	76	.08	90	.035	106	.08	116	.05

Bank Sta: Left Right Coeff Contr. Expan.
90 102 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	89	203.2	F
103	205	203.2	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 Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method

Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT Profile #100-year

E.G. US. (m)	202.69	Element	Inside BR US	Inside BR DS
W.S. US. (m)	202.68	E.G. Elev (m)	202.66	202.66
Q Total (m3/s)	22.11	W.S. Elev (m)	202.53	202.52
Q Bridge (m3/s)	22.11	Crit W.S. (m)	200.26	200.26
Q Weir (m3/s)		Max Chl Dpth (m)	3.19	3.18
Weir Sta Lft (m)		Vel Total (m/s)	1.62	1.62
Weir Sta Rgt (m)		Flow Area (m2)	13.69	13.69
Weir Submerg		Froude # Chl	0.29	0.29
Weir Max Depth (m)		Specif Force (m3)	36.72	36.70
Min El Weir Flow (m)	203.21	Hydr Depth (m)		
Min El Prs (m)	200.70	W.P. Total (m)	25.52	25.52
Delta EG (m)	0.10	Conv. Total (m3/s)	267.9	267.9
Delta WS (m)	0.10	Top Width (m)		
BR Open Area (m2)	13.69	Frctn Loss (m)	0.00	0.00
BR Open Vel (m/s)	1.62	C & E Loss (m)	0.00	0.06
BR Sluice Coef		Shear Total (N/m2)	35.80	35.80
BR Sel Method	Energy only	Power Total (N/m s)	57.81	57.81

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
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.

BRIDGE OUTPUT Profile #Regional w red'n

E.G. US. (m)	204.36	Element	Inside BR US	Inside BR DS
W.S. US. (m)	204.33	E.G. Elev (m)	204.33	

Q Total (m3/s)	81.91	W.S. Elev (m)	204.21
Q Bridge (m3/s)	21.55	Crit W.S. (m)	203.76
Q Weir (m3/s)		Max Chl Dpth (m)	4.87
Weir Sta Lft (m)		Vel Total (m/s)	1.17
Weir Sta Rgt (m)		Flow Area (m2)	70.23
Weir Submerg		Froude # Chl	0.22
Weir Max Depth (m)		Specif Force (m3)	83.91
Min El Weir Flow (m)	203.21	Hydr Depth (m)	0.40
Min El Prs (m)	200.70	W.P. Total (m)	204.73
Delta EG (m)	0.07	Conv. Total (m3/s)	991.8
Delta WS (m)	0.08	Top Width (m)	177.41
BR Open Area (m2)	13.69	Frctn Loss (m)	0.00
BR Open Vel (m/s)	1.57	C & E Loss (m)	0.00
BR Sluice Coef		Shear Total (N/m2)	22.95
BR Sel Method	Energy only	Power Total (N/m s)	26.76

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
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: RIVER-1
REACH: Reach-1 RS: 46.273

INPUT
Description: Section 46.273 - Jane Street - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	76	204	83	201	90	200
94	199.34	98	199.34	102	200	106	201	116	204
130	204	205	204	205	206				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	76	.08	90	.035	106	.08	116	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	102	4	4	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	89	203.2	F
103	205	203.2	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.60	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.035
W.S. Elev (m)	202.58	Reach Len. (m)	4.00	4.00	4.00
Crit W.S. (m)	200.27	Flow Area (m2)	2.51	36.27	2.46
E.G. Slope (m/m)	0.000090	Area (m2)	17.50	36.27	12.51
Q Total (m3/s)	22.11	Flow (m3/s)	0.55	20.37	1.19
Top Width (m)	31.97	Top Width (m)	10.69	12.00	9.28
Vel Total (m/s)	0.54	Avg. Vel. (m/s)	0.22	0.56	0.48
Max Chl Dpth (m)	3.24	Hydr. Depth (m)	2.51	3.02	2.46
Conv. Total (m3/s)	2336.5	Conv. (m3/s)	57.6	2153.6	125.3
Length Wtd. (m)	4.00	Wetted Per. (m)	1.01	12.11	1.03
Min Ch El (m)	199.34	Shear (N/m2)	2.18	2.63	2.09
Alpha	1.06	Stream Power (N/m s)	0.47	1.48	1.01
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	98.81	146.11	62.06
C & E Loss (m)	0.01	Cum SA (1000 m2)	89.91	43.73	71.18

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.28	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.077	0.035	0.046
W.S. Elev (m)	204.25	Reach Len. (m)	4.00	4.00	4.00
Crit W.S. (m)	201.19	Flow Area (m2)	50.15	56.34	55.25
E.G. Slope (m/m)	0.000137	Area (m2)	50.15	56.34	55.25
Q Total (m3/s)	81.91	Flow (m3/s)	11.76	52.50	17.65
Top Width (m)	178.92	Top Width (m)	63.92	12.00	

103.00					
Vel Total (m/s)	0.51	Avg. Vel. (m/s)	0.23	0.93	
0.32					
Max Chl Dpth (m)	4.91	Hydr. Depth (m)	0.78	4.69	
0.54					
Conv. Total (m3/s)	6998.9	Conv. (m3/s)	1005.1	4485.9	
1507.9					
Length Wtd. (m)	4.00	Wetted Per. (m)	64.61	12.11	
103.82					
Min Ch El (m)	199.34	Shear (N/m2)	1.04	6.25	
0.71					
Alpha	2.29	Stream Power (N/m s)	0.24	5.82	
0.23					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	251.25	279.43	
240.52					
C & E Loss (m)	0.01	Cum SA (1000 m2)	168.55	43.73	
162.70					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.272

INPUT
Description: Section 46.272 - Jane Street - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	80	204	90	201	91	200
92	199.34	100	199.34	101	200	102	201	105	202
115	203	120	204	130	204	205	204	205	206

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	80	.08	91	.035	102	.08	120	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
91	101	100	80	60	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	92	204	F
100	205	204	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.59	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.04	Wt. n-Val.		0.035	
W.S. Elev (m)	202.55	Reach Len. (m)	100.00	80.00	
60.00					
Crit W.S. (m)	200.26	Flow Area (m2)		25.71	
E.G. Slope (m/m)	0.000191	Area (m2)	6.07	31.47	
6.74					
Q Total (m3/s)	22.11	Flow (m3/s)		22.11	

Top Width (m)	25.71	Top Width (m)	6.18	10.00	9.53
Vel Total (m/s)	0.86	Avg. Vel. (m/s)		0.86	
Max Chl Dpth (m)	3.21	Hydr. Depth (m)		3.21	
Conv. Total (m3/s)	1599.3	Conv. (m3/s)		1599.3	
Length Wtd. (m)	80.00	Wetted Per. (m)		8.00	
Min Ch El (m)	199.34	Shear (N/m2)		6.02	
Alpha	1.00	Stream Power (N/m s)		5.18	
Frctn Loss (m)		Cum Volume (1000 m3)	98.76	145.98	62.02
C & E Loss (m)		Cum SA (1000 m2)	89.88	43.69	71.14

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.27	Element	Left OB	Channel	Right OB	
Vel Head (m)	0.06	Wt. n-Val.	0.075	0.035	0.064	
W.S. Elev (m)	204.21	Reach Len. (m)	100.00	80.00	60.00	
Crit W.S. (m)	201.54	Flow Area (m2)	31.05	48.04	50.37	
E.G. Slope (m/m)	0.000261	Area (m2)	31.05	48.04	50.37	
Q Total (m3/s)	81.91	Flow (m3/s)	7.23	61.53	13.16	
Top Width (m)	177.36	Top Width (m)	63.36	10.00	104.00	
Vel Total (m/s)	0.63	Avg. Vel. (m/s)	0.23	1.28	0.26	
Max Chl Dpth (m)	4.87	Hydr. Depth (m)	0.49	4.80	0.48	
Conv. Total (m3/s)	5070.0	Conv. (m3/s)	447.6	3808.1	814.3	
Length Wtd. (m)	80.00	Wetted Per. (m)	64.22	10.40	104.94	
Min Ch El (m)	199.34	Shear (N/m2)	1.24	11.83	1.23	
Alpha	3.12	Stream Power (N/m s)	0.29	15.15	0.32	
Frctn Loss (m)		Cum Volume (1000 m3)	251.08	279.22	240.30	
C & E Loss (m)		Cum SA (1000 m2)	168.30	43.69	162.29	

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2715

INPUT
Description: Hum 13A-1R. Jane Street Culverts - Twin Cell - 2.44 m W x 2.135 m H x 59 m L Concrete Box Culverts and Single Cel 2.44 W x 1.22 m H x 59 m L. Drawings by Ander Engineering Ltd. (85-101-7 & 85-101-1) 1985.

New HEC-RAS coding January 2004 by Acres
included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.
Distance from Upstream XS = 5
Deck/Roadway Width = 59
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	204	173	204

Upstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	80	204	90	201	91	200
92	199.34	100	199.34	101	200	102	201	105	202
115	203	120	204	130	204	205	204	205	206

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	80	.08	91	.035	102	.08	120	.05

Bank Sta: Left Right Coeff Contr. Expan.
91 101 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	92	204	F
100	205	204	F

Downstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	204	173	204

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	3	204	30	204	67	204	71	203
74	201	77	200	79	198.983	91	198.983	93	200
97	201	105	202	106	203	107	203.6	165	203.8

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.05	71	.08	77	.035	93	.08
106	.05								

Bank Sta: Left Right Coeff Contr. Expan.
77 93 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent

```
       0      81   202.5       F
      89     165   202.5       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 =  2

Culvert Name     Shape      Rise    Span
Culvert #1           Box   2.135    2.44
FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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
                 5      59     .015     .015        0                   .5
      1
Number of Barrels =  2
Upstream   Elevation =  200.78
Centerline Stations
    Sta.    Sta.
    93.6    98.4
Downstream Elevation =  200.403
Centerline Stations
    Sta.    Sta.
    82.6    87.4

Culvert Name     Shape      Rise    Span
Culvert #2           Box    1.22    2.44
FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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
                 5      59     .015     .015        0                   .5
      1
Upstream   Elevation =  199.34
           Centerline Station =  96
Downstream Elevation =  198.983
           Centerline Station =  85

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      16.30    Culv Full Len (m)
  # Barrels                   2     Culv Vel US (m/s)        2.52
  Q Barrel (m3/s)           8.15    Culv Vel DS (m/s)        1.93
  E.G. US. (m)            202.59    Culv Inv El Up (m)     200.78
  W.S. US. (m)            202.55    Culv Inv El Dn (m)     200.40
  E.G. DS (m)             202.17    Culv Frctn Ls (m)        0.03
  W.S. DS (m)             202.13    Culv Exit Loss (m)       0.15
  Delta EG (m)              0.42    Culv Entr Loss (m)       0.16
  Delta WS (m)              0.42    Q Weir (m3/s)
  E.G. IC (m)             202.49    Weir Sta Lft (m)
  E.G. OC (m)             202.59    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
  Culv WS Inlet (m)       202.11    Weir Max Depth (m)
  Culv WS Outlet (m)      202.13    Weir Avg Depth (m)
  Culv Nml Depth (m)        0.95    Weir Flow Area (m2)
```

Culv Crt Depth (m)	1.04	Min El Weir Flow (m)	204.00

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	35.38	Culv Full Len (m)	59.00
# Barrels	2	Culv Vel US (m/s)	3.40
Q Barrel (m3/s)	17.69	Culv Vel DS (m/s)	3.40
E.G. US. (m)	204.28	Culv Inv El Up (m)	200.78
W.S. US. (m)	204.21	Culv Inv El Dn (m)	200.40
E.G. DS (m)	203.13	Culv Frctn Ls (m)	0.32
W.S. DS (m)	203.07	Culv Exit Loss (m)	0.53
Delta EG (m)	1.15	Culv Entr Loss (m)	0.29
Delta WS (m)	1.14	Q Weir (m3/s)	37.12
E.G. IC (m)	203.89	Weir Sta Lft (m)	25.18
E.G. OC (m)	204.28	Weir Sta Rgt (m)	205.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	202.92	Weir Max Depth (m)	0.28
Culv WS Outlet (m)	202.54	Weir Avg Depth (m)	0.27
Culv Nml Depth (m)		Weir Flow Area (m2)	49.05
Culv Crt Depth (m)	1.75	Min El Weir Flow (m)	204.00

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #2

Q Culv Group (m3/s)	5.81	Culv Full Len (m)	59.00
# Barrels	1	Culv Vel US (m/s)	1.95
Q Barrel (m3/s)	5.81	Culv Vel DS (m/s)	1.95
E.G. US. (m)	202.59	Culv Inv El Up (m)	199.34
W.S. US. (m)	202.55	Culv Inv El Dn (m)	198.98
E.G. DS (m)	202.17	Culv Frctn Ls (m)	0.17
W.S. DS (m)	202.13	Culv Exit Loss (m)	0.15
Delta EG (m)	0.42	Culv Entr Loss (m)	0.10
Delta WS (m)	0.42	Q Weir (m3/s)	
E.G. IC (m)	200.71	Weir Sta Lft (m)	
E.G. OC (m)	202.59	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	200.56	Weir Max Depth (m)	
Culv WS Outlet (m)	200.20	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.83	Min El Weir Flow (m)	204.00

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #2

Q Culv Group (m3/s)	9.41	Culv Full Len (m)	59.00
# Barrels	1	Culv Vel US (m/s)	3.16
Q Barrel (m3/s)	9.41	Culv Vel DS (m/s)	3.16
E.G. US. (m)	204.28	Culv Inv El Up (m)	199.34
W.S. US. (m)	204.21	Culv Inv El Dn (m)	198.98
E.G. DS (m)	203.13	Culv Frctn Ls (m)	0.44
W.S. DS (m)	203.07	Culv Exit Loss (m)	0.45
Delta EG (m)	1.15	Culv Entr Loss (m)	0.25
Delta WS (m)	1.14	Q Weir (m3/s)	37.12
E.G. IC (m)	201.53	Weir Sta Lft (m)	25.18
E.G. OC (m)	204.28	Weir Sta Rgt (m)	205.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	200.56	Weir Max Depth (m)	0.28
Culv WS Outlet (m)	200.20	Weir Avg Depth (m)	0.27
Culv Nml Depth (m)		Weir Flow Area (m2)	49.05
Culv Crt Depth (m)	1.15	Min El Weir Flow (m)	204.00

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.271

INPUT
Description: Section 46.271 - Jane Street - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	3	204	30	204	67	204	71	203
74	201	77	200	79	198.983	91	198.983	93	200
97	201	105	202	106	203	107	203.6	165	203.8

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.05	71	.08	77	.035	93	.08
106	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
77	93	55	60	70	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	81	202.5	F
89	165	202.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.17	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.		0.035	
W.S. Elev (m)	202.13	Reach Len. (m)	55.00	60.00	70.00
Crit W.S. (m)	199.90	Flow Area (m2)		25.19	
E.G. Slope (m/m)	0.000204	Area (m2)	5.85	48.34	11.58
Q Total (m3/s)	22.11	Flow (m3/s)		22.11	
Top Width (m)	32.83	Top Width (m)	4.70	16.00	12.13
Vel Total (m/s)	0.88	Avg. Vel. (m/s)		0.88	
Max Chl Dpth (m)	3.15	Hydr. Depth (m)		3.15	
Conv. Total (m3/s)	1545.9	Conv. (m3/s)		1545.9	
Length Wtd. (m)	61.12	Wetted Per. (m)		8.00	
Min Ch El (m)	198.98	Shear (N/m2)		6.31	
Alpha	1.00	Stream Power (N/m s)		5.54	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	98.76	145.33	62.02
C & E Loss (m)	0.00	Cum SA (1000 m2)	89.33	42.65	70.49

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	203.13	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.07	Reach Len. (m)	55.00	60.00	70.00
Crit W.S. (m)	201.18	Flow Area (m2)	10.93	63.37	23.42
E.G. Slope (m/m)	0.000263	Area (m2)	10.93	63.37	23.42
Q Total (m3/s)	81.91	Flow (m3/s)	3.05	72.05	6.82
Top Width (m)	35.40	Top Width (m)	6.28	16.00	13.12
Vel Total (m/s)	0.84	Avg. Vel. (m/s)	0.28	1.14	0.29
Max Chl Dpth (m)	4.09	Hydr. Depth (m)	1.74	3.96	1.79
Conv. Total (m3/s)	5050.3	Conv. (m3/s)	187.9	4442.0	420.4
Length Wtd. (m)	61.45	Wetted Per. (m)	7.06	16.49	13.74
Min Ch El (m)	198.98	Shear (N/m2)	4.00	9.91	4.40
Alpha	1.63	Stream Power (N/m s)	1.11	11.27	1.28
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	251.08	274.91	240.30
C & E Loss (m)	0.05	Cum SA (1000 m2)	164.82	42.65	158.78

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.27

INPUT
Description: Section 46.27 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	10	204	40	204	63	206	73	206
78	204	90	203	100	200	103	199	104	198.9
105	198.9	106	199	112	200	120	203	147	203.5

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	103	.035	106	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
103	106	100	110	120	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.15	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.12	Reach Len. (m)	100.00	110.00	120.00
Crit W.S. (m)		Flow Area (m2)	15.34	9.56	21.71
E.G. Slope (m/m)	0.000320	Area (m2)	15.34	9.56	21.71
Q Total (m3/s)	22.11	Flow (m3/s)	4.41	10.55	7.15
Top Width (m)	24.72	Top Width (m)	10.06	3.00	11.65
Vel Total (m/s)	0.47	Avg. Vel. (m/s)	0.29	1.10	0.33
Max Chl Dpth (m)	3.22	Hydr. Depth (m)	1.52	3.19	1.86
Conv. Total (m3/s)	1236.5	Conv. (m3/s)	246.4	590.0	400.1
Length Wtd. (m)	110.32	Wetted Per. (m)	10.54	3.01	12.12
Min Ch El (m)	198.90	Shear (N/m2)	4.56	9.95	5.61
Alpha	2.81	Stream Power (N/m s)	1.31	10.98	1.85
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	98.18	143.59	60.85
C & E Loss (m)	0.00	Cum SA (1000 m2)	88.93	42.08	69.66

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	203.04	Element	Left OB	Channel	Right OB
Vel Head (m)	0.23	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.81	Reach Len. (m)	100.00	110.00	120.00
Crit W.S. (m)		Flow Area (m2)	23.12	11.64	30.42
E.G. Slope (m/m)	0.001900	Area (m2)	23.12	11.64	30.42
Q Total (m3/s)	81.91	Flow (m3/s)	18.54	35.70	27.68
Top Width (m)	28.87	Top Width (m)	12.37	3.00	13.50

Vel Total (m/s)	1.26	Avg. Vel. (m/s)	0.80	3.07	0.91
Max Chl Dpth (m)	3.91	Hydr. Depth (m)	1.87	3.88	2.25
Conv. Total (m3/s)	1879.1	Conv. (m3/s)	425.2	818.9	635.0
Length Wtd. (m)	110.36	Wetted Per. (m)	12.95	3.01	14.09
Min Ch El (m)	198.90	Shear (N/m2)	33.27	72.04	40.22
Alpha	2.87	Stream Power (N/m s)	26.68	221.02	36.61
Frctn Loss (m)	0.14	Cum Volume (1000 m3)	250.15	272.66	238.42
C & E Loss (m)	0.02	Cum SA (1000 m2)	164.30	42.08	157.84

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.26

INPUT
Description: Section 46.26 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	15	204	24	200	30	199	32	198.8
34	198.8	36	199	47	202	54	202.5	64	202.5
64	205	109	205						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	15	.08	30	.035	36	.08	54	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
30	36	115	120	120	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.13	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.11	Reach Len. (m)	115.00	120.00	120.00
Crit W.S. (m)		Flow Area (m2)	20.63	19.44	17.75
E.G. Slope (m/m)	0.000139	Area (m2)	20.63	19.44	17.75
Q Total (m3/s)	22.11	Flow (m3/s)	4.55	14.31	3.24
Top Width (m)	29.23	Top Width (m)	10.74	6.00	12.49
Vel Total (m/s)	0.38	Avg. Vel. (m/s)	0.22	0.74	0.18
Max Chl Dpth (m)	3.31	Hydr. Depth (m)	1.92	3.24	1.42
Conv. Total (m3/s)	1873.9	Conv. (m3/s)	386.0	1213.4	274.6

Length Wtd. (m)	119.31	Wetted Per. (m)	11.27	6.02	12.90
Min Ch El (m)	198.80	Shear (N/m2)	2.50	4.41	1.88
Alpha	2.50	Stream Power (N/m s)	0.55	3.24	0.34
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	96.38	142.00	58.49
C & E Loss (m)	0.00	Cum SA (1000 m2)	87.89	41.58	68.21

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.88	Element	Left OB	Channel	Right OB
Vel Head (m)	0.15	Wt. n-Val.	0.080	0.035	0.079
W.S. Elev (m)	202.73	Reach Len. (m)	115.00	120.00	120.00
Crit W.S. (m)		Flow Area (m2)	27.73	23.16	30.10
E.G. Slope (m/m)	0.000934	Area (m2)	27.73	23.16	30.10
Q Total (m3/s)	81.91	Flow (m3/s)	17.74	49.66	14.51
Top Width (m)	46.14	Top Width (m)	12.14	6.00	28.00
Vel Total (m/s)	1.01	Avg. Vel. (m/s)	0.64	2.14	0.48
Max Chl Dpth (m)	3.93	Hydr. Depth (m)	2.28	3.86	1.08
Conv. Total (m3/s)	2680.0	Conv. (m3/s)	580.3	1624.9	474.8
Length Wtd. (m)	119.21	Wetted Per. (m)	12.80	6.02	28.65
Min Ch El (m)	198.80	Shear (N/m2)	19.85	35.25	9.63
Alpha	2.85	Stream Power (N/m s)	12.70	75.58	4.64
Frctn Loss (m)	0.10	Cum Volume (1000 m3)	247.61	270.74	234.79
C & E Loss (m)	0.01	Cum SA (1000 m2)	163.08	41.58	155.35

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: RIVER-1
REACH: Reach-1 RS: 46.25

INPUT
Description: Section 46.25 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	26	203	36	200	40	199	44	198.6
46	198.6	50	199	68	202	84	203	154	204

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	26	.08	40	.035	50	.08	68	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
40	50	140	130	125	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.10	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.07	Reach Len. (m)	140.00	130.00	125.00
Crit W.S. (m)		Flow Area (m2)	17.44	33.12	28.33
E.G. Slope (m/m)	0.000203	Area (m2)	17.44	33.12	28.33
Q Total (m3/s)	40.81	Flow (m3/s)	4.14	29.90	6.76
Top Width (m)	40.05	Top Width (m)	10.91	10.00	19.15
Vel Total (m/s)	0.52	Avg. Vel. (m/s)	0.24	0.90	0.24
Max Chl Dpth (m)	3.47	Hydr. Depth (m)	1.60	3.31	1.48
Conv. Total (m3/s)	2860.9	Conv. (m3/s)	290.6	2096.6	473.8
Length Wtd. (m)	130.55	Wetted Per. (m)	11.33	10.04	19.40
Min Ch El (m)	198.60	Shear (N/m2)	3.07	6.58	2.91
Alpha	2.29	Stream Power (N/m s)	0.73	5.94	0.70
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	94.19	138.84	55.72
C & E Loss (m)	0.00	Cum SA (1000 m2)	86.64	40.62	66.32

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.77	Element	Left OB	Channel	Right OB
Vel Head (m)	0.13	Wt. n-Val.	0.080	0.035	0.079
W.S. Elev (m)	202.64	Reach Len. (m)	140.00	130.00	125.00
Crit W.S. (m)		Flow Area (m2)	24.23	38.84	41.92
E.G. Slope (m/m)	0.000726	Area (m2)	24.23	38.84	41.92

Q Total (m3/s)	108.10	Flow (m3/s)	12.16	73.68	22.26
Top Width (m)	51.12	Top Width (m)	12.81	10.00	28.31
Vel Total (m/s)	1.03	Avg. Vel. (m/s)	0.50	1.90	0.53
Max Chl Dpth (m)	4.04	Hydr. Depth (m)	1.89	3.88	1.48
Conv. Total (m3/s)	4012.4	Conv. (m3/s)	451.3	2735.0	826.1
Length Wtd. (m)	130.59	Wetted Per. (m)	13.33	10.04	28.58
Min Ch El (m)	198.60	Shear (N/m2)	12.94	27.54	10.44
Alpha	2.40	Stream Power (N/m s)	6.49	52.23	5.54
Frctn Loss (m)	0.12	Cum Volume (1000 m3)	244.62	267.02	230.47
C & E Loss (m)	0.01	Cum SA (1000 m2)	161.64	40.62	151.98

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.24

INPUT
Description: Section 46.24 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	13	203	30	200	34	199	36	198.4
38	198.4	43	199	52	202	60	203	80	204

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	13	.08	34	.035	43	.08	60	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
34	43	54	51	45	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.07	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.03	Reach Len. (m)	54.00	51.00	45.00
Crit W.S. (m)		Flow Area (m2)	21.76	30.55	13.75
E.G. Slope (m/m)	0.000265	Area (m2)	21.76	30.55	13.75
Q Total (m3/s)	40.81	Flow (m3/s)	5.48	31.79	3.53
Top Width (m)	33.71	Top Width (m)	15.49	9.00	9.22
Vel Total (m/s)	0.62	Avg. Vel. (m/s)	0.25	1.04	0.26
Max Chl Dpth (m)	3.63	Hydr. Depth (m)	1.40	3.39	

1.49					
Conv. Total (m3/s)	2507.1	Conv. (m3/s)	336.9	1953.4	
216.8					
Length Wtd. (m)	50.57	Wetted Per. (m)	15.79	9.12	
9.71					
Min Ch El (m)	198.40	Shear (N/m2)	3.58	8.70	
3.68					
Alpha	2.25	Stream Power (N/m s)	0.90	9.05	
0.94					
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	91.45	134.70	
53.09					
C & E Loss (m)	0.00	Cum SA (1000 m2)	84.79	39.39	
64.54					

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.64	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.23	Wt. n-Val.	0.080	0.035	
0.080					
W.S. Elev (m)	202.42	Reach Len. (m)	54.00	51.00	
45.00					
Crit W.S. (m)		Flow Area (m2)	28.23	34.06	
17.95					
E.G. Slope (m/m)	0.001218	Area (m2)	28.23	34.06	
17.95					
Q Total (m3/s)	108.10	Flow (m3/s)	16.60	81.71	
9.79					
Top Width (m)	39.04	Top Width (m)	17.70	9.00	
12.34					
Vel Total (m/s)	1.35	Avg. Vel. (m/s)	0.59	2.40	
0.55					
Max Chl Dpth (m)	4.02	Hydr. Depth (m)	1.59	3.78	
1.45					
Conv. Total (m3/s)	3097.6	Conv. (m3/s)	475.7	2341.4	
280.5					
Length Wtd. (m)	50.47	Wetted Per. (m)	18.03	9.12	
12.85					
Min Ch El (m)	198.40	Shear (N/m2)	18.69	44.58	
16.68					
Alpha	2.44	Stream Power (N/m s)	10.99	106.95	
9.09					
Frctn Loss (m)	0.07	Cum Volume (1000 m3)	240.95	262.28	
226.73					
C & E Loss (m)	0.02	Cum SA (1000 m2)	159.51	39.39	
149.44					

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2375

INPUT
Description: Based on Bridge Section US
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-1380	205.2	-1375	205.1	-1370	204.5	-1360	204.5	-1340	204.4

-1330	204.2	-1320	204.4	-1318	204	-1310	203	-1305	202
-1300	201	-1295	200	-1290	199.3	-1288	199.2	-1287	198.8
-1285	198.6	-1284	198.6	-1282	199.2	-1280	199.4	-1275	200
-1270	201	-1260	201.3	-1250	202	-1242	203	-1240	204.3
-1236	204.6	-1233	204.7	-1230	204.5	-1220	204.6	-1215	205
-1200	205								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-1380	.05	-1320	.08	-1288	.035	-1282	.08	-1233	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-1288	-1282	30	30	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.05	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035
0.080				
W.S. Elev (m)	202.02	Reach Len. (m)	30.00	30.00
30.00				
Crit W.S. (m)		Flow Area (m2)	27.51	19.30
36.88				
E.G. Slope (m/m)	0.000360	Area (m2)	27.51	19.30
36.88				
Q Total (m3/s)	40.81	Flow (m3/s)	8.88	22.36
9.56				
Top Width (m)	55.19	Top Width (m)	17.07	6.00
32.12				
Vel Total (m/s)	0.49	Avg. Vel. (m/s)	0.32	1.16
0.26				
Max Chl Dpth (m)	3.42	Hydr. Depth (m)	1.61	3.22
1.15				
Conv. Total (m3/s)	2149.9	Conv. (m3/s)	467.9	1178.2
503.8				
Length Wtd. (m)	30.00	Wetted Per. (m)	17.32	6.18
32.29				
Min Ch El (m)	198.60	Shear (N/m2)	5.61	11.04
4.04				
Alpha	3.26	Stream Power (N/m s)	1.81	12.79
1.05				
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	90.12	133.43
51.95				
C & E Loss (m)	0.00	Cum SA (1000 m2)	83.92	39.01
63.61				

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.56	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.17	Wt. n-Val.	0.080	0.035
0.080				
W.S. Elev (m)	202.39	Reach Len. (m)	30.00	30.00
30.00				
Crit W.S. (m)		Flow Area (m2)	34.19	21.52
49.36				
E.G. Slope (m/m)	0.001477	Area (m2)	34.19	21.52
49.36				

Q Total (m3/s)	108.10	Flow (m3/s)	24.11	54.33	29.66
Top Width (m)	60.02	Top Width (m)	18.93	6.00	35.09
Vel Total (m/s)	1.03	Avg. Vel. (m/s)	0.71	2.52	0.60
Max Chl Dpth (m)	3.79	Hydr. Depth (m)	1.81	3.59	1.41
Conv. Total (m3/s)	2812.6	Conv. (m3/s)	627.4	1413.5	771.6
Length Wtd. (m)	30.00	Wetted Per. (m)	19.22	6.18	35.29
Min Ch El (m)	198.60	Shear (N/m2)	25.77	50.48	20.26
Alpha	3.22	Stream Power (N/m s)	18.17	127.40	12.17
Frctn Loss (m)	0.05	Cum Volume (1000 m3)	239.26	260.87	225.21
C & E Loss (m)	0.00	Cum SA (1000 m2)	158.52	39.01	148.37

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2325

INPUT
Description: Based on Bridge Section DS
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-1380	205.2	-1375	205.1	-1370	204.5	-1360	204.5	-1340	204.4
-1330	204.2	-1320	204.4	-1318	204	-1310	203	-1305	202
-1300	201	-1295	200	-1290	199.3	-1288	199.2	-1287	198.8
-1285	198.6	-1284	198.6	-1282	199.2	-1280	199.4	-1275	200
-1270	201	-1260	201.3	-1250	202	-1242	203	-1240	204.3
-1236	204.6	-1233	204.7	-1230	204.5	-1220	204.6	-1215	205
-1200	205								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-1380	.05	-1320	.08	-1288	.035	-1282	.08	-1233	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-1288	-1282	94	94	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.04	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.00	Reach Len. (m)	94.00	94.00	94.00
Crit W.S. (m)		Flow Area (m2)	27.31	19.23	36.52
E.G. Slope (m/m)	0.000367	Area (m2)	27.31	19.23	36.52
Q Total (m3/s)	40.81	Flow (m3/s)	8.87	22.43	9.50

Top Width (m)	55.05	Top Width (m)	17.02	6.00	32.03
Vel Total (m/s)	0.49	Avg. Vel. (m/s)	0.32	1.17	0.26
Max Chl Dpth (m)	3.40	Hydr. Depth (m)	1.60	3.20	1.14
Conv. Total (m3/s)	2131.1	Conv. (m3/s)	463.4	1171.2	496.4
Length Wtd. (m)	94.00	Wetted Per. (m)	17.27	6.18	32.20
Min Ch El (m)	198.60	Shear (N/m2)	5.69	11.19	4.08
Alpha	3.26	Stream Power (N/m s)	1.85	13.06	1.06
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	89.30	132.86	50.85
C & E Loss (m)	0.01	Cum SA (1000 m2)	83.40	38.83	62.65

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.51	Element	Left OB	Channel	Right OB
Vel Head (m)	0.19	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.33	Reach Len. (m)	94.00	94.00	94.00
Crit W.S. (m)		Flow Area (m2)	33.05	21.16	47.25
E.G. Slope (m/m)	0.001606	Area (m2)	33.05	21.16	47.25
Q Total (m3/s)	108.10	Flow (m3/s)	24.02	55.06	29.02
Top Width (m)	59.23	Top Width (m)	18.63	6.00	34.60
Vel Total (m/s)	1.07	Avg. Vel. (m/s)	0.73	2.60	0.61
Max Chl Dpth (m)	3.73	Hydr. Depth (m)	1.77	3.53	1.37
Conv. Total (m3/s)	2697.7	Conv. (m3/s)	599.5	1374.0	724.2
Length Wtd. (m)	94.00	Wetted Per. (m)	18.91	6.18	34.80
Min Ch El (m)	198.60	Shear (N/m2)	27.52	53.94	21.38
Alpha	3.23	Stream Power (N/m s)	20.00	140.35	13.13
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	238.25	260.23	223.76
C & E Loss (m)	0.05	Cum SA (1000 m2)	157.95	38.83	147.32

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: RIVER-1
REACH: Reach-1 RS: 46.23

INPUT
Description: Section 46.23 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	38	204	52	201	63	200	90	199
100	198.2	113	199	118	200	126	204	160	204
160	206	210	206						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	38	.08	90	.035	113	.08	126	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	113	101	95	89	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.03	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.02	Reach Len. (m)	101.00	95.00	89.00
Crit W.S. (m)		Flow Area (m2)	87.23	78.68	16.69
E.G. Slope (m/m)	0.000033	Area (m2)	87.23	78.68	16.69
Q Total (m3/s)	40.81	Flow (m3/s)	9.99	29.10	1.72
Top Width (m)	74.81	Top Width (m)	42.76	23.00	9.04
Vel Total (m/s)	0.22	Avg. Vel. (m/s)	0.11	0.37	0.10
Max Chl Dpth (m)	3.82	Hydr. Depth (m)	2.04	3.42	1.85
Conv. Total (m3/s)	7145.7	Conv. (m3/s)	1748.9	5095.6	301.2
Length Wtd. (m)	97.05	Wetted Per. (m)	42.94	23.06	9.62
Min Ch El (m)	198.20	Shear (N/m2)	0.65	1.09	0.55
Alpha	2.03	Stream Power (N/m s)	0.07	0.40	0.06
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	83.91	128.25	48.35
C & E Loss (m)	0.00	Cum SA (1000 m2)	80.59	37.46	60.72

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)

is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.43	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.40	Reach Len. (m)	101.00	95.00	89.00
Crit W.S. (m)		Flow Area (m2)	103.96	87.50	20.30
E.G. Slope (m/m)	0.000152	Area (m2)	103.96	87.50	20.30
Q Total (m3/s)	108.10	Flow (m3/s)	28.13	75.09	4.87
Top Width (m)	77.36	Top Width (m)	44.55	23.00	9.81
Vel Total (m/s)	0.51	Avg. Vel. (m/s)	0.27	0.86	0.24
Max Chl Dpth (m)	4.20	Hydr. Depth (m)	2.33	3.80	2.07
Conv. Total (m3/s)	8755.4	Conv. (m3/s)	2278.8	6082.1	394.4
Length Wtd. (m)	97.07	Wetted Per. (m)	44.77	23.06	10.47
Min Ch El (m)	198.20	Shear (N/m2)	3.47	5.67	2.90
Alpha	2.05	Stream Power (N/m s)	0.94	4.87	0.69
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	231.81	255.12	220.59
C & E Loss (m)	0.01	Cum SA (1000 m2)	154.99	37.46	145.24

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: RIVER-1
REACH: Reach-1 RS: 46.22

INPUT
Description: Section 46.22 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	12	201	22	200	36	199	52	198
72	197.5	77	198	79	199	87	203	102	203
112	199	114	198	132	197.5	146	198	152	199
172	202	175	203	192	204				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	36	.035	79	.08	112	.035	152	.05

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

112 152 125 140 115 .1 .3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.02	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.039	0.035	0.050
W.S. Elev (m)	202.02	Reach Len. (m)	125.00	140.00	115.00
Crit W.S. (m)		Flow Area (m2)	243.50	164.94	30.47
E.G. Slope (m/m)	0.000002	Area (m2)	243.50	164.94	30.47
Q Total (m3/s)	40.81	Flow (m3/s)	20.86	18.71	1.24
Top Width (m)	144.77	Top Width (m)	84.70	40.00	20.07
Vel Total (m/s)	0.09	Avg. Vel. (m/s)	0.09	0.11	0.04
Max Chl Dpth (m)	4.52	Hydr. Depth (m)	2.87	4.12	1.52
Conv. Total (m3/s)	26284.7	Conv. (m3/s)	13434.2	12051.5	799.0
Length Wtd. (m)	133.79	Wetted Per. (m)	86.51	40.33	20.30
Min Ch El (m)	197.50	Shear (N/m2)	0.07	0.10	0.04
Alpha	1.12	Stream Power (N/m s)	0.01	0.01	0.00
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	67.21	116.68	46.25
C & E Loss (m)	0.00	Cum SA (1000 m2)	74.16	34.47	59.42

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.040	0.035	0.050
W.S. Elev (m)	202.42	Reach Len. (m)	125.00	140.00	115.00
Crit W.S. (m)		Flow Area (m2)	277.60	180.74	38.63
E.G. Slope (m/m)	0.000012	Area (m2)	277.60	180.74	38.63
Q Total (m3/s)	108.10	Flow (m3/s)	55.43	48.71	3.96
Top Width (m)	149.31	Top Width (m)	88.06	40.00	21.26
Vel Total (m/s)	0.22	Avg. Vel. (m/s)	0.20	0.27	0.10
Max Chl Dpth (m)	4.92	Hydr. Depth (m)	3.15	4.52	1.82
Conv. Total (m3/s)	31148.0	Conv. (m3/s)	15972.4	14035.5	1140.2

Length Wtd. (m)	134.82	Wetted Per. (m)	90.08	40.33	21.55
Min Ch El (m)	197.50	Shear (N/m2)	0.36	0.53	0.21
Alpha	1.13	Stream Power (N/m s)	0.07	0.14	0.02
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	212.54	242.38	217.97
C & E Loss (m)	0.00	Cum SA (1000 m2)	148.29	34.47	143.85

Warning: Divided flow computed for this cross-section.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.214

INPUT
Description: Section 46.214 - Jane St & Hwy 7 Pond Outlet - In-Line Weir - U/S Bounding Section

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	37	202	100	202	122	201	132	200
133	199	134	198	140	196.7	172	196.7	180	198
207	202	273	203	303	204				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	134	.035	180	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
134	180	1	1	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	123	202	F
190	303	202	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.02	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	202.02	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	197.02	Flow Area (m2)	34.28	235.78	54.65
E.G. Slope (m/m)	0.000001	Area (m2)	34.28	235.78	54.65
Q Total (m3/s)	19.06	Flow (m3/s)	0.30	17.82	0.93
Top Width (m)	172.41	Top Width (m)	97.87	46.00	28.55
Vel Total (m/s)	0.06	Avg. Vel. (m/s)	0.01	0.08	0.02
Max Chl Dpth (m)	5.32	Hydr. Depth (m)	0.35	5.13	1.91
Conv. Total (m3/s)	21341.3	Conv. (m3/s)	338.6	19956.5	

1046.2					
Length Wtd. (m)	1.00	Wetted Per. (m)	98.77	46.24	28.84
Min Ch El (m)	196.70	Shear (N/m2)	0.00	0.04	0.01
Alpha	1.56	Stream Power (N/m s)	0.00	0.00	0.00
Frctn Loss (m)		Cum Volume (1000 m3)	49.85	88.63	41.36
C & E Loss (m)		Cum SA (1000 m2)	62.75	28.45	56.63

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	202.41	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	197.69	Flow Area (m2)	75.06	253.64	70.71
E.G. Slope (m/m)	0.000019	Area (m2)	75.06	253.64	70.71
Q Total (m3/s)	108.10	Flow (m3/s)	4.99	98.51	4.60
Top Width (m)	212.40	Top Width (m)	112.23	46.00	54.17
Vel Total (m/s)	0.27	Avg. Vel. (m/s)	0.07	0.39	0.07
Max Chl Dpth (m)	5.71	Hydr. Depth (m)	0.67	5.51	1.31
Conv. Total (m3/s)	24731.7	Conv. (m3/s)	1141.8	22538.2	1051.7
Length Wtd. (m)	1.00	Wetted Per. (m)	113.14	46.24	54.47
Min Ch El (m)	196.70	Shear (N/m2)	0.12	1.03	0.24
Alpha	1.88	Stream Power (N/m s)	0.01	0.40	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	190.50	211.97	211.68
C & E Loss (m)		Cum SA (1000 m2)	135.77	28.45	139.52

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

INLINE STRUCTURE

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2135

INPUT

Description: Hum 13-5R. Jane St. & Hwy 7 Pond Outlet Weir x 45 m Drawings by Ander Engineering Ltd. (Dwg No. 85-101-5, 1986 & Figure 1, date/source unknown).

New HEC-RAS coding January 2004 by Acres
included coding of in-line in HEC-RAS.

Distance from Upstream XS = .5
Deck/Roadway Width = .25
Weir Coefficient = 1.72
Weir Embankment Coordinates num = 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
100	202	123	202	123.75	201.95	137.75	201.95	153	201.95
153	200.9	161	200.9	161	201.95	175.3	201.95	189.3	201.95
190	202	207	202						

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 =
Weir crest shape = Broad Crested

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.213

INPUT
Description: Section 46.213 - Jane St. & Hwy 7 Pond Outlet - In-Line Weir - D/S Bounding Section
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	37	202	100	202	122	201	132	200
133	199	134	198	140	196.7	172	196.7	180	198
207	202	273	203	303	204				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	134	.035	180	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
134	180	15	15	15	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	123	202	F
190	303	202	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.73	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	200.73	Reach Len. (m)	15.00	15.00	15.00
Crit W.S. (m)	197.02	Flow Area (m2)	6.12	176.25	19.89
E.G. Slope (m/m)	0.000002	Area (m2)	6.12	176.25	25.14
Q Total (m3/s)	19.06	Flow (m3/s)	0.13	18.34	0.58

Top Width (m)	73.71	Top Width (m)	9.29	46.00	18.42
Vel Total (m/s)	0.09	Avg. Vel. (m/s)	0.02	0.10	0.03
Max Chl Dpth (m)	4.03	Hydr. Depth (m)	0.66	3.83	1.99
Conv. Total (m3/s)	12764.2	Conv. (m3/s)	87.3	12286.7	390.2
Length Wtd. (m)	15.00	Wetted Per. (m)	10.16	46.24	10.11
Min Ch El (m)	196.70	Shear (N/m2)	0.01	0.08	0.04
Alpha	1.18	Stream Power (N/m s)	0.00	0.01	0.00
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	49.85	88.50	41.36
C & E Loss (m)	0.00	Cum SA (1000 m2)	62.69	28.41	56.61

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	202.32	Reach Len. (m)	15.00	15.00	15.00
Crit W.S. (m)	197.69	Flow Area (m2)	65.09	249.49	66.09
E.G. Slope (m/m)	0.000021	Area (m2)	65.09	249.49	66.09
Q Total (m3/s)	108.10	Flow (m3/s)	4.16	99.34	4.60
Top Width (m)	203.12	Top Width (m)	108.90	46.00	48.22
Vel Total (m/s)	0.28	Avg. Vel. (m/s)	0.06	0.40	0.07
Max Chl Dpth (m)	5.62	Hydr. Depth (m)	0.60	5.42	1.37
Conv. Total (m3/s)	23861.5	Conv. (m3/s)	918.7	21927.6	1015.2
Length Wtd. (m)	15.00	Wetted Per. (m)	109.80	46.24	48.52
Min Ch El (m)	196.70	Shear (N/m2)	0.12	1.09	0.27
Alpha	1.81	Stream Power (N/m s)	0.01	0.43	0.02
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	190.50	211.77	211.68
C & E Loss (m)	0.00	Cum SA (1000 m2)	135.66	28.41	139.47

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: RIVER-1
REACH: Reach-1 RS: 46.212

INPUT
Description: Section 46.212 - Jane St. & Hwy 7 Pond Outlet - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	37	202	100	202	122	201	132	200
133	199	134	198	140	196.6	172	196.6	180	198
207	199	252	199.5	273	203	303	204		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	133	.035	207	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
133	207	55	45	10	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	149.5	202	F
160.5	303	202	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.73	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.035	
W.S. Elev (m)	200.72	Reach Len. (m)	55.00	45.00	10.00
Crit W.S. (m)	197.27	Flow Area (m2)		45.30	
E.G. Slope (m/m)	0.000033	Area (m2)	3.80	241.75	70.52
Q Total (m3/s)	19.06	Flow (m3/s)		19.06	
Top Width (m)	134.49	Top Width (m)	8.18	74.00	52.31
Vel Total (m/s)	0.42	Avg. Vel. (m/s)		0.42	
Max Chl Dpth (m)	4.12	Hydr. Depth (m)		4.12	
Conv. Total (m3/s)	3325.3	Conv. (m3/s)		3325.3	
Length Wtd. (m)	45.00	Wetted Per. (m)		11.00	
Min Ch El (m)	196.60	Shear (N/m2)		1.33	
Alpha	1.00	Stream Power (N/m s)		0.56	
Frctn Loss (m)		Cum Volume (1000 m3)	49.78	85.36	40.64

C & E Loss (m)		Cum SA (1000 m2)	62.56	27.51 56.07

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.33	Element	Left OB	Channel Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035 0.080
W.S. Elev (m)	202.32	Reach Len. (m)	55.00	45.00 10.00
Crit W.S. (m)	198.74	Flow Area (m2)	61.49	360.55 162.22
E.G. Slope (m/m)	0.000010	Area (m2)	61.49	360.55 162.22
Q Total (m3/s)	108.10	Flow (m3/s)	2.67	93.24 12.18
Top Width (m)	243.91	Top Width (m)	107.97	74.00 61.94
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.04	0.26 0.08
Max Chl Dpth (m)	5.72	Hydr. Depth (m)	0.57	4.87 2.62
Conv. Total (m3/s)	34102.2	Conv. (m3/s)	842.4	29416.7 3843.1
Length Wtd. (m)	45.00	Wetted Per. (m)	108.46	74.72 62.18
Min Ch El (m)	196.60	Shear (N/m2)	0.06	0.48 0.26
Alpha	1.71	Stream Power (N/m s)	0.00	0.12 0.02
Frctn Loss (m)		Cum Volume (1000 m3)	189.55	207.19 209.97
C & E Loss (m)		Cum SA (1000 m2)	134.03	27.51 138.64

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2115

INPUT
Description: Hum 13-5R. Jane St & Hwy 7 Pond Outlet Culverts - Triple Cell - 3.0 m W x 1.5 m H x 23.2 m L Concrete Box Culverts. No drawings available (some info on Ander Eng Ltd Dwg 85-101-5, 1986) and York Regional Municipal Culvert Sheet.

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.
Distance from Upstream XS = 10

Deck/Roadway Width = 23.2
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	202	303	202

Upstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	37	202	100	202	122	201	132	200
133	199	134	198	140	196.6	172	196.6	180	198
207	199	252	199.5	273	203	303	204		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	133	.035	207	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
133	207	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	149.5	202	F
160.5	303	202	F

Downstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	202	303	202

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	47	201	103	200	150	200	152	199
160	198	162	197	163	196.4	175	196.4	178	197
181	200	185	201	201	201	261	202	306	203

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	162	.035	178	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
162	178	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	163	200.6	F
175	306	200.6	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	Box	1.5	3

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
	10	23.2	.015	.015	0	.9	1

Number of Barrels = 3
Upstream Elevation = 196.6
Centerline Stations
Sta. Sta. Sta.
151.5 154.85 158.5
Downstream Elevation = 196.4
Centerline Stations
Sta. Sta. Sta.
165.5 168.85 172.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	19.06	Culv Full Len (m)	23.20
# Barrels	3	Culv Vel US (m/s)	1.41
Q Barrel (m3/s)	6.35	Culv Vel DS (m/s)	1.41
E.G. US. (m)	200.73	Culv Inv El Up (m)	196.60
W.S. US. (m)	200.72	Culv Inv El Dn (m)	196.40
E.G. DS (m)	200.52	Culv Frctn Ls (m)	0.03
W.S. DS (m)	200.51	Culv Exit Loss (m)	0.09
Delta EG (m)	0.21	Culv Entr Loss (m)	0.09
Delta WS (m)	0.21	Q Weir (m3/s)	
E.G. IC (m)	197.94	Weir Sta Lft (m)	
E.G. OC (m)	200.73	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	198.10	Weir Max Depth (m)	
Culv WS Outlet (m)	197.90	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.77	Min El Weir Flow (m)	202.00

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	43.23	Culv Full Len (m)	23.20
# Barrels	3	Culv Vel US (m/s)	3.20
Q Barrel (m3/s)	14.41	Culv Vel DS (m/s)	3.20
E.G. US. (m)	202.33	Culv Inv El Up (m)	196.60
W.S. US. (m)	202.32	Culv Inv El Dn (m)	196.40
E.G. DS (m)	201.23	Culv Frctn Ls (m)	0.13
W.S. DS (m)	201.20	Culv Exit Loss (m)	0.49
Delta EG (m)	1.09	Culv Entr Loss (m)	0.47
Delta WS (m)	1.13	Q Weir (m3/s)	64.87
E.G. IC (m)	202.20	Weir Sta Lft (m)	24.70
E.G. OC (m)	202.33	Weir Sta Rgt (m)	268.99
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	198.10	Weir Max Depth (m)	0.33
Culv WS Outlet (m)	197.90	Weir Avg Depth (m)	0.32
Culv Nml Depth (m)		Weir Flow Area (m2)	78.79
Culv Crt Depth (m)	1.33	Min El Weir Flow (m)	202.00

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.211

INPUT
Description: Section 46.211 - Jane St. & Hwy 7 Pond Outlet - D/S Bounding
Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	47	201	103	200	150	200	152	199
160	198	162	197	163	196.4	175	196.4	178	197
181	200	185	201	201	201	261	202	306	203

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	162	.035	178	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
162	178	10	10	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	163	200.6	F
175	306	200.6	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.52	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.035	
W.S. Elev (m)	200.51	Reach Len. (m)	10.00	10.00	10.00
Crit W.S. (m)	197.04	Flow Area (m2)		49.29	
E.G. Slope (m/m)	0.000028	Area (m2)	55.19	64.53	6.54
Q Total (m3/s)	19.06	Flow (m3/s)		19.06	
Top Width (m)	108.47	Top Width (m)	87.44	16.00	5.03
Vel Total (m/s)	0.39	Avg. Vel. (m/s)		0.39	
Max Chl Dpth (m)	4.11	Hydr. Depth (m)		4.11	
Conv. Total (m3/s)	3612.6	Conv. (m3/s)		3612.6	
Length Wtd. (m)	10.00	Wetted Per. (m)		12.00	
Min Ch El (m)	196.40	Shear (N/m2)		1.12	
Alpha	1.00	Stream Power (N/m s)		0.43	
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	49.78	82.05	40.64
C & E Loss (m)	0.00	Cum SA (1000 m2)	59.93	25.48	55.79

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.23	Element	Left OB	Channel

Right OB					
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	201.20	Reach Len. (m)	10.00	10.00	10.00
Crit W.S. (m)	198.42	Flow Area (m2)	128.26	75.57	15.24
E.G. Slope (m/m)	0.000151	Area (m2)	128.26	75.57	15.24
Q Total (m3/s)	108.10	Flow (m3/s)	32.87	73.91	1.31
Top Width (m)	170.55	Top Width (m)	119.66	16.00	34.89
Vel Total (m/s)	0.49	Avg. Vel. (m/s)	0.26	0.98	0.09
Max Chl Dpth (m)	4.80	Hydr. Depth (m)	1.07	4.72	0.44
Conv. Total (m3/s)	8807.5	Conv. (m3/s)	2678.6	6022.0	106.9
Length Wtd. (m)	10.00	Wetted Per. (m)	120.21	16.23	36.26
Min Ch El (m)	196.40	Shear (N/m2)	1.58	6.88	0.62
Alpha	2.77	Stream Power (N/m s)	0.40	6.73	0.05
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	189.55	198.58	209.97
C & E Loss (m)	0.01	Cum SA (1000 m2)	127.77	25.48	138.15

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: RIVER-1
REACH: Reach-1 RS: 46.21

INPUT
Description: Section 46.21 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	0	201	40	200	76	200	82	199
91	197	91.5	196.3	92.5	196.3	93	197	97	198
108	201	124	202	186	202	230	203		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	91	.035	93	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
91	93	30	30	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.51	Element	Left OB	Channel

Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	200.51	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)		Flow Area (m2)	52.06	8.07	23.56
E.G. Slope (m/m)	0.000106	Area (m2)	52.06	8.07	23.56
Q Total (m3/s)	20.59	Flow (m3/s)	8.69	4.91	7.00
Top Width (m)	86.51	Top Width (m)	71.32	2.00	13.20
Vel Total (m/s)	0.25	Avg. Vel. (m/s)	0.17	0.61	0.30
Max Chl Dpth (m)	4.21	Hydr. Depth (m)	0.73	4.03	1.79
Conv. Total (m3/s)	1995.5	Conv. (m3/s)	841.8	475.7	678.0
Length Wtd. (m)	30.00	Wetted Per. (m)	71.62	2.72	13.65
Min Ch El (m)	196.30	Shear (N/m2)	0.76	3.10	1.80
Alpha	2.15	Stream Power (N/m s)	0.13	1.88	0.53
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	49.24	81.69	40.49
C & E Loss (m)	0.00	Cum SA (1000 m2)	59.14	25.39	55.70

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.22	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.17	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)		Flow Area (m2)	107.13	9.38	33.22
E.G. Slope (m/m)	0.000946	Area (m2)	107.13	9.38	33.22
Q Total (m3/s)	122.56	Flow (m3/s)	73.21	18.82	30.52
Top Width (m)	110.66	Top Width (m)	91.00	2.00	17.66
Vel Total (m/s)	0.82	Avg. Vel. (m/s)	0.68	2.01	0.92
Max Chl Dpth (m)	4.87	Hydr. Depth (m)	1.18	4.69	1.88
Conv. Total (m3/s)	3985.0	Conv. (m3/s)	2380.5	612.0	992.5
Length Wtd. (m)	30.00	Wetted Per. (m)	91.48	2.72	18.19
Min Ch El (m)	196.30	Shear (N/m2)	10.86	32.00	16.94

Alpha	1.65	Stream Power (N/m s)	7.42	64.19	15.57
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	188.38	198.16	209.72
C & E Loss (m)	0.00	Cum SA (1000 m2)	126.72	25.39	137.89

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: RIVER-1
REACH: Reach-1 RS: 46.202

INPUT
Description: Section 46.202 - Highway 7 - U/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	50	200	111	200	113	199	115.5	197
116	196	123	196	123.5	197	129	200	227	202
272	203								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	115.5	.035	123.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
115.5	123.5	70	70	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116	200.23	F
123	272	200.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.51	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	200.51	Reach Len. (m)	70.00	70.00	70.00
Crit W.S. (m)	196.96	Flow Area (m2)	45.47	35.54	17.28
E.G. Slope (m/m)	0.000039	Area (m2)	45.47	35.54	17.28
Q Total (m3/s)	20.59	Flow (m3/s)	3.56	15.57	1.46
Top Width (m)	129.01	Top Width (m)	90.76	8.00	30.25
Vel Total (m/s)	0.21	Avg. Vel. (m/s)	0.08	0.44	0.08
Max Chl Dpth (m)	4.51	Hydr. Depth (m)	0.50	4.44	0.57
Conv. Total (m3/s)	3297.3	Conv. (m3/s)	569.7	2493.6	234.0
Length Wtd. (m)	70.00	Wetted Per. (m)	91.70	9.24	

31.02					
Min Ch El (m)	196.00	Shear (N/m2)	0.19	1.47	
0.21					
Alpha	3.34	Stream Power (N/m s)	0.01	0.64	
0.02					
Frctn Loss (m)		Cum Volume (1000 m3)	47.78	81.04	
39.88					
C & E Loss (m)		Cum SA (1000 m2)	56.71	25.24	
55.05					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.20	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.07	Wt. n-Val.	0.050	0.035	
0.050					
W.S. Elev (m)	201.14	Reach Len. (m)	70.00	70.00	
70.00					
Crit W.S. (m)	199.15	Flow Area (m2)	112.34	40.60	
46.19					
E.G. Slope (m/m)	0.000409	Area (m2)	112.34	40.60	
46.19					
Q Total (m3/s)	122.56	Flow (m3/s)	44.31	62.91	
15.34					
Top Width (m)	184.72	Top Width (m)	115.50	8.00	
61.22					
Vel Total (m/s)	0.62	Avg. Vel. (m/s)	0.39	1.55	
0.33					
Max Chl Dpth (m)	5.14	Hydr. Depth (m)	0.97	5.07	
0.75					
Conv. Total (m3/s)	6063.7	Conv. (m3/s)	2192.0	3112.5	
759.1					
Length Wtd. (m)	70.00	Wetted Per. (m)	116.58	9.24	
62.00					
Min Ch El (m)	196.00	Shear (N/m2)	3.86	17.61	
2.98					
Alpha	3.44	Stream Power (N/m s)	1.52	27.29	
0.99					
Frctn Loss (m)		Cum Volume (1000 m3)	185.08	197.41	
208.53					
C & E Loss (m)		Cum SA (1000 m2)	123.62	25.24	
136.71					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2015

INPUT
Description: Hum 13-4RR. Highway 7 Culvert - 3.7 m W x 1.5 m H x 64 m L
Concrete Box Culvert. Based on drawings. July 2010

New HEC-RAS
coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 64
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201		50	200.45		95	200.23	
168	201		216	202		227	202.5	
272	203.5							

Upstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	50	200	111	200	113	199	115.5	197
116	196	123	196	123.5	197	129	200	227	202
272	203								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	115.5	.035	123.5	.05

Bank Sta: Left Right Coeff Contr. Expan.
115.5 123.5 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116	200.23	F
123	272	200.5	F

Downstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201		50	200.45		95	200.23	
168	201		216	202		227	202.5	
272	203.5							

Downstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	50	200	111	200	113	199	115.5	197
116	196	123	196	123.5	197	129	200	227	202
272	203								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	115.5	.035	123.5	.05

Bank Sta: Left Right Coeff Contr. Expan.
115.5 123.5 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116	199	F
123	272	199	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	Box	1.52	3.66

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
1	5	64	.015	.015	0	.5	1

Upstream Elevation = 196
Centerline Station = 119.5
Downstream Elevation = 196
Centerline Station = 119.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	14.09	Culv Full Len (m)	64.00
# Barrels	1	Culv Vel US (m/s)	2.53
Q Barrel (m3/s)	14.09	Culv Vel DS (m/s)	2.53
E.G. US. (m)	200.51	Culv Inv El Up (m)	196.00
W.S. US. (m)	200.51	Culv Inv El Dn (m)	196.00
E.G. DS (m)	199.83	Culv Frctn Ls (m)	0.21
W.S. DS (m)	199.81	Culv Exit Loss (m)	0.31
Delta EG (m)	0.69	Culv Entr Loss (m)	0.16
Delta WS (m)	0.69	Q Weir (m3/s)	6.50
E.G. IC (m)	199.01	Weir Sta Lft (m)	44.67
E.G. OC (m)	200.51	Weir Sta Rgt (m)	121.40
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	197.52	Weir Max Depth (m)	0.28
Culv WS Outlet (m)	197.52	Weir Avg Depth (m)	0.15
Culv Nml Depth (m)		Weir Flow Area (m2)	11.41
Culv Crt Depth (m)	1.15	Min El Weir Flow (m)	200.23

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	2.55	Culv Full Len (m)	64.00
# Barrels	1	Culv Vel US (m/s)	0.46
Q Barrel (m3/s)	2.55	Culv Vel DS (m/s)	0.46
E.G. US. (m)	201.20	Culv Inv El Up (m)	196.00
W.S. US. (m)	201.14	Culv Inv El Dn (m)	196.00
E.G. DS (m)	201.19	Culv Frctn Ls (m)	0.01
W.S. DS (m)	201.12	Culv Exit Loss (m)	0.00
Delta EG (m)	0.01	Culv Entr Loss (m)	0.01
Delta WS (m)	0.01	Q Weir (m3/s)	120.02
E.G. IC (m)	201.19	Weir Sta Lft (m)	0.00
E.G. OC (m)	201.20	Weir Sta Rgt (m)	178.47
Culvert Control	Outlet	Weir Submerg	0.87
Culv WS Inlet (m)	197.52	Weir Max Depth (m)	0.99
Culv WS Outlet (m)	197.52	Weir Avg Depth (m)	0.61
Culv Nml Depth (m)		Weir Flow Area (m2)	109.34
Culv Crt Depth (m)	0.37	Min El Weir Flow (m)	200.23

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.201

INPUT
Description: Section 46.201 - Highway 7 - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	50	200	111	200	113	199	115.5	197
116	196	123	196	123.5	197	129	200	227	202
272	203								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	115.5	.035	123.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
115.5	123.5	20	25	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116	199	F
123	272	199	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.83	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.81	Reach Len. (m)	20.00	25.00	30.00
Crit W.S. (m)	196.96	Flow Area (m2)	5.18	29.98	7.24
E.G. Slope (m/m)	0.000092	Area (m2)	5.18	29.98	7.24
Q Total (m3/s)	20.59	Flow (m3/s)	1.01	17.98	1.59
Top Width (m)	17.27	Top Width (m)	4.12	8.00	5.15
Vel Total (m/s)	0.49	Avg. Vel. (m/s)	0.20	0.60	0.22
Max Chl Dpth (m)	3.81	Hydr. Depth (m)	1.26	3.75	1.41
Conv. Total (m3/s)	2150.8	Conv. (m3/s)	106.0	1878.2	166.6
Length Wtd. (m)	25.07	Wetted Per. (m)	5.01	9.24	5.87
Min Ch El (m)	196.00	Shear (N/m2)	0.93	2.92	1.11
Alpha	1.36	Stream Power (N/m s)	0.18	1.75	0.24
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	47.78	79.37	39.88
C & E Loss (m)	0.00	Cum SA (1000 m2)	53.39	24.68	53.81

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.19	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.12	Reach Len. (m)	20.00	25.00	30.00
Crit W.S. (m)	199.00	Flow Area (m2)	110.67	40.48	45.31
E.G. Slope (m/m)	0.000421	Area (m2)	110.67	40.48	45.31
Q Total (m3/s)	122.56	Flow (m3/s)	43.85	63.52	15.19
Top Width (m)	184.01	Top Width (m)	115.50	8.00	60.51
Vel Total (m/s)	0.62	Avg. Vel. (m/s)	0.40	1.57	0.34
Max Chl Dpth (m)	5.12	Hydr. Depth (m)	0.96	5.06	0.75
Conv. Total (m3/s)	5976.8	Conv. (m3/s)	2138.2	3097.8	740.8
Length Wtd. (m)	23.94	Wetted Per. (m)	116.57	9.24	61.29
Min Ch El (m)	196.00	Shear (N/m2)	3.92	18.08	3.05
Alpha	3.46	Stream Power (N/m s)	1.55	28.36	1.02
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	185.08	188.48	208.53
C & E Loss (m)	0.02	Cum SA (1000 m2)	115.54	24.68	132.45

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.192

INPUT
Description: Section 46.192 - Private Driveway - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	5	200	30	199	56	199	60	197
61.5	195.9	65.5	195.9	67	197	85	200	95	200
95	203	135	203						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	60	.035	67	.05

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
60 67 25 25 25 .3 .5
Ineffective Flow num= 2
Sta L Sta R Elev Permanent
0 61.5 199 F
65.5 135 199.3 F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.82	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.81	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)	197.29	Flow Area (m2)	36.67	25.75	23.75
E.G. Slope (m/m)	0.000053	Area (m2)	36.67	25.75	23.75
Q Total (m3/s)	20.59	Flow (m3/s)	4.30	11.98	4.31
Top Width (m)	74.22	Top Width (m)	50.34	7.00	16.88
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.12	0.47	0.18
Max Chl Dpth (m)	3.91	Hydr. Depth (m)	0.73	3.68	1.41
Conv. Total (m3/s)	2822.8	Conv. (m3/s)	590.1	1641.9	590.9
Length Wtd. (m)	25.00	Wetted Per. (m)	50.82	7.72	17.11
Min Ch El (m)	195.90	Shear (N/m2)	0.38	1.74	0.72
Alpha	2.38	Stream Power (N/m s)	0.04	0.81	0.13
Frctn Loss (m)		Cum Volume (1000 m3)	47.36	78.68	39.41
C & E Loss (m)		Cum SA (1000 m2)	52.84	24.49	53.48

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.17	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.13	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)	199.36	Flow Area (m2)	112.00	34.98	58.73
E.G. Slope (m/m)	0.000236	Area (m2)	112.00	34.98	58.73
Q Total (m3/s)	122.56	Flow (m3/s)	51.81	42.09	28.66
Top Width (m)	95.00	Top Width (m)	60.00	7.00	

28.00					
Vel Total (m/s)	0.60	Avg. Vel. (m/s)	0.46	1.20	0.49
Max Chl Dpth (m)	5.23	Hydr. Depth (m)	1.87	5.00	2.10
Conv. Total (m3/s)	7969.8	Conv. (m3/s)	3368.7	2737.1	1864.0
Length Wtd. (m)	25.00	Wetted Per. (m)	60.72	7.72	29.38
Min Ch El (m)	195.90	Shear (N/m2)	4.28	10.51	4.64
Alpha	1.81	Stream Power (N/m s)	1.98	12.64	2.26
Frctn Loss (m)		Cum Volume (1000 m3)	182.86	187.54	206.97
C & E Loss (m)		Cum SA (1000 m2)	113.78	24.49	131.12

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1915

INPUT
Description: Hum-MM. Private Driveway Culvert - 3.75m x 1.5m Box culvert - sizes determined from Site visit - July 2010

New HEC-RAS coding
January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 4
Deck/Roadway Width = 17
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
30	199		56	199		85	200	

Upstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	5	200	30	199	56	199	60	197
61.5	195.9	65.5	195.9	67	197	85	200	95	200
95	203	135	203						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	60	.035	67	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
60	67	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	61.5	199	F
65.5	135	199.3	F

Downstream Deck/Roadway Coordinates
num= 3

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
30	199	56	199	85	200

Downstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	5	200	30	199	56	199	60	197
61.5	195.9	65.5	195.9	67	197	85	200	95	200
95	203	135	203						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	60	.035	67	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
60	67	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	61.5	198.5	F
65.5	135	198.5	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	Box	1.5	3.75

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
	4	17	.013	.024	0	.5	1

Upstream Elevation = 195.9
Centerline Station = 63.5
Downstream Elevation = 195.9
Centerline Station = 63.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	2.16	Culv Full Len (m)	17.00
# Barrels	1	Culv Vel US (m/s)	0.38
Q Barrel (m3/s)	2.16	Culv Vel DS (m/s)	0.38
E.G. US. (m)	199.82	Culv Inv El Up (m)	195.90
W.S. US. (m)	199.81	Culv Inv El Dn (m)	195.90
E.G. DS (m)	199.81	Culv Frctn Ls (m)	0.00
W.S. DS (m)	199.81	Culv Exit Loss (m)	0.00
Delta EG (m)	0.01	Culv Entr Loss (m)	0.00
Delta WS (m)	0.01	Q Weir (m3/s)	18.43
E.G. IC (m)	198.86	Weir Sta Lft (m)	9.51
E.G. OC (m)	199.82	Weir Sta Rgt (m)	79.76
Culvert Control	Outlet	Weir Submerg	0.99
Culv WS Inlet (m)	197.40	Weir Max Depth (m)	0.82
Culv WS Outlet (m)	197.40	Weir Avg Depth (m)	0.56

Culv Nml Depth (m)		Weir Flow Area (m2)	39.44
Culv Crt Depth (m)	0.32	Min El Weir Flow (m)	199.00

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	1.13	Culv Full Len (m)	17.00
# Barrels	1	Culv Vel US (m/s)	0.20
Q Barrel (m3/s)	1.13	Culv Vel DS (m/s)	0.20
E.G. US. (m)	201.17	Culv Inv El Up (m)	195.90
W.S. US. (m)	201.13	Culv Inv El Dn (m)	195.90
E.G. DS (m)	201.17	Culv Frctn Ls (m)	0.00
W.S. DS (m)	201.13	Culv Exit Loss (m)	0.00
Delta EG (m)	0.00	Culv Entr Loss (m)	0.00
Delta WS (m)	0.00	Q Weir (m3/s)	121.43
E.G. IC (m)	201.17	Weir Sta Lft (m)	0.00
E.G. OC (m)	201.17	Weir Sta Rgt (m)	95.00
Culvert Control	Outlet	Weir Submerg	0.99
Culv WS Inlet (m)	197.40	Weir Max Depth (m)	2.18
Culv WS Outlet (m)	197.40	Weir Avg Depth (m)	1.71
Culv Nml Depth (m)		Weir Flow Area (m2)	162.42
Culv Crt Depth (m)	0.21	Min El Weir Flow (m)	199.00

Warning: The weir over culvert is submerged.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.191

INPUT
Description: Section 46.191 - Private Driveway - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	5	200	30	199	56	199	60	197
61.5	195.9	65.5	195.9	67	197	85	200	95	200
95	203	135	203						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	60	.035	67	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
60	67	50	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	61.5	198.5	F
65.5	135	198.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.81	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	

0.050					
W.S. Elev (m)	199.81	Reach Len. (m)	50.00	50.00	
50.00					
Crit W.S. (m)	197.29	Flow Area (m2)	36.37	25.70	
23.64					
E.G. Slope (m/m)	0.000054	Area (m2)	36.37	25.70	
23.64					
Q Total (m3/s)	20.59	Flow (m3/s)	4.28	12.01	
4.31					
Top Width (m)	74.03	Top Width (m)	50.18	7.00	
16.84					
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.12	0.47	
0.18					
Max Chl Dpth (m)	3.91	Hydr. Depth (m)	0.72	3.67	
1.40					
Conv. Total (m3/s)	2807.9	Conv. (m3/s)	583.1	1637.3	
587.5					
Length Wtd. (m)	50.00	Wetted Per. (m)	50.67	7.72	
17.08					
Min Ch El (m)	195.90	Shear (N/m2)	0.38	1.76	
0.73					
Alpha	2.38	Stream Power (N/m s)	0.04	0.82	
0.13					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	47.36	77.39	
39.41					
C & E Loss (m)	0.00	Cum SA (1000 m2)	51.59	24.32	
53.05					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.17	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	
0.050					
W.S. Elev (m)	201.13	Reach Len. (m)	50.00	50.00	
50.00					
Crit W.S. (m)	199.36	Flow Area (m2)	111.98	34.98	
58.72					
E.G. Slope (m/m)	0.000237	Area (m2)	111.98	34.98	
58.72					
Q Total (m3/s)	122.56	Flow (m3/s)	51.80	42.10	
28.66					
Top Width (m)	95.00	Top Width (m)	60.00	7.00	
28.00					
Vel Total (m/s)	0.60	Avg. Vel. (m/s)	0.46	1.20	
0.49					
Max Chl Dpth (m)	5.23	Hydr. Depth (m)	1.87	5.00	
2.10					
Conv. Total (m3/s)	7968.1	Conv. (m3/s)	3367.7	2736.8	
1863.5					
Length Wtd. (m)	50.00	Wetted Per. (m)	60.72	7.72	
29.38					
Min Ch El (m)	195.90	Shear (N/m2)	4.28	10.51	
4.64					
Alpha	1.81	Stream Power (N/m s)	1.98	12.65	
2.26					
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	182.86	183.19	

206.97
  C & E Loss (m) 0.01 Cum SA (1000 m2) 112.28 24.32
130.42

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.19

INPUT
Description: Section 46.19 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	0	201	8	201	50	201	58	200
63	199	94	199	104	196.5	105	195.5	106	195.5
107	196.5	114	198	119	198.7	143	198.7	143	203
169	203								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	8	.025	50	.05	104	.035	107	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
104	107	45	45	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.81	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (m)	199.81	Reach Len. (m)	45.00	45.00
45.00				
Crit W.S. (m)		Flow Area (m2)	47.20	11.92
51.74				
E.G. Slope (m/m)	0.000048	Area (m2)	47.20	11.92
51.74				
Q Total (m3/s)	20.59	Flow (m3/s)	6.69	5.01
8.89				
Top Width (m)	84.03	Top Width (m)	45.03	3.00
36.00				
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.14	0.42
0.17				
Max Chl Dpth (m)	4.31	Hydr. Depth (m)	1.05	3.97
1.44				
Conv. Total (m3/s)	2981.7	Conv. (m3/s)	968.6	726.2
1286.8				
Length Wtd. (m)	45.00	Wetted Per. (m)	45.42	3.83
37.31				
Min Ch El (m)	195.50	Shear (N/m2)	0.49	1.46
0.65				
Alpha	1.81	Stream Power (N/m s)	0.07	0.61
0.11				
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	45.27	76.45
37.53				
C & E Loss (m)	0.00	Cum SA (1000 m2)	49.21	24.07

51.73

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.15	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.13	Reach Len. (m)	45.00	45.00	45.00
Crit W.S. (m)		Flow Area (m2)	119.45	15.89	99.36
E.G. Slope (m/m)	0.000201	Area (m2)	119.45	15.89	99.36
Q Total (m3/s)	122.56	Flow (m3/s)	53.01	16.63	52.92
Top Width (m)	143.00	Top Width (m)	104.00	3.00	36.00
Vel Total (m/s)	0.52	Avg. Vel. (m/s)	0.44	1.05	0.53
Max Chl Dpth (m)	5.63	Hydr. Depth (m)	1.15	5.30	2.76
Conv. Total (m3/s)	8638.4	Conv. (m3/s)	3736.2	1172.4	3729.8
Length Wtd. (m)	45.00	Wetted Per. (m)	104.60	3.83	38.64
Min Ch El (m)	195.50	Shear (N/m2)	2.25	8.19	5.08
Alpha	1.31	Stream Power (N/m s)	1.00	8.58	2.70
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	177.07	181.92	203.02
C & E Loss (m)	0.00	Cum SA (1000 m2)	108.18	24.07	128.82

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.182

INPUT
Description: Section 46.182 - Private Driveway - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 47

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.972	.42	201.961	.55	201.96	1.85	201.935	8.17	201.804
21.62	201.526	31.13	201.301	35.82	201.196	38.11	201.147	43.98	201
47.21	201	54.76	201	59.23	201.022	59.93	201.025	61.24	201.019
63.83	201.008	65.54	201	67.48	200.312	68.6	200	69.51	199.67
71.2	199	80.47	198.706	97.37	198.231	101.25	198.152	103.18	198.11
108.63	198	109.89	197.509	111.25	197	113.61	196.424	114.44	196
115	195.5	117	195.5	119.57	196.761	120.39	197	120.93	197.262
122.38	198	123.56	198.575	124.53	199	125.86	199.005	126.15	199.005
126.32	199.005	128.81	199.016	129.09	199.016	133.53	199.074	152.28	199.311
155.51	199.353	179.8	199.659						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	43.98	.025	65.54	.05	111.25	.035	120.39	.05

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
111.25 120.39 30 30 30 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	114	197.8	F
118	179.8	198.1	F

Left Levee Station= 59.93 Elevation= 201.025
Blocked Obstructions num= 1

Sta L	Sta R	Elev
143.39	178.45	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.81	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (m)	199.80	Reach Len. (m)	30.00	30.00
30.00				
Crit W.S. (m)	197.06	Flow Area (m2)	57.30	33.00
21.18				
E.G. Slope (m/m)	0.000028	Area (m2)	57.30	33.00
21.18				
Q Total (m3/s)	20.59	Flow (m3/s)	7.39	11.17
2.03				
Top Width (m)	75.60	Top Width (m)	42.11	9.14
24.35				
Vel Total (m/s)	0.18	Avg. Vel. (m/s)	0.13	0.34
0.10				
Max Chl Dpth (m)	4.30	Hydr. Depth (m)	1.36	3.61
0.87				
Conv. Total (m3/s)	3897.4	Conv. (m3/s)	1399.5	2114.3
383.6				
Length Wtd. (m)	30.00	Wetted Per. (m)	42.46	9.83
25.73				
Min Ch El (m)	195.50	Shear (N/m2)	0.37	0.92
0.23				
Alpha	2.02	Stream Power (N/m s)	0.05	0.31
0.02				
Frctn Loss (m)		Cum Volume (1000 m3)	42.92	75.43
35.89				
C & E Loss (m)		Cum SA (1000 m2)	47.24	23.79
50.38				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.14	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (m)	201.11	Reach Len. (m)	30.00	30.00
30.00				
Crit W.S. (m)	198.95	Flow Area (m2)	117.48	44.95

53.01					
E.G. Slope (m/m)	0.000169	Area (m2)	117.48	44.95	
53.01					
Q Total (m3/s)	122.56	Flow (m3/s)	55.11	46.00	
21.45					
Top Width (m)	105.23	Top Width (m)	71.74	9.14	
24.35					
Vel Total (m/s)	0.57	Avg. Vel. (m/s)	0.47	1.02	
0.40					
Max Chl Dpth (m)	5.61	Hydr. Depth (m)	1.64	4.92	
2.18					
Conv. Total (m3/s)	9427.7	Conv. (m3/s)	4239.3	3538.4	
1650.0					
Length Wtd. (m)	30.00	Wetted Per. (m)	72.29	9.83	
29.65					
Min Ch El (m)	195.50	Shear (N/m2)	2.69	7.58	
2.96					
Alpha	1.61	Stream Power (N/m s)	1.26	7.76	
1.20					
Frctn Loss (m)		Cum Volume (1000 m3)	171.74	180.55	
199.59					
C & E Loss (m)		Cum SA (1000 m2)	104.23	23.79	
127.46					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1815

INPUT
Description: Hum-LL - Private Driveway Culvert - 3.23 m W x 2.1 m H x 20 m L Corrugated Metal Pipe Arch Culvert. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004
by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 20
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 68

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.814		8.43	201.594		9.83	201.579	
23.38	201.318		38.06	201.013		38.92	201.052	
39.19	201.044		39.55	201.046		40.67	201.053	
44.98	201.024		45.55	201		48.21	201	
51.41	201		53.82	201		57.05	201.013	
59.14	201.02		61.55	201.011		63.08	201.006	
64.24	201		66.61	200.06		66.78	200	
66.95	199.933		69.25	199		73.56	198.862	
78.46	198.707		78.57	198.703		91.01	198.328	
92.38	198.309		94.38	198.276		94.4	198.275	
94.48	198.274		104.2	198.082		107.92	198.006	
108.02	198.006		108.27	198.006		108.69	198.005	
109.45	198.005		110.23	198.004		110.59	198.004	
111.09	198.004		112.19	198.004		112.58	198.004	

113.44	198.003	114.64	198.003	115.23	198.003
115.68	198.003	116.18	198.002	116.54	198.038
119.63	198.468	121.93	198.762	122.56	198.775
123.93	198.92	125.6	198.914	126.73	198.921
128.12	198.95	128.92	198.942	130.41	198.978
130.95	199	130.96	199	131.04	199
131.13	199	131.47	199.005	131.56	199.007
133.71	199.023	134.52	199.03	136.57	199.051
136.8	199.053	177.16	199.555		

Upstream Bridge Cross Section Data

Station Elevation Data num= 47

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.972	.42	201.961	.55	201.96	1.85	201.935	8.17	201.804
21.62	201.526	31.13	201.301	35.82	201.196	38.11	201.147	43.98	201
47.21	201	54.76	201	59.23	201.022	59.93	201.025	61.24	201.019
63.83	201.008	65.54	201	67.48	200.312	68.6	200	69.51	199.67
71.2	199	80.47	198.706	97.37	198.231	101.25	198.152	103.18	198.11
108.63	198	109.89	197.509	111.25	197	113.61	196.424	114.44	196
115	195.5	117	195.5	119.57	196.761	120.39	197	120.93	197.262
122.38	198	123.56	198.575	124.53	199	125.86	199.005	126.15	199.005
126.32	199.005	128.81	199.016	129.09	199.016	133.53	199.074	152.28	199.311
155.51	199.353	179.8	199.659						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	43.98	.025	65.54	.05	111.25	.035	120.39	.05

Bank Sta: Left Right Coeff Contr. Expan.

111.25 120.39 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	114	197.8	F
118	179.8	198.1	F

Left Levee Station= 59.93 Elevation= 201.025

Blocked Obstructions num= 1

Sta L	Sta R	Elev
143.39	178.45	204

Downstream Deck/Roadway Coordinates

num= 68

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.814		8.43	201.594		9.83	201.579	
23.38	201.318		38.06	201.013		38.92	201.052	
39.19	201.044		39.55	201.046		40.67	201.053	
44.98	201.024		45.55	201		48.21	201	
51.41	201		53.82	201		57.05	201.013	
59.14	201.02		61.55	201.011		63.08	201.006	
64.24	201		66.61	200.06		66.78	200	
66.95	199.933		69.25	199		73.56	198.862	
78.46	198.707		78.57	198.703		91.01	198.328	
92.38	198.309		94.38	198.276		94.4	198.275	
94.48	198.274		104.2	198.082		107.92	198.006	
108.02	198.006		108.27	198.006		108.69	198.005	
109.45	198.005		110.23	198.004		110.59	198.004	
111.09	198.004		112.19	198.004		112.58	198.004	
113.44	198.003		114.64	198.003		115.23	198.003	
115.68	198.003		116.18	198.002		116.54	198.038	
119.63	198.468		121.93	198.762		122.56	198.775	
123.93	198.92		125.6	198.914		126.73	198.921	
128.12	198.95		128.92	198.942		130.41	198.978	
130.95	199		130.96	199		131.04	199	
131.13	199		131.47	199.005		131.56	199.007	

```
  133.71 199.023          134.52  199.03          136.57 199.051
   136.8 199.053          177.16 199.555

Downstream Bridge Cross Section Data
Station Elevation Data    num=      63
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 201.672   10.15 201.391   16.44 201.227   19.11 201.198   28.76 201.012
   29.08 201.003   29.75 201.003   30.18 201.003   33.16 201.006   34.09 201.007
   34.71 201.007   38.11 201.008   40.91 201.007   42.47 201.009   46.32  201.01
   49.08  201.01   50.09  201.01   52.79 201.011   53.95 201.011   55.33  201.01
   55.52  201.01   57.16 201.007    59.2 201.008   61.08 201.003   61.53 201.002
   62.11     201   63.74 200.449   63.89 200.402   64.96     200   67.14 199.213
   67.66     199   85.51 198.472   98.03 198.095  102.22 198.037  104.14 198.005
  104.83     198  107.05 197.336  108.45     197   109.6 196.471  110.03 196.349
   110.3 196.132  110.55   195.7  111.55  195.42  112.65  195.42  113.45   195.7
  113.65 196.153  114.19 196.347  114.96 196.478  115.28 196.495  115.54 196.648
  115.97     197  117.96 197.685   118.9     198  119.49 198.157  122.24     199
  123.93 199.013  125.15 199.031  128.94  199.07  130.34 199.094  131.13 199.106
  131.15 199.106  139.61 199.169  174.54 199.456

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   28.76    .025   62.11     .05  108.45    .035  115.97     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
        108.45  115.97            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     110   197.8       F
     114  174.54   197.8       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
  139.13  174.54     204

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     Pipe Arch     2.1    3.23
FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                 5      20     .024     .024        0                    .9
      1
Upstream   Elevation =  195.5
           Centerline Station =  116
Downstream Elevation =  195.42
           Centerline Station =  112

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       1.13    Culv Full Len (m)        20.00
  # Barrels                    1    Culv Vel US (m/s)         0.22
  Q Barrel (m3/s)           1.13    Culv Vel DS (m/s)         0.22
```

E.G. US. (m)	199.81	Culv Inv El Up (m)	195.50
W.S. US. (m)	199.80	Culv Inv El Dn (m)	195.42
E.G. DS (m)	199.81	Culv Frctn Ls (m)	0.00
W.S. DS (m)	199.80	Culv Exit Loss (m)	0.00
Delta EG (m)	0.00	Culv Entr Loss (m)	0.00
Delta WS (m)	0.00	Q Weir (m3/s)	19.46
E.G. IC (m)	199.19	Weir Sta Lft (m)	69.13
E.G. OC (m)	199.81	Weir Sta Rgt (m)	179.80
Culvert Control	Outlet	Weir Submerg	1.00
Culv WS Inlet (m)	197.60	Weir Max Depth (m)	1.81
Culv WS Outlet (m)	197.52	Weir Avg Depth (m)	1.18
Culv Nml Depth (m)		Weir Flow Area (m2)	89.52
Culv Crt Depth (m)	0.31	Min El Weir Flow (m)	198.01

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	3.10	Culv Full Len (m)	20.00
# Barrels	1	Culv Vel US (m/s)	0.59
Q Barrel (m3/s)	3.10	Culv Vel DS (m/s)	0.59
E.G. US. (m)	201.14	Culv Inv El Up (m)	195.50
W.S. US. (m)	201.11	Culv Inv El Dn (m)	195.42
E.G. DS (m)	201.11	Culv Frctn Ls (m)	0.01
W.S. DS (m)	201.09	Culv Exit Loss (m)	0.00
Delta EG (m)	0.02	Culv Entr Loss (m)	0.02
Delta WS (m)	0.03	Q Weir (m3/s)	119.46
E.G. IC (m)	201.12	Weir Sta Lft (m)	39.13
E.G. OC (m)	201.14	Weir Sta Rgt (m)	179.80
Culvert Control	Outlet	Weir Submerg	0.99
Culv WS Inlet (m)	197.60	Weir Max Depth (m)	3.12
Culv WS Outlet (m)	197.52	Weir Avg Depth (m)	1.84
Culv Nml Depth (m)		Weir Flow Area (m2)	194.21
Culv Crt Depth (m)	0.55	Min El Weir Flow (m)	198.01

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.181

INPUT
Description: Section 46.181 - Private Driveway - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 63

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.672	10.15	201.391	16.44	201.227	19.11	201.198	28.76	201.012
29.08	201.003	29.75	201.003	30.18	201.003	33.16	201.006	34.09	201.007
34.71	201.007	38.11	201.008	40.91	201.007	42.47	201.009	46.32	201.01
49.08	201.01	50.09	201.01	52.79	201.011	53.95	201.011	55.33	201.01
55.52	201.01	57.16	201.007	59.2	201.008	61.08	201.003	61.53	201.002
62.11	201	63.74	200.449	63.89	200.402	64.96	200	67.14	199.213
67.66	199	85.51	198.472	98.03	198.095	102.22	198.037	104.14	198.005

```
  104.83     198  107.05 197.336  108.45     197   109.6 196.471  110.03 196.349
   110.3 196.132  110.55   195.7  111.55  195.42  112.65  195.42  113.45   195.7
  113.65 196.153  114.19 196.347  114.96 196.478  115.28 196.495  115.54 196.648
  115.97     197  117.96 197.685   118.9     198  119.49 198.157  122.24     199
  123.93 199.013  125.15 199.031  128.94  199.07  130.34 199.094  131.13 199.106
  131.15 199.106  139.61 199.169  174.54 199.456

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   28.76    .025   62.11     .05  108.45    .035  115.97     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        108.45  115.97               10      10      10             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     110   197.8       F
     114  174.54   197.8       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
  139.13  174.54     204

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           199.81    Element                Left OB    Channel
Right OB
  Vel Head (m)              0.00    Wt. n-Val.              0.050      0.035
0.050
  W.S. Elev (m)           199.80    Reach Len. (m)          10.00      10.00
10.00
  Crit W.S. (m)           197.07    Flow Area (m2)          59.22      27.86
23.15
  E.G. Slope (m/m)      0.000032    Area (m2)               59.22      27.86
23.15
  Q Total (m3/s)            20.59   Flow (m3/s)              8.22       9.83
2.54
  Top Width (m)             73.62   Top Width (m)           42.94       7.52
23.16
  Vel Total (m/s)           0.19    Avg. Vel. (m/s)          0.14       0.35
0.11
  Max Chl Dpth (m)          4.38    Hydr. Depth (m)          1.38       3.70
1.00
  Conv. Total (m3/s)      3657.4    Conv. (m3/s)           1460.9     1746.0
450.5
  Length Wtd. (m)           10.00   Wetted Per. (m)         43.24       8.57
24.11
  Min Ch El (m)           195.42    Shear (N/m2)             0.43       1.01
0.30
  Alpha                     1.97    Stream Power (N/m s)     0.06       0.36
0.03
  Frctn Loss (m)            0.00    Cum Volume (1000 m3)    42.92      72.51
35.89
  C & E Loss (m)            0.00    Cum SA (1000 m2)        45.97      23.54
49.66



Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #Regional w red'n
```

E.G. Elev (m)	201.11	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.09	Reach Len. (m)	10.00	10.00	10.00
Crit W.S. (m)	199.00	Flow Area (m2)	119.37	37.51	52.88
E.G. Slope (m/m)	0.000190	Area (m2)	119.37	37.51	52.88
Q Total (m3/s)	122.56	Flow (m3/s)	59.30	39.50	23.76
Top Width (m)	114.19	Top Width (m)	83.51	7.52	23.16
Vel Total (m/s)	0.58	Avg. Vel. (m/s)	0.50	1.05	0.45
Max Chl Dpth (m)	5.67	Hydr. Depth (m)	1.43	4.99	2.28
Conv. Total (m3/s)	8896.6	Conv. (m3/s)	4304.8	2867.1	1724.7
Length Wtd. (m)	10.00	Wetted Per. (m)	84.01	8.57	25.39
Min Ch El (m)	195.42	Shear (N/m2)	2.64	8.14	3.88
Alpha	1.51	Stream Power (N/m s)	1.31	8.58	1.74
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	171.74	174.48	199.59
C & E Loss (m)	0.00	Cum SA (1000 m2)	101.90	23.54	126.75

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.18

INPUT
Description: Section 46.18 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 36

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.977	11.8	201.517	19.72	201.217	24.63	201.027	25.49	201
25.73	200.891	27.72	200	72.09	200	72.38	200.049	72.68	200
73.08	199.878	75.33	199	90.41	198.582	110.99	198	113.81	197.148
114.16	197	114.84	196.777	115.23	196.607	117.24	196	118.92	195.419
119.01	195.418	119.32	195.43	120.38	195.971	120.82	196	123.44	196.968
123.53	197	123.87	197.147	125.89	198	126.38	198.193	128.56	199
130.21	199.025	143.32	199.109	146.37	199.102	152.23	199.148	160.44	199.206
181.15	199.373								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	117.24	.035	120.82	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
117.24	120.82	25	25	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
146.08	181.15	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.80	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)		Flow Area (m2)	64.59	14.65	30.67
E.G. Slope (m/m)	0.000038	Area (m2)	64.59	14.65	30.67
Q Total (m3/s)	20.59	Flow (m3/s)	10.15	6.30	4.14
Top Width (m)	72.80	Top Width (m)	43.96	3.58	25.26
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.16	0.43	0.14
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.47	4.09	1.21
Conv. Total (m3/s)	3360.8	Conv. (m3/s)	1657.3	1027.6	676.0
Length Wtd. (m)	25.00	Wetted Per. (m)	44.44	3.81	26.52
Min Ch El (m)	195.42	Shear (N/m2)	0.53	1.42	0.43
Alpha	2.06	Stream Power (N/m s)	0.08	0.61	0.06
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	42.30	72.30	35.62
C & E Loss (m)	0.00	Cum SA (1000 m2)	45.53	23.49	49.42

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.11	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.09	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)		Flow Area (m2)	172.08	19.25	63.15
E.G. Slope (m/m)	0.000189	Area (m2)	172.08	19.25	63.15
Q Total (m3/s)	122.56	Flow (m3/s)	70.32	22.26	29.98
Top Width (m)	122.99	Top Width (m)	94.15	3.58	25.26
Vel Total (m/s)	0.48	Avg. Vel. (m/s)	0.41	1.16	0.47
Max Chl Dpth (m)	5.67	Hydr. Depth (m)	1.83	5.38	2.50
Conv. Total (m3/s)	8920.1	Conv. (m3/s)	5117.8	1620.2	2182.2
Length Wtd. (m)	25.00	Wetted Per. (m)	94.89	3.81	27.81
Min Ch El (m)	195.42	Shear (N/m2)	3.36	9.36	4.20
Alpha	1.70	Stream Power (N/m s)	1.37	10.82	

2.00
  Frctn Loss (m) 0.00 Cum Volume (1000 m3) 170.28 174.20 199.01
  C & E Loss (m) 0.00 Cum SA (1000 m2) 101.01 23.49 126.51

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: RIVER-1
REACH: Reach-1 RS: 46.172

INPUT
Description: Section 46.172 - Doughton Road - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 112

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.734	12.56	201.239	18.71	201	19.16	200.796	20.83	200
22.76	199.053	22.87	199	62.25	199	63.17	199.011	64.63	199.022
66.94	199.001	66.98	199	67.01	199	68.2	198.967	103.48	198
104.09	197.739	105.82	197	106.27	196.833	107.29	196.474	107.64	196.354
108.58	196	109	195.6	109.6	195.423	111	195.423	111.7	195.6
112.13	196	114.2	196.671	115.34	197	118.55	197.877	118.99	198
121.05	198.574	123.33	199	123.42	199.001	123.5	199.001	123.54	199.001
123.9	199.003	124.23	199.004	124.61	199.005	126.14	199.011	127.45	199.01
127.51	199.01	130.18	199.02	131.13	199.023	131.75	199.022	131.93	199.022
136.67	199.034	138.19	199.034	142.37	199.028	144.48	199.031	146.18	199.033
147.98	199.03	151.4	199.025	152.23	199.024	153.19	199.023	162.26	199.102
168.85	199.106	176.2	199.054	176.37	199.053	179.61	199.282	179.92	199.303
181.07	199.326	182.68	199.444	185.09	199.554	185.23	199.561	190.14	200
190.33	200.08	192.14	200.106	194.32	200.348	197.51	200.575	198.87	200.608
201.34	200.55	205.59	200.325	205.97	200.323	207.47	200.186	208.18	200.159
208.63	200.138	208.84	200.128	209.03	200.12	209.29	200.117	209.54	200.119
210.38	200.139	210.98	200.174	211.81	200.246	213.46	200.375	218.29	200.752
218.48	200.763	218.67	200.765	219.17	200.789	219.59	200.805	220.25	200.786
223.9	200.72	227.49	200.773	227.81	200.78	230.24	200.911	230.52	200.931
231.19	201	231.74	201.005	232.08	201.007	242.92	201.282	250.3	201.41
251.76	201.387	251.9	201.386	253.2	201.371	255.13	201.441	255.57	201.457
256.04	201.474	256.2	201.479	256.73	201.495	258.39	201.529	263.36	201.693
264.27	201.707	264.32	201.707						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	108.58	.035	112.13	.05

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
108.58 112.13 40 40 40 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	108.23	197.78	F
112.38	264.32	197.78	F

Right Levee Station= 198.87 Elevation= 200.608

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m) 199.80 Element Left OB Channel

Right OB					
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.80	Reach Len. (m)	40.00	40.00	40.00
Crit W.S. (m)	197.01	Flow Area (m2)	97.96	15.11	68.87
E.G. Slope (m/m)	0.000021	Area (m2)	97.96	15.11	68.87
Q Total (m3/s)	20.59	Flow (m3/s)	9.73	4.91	5.95
Top Width (m)	166.69	Top Width (m)	87.35	3.55	75.79
Vel Total (m/s)	0.11	Avg. Vel. (m/s)	0.10	0.32	0.09
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.12	4.26	0.91
Conv. Total (m3/s)	4455.0	Conv. (m3/s)	2105.7	1062.1	1287.3
Length Wtd. (m)	40.00	Wetted Per. (m)	87.93	3.92	76.22
Min Ch El (m)	195.42	Shear (N/m2)	0.23	0.81	0.19
Alpha	2.50	Stream Power (N/m s)	0.02	0.26	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	40.27	71.92	34.37
C & E Loss (m)		Cum SA (1000 m2)	43.89	23.40	48.16

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.10	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.09	Reach Len. (m)	40.00	40.00	40.00
Crit W.S. (m)	199.38	Flow Area (m2)	212.63	19.69	193.70
E.G. Slope (m/m)	0.000074	Area (m2)	212.63	19.69	193.70
Q Total (m3/s)	122.56	Flow (m3/s)	63.45	14.21	44.90
Top Width (m)	219.18	Top Width (m)	92.27	3.55	123.35
Vel Total (m/s)	0.29	Avg. Vel. (m/s)	0.30	0.72	0.23
Max Chl Dpth (m)	5.67	Hydr. Depth (m)	2.30	5.55	1.57
Conv. Total (m3/s)	14244.4	Conv. (m3/s)	7373.8	1652.0	5218.7
Length Wtd. (m)	40.00	Wetted Per. (m)	93.13	3.92	123.88
Min Ch El (m)	195.42	Shear (N/m2)	1.66	3.65	1.14
Alpha	1.52	Stream Power (N/m s)	0.49	2.64	

0.26
  Frctn Loss (m) Cum Volume (1000 m3) 165.48 173.71 195.80
  C & E Loss (m) Cum SA (1000 m2) 98.68 23.40 124.65

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1715

INPUT
Description: Hum 13-4R. Doughton Road Culvert - 3.54 m W x 2.27 m H x 30 m L Corrugated Metal Pipe Arch Culvert. Drawing by Paul Theil (Dwg No. 8036P-A-17, February 1998) used to code culvert in HEC-RAS format..

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 30
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 146

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.659		17.1	201		18.56	200.215	
19.04	200		20.71	199.079		20.88	199	
58.5	199		58.75	199.001		59.61	199.002	
59.67	199.002		60.49	199.079		61.88	199.001	
62.77	199		62.78	198.999		62.87	198.999	
64.51	198.988		77.88	198.499		79.03	198.456	
80.45	198.394		80.53	198.393		80.55	198.393	
82.71	198.354		101.77	198.004		101.87	198.004	
102.35	198.004		102.49	198.003		103.08	198.003	
103.88	198.003		104.94	198.002		105.2	198.001	
105.36	198.001		105.37	198.001		105.48	198.001	
105.59	198.001		106.17	198		111.07	197.984	
112.06	197.981		112.22	197.981		112.33	197.981	
112.33	197.981		114.49	197.978		114.57	197.978	
114.65	197.978		115.8	197.978		118.45	197.973	
118.88	197.972		119.32	197.973		119.67	197.973	
120.76	197.97		121.29	197.971		125.31	197.974	
128.81	197.969		129.56	197.969		129.66	197.969	
131.93	197.969		135.28	197.977		135.33	197.977	
135.42	197.977		135.86	197.977		136.49	197.98	
136.85	197.98		138.97	197.983		140.58	197.983	
142.91	197.985		143.34	197.986		144	197.987	
148.3	197.988		148.81	197.988		150.8	197.989	
151.39	197.989		151.44	197.989		151.49	197.989	
152.06	197.99		152.7	197.99		156.88	197.993	
158.94	197.995		160.16	197.995		160.52	197.995	
163.7	197.998		163.89	197.998		166.05	198	
171.66	198.147		174	198.212		174.94	198.277	
175.14	198.281		175.27	198.285		175.43	198.29	

175.45	198.29	175.57	198.292	181.56	199		
181.89	199	188.35	199	188.45	199		
189.17	199	189.18	199	189.3	199		
189.37	199	189.43	199	190.46	199		
190.69	199	196.39	199	199.89	199		
200.58	199	201.89	199	202.2	199		
202.34	199	205.71	199	205.77	199		
206.03	199	207.51	199	207.73	199		
208.17	199	209.97	199	211.96	199.213		
212.01	199.214	213.13	199.214	220.85	199.754		
223.57	199.952	224.34	199.955	224.39	199.955		
224.45	199.955	225.21	199.96	227.97	199.964		
228.07	199.964	229.26	199.965	230.05	199.967		
232.33	199.971	235.53	199.979	235.78	199.979		
238.51	199.989	241.24	199.999	241.32	199.999		
241.46	199.999	241.56	200	242.02	200.028		
242.12	200.031	255.22	200.891	257.31	200.902		
257.33	200.902	259.53	200.742	259.59	200.74		
260.02	200.761	260.61	200.75	262.62	200.866		
263.38	200.931	263.45	200.931				

Upstream Bridge Cross Section Data
Station Elevation Data num= 112

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.734	12.56	201.239	18.71	201	19.16	200.796	20.83	200
22.76	199.053	22.87	199	62.25	199	63.17	199.011	64.63	199.022
66.94	199.001	66.98	199	67.01	199	68.2	198.967	103.48	198
104.09	197.739	105.82	197	106.27	196.833	107.29	196.474	107.64	196.354
108.58	196	109	195.6	109.6	195.423	111	195.423	111.7	195.6
112.13	196	114.2	196.671	115.34	197	118.55	197.877	118.99	198
121.05	198.574	123.33	199	123.42	199.001	123.5	199.001	123.54	199.001
123.9	199.003	124.23	199.004	124.61	199.005	126.14	199.011	127.45	199.01
127.51	199.01	130.18	199.02	131.13	199.023	131.75	199.022	131.93	199.022
136.67	199.034	138.19	199.034	142.37	199.028	144.48	199.031	146.18	199.033
147.98	199.03	151.4	199.025	152.23	199.024	153.19	199.023	162.26	199.102
168.85	199.106	176.2	199.054	176.37	199.053	179.61	199.282	179.92	199.303
181.07	199.326	182.68	199.444	185.09	199.554	185.23	199.561	190.14	200
190.33	200.08	192.14	200.106	194.32	200.348	197.51	200.575	198.87	200.608
201.34	200.55	205.59	200.325	205.97	200.323	207.47	200.186	208.18	200.159
208.63	200.138	208.84	200.128	209.03	200.12	209.29	200.117	209.54	200.119
210.38	200.139	210.98	200.174	211.81	200.246	213.46	200.375	218.29	200.752
218.48	200.763	218.67	200.765	219.17	200.789	219.59	200.805	220.25	200.786
223.9	200.72	227.49	200.773	227.81	200.78	230.24	200.911	230.52	200.931
231.19	201	231.74	201.005	232.08	201.007	242.92	201.282	250.3	201.41
251.76	201.387	251.9	201.386	253.2	201.371	255.13	201.441	255.57	201.457
256.04	201.474	256.2	201.479	256.73	201.495	258.39	201.529	263.36	201.693
264.27	201.707	264.32	201.707						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	108.58	.035	112.13	.05

Bank Sta: Left Right Coeff Contr. Expan.
108.58 112.13 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	108.23	197.78	F
112.38	264.32	197.78	F

Right Levee Station= 198.87 Elevation= 200.608

Downstream Deck/Roadway Coordinates
num= 146

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord

0	201.659	17.1	201	18.56	200.215		
19.04	200	20.71	199.079	20.88	199		
58.5	199	58.75	199.001	59.61	199.002		
59.67	199.002	60.49	199.079	61.88	199.001		
62.77	199	62.78	198.999	62.87	198.999		
64.51	198.988	77.88	198.499	79.03	198.456		
80.45	198.394	80.53	198.393	80.55	198.393		
82.71	198.354	101.77	198.004	101.87	198.004		
102.35	198.004	102.49	198.003	103.08	198.003		
103.88	198.003	104.94	198.002	105.2	198.001		
105.36	198.001	105.37	198.001	105.48	198.001		
105.59	198.001	106.17	198	111.07	197.984		
112.06	197.981	112.22	197.981	112.33	197.981		
112.33	197.981	114.49	197.978	114.57	197.978		
114.65	197.978	115.8	197.978	118.45	197.973		
118.88	197.972	119.32	197.973	119.67	197.973		
120.76	197.97	121.29	197.971	125.31	197.974		
128.81	197.969	129.56	197.969	129.66	197.969		
131.93	197.969	135.28	197.977	135.33	197.977		
135.42	197.977	135.86	197.977	136.49	197.98		
136.85	197.98	138.97	197.983	140.58	197.983		
142.91	197.985	143.34	197.986	144	197.987		
148.3	197.988	148.81	197.988	150.8	197.989		
151.39	197.989	151.44	197.989	151.49	197.989		
152.06	197.99	152.7	197.99	156.88	197.993		
158.94	197.995	160.16	197.995	160.52	197.995		
163.7	197.998	163.89	197.998	166.05	198		
171.66	198.147	174	198.212	174.94	198.277		
175.14	198.281	175.27	198.285	175.43	198.29		
175.45	198.29	175.57	198.292	181.56	199		
181.89	199	188.35	199	188.45	199		
189.17	199	189.18	199	189.3	199		
189.37	199	189.43	199	190.46	199		
190.69	199	196.39	199	199.89	199		
200.58	199	201.89	199	202.2	199		
202.34	199	205.71	199	205.77	199		
206.03	199	207.51	199	207.73	199		
208.17	199	209.97	199	211.96	199.213		
212.01	199.214	213.13	199.214	220.85	199.754		
223.57	199.952	224.34	199.955	224.39	199.955		
224.45	199.955	225.21	199.96	227.97	199.964		
228.07	199.964	229.26	199.965	230.05	199.967		
232.33	199.971	235.53	199.979	235.78	199.979		
238.51	199.989	241.24	199.999	241.32	199.999		
241.46	199.999	241.56	200	242.02	200.028		
242.12	200.031	255.22	200.891	257.31	200.902		
257.33	200.902	259.53	200.742	259.59	200.74		
260.02	200.761	260.61	200.75	262.62	200.866		
263.38	200.931	263.45	200.931				

Downstream Bridge Cross Section Data
Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.96	4.98	201.796	12.44	201.256	13.15	201.237	13.25	201.233
14.75	201.164	14.84	201.161	15.12	201.157	15.39	201.155	15.62	201.154
15.69	201.151	15.99	201	16.36	200.819	17.96	200	56.42	200
56.75	200.006	57.02	200.008	57.33	200.003	57.62	200	58.14	199.138
58.25	199.189	58.47	199	60.02	198.995	63.55	198.984	63.81	198.985
64	198.985	65.42	198.99	68.25	198.998	68.82	199	72	199.002
72.03	199.002	72.61	199.001	73.78	199.001	75.32	199	75.36	199
80.19	198.767	92.67	198.166	96.3	198	97.51	197.516	98.72	197
99.68	196.606	99.91	196.501	100.61	196.23	100.78	196	101.09	195.65
102	195.4	103	195.4	103.89	195.65	104.2	196	105.92	196.441

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  106.96 196.581   107.6 196.655   107.9  196.67  111.41     197  111.54 197.014
  111.55 197.013  112.49 197.087  113.31  197.14  116.28 197.185  119.01 197.211
  119.24 197.207  121.22 197.229  124.15 197.307  124.51  197.35  124.99  197.41
  125.11 197.425  127.76  197.44  128.22 197.417  130.42     198  132.06 198.488
  133.88     199  134.14 199.003  134.41 199.003  134.45 199.003  137.25 199.032
  137.75 199.031  141.77 199.052  141.83 199.052  141.86 199.053  148.67 199.216
  150.74 199.224  152.75 199.228  159.58 199.291  160.35 199.297   162.8 199.347
  166.55 199.342   166.7 199.342  167.68 199.362  170.27 199.374  170.75 199.383
  172.18 199.397  173.54 199.408  175.72 199.407  176.75 199.414  180.91  199.49
  186.98 199.604   187.2 199.611  193.04 199.639     200     200  200.45 200.012
  202.09 200.042  206.82 200.085  218.03   200.5  221.19 200.617  221.21 200.618
  221.33 200.618  221.54 200.615  221.57 200.615   229.4 200.491  229.74  200.48
  236.66 200.579  244.75 200.914  250.98 200.952  251.55 200.969  251.75 200.978
  251.93 200.979   253.5     201  255.98 201.045  256.93 201.053  257.81 201.067
  258.72 201.075  258.93 201.079

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05  100.78    .035   104.2     .05  133.88    .025

Bank Sta: Left   Right    Coeff Contr.   Expan.
        100.78   104.2            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0  100.49   197.5       F
  104.45  258.93   197.5       F
Right Levee     Station=  221.19      Elevation=  200.62

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     Pipe Arch    2.27    3.54
FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                 5      30     .024     .024        0                   .9
      1
Upstream   Elevation =  195.423
           Centerline Station =  110.35
Downstream Elevation =  195.4
           Centerline Station =  102.49

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       0.95    Culv Full Len (m)        30.00
  # Barrels                    1    Culv Vel US (m/s)         0.15
  Q Barrel (m3/s)           0.95    Culv Vel DS (m/s)         0.15
  E.G. US. (m)            199.80    Culv Inv El Up (m)      195.42
  W.S. US. (m)            199.80    Culv Inv El Dn (m)      195.40
  E.G. DS (m)             199.80    Culv Frctn Ls (m)         0.00
  W.S. DS (m)             199.80    Culv Exit Loss (m)        0.00
  Delta EG (m)              0.00    Culv Entr Loss (m)        0.00
  Delta WS (m)              0.00    Q Weir (m3/s)            19.64
```

E.G. IC (m)	198.51	Weir Sta Lft (m)	21.23
E.G. OC (m)	199.80	Weir Sta Rgt (m)	187.93
Culvert Control	Outlet	Weir Submerg	1.00
Culv WS Inlet (m)	197.69	Weir Max Depth (m)	1.83
Culv WS Outlet (m)	197.67	Weir Avg Depth (m)	0.97
Culv Nml Depth (m)		Weir Flow Area (m2)	161.62
Culv Crt Depth (m)	0.28	Min El Weir Flow (m)	197.97

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	2.17	Culv Full Len (m)	30.00
# Barrels	1	Culv Vel US (m/s)	0.35
Q Barrel (m3/s)	2.17	Culv Vel DS (m/s)	0.35
E.G. US. (m)	201.10	Culv Inv El Up (m)	195.42
W.S. US. (m)	201.09	Culv Inv El Dn (m)	195.40
E.G. DS (m)	201.09	Culv Frctn Ls (m)	0.00
W.S. DS (m)	201.08	Culv Exit Loss (m)	0.00
Delta EG (m)	0.01	Culv Entr Loss (m)	0.01
Delta WS (m)	0.01	Q Weir (m3/s)	120.40
E.G. IC (m)	201.09	Weir Sta Lft (m)	16.33
E.G. OC (m)	201.10	Weir Sta Rgt (m)	235.46
Culvert Control	Outlet	Weir Submerg	1.00
Culv WS Inlet (m)	197.69	Weir Max Depth (m)	3.12
Culv WS Outlet (m)	197.67	Weir Avg Depth (m)	1.85
Culv Nml Depth (m)		Weir Flow Area (m2)	405.36
Culv Crt Depth (m)	0.43	Min El Weir Flow (m)	197.97

Warning: The weir over culvert is submerged.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.171

INPUT
Description: Section 46.171 - Doughton Road - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.96	4.98	201.796	12.44	201.256	13.15	201.237	13.25	201.233
14.75	201.164	14.84	201.161	15.12	201.157	15.39	201.155	15.62	201.154
15.69	201.151	15.99	201	16.36	200.819	17.96	200	56.42	200
56.75	200.006	57.02	200.008	57.33	200.003	57.62	200	58.14	199.138
58.25	199.189	58.47	199	60.02	198.995	63.55	198.984	63.81	198.985
64	198.985	65.42	198.99	68.25	198.998	68.82	199	72	199.002
72.03	199.002	72.61	199.001	73.78	199.001	75.32	199	75.36	199
80.19	198.767	92.67	198.166	96.3	198	97.51	197.516	98.72	197
99.68	196.606	99.91	196.501	100.61	196.23	100.78	196	101.09	195.65
102	195.4	103	195.4	103.89	195.65	104.2	196	105.92	196.441
106.96	196.581	107.6	196.655	107.9	196.67	111.41	197	111.54	197.014
111.55	197.013	112.49	197.087	113.31	197.14	116.28	197.185	119.01	197.211
119.24	197.207	121.22	197.229	124.15	197.307	124.51	197.35	124.99	197.41
125.11	197.425	127.76	197.44	128.22	197.417	130.42	198	132.06	198.488
133.88	199	134.14	199.003	134.41	199.003	134.45	199.003	137.25	199.032
137.75	199.031	141.77	199.052	141.83	199.052	141.86	199.053	148.67	199.216

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  150.74 199.224  152.75 199.228  159.58 199.291  160.35 199.297   162.8 199.347
  166.55 199.342   166.7 199.342  167.68 199.362  170.27 199.374  170.75 199.383
  172.18 199.397  173.54 199.408  175.72 199.407  176.75 199.414  180.91  199.49
  186.98 199.604   187.2 199.611  193.04 199.639     200     200  200.45 200.012
  202.09 200.042  206.82 200.085  218.03   200.5  221.19 200.617  221.21 200.618
  221.33 200.618  221.54 200.615  221.57 200.615   229.4 200.491  229.74  200.48
  236.66 200.579  244.75 200.914  250.98 200.952  251.55 200.969  251.75 200.978
  251.93 200.979   253.5     201  255.98 201.045  256.93 201.053  257.81 201.067
  258.72 201.075  258.93 201.079

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05  100.78    .035   104.2     .05  133.88    .025

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        100.78   104.2                 20      20      20             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0  100.49   197.5       F
  104.45  258.93   197.5       F
Right Levee     Station=  221.19      Elevation=  200.62

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           199.80    Element                 Left OB    Channel
Right OB
  Vel Head (m)              0.00    Wt. n-Val.               0.050      0.035
0.045
  W.S. Elev (m)           199.80    Reach Len. (m)           20.00      20.00
20.00
  Crit W.S. (m)           197.05    Flow Area (m2)           53.47      14.56
103.52
  E.G. Slope (m/m)      0.000013    Area (m2)                53.47      14.56
103.52
  Q Total (m3/s)           20.59    Flow (m3/s)               4.42       3.69
12.48
  Top Width (m)           138.41    Top Width (m)            43.04       3.42
91.95
  Vel Total (m/s)           0.12    Avg. Vel. (m/s)           0.08       0.25
0.12
  Max Chl Dpth (m)          4.40    Hydr. Depth (m)           1.24       4.26
1.13
  Conv. Total (m3/s)      5677.0    Conv. (m3/s)            1218.0     1018.1
3441.0
  Length Wtd. (m)          20.00    Wetted Per. (m)          43.98       3.80
92.28
  Min Ch El (m)           195.40    Shear (N/m2)              0.16       0.49
0.14
  Alpha                     1.51    Stream Power (N/m s)      0.01       0.13
0.02
  Frctn Loss (m)            0.00    Cum Volume (1000 m3)     40.27      65.14
34.37
  C & E Loss (m)            0.00    Cum SA (1000 m2)         41.29      23.26
44.80



Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #Regional w red'n
```

E.G. Elev (m)	201.09	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.037
W.S. Elev (m)	201.08	Reach Len. (m)	20.00	20.00	20.00
Crit W.S. (m)	198.40	Flow Area (m2)	152.90	18.95	256.04
E.G. Slope (m/m)	0.000047	Area (m2)	152.90	18.95	256.04
Q Total (m3/s)	122.56	Flow (m3/s)	30.86	10.88	80.82
Top Width (m)	243.10	Top Width (m)	84.95	3.42	154.73
Vel Total (m/s)	0.29	Avg. Vel. (m/s)	0.20	0.57	0.32
Max Chl Dpth (m)	5.68	Hydr. Depth (m)	1.80	5.54	1.65
Conv. Total (m3/s)	17786.0	Conv. (m3/s)	4478.4	1578.9	11728.6
Length Wtd. (m)	20.00	Wetted Per. (m)	86.27	3.80	155.09
Min Ch El (m)	195.40	Shear (N/m2)	0.83	2.32	0.77
Alpha	1.28	Stream Power (N/m s)	0.17	1.33	0.24
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	165.48	157.18	195.80
C & E Loss (m)	0.00	Cum SA (1000 m2)	95.14	23.26	119.09

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.17

INPUT
Description: Section 46.17 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 116

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.688	1.92	202.495	4.4	202.266	4.48	202.251	4.75	202.184
4.79	202.176	6.6	202	12.45	201.979	17.91	201.166	18.18	201.154
19.37	201.103	21.4	201	23.54	200.628	24.48	200.486	25.02	200.437
25.18	200.42	27.13	200.345	28.69	200.283	51.47	200.233	52.85	200.015
52.9	200.016	53.01	200.016	53.18	200.017	53.5	200.019	53.65	200.018
55.08	200	55.93	199.504	57.96	199	58.81	198.999	60.02	198.998
60.13	198.998	60.21	198.998	60.95	199	66.84	199.005	72.96	199.008
73.69	199.009	73.9	199.009	74.3	199.009	84.33	199.001	84.69	199
87.85	198.724	88.8	198.65	91.93	198.411	92.06	198.399	92.24	198.395
94.4	198.329	97.14	198.228	101.19	198	104.3	197.667	105.19	197.601
106.64	197.457	107.07	197.401	107.61	197.33	109.57	197.016	109.72	197
111.4	196.518	112.75	196.275	112.89	196.246	114	196	115.21	195.596
116.81	195.074	118.88	195.516	119.22	195.58	121	195.98	121.83	196
122.59	196.161	122.66	196.178	126.09	197	126.52	197.207	127.48	197.726
128.12	198	128.84	198.316	128.95	198.391	130.41	199	131.35	199.029
131.66	199.042	131.84	199.047	145.77	199.679	145.82	199.68	148.15	199.686

148.22 199.687 150.32 199.708 150.42 199.708 155.89 199.771 163.77 199.844
166.6 199.87 172.77 199.998 172.98 200 173.86 200 177.76 200.001
180.71 200.001 182.41 200.001 187.06 200 189.66 200 190.48 200
191.66 199.999 192.68 200 193.35 200 195.14 200.052 210.59 200.774
213.61 200.883 216.46 200.997 216.77 200.998 216.8 201 218.28 201.01
220.35 201.021 223.37 201.004 223.38 201.003 223.46 201.003 223.87 201.001
224 201.001 224.1 201.001 224.26 201.001 247.41 201.031 254.26 201.314
261.99 201.319

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	114	.035	121.83	.05	130.41	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
114	121.83	25	25	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
224	254.26	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.046
W.S. Elev (m)	199.80	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)		Flow Area (m2)	78.43	33.06	29.72
E.G. Slope (m/m)	0.000016	Area (m2)	78.43	33.06	29.72
Q Total (m3/s)	20.59	Flow (m3/s)	7.48	9.53	3.58
Top Width (m)	103.45	Top Width (m)	58.57	7.83	37.04
Vel Total (m/s)	0.15	Avg. Vel. (m/s)	0.10	0.29	0.12
Max Chl Dpth (m)	4.72	Hydr. Depth (m)	1.34	4.22	0.80
Conv. Total (m3/s)	5225.2	Conv. (m3/s)	1897.9	2417.7	909.5
Length Wtd. (m)	25.00	Wetted Per. (m)	58.93	8.08	37.62
Min Ch El (m)	195.07	Shear (N/m2)	0.20	0.62	0.12
Alpha	2.08	Stream Power (N/m s)	0.02	0.18	0.01
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	38.95	64.66	33.04
C & E Loss (m)	0.00	Cum SA (1000 m2)	40.27	23.15	43.51

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.09	Element	Left OB	Channel

Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.032
W.S. Elev (m)	201.08	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)		Flow Area (m2)	179.99	43.06	129.50
E.G. Slope (m/m)	0.000069	Area (m2)	179.99	43.06	129.50
Q Total (m3/s)	122.56	Flow (m3/s)	45.88	31.16	45.52
Top Width (m)	204.08	Top Width (m)	94.08	7.83	102.17
Vel Total (m/s)	0.35	Avg. Vel. (m/s)	0.25	0.72	0.35
Max Chl Dpth (m)	6.00	Hydr. Depth (m)	1.91	5.50	1.27
Conv. Total (m3/s)	14769.6	Conv. (m3/s)	5529.1	3754.9	5485.6
Length Wtd. (m)	25.00	Wetted Per. (m)	94.56	8.08	102.85
Min Ch El (m)	195.07	Shear (N/m2)	1.29	3.60	0.85
Alpha	1.68	Stream Power (N/m s)	0.33	2.61	0.30
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	162.15	156.56	191.95
C & E Loss (m)	0.00	Cum SA (1000 m2)	93.35	23.15	116.52

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: RIVER-1
REACH: Reach-1 RS: 46.162

INPUT
Description: Section 46.162 - Private Roadway - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 109

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.192	1.24	201.169	3.79	201.018	4.16	201	4.19	201
4.59	201	4.76	201	7.68	200.999	11.04	200.998	13.8	200.998
16.96	200.999	17.05	200.985	18.41	200.657	20.17	200.244	20.23	200.243
23.96	200	24.33	200	24.56	200	24.59	200	24.88	200
26.07	200.001	26.81	200.001	26.89	200.001	27.42	200.001	28.48	200.001
30.58	200.002	32.04	200.002	32.36	200.002	32.54	200.002	32.61	200.002
32.89	200.003	34.51	199.895	34.73	199.893	44.5	199.802	46.83	199.776
54.07	199.447	58.78	199.43	64.92	199.322	69.2	199.246	76.37	199.103
81.58	199.008	81.84	199	87.1	198.433	90.24	198	91.32	197.577
93.35	197	93.64	196.919	94.7	196.457	95.67	196.041	95.77	196
95.88	195.96	97	195.074	98.92	195.074	100.12	195.765	100.4	196
101.1	196.258	101.63	196.43	103.42	197	104.06	197.319	105.45	198
106.48	198.488	107.42	199	110.59	199.341	122.09	199.985	122.25	199.995
122.4	200	122.41	200	122.46	200	122.47	200	122.58	200
123.04	200	129.01	200	130.19	200	140.85	200	144.86	200
145.37	200	145.55	200	145.59	200	148.08	200	150.4	200

```
  151.72 200.029  154.44 200.045  164.08 200.101  179.01 200.467  180.22 200.507
  181.74 200.559  183.87 200.633  184.02 200.638  184.28 200.645  187.85 200.734
  192.91 200.868  197.74     201  200.12  201.06  203.17 201.141  203.19 201.141
  203.79 201.145  209.64 201.071  209.78  201.07  219.82 201.072  226.92 201.085
  234.49 201.039   242.9 201.219  248.47 201.125  248.56 201.126  248.94  201.13
  253.08  201.56  254.15 201.702  256.45 201.992   256.6     202

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   95.77    .035   100.4     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         95.77   100.4                 30      30      30             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0      96   198.8        F
     100   256.6   198.8        F
Blocked Obstructions     num=       2
   Sta L   Sta R    Elev   Sta L   Sta R    Elev
  154.44  183.87     204  209.64  248.47     204

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           199.80    Element                Left OB    Channel
Right OB
  Vel Head (m)              0.01    Wt. n-Val.              0.050      0.035
0.050
  W.S. Elev (m)           199.79    Reach Len. (m)          30.00      30.00
30.00
  Crit W.S. (m)           196.65    Flow Area (m2)          41.88      20.60
20.89
  E.G. Slope (m/m)      0.000060    Area (m2)               41.88      20.60
20.89
  Q Total (m3/s)            20.59   Flow (m3/s)              5.72      11.40
3.46
  Top Width (m)             73.08   Top Width (m)           50.24       4.63
18.21
  Vel Total (m/s)           0.25    Avg. Vel. (m/s)          0.14       0.55
0.17
  Max Chl Dpth (m)          4.72    Hydr. Depth (m)          0.83       4.45
1.15
  Conv. Total (m3/s)      2655.0    Conv. (m3/s)            737.6     1470.6
446.8
  Length Wtd. (m)           30.00   Wetted Per. (m)         50.67       5.22
18.88
  Min Ch El (m)           195.07    Shear (N/m2)             0.49       2.33
0.65
  Alpha                     2.94    Stream Power (N/m s)     0.07       1.29
0.11
  Frctn Loss (m)                    Cum Volume (1000 m3)    37.44      63.99
32.41
  C & E Loss (m)                    Cum SA (1000 m2)        38.91      22.99
42.82



Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #Regional w red'n
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E.G. Elev (m)	201.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.05	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)	198.81	Flow Area (m2)	135.12	26.43	85.01
E.G. Slope (m/m)	0.000245	Area (m2)	135.12	26.43	85.01
Q Total (m3/s)	122.56	Flow (m3/s)	54.28	34.89	33.39
Top Width (m)	167.01	Top Width (m)	92.51	4.63	69.87
Vel Total (m/s)	0.50	Avg. Vel. (m/s)	0.40	1.32	0.39
Max Chl Dpth (m)	5.98	Hydr. Depth (m)	1.46	5.71	1.22
Conv. Total (m3/s)	7825.2	Conv. (m3/s)	3465.7	2227.8	2131.7
Length Wtd. (m)	30.00	Wetted Per. (m)	93.05	5.22	71.97
Min Ch El (m)	195.07	Shear (N/m2)	3.49	12.19	2.84
Alpha	2.47	Stream Power (N/m s)	1.40	16.10	1.12
Frctn Loss (m)		Cum Volume (1000 m3)	158.21	155.69	189.26
C & E Loss (m)		Cum SA (1000 m2)	91.01	22.99	114.37

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1615

INPUT
Description: Hum 13-KK. Paradise Convention Centre Culvert - 3.23 m W x 2.1 m H x 20 m L Corrugated Metal Pipe Arch Culvert. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 20
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 126

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.017		9.94	201		10.9	201	
11.2	200.998		11.24	200.998		11.49	200.997	
11.55	200.996		11.63	200.996		11.72	200.995	
11.81	200.995		12.69	200.991		13.63	200.995	
13.69	200.995		13.79	200.995		13.91	200.995	
14.12	200.995		14.43	200.995		15.32	200.994	
16.77	200.993		17.25	200.993		17.58	200.992	
17.88	200.988		18.13	200.991		18.74	201	

19.67	201	20.75	201	22.23	201
22.68	201	23	201	25.78	200.523
29.88	200	30.35	200	30.39	200
30.42	200	30.46	200	30.91	200
31.74	200	31.8	200	31.81	200
32.21	199.978	32.38	199.976	37.76	199.901
45.3	199.796	45.48	199.793	46.6	199.774
47.47	199.76	48.2	199.747	48.73	199.737
52.37	199.712	62.24	199.953	80.06	199.792
80.14	199.784	82.52	199.86	83.52	199.767
86.47	199.141	86.75	199.129	86.83	199.126
86.88	199.126	87.13	199.124	87.38	199.123
92.32	199.013	93.07	199.015	93.82	199.013
94.29	199.014	95.15	199.016	97.02	199.018
99.48	199.024	101.85	199.025	101.94	199.025
102.27	199.026	102.57	199.026	108.65	199.546
109.85	199.579	110.34	199.599	111.74	199.692
113.68	199.827	113.8	199.834	114.21	199.865
114.64	199.898	115.6	200	115.65	200
115.87	200	115.88	200	116.22	200
133.27	200.001	141.62	200.001	151.28	200
152.5	200	152.57	200	152.67	200
153.56	200.001	154.38	200	157.21	200.062
161.12	200.085	198.43	201	198.44	201
198.44	201	198.46	201	198.85	201.004
198.89	201.004	199.24	201.005	201.34	201.009
203.5	201.021	204.2	201.024	204.77	201.027
206.84	201.024	207.23	201.023	207.31	201.023
207.75	201.023	208.37	201.022	211.58	201.02
227.39	201.113	228.72	201.124	234.54	201.088
245.86	201	245.92	201	245.93	201
245.97	201	247.18	201	247.71	201
247.87	201	248.82	201.063	250.46	201.201
257.76	202	258.46	202.763	258.74	203

Upstream Bridge Cross Section Data
Station Elevation Data num= 109

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.192	1.24	201.169	3.79	201.018	4.16	201	4.19	201
4.59	201	4.76	201	7.68	200.999	11.04	200.998	13.8	200.998
16.96	200.999	17.05	200.985	18.41	200.657	20.17	200.244	20.23	200.243
23.96	200	24.33	200	24.56	200	24.59	200	24.88	200
26.07	200.001	26.81	200.001	26.89	200.001	27.42	200.001	28.48	200.001
30.58	200.002	32.04	200.002	32.36	200.002	32.54	200.002	32.61	200.002
32.89	200.003	34.51	199.895	34.73	199.893	44.5	199.802	46.83	199.776
54.07	199.447	58.78	199.43	64.92	199.322	69.2	199.246	76.37	199.103
81.58	199.008	81.84	199	87.1	198.433	90.24	198	91.32	197.577
93.35	197	93.64	196.919	94.7	196.457	95.67	196.041	95.77	196
95.88	195.96	97	195.074	98.92	195.074	100.12	195.765	100.4	196
101.1	196.258	101.63	196.43	103.42	197	104.06	197.319	105.45	198
106.48	198.488	107.42	199	110.59	199.341	122.09	199.985	122.25	199.995
122.4	200	122.41	200	122.46	200	122.47	200	122.58	200
123.04	200	129.01	200	130.19	200	140.85	200	144.86	200
145.37	200	145.55	200	145.59	200	148.08	200	150.4	200
151.72	200.029	154.44	200.045	164.08	200.101	179.01	200.467	180.22	200.507
181.74	200.559	183.87	200.633	184.02	200.638	184.28	200.645	187.85	200.734
192.91	200.868	197.74	201	200.12	201.06	203.17	201.141	203.19	201.141
203.79	201.145	209.64	201.071	209.78	201.07	219.82	201.072	226.92	201.085
234.49	201.039	242.9	201.219	248.47	201.125	248.56	201.126	248.94	201.13
253.08	201.56	254.15	201.702	256.45	201.992	256.6	202		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val

0	.05	95.77	.035	100.4	.05

Bank Sta: Left Right Coeff Contr. Expan.

95.77	100.4	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	96	198.8	F
100	256.6	198.8	F

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
154.44	183.87	204	209.64	248.47	204

Downstream Deck/Roadway Coordinates

num= 126

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.017		9.94	201		10.9	201	
11.2	200.998		11.24	200.998		11.49	200.997	
11.55	200.996		11.63	200.996		11.72	200.995	
11.81	200.995		12.69	200.991		13.63	200.995	
13.69	200.995		13.79	200.995		13.91	200.995	
14.12	200.995		14.43	200.995		15.32	200.994	
16.77	200.993		17.25	200.993		17.58	200.992	
17.88	200.988		18.13	200.991		18.74	201	
19.67	201		20.75	201		22.23	201	
22.68	201		23	201		25.78	200.523	
29.88	200		30.35	200		30.39	200	
30.42	200		30.46	200		30.91	200	
31.74	200		31.8	200		31.81	200	
32.21	199.978		32.38	199.976		37.76	199.901	
45.3	199.796		45.48	199.793		46.6	199.774	
47.47	199.76		48.2	199.747		48.73	199.737	
52.37	199.712		62.24	199.953		80.06	199.792	
80.14	199.784		82.52	199.86		83.52	199.767	
86.47	199.141		86.75	199.129		86.83	199.126	
86.88	199.126		87.13	199.124		87.38	199.123	
92.32	199.013		93.07	199.015		93.82	199.013	
94.29	199.014		95.15	199.016		97.02	199.018	
99.48	199.024		101.85	199.025		101.94	199.025	
102.27	199.026		102.57	199.026		108.65	199.546	
109.85	199.579		110.34	199.599		111.74	199.692	
113.68	199.827		113.8	199.834		114.21	199.865	
114.64	199.898		115.6	200		115.65	200	
115.87	200		115.88	200		116.22	200	
133.27	200.001		141.62	200.001		151.28	200	
152.5	200		152.57	200		152.67	200	
153.56	200.001		154.38	200		157.21	200.062	
161.12	200.085		198.43	201		198.44	201	
198.44	201		198.46	201		198.85	201.004	
198.89	201.004		199.24	201.005		201.34	201.009	
203.5	201.021		204.2	201.024		204.77	201.027	
206.84	201.024		207.23	201.023		207.31	201.023	
207.75	201.023		208.37	201.022		211.58	201.02	
227.39	201.113		228.72	201.124		234.54	201.088	
245.86	201		245.92	201		245.93	201	
245.97	201		247.18	201		247.71	201	
247.87	201		248.82	201.063		250.46	201.201	
257.76	202		258.46	202.763		258.74	203	

Downstream Bridge Cross Section Data

Station Elevation Data num= 97

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.234	6.98	201.333	9.75	201.336	9.77	201.336	17.8	201.001
17.86	201.001	18.1	201.001	19.36	201.001	20.8	201.001	25.37	201

```
   25.69     201   26.12     201    29.2     201   35.72 200.103   36.41     200
   36.94  199.99   50.43 199.898   66.47 200.295   73.43 200.347   83.13 199.309
   84.14     199   88.09  198.41   90.41     198   91.93 197.362   92.38 197.153
   92.68     197    92.7 196.996   92.92 196.907   94.09 196.435   94.82 196.155
   94.98 196.097   95.34     196   95.45 195.993    95.5 195.993   95.57  195.99
    95.6  195.99   95.68 195.987   95.95 195.983   96.08 195.977   96.09 195.977
    96.4   195.5    97.3 195.055   98.25 195.055   98.61 195.055   99.49   195.4
  100.35     196  100.36 196.016  100.39 196.018   100.4 196.019  101.12 196.161
  101.26 196.181   101.4 196.224  101.65 196.305  102.38 196.618   102.6 196.702
  103.35     197  103.53 197.076  104.33   197.5  105.15     198   105.7 198.366
  106.74     199  112.96 199.847  113.59 200.124  114.14     200  115.59     200
  121.06     200  128.26 200.001  134.61 200.001  134.71 200.001  134.82 200.001
  140.07 200.001  142.39 200.001  148.34 200.001  158.18 200.001   158.9 200.001
  160.19     200  160.29     200  163.09 200.057  163.77 200.072  188.65 200.623
  188.78 200.626   191.1 200.678  193.84 200.742  203.22 200.935  204.53 200.978
  204.69  200.98  205.35     201  205.36     201  205.87     201  205.94     201
  205.95     201  210.51 200.999  213.45     201  228.33 201.138  239.76 201.423
  255.77 201.644  259.74     202

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   95.34    .035  100.35     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
         95.34  100.35            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0      96   198.8       F
     100  259.74   198.8       F
Left Levee      Station=   73.43      Elevation=  200.35
Blocked Obstructions     num=       2
   Sta L   Sta R    Elev   Sta L   Sta R    Elev
  112.96  193.84     204  213.45  255.77     204

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        =     199
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     Pipe Arch     2.1    3.23
FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                 5      20     .024     .024        0                    .9
      1
Upstream   Elevation =  195.074
           Centerline Station =  98
Downstream Elevation =  195.055
           Centerline Station =  98

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       3.51    Culv Full Len (m)        20.00
  # Barrels                    1    Culv Vel US (m/s)         0.67
  Q Barrel (m3/s)           3.51    Culv Vel DS (m/s)         0.67
```

E.G. US. (m)	199.80	Culv Inv El Up (m)	195.07
W.S. US. (m)	199.79	Culv Inv El Dn (m)	195.05
E.G. DS (m)	199.76	Culv Frctn Ls (m)	0.01
W.S. DS (m)	199.75	Culv Exit Loss (m)	0.01
Delta EG (m)	0.04	Culv Entr Loss (m)	0.02
Delta WS (m)	0.04	Q Weir (m3/s)	17.08
E.G. IC (m)	198.77	Weir Sta Lft (m)	45.02
E.G. OC (m)	199.80	Weir Sta Rgt (m)	113.29
Culvert Control	Outlet	Weir Submerg	0.91
Culv WS Inlet (m)	197.17	Weir Max Depth (m)	0.79
Culv WS Outlet (m)	197.16	Weir Avg Depth (m)	0.41
Culv Nml Depth (m)		Weir Flow Area (m2)	17.62
Culv Crt Depth (m)	0.59	Min El Weir Flow (m)	199.02

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	1.98	Culv Full Len (m)	20.00
# Barrels	1	Culv Vel US (m/s)	0.38
Q Barrel (m3/s)	1.98	Culv Vel DS (m/s)	0.38
E.G. US. (m)	201.08	Culv Inv El Up (m)	195.07
W.S. US. (m)	201.05	Culv Inv El Dn (m)	195.05
E.G. DS (m)	201.07	Culv Frctn Ls (m)	0.00
W.S. DS (m)	200.99	Culv Exit Loss (m)	0.00
Delta EG (m)	0.01	Culv Entr Loss (m)	0.01
Delta WS (m)	0.06	Q Weir (m3/s)	118.27
E.G. IC (m)	201.07	Weir Sta Lft (m)	2.73
E.G. OC (m)	201.08	Weir Sta Rgt (m)	209.64
Culvert Control	Outlet	Weir Submerg	0.98
Culv WS Inlet (m)	197.17	Weir Max Depth (m)	2.07
Culv WS Outlet (m)	197.16	Weir Avg Depth (m)	1.03
Culv Nml Depth (m)		Weir Flow Area (m2)	175.13
Culv Crt Depth (m)	0.43	Min El Weir Flow (m)	199.02

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.161

INPUT
Description: Section 46.161 - Private Roadway - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 97

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.234	6.98	201.333	9.75	201.336	9.77	201.336	17.8	201.001
17.86	201.001	18.1	201.001	19.36	201.001	20.8	201.001	25.37	201
25.69	201	26.12	201	29.2	201	35.72	200.103	36.41	200
36.94	199.99	50.43	199.898	66.47	200.295	73.43	200.347	83.13	199.309
84.14	199	88.09	198.41	90.41	198	91.93	197.362	92.38	197.153
92.68	197	92.7	196.996	92.92	196.907	94.09	196.435	94.82	196.155
94.98	196.097	95.34	196	95.45	195.993	95.5	195.993	95.57	195.99
95.6	195.99	95.68	195.987	95.95	195.983	96.08	195.977	96.09	195.977

```
    96.4   195.5    97.3 195.055   98.25 195.055   98.61 195.055   99.49   195.4
  100.35     196  100.36 196.016  100.39 196.018   100.4 196.019  101.12 196.161
  101.26 196.181   101.4 196.224  101.65 196.305  102.38 196.618   102.6 196.702
  103.35     197  103.53 197.076  104.33   197.5  105.15     198   105.7 198.366
  106.74     199  112.96 199.847  113.59 200.124  114.14     200  115.59     200
  121.06     200  128.26 200.001  134.61 200.001  134.71 200.001  134.82 200.001
  140.07 200.001  142.39 200.001  148.34 200.001  158.18 200.001   158.9 200.001
  160.19     200  160.29     200  163.09 200.057  163.77 200.072  188.65 200.623
  188.78 200.626   191.1 200.678  193.84 200.742  203.22 200.935  204.53 200.978
  204.69  200.98  205.35     201  205.36     201  205.87     201  205.94     201
  205.95     201  210.51 200.999  213.45     201  228.33 201.138  239.76 201.423
  255.77 201.644  259.74     202

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   95.34    .035  100.35     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         95.34  100.35              115     115     110             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0      96   198.8       F
     100  259.74   198.8       F
Left Levee      Station=   73.43      Elevation=  200.35
Blocked Obstructions     num=       2
   Sta L   Sta R    Elev   Sta L   Sta R    Elev
  112.96  193.84     204  213.45  255.77     204

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           199.76    Element                 Left OB    Channel
Right OB
  Vel Head (m)              0.01    Wt. n-Val.               0.050      0.035
0.050
  W.S. Elev (m)           199.75    Reach Len. (m)          115.00     115.00
110.00
  Crit W.S. (m)           196.68    Flow Area (m2)           22.94      21.69
18.04
  E.G. Slope (m/m)      0.000066    Area (m2)                22.94      21.69
18.04
  Q Total (m3/s)            20.59   Flow (m3/s)               4.56      12.33
3.70
  Top Width (m)             33.18   Top Width (m)            16.30       5.01
11.87
  Vel Total (m/s)           0.33    Avg. Vel. (m/s)           0.20       0.57
0.21
  Max Chl Dpth (m)          4.69    Hydr. Depth (m)           1.41       4.33
1.52
  Conv. Total (m3/s)      2543.9    Conv. (m3/s)             563.8     1523.0
457.0
  Length Wtd. (m)         114.24    Wetted Per. (m)          16.84       5.63
12.65
  Min Ch El (m)           195.05    Shear (N/m2)              0.87       2.48
0.92
  Alpha                     1.94    Stream Power (N/m s)      0.17       1.41
0.19
  Frctn Loss (m)            0.01    Cum Volume (1000 m3)     37.44      63.00
32.41
  C & E Loss (m)            0.00    Cum SA (1000 m2)         37.91      22.85
42.37
```

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.07	Element	Left OB	Channel	Right OB
Vel Head (m)	0.08	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	200.99	Reach Len. (m)	115.00	115.00	110.00
Crit W.S. (m)	198.80	Flow Area (m2)	85.42	27.90	35.07
E.G. Slope (m/m)	0.000494	Area (m2)	85.42	27.90	35.07
Q Total (m3/s)	122.56	Flow (m3/s)	44.76	51.49	26.31
Top Width (m)	94.74	Top Width (m)	66.04	5.01	23.68
Vel Total (m/s)	0.83	Avg. Vel. (m/s)	0.52	1.85	0.75
Max Chl Dpth (m)	5.93	Hydr. Depth (m)	1.29	5.57	1.48
Conv. Total (m3/s)	5517.0	Conv. (m3/s)	2014.8	2317.8	1184.4
Length Wtd. (m)	113.39	Wetted Per. (m)	66.70	5.63	25.86
Min Ch El (m)	195.05	Shear (N/m2)	6.20	24.00	6.56
Alpha	2.42	Stream Power (N/m s)	3.25	44.28	4.92
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	158.21	149.95	189.26
C & E Loss (m)	0.03	Cum SA (1000 m2)	88.64	22.85	112.97

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.15

INPUT
Description: Section 46.15 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 127

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.186	1.5	202.211	3.88	202.172	12.6	202	18.62	201.651
19.7	201.593	24.97	201.562	31.47	201.499	34.76	201.41	37.06	201.349
38.71	201.307	40.01	201.275	46.43	201.234	53.66	201.182	63.04	201.024
64.83	201	71.77	201	81.8	201.001	98.39	201	98.42	201
98.43	201	98.62	201	99	201	99.33	201	102.54	201
105.72	201	107.82	201	116.56	201	116.8	201	116.89	201
117.43	201	120.19	201	129	201.384	129.41	201.366	129.47	201.361
130.32	201.338	132.46	201.25	145.66	201.39	149.94	201.365	150.29	201.371

```
  150.32 201.371  150.34  201.37   165.5 201.241  174.71 201.093  174.73 201.093
  178.62 201.002  178.71     201  179.11 200.997  180.09 200.997  180.29 200.997
  182.91 200.994  183.59 200.992  187.46  200.99  189.73 200.989  193.41 200.986
  196.61 200.981  201.38 200.993  202.28 200.998   202.8     201  202.82 201.001
   204.7 201.012  204.87 201.012  207.02     201  215.88 200.597  217.98 200.503
   229.1     200  239.57     200  240.14     200  240.35     200  240.69     200
  241.46 200.001  244.02 200.003  244.52 200.003  247.88     200  252.68 199.697
  253.79 199.631  254.22 199.606  254.25 199.604  254.45 199.589  254.57 199.581
  254.58  199.58  257.09 199.519  293.77     199  311.44 198.052  312.46     198
  313.91 197.526  315.84     197  316.71 196.647  317.76     196  318.28 195.859
  320.41 195.022  323.03  195.56  324.63     196   325.3 196.405  326.37     197
  327.54 197.629   328.2     198  330.14 198.631  330.95     199  332.88 199.124
  334.89 199.177  336.12 199.217  343.97   199.5  348.81 199.629  349.11 199.635
  350.43 199.664  351.55 199.685  352.86 199.711  358.34 199.849  358.57 199.852
  363.52  199.98  371.23 199.957  379.73  199.99  380.54 199.992  381.05 199.993
  381.68 199.994  381.77 199.994  381.97 199.994  381.98 199.994  382.55 199.994
  383.23 199.994  383.28 199.994  383.63 199.994  388.93  199.98  393.62 199.989
  395.11 199.992  396.07 199.992

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05  293.77     .08  317.76    .035  324.63     .08  330.95    .025

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        317.76  324.63               50      50      50             .1       .3
Left Levee      Station=  145.66      Elevation=  201.39
Blocked Obstructions     num=       2
   Sta L   Sta R    Elev   Sta L   Sta R    Elev
   38.64   61.59     204  257.09  293.77     204

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           199.75    Element                Left OB    Channel
Right OB
  Vel Head (m)              0.01    Wt. n-Val.              0.080      0.035
0.061
  W.S. Elev (m)           199.74    Reach Len. (m)          50.00      50.00
50.00
  Crit W.S. (m)           196.48    Flow Area (m2)          37.70      29.14
20.59
  E.G. Slope (m/m)      0.000044    Area (m2)               37.70      29.14
20.59
  Q Total (m3/s)            20.59   Flow (m3/s)              3.98      14.03
2.58
  Top Width (m)             65.42   Top Width (m)           29.11       6.87
29.44
  Vel Total (m/s)           0.24    Avg. Vel. (m/s)          0.11       0.48
0.13
  Max Chl Dpth (m)          4.72    Hydr. Depth (m)          1.30       4.24
0.70
  Conv. Total (m3/s)      3113.9    Conv. (m3/s)            602.0     2122.3
389.5
  Length Wtd. (m)           50.00   Wetted Per. (m)         30.50       7.16
30.16
  Min Ch El (m)           195.02    Shear (N/m2)             0.53       1.74
0.29
  Alpha                     2.92    Stream Power (N/m s)     0.06       0.84
0.04
  Frctn Loss (m)            0.00    Cum Volume (1000 m3)    33.96      60.08
30.28
  C & E Loss (m)            0.00    Cum SA (1000 m2)        35.30      22.16
40.10
```

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.01	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.071	0.035	0.032
W.S. Elev (m)	200.99	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	198.74	Flow Area (m2)	107.71	37.69	100.58
E.G. Slope (m/m)	0.000161	Area (m2)	107.71	37.69	100.58
Q Total (m3/s)	122.56	Flow (m3/s)	28.62	41.35	52.59
Top Width (m)	156.70	Top Width (m)	78.39	6.87	71.44
Vel Total (m/s)	0.50	Avg. Vel. (m/s)	0.27	1.10	0.52
Max Chl Dpth (m)	5.96	Hydr. Depth (m)	1.37	5.49	1.41
Conv. Total (m3/s)	9655.4	Conv. (m3/s)	2254.7	3257.8	4142.8
Length Wtd. (m)	50.00	Wetted Per. (m)	82.30	7.16	73.15
Min Ch El (m)	195.02	Shear (N/m2)	2.07	8.32	2.17
Alpha	2.18	Stream Power (N/m s)	0.55	9.12	1.14
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	147.10	146.18	181.80
C & E Loss (m)	0.01	Cum SA (1000 m2)	80.33	22.16	107.73

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.142

INPUT
Description: Section 46.142 - Private Roadway - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 54

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

```
       0 201.236   12.59     201      21 200.671   22.43 200.623   37.81     200
   39.38     200   40.23     200   42.31 200.027   44.55 200.047   44.93 200.051
   45.27 200.048   49.43     200   56.95 199.696   56.96 199.695   56.98 199.695
   85.47 199.453   94.46     199   96.11 198.897  108.79     198  110.82 197.095
  111.08     197  111.27 196.916  113.02     196  115.02  195.28  116.06     195
  116.72  194.83  117.13  194.83  117.19  194.83  117.27  194.83   118.2     195
  120.05   195.7  120.42 195.827     121     196  123.66 196.903  123.94     197
  124.59 197.177  124.93 197.245  126.67     198  128.21 198.693  128.78     199
  131.04 199.231  132.73   199.5  140.22 199.865  142.99     200  146.99 200.195
  153.53   200.5  153.55   200.5  156.96 200.577  157.48 200.588  173.76 200.995
  173.97     201  179.85 201.266  181.95 201.351  185.83   201.5

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   94.46     .08  113.02    .035     121     .08  142.99    .025

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        113.02     121               60      60      60             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0  115.11   199.5       F
  119.14  185.83   199.5       F
Left Levee      Station=   44.93      Elevation= 200.051
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
   56.98   96.11     204

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           199.75    Element                Left OB    Channel
Right OB
  Vel Head (m)              0.01    Wt. n-Val.              0.080      0.035
0.080
  W.S. Elev (m)           199.74    Reach Len. (m)          60.00      60.00
60.00
  Crit W.S. (m)           196.40    Flow Area (m2)          27.82      35.17
21.08
  E.G. Slope (m/m)      0.000037    Area (m2)               27.82      35.17
21.08
  Q Total (m3/s)            20.59   Flow (m3/s)              2.80      15.95
1.83
  Top Width (m)             42.64   Top Width (m)           18.02       7.98
16.65
  Vel Total (m/s)           0.24    Avg. Vel. (m/s)          0.10       0.45
0.09
  Max Chl Dpth (m)          4.91    Hydr. Depth (m)          1.54       4.41
1.27
  Conv. Total (m3/s)      3380.5    Conv. (m3/s)            460.2     2619.3
301.0
  Length Wtd. (m)           60.00   Wetted Per. (m)         19.39       8.35
17.26
  Min Ch El (m)           194.83    Shear (N/m2)             0.52       1.53
0.44
  Alpha                     2.69    Stream Power (N/m s)     0.05       0.69
0.04
  Frctn Loss (m)                    Cum Volume (1000 m3)    32.32      58.47
29.24
  C & E Loss (m)                    Cum SA (1000 m2)        34.12      21.79
38.95
```

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.00	Element	Left OB	Channel	Right OB
Vel Head (m)	0.08	Wt. n-Val.	0.071	0.035	0.069
W.S. Elev (m)	200.91	Reach Len. (m)	60.00	60.00	60.00
Crit W.S. (m)	199.50	Flow Area (m2)	76.41	44.53	56.71
E.G. Slope (m/m)	0.000350	Area (m2)	76.41	44.53	56.71
Q Total (m3/s)	122.56	Flow (m3/s)	28.44	72.59	21.53
Top Width (m)	116.53	Top Width (m)	59.07	7.98	49.48
Vel Total (m/s)	0.69	Avg. Vel. (m/s)	0.37	1.63	0.38
Max Chl Dpth (m)	6.08	Hydr. Depth (m)	1.29	5.58	1.15
Conv. Total (m3/s)	6554.2	Conv. (m3/s)	1521.0	3881.9	1151.2
Length Wtd. (m)	60.00	Wetted Per. (m)	62.81	8.35	50.12
Min Ch El (m)	194.83	Shear (N/m2)	4.17	18.28	3.88
Alpha	3.43	Stream Power (N/m s)	1.55	29.80	1.47
Frctn Loss (m)		Cum Volume (1000 m3)	142.50	144.12	177.87
C & E Loss (m)		Cum SA (1000 m2)	76.89	21.79	104.71

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1415

INPUT
Description: Hum 13-JJ. Private Driveway Culvert - 3.23 m W x 2.1 m H x 52 m L Corrugated Metal Pipe Arch Culvert. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004
by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 52
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 76

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.501		9.03	201.276		10.69	201.235	

```
   11.93 201.205          15.26 201.124          15.65 201.116
   17.33 201.085           18.3 201.067          21.82     201
   22.59 200.991          22.61 200.991          24.72 200.975
   26.52 200.961          27.55 200.966          33.24 200.845
   34.76 200.824          37.08 200.776          39.72 200.726
   44.95 200.557           45.1 200.554          54.53  200.18
   61.95     200          72.68 199.814          72.97 199.813
   73.26 199.813          73.34 199.813          76.99 199.789
   82.12 199.738          84.44 199.737          86.82 199.742
   87.45 199.733          88.14 199.722          88.29  199.72
   94.48 199.736          95.23 199.732          95.99 199.728
   96.52 199.728          97.04 199.728          97.15 199.728
   97.87 199.727          98.58 199.727         100.35 199.739
     106 199.685         107.51 199.675         109.42 199.671
  109.55  199.67         110.18 199.672         116.42 199.732
  116.58 199.736         116.81 199.741         117.04 199.746
  117.21  199.75         120.07  199.82         125.43 199.969
  126.11 199.987          126.2 199.988         126.71     200
  126.77 200.001         127.26 200.002         127.65 200.002
  133.77 200.118         138.89 200.206         139.11 200.209
  140.01 200.216         140.99 200.224         148.28 200.355
   148.4 200.357         153.83 200.495         154.42 200.496
  154.61 200.497         155.83   200.5         162.15 200.643
  176.54     201         177.09 201.017         191.23   201.5
  191.27   201.5

Upstream Bridge Cross Section Data
Station Elevation Data    num=      54
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 201.236   12.59     201      21 200.671   22.43 200.623   37.81     200
   39.38     200   40.23     200   42.31 200.027   44.55 200.047   44.93 200.051
   45.27 200.048   49.43     200   56.95 199.696   56.96 199.695   56.98 199.695
   85.47 199.453   94.46     199   96.11 198.897  108.79     198  110.82 197.095
  111.08     197  111.27 196.916  113.02     196  115.02  195.28  116.06     195
  116.72  194.83  117.13  194.83  117.19  194.83  117.27  194.83   118.2     195
  120.05   195.7  120.42 195.827     121     196  123.66 196.903  123.94     197
  124.59 197.177  124.93 197.245  126.67     198  128.21 198.693  128.78     199
  131.04 199.231  132.73   199.5  140.22 199.865  142.99     200  146.99 200.195
  153.53   200.5  153.55   200.5  156.96 200.577  157.48 200.588  173.76 200.995
  173.97     201  179.85 201.266  181.95 201.351  185.83   201.5

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   94.46     .08  113.02    .035     121     .08  142.99    .025

Bank Sta: Left   Right    Coeff Contr.   Expan.
        113.02     121            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0  115.11   199.5       F
  119.14  185.83   199.5       F
Left Levee      Station=   44.93      Elevation= 200.051
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
   56.98   96.11     204

Downstream  Deck/Roadway Coordinates
    num=      76
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0 201.501            9.03 201.276          10.69 201.235
   11.93 201.205          15.26 201.124          15.65 201.116
   17.33 201.085           18.3 201.067          21.82     201
   22.59 200.991          22.61 200.991          24.72 200.975
```

26.52	200.961	27.55	200.966	33.24	200.845
34.76	200.824	37.08	200.776	39.72	200.726
44.95	200.557	45.1	200.554	54.53	200.18
61.95	200	72.68	199.814	72.97	199.813
73.26	199.813	73.34	199.813	76.99	199.789
82.12	199.738	84.44	199.737	86.82	199.742
87.45	199.733	88.14	199.722	88.29	199.72
94.48	199.736	95.23	199.732	95.99	199.728
96.52	199.728	97.04	199.728	97.15	199.728
97.87	199.727	98.58	199.727	100.35	199.739
106	199.685	107.51	199.675	109.42	199.671
109.55	199.67	110.18	199.672	116.42	199.732
116.58	199.736	116.81	199.741	117.04	199.746
117.21	199.75	120.07	199.82	125.43	199.969
126.11	199.987	126.2	199.988	126.71	200
126.77	200.001	127.26	200.002	127.65	200.002
133.77	200.118	138.89	200.206	139.11	200.209
140.01	200.216	140.99	200.224	148.28	200.355
148.4	200.357	153.83	200.495	154.42	200.496
154.61	200.497	155.83	200.5	162.15	200.643
176.54	201	177.09	201.017	191.23	201.5
191.27	201.5				

Downstream Bridge Cross Section Data
Station Elevation Data num= 102

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.964	2.43	201.92	2.94	201.91	3.53	201.894	4.38	201.869
5.84	201.802	10.38	201.593	13.97	201.399	14.53	201.37	16.68	201.262
16.97	201.25	18.86	201.161	21.88	201.012	22.13	201.011	23.05	201.004
26.53	201	27.47	200.995	28.29	200.997	28.76	200.997	28.82	200.997
29.15	200.996	33.62	200.993	33.7	200.993	37.58	200.533	37.75	200.516
37.79	200.514	38.56	200.515	42.31	200.545	48.93	200.615	49.07	200.618
50.33	200.646	50.39	200.649	61.33	200.328	70.12	200.012	72.92	200.006
73.26	200.005	73.27	200.005	73.46	200.005	73.47	200.004	78.8	200.01
78.81	200.01	80.68	200	84.14	199.945	85.98	199.929	88.28	199.936
92.02	199.995	93.24	199.991	94.47	199.996	95.37	200	97.6	200.002
98.34	200.002	99.45	200.003	100.7	200.002	101.57	200.001	102.44	200
103.62	199.631	105.8	199	106.7	198.73	108.53	198.229	108.84	198.134
109.24	198	109.55	197.899	109.76	197.822	111.11	197	111.52	196.37
111.75	196	111.95	195.708	112.46	195	117.89	194.823	120.59	194.823
122.27	194.884	125.1	195	126.97	195.253	128.35	195.435	132.42	195.983
132.63	195.986	132.82	196	134.16	196.531	134.6	196.682	135.45	197
135.58	197.071	137.13	198	137.6	198.204	137.71	198.254	139.23	199
140.32	199.45	141.61	200	146.06	200.194	161.96	200.967	165.01	200.972
168.03	200.99	169.39	200.999	169.49	201	169.5	201.001	169.55	201.001
170.18	201.005	170.26	201.005	170.49	201.006	172.16	201.006	179.97	201.133
180.44	201.14	194	201.345						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	105.8	.08	112.46	.035	125.1	.08	139.23	.025

Bank Sta: Left Right Coeff Contr. Expan.
112.46 125.1 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116.68	197	F
120.7	194	197	F

Left Levee Station= 50.33 Elevation= 200.65

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	Pipe Arch	2.1	3.23

FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	5	52	.024	.024	0	.9	1

Upstream Elevation = 194.88
Centerline Station = 117.13
Downstream Elevation = 194.82
Centerline Station = 118.7

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	20.31	Culv Full Len (m)	52.00
# Barrels	1	Culv Vel US (m/s)	3.87
Q Barrel (m3/s)	20.31	Culv Vel DS (m/s)	3.87
E.G. US. (m)	199.75	Culv Inv El Up (m)	194.88
W.S. US. (m)	199.74	Culv Inv El Dn (m)	194.82
E.G. DS (m)	197.45	Culv Frctn Ls (m)	0.87
W.S. DS (m)	197.43	Culv Exit Loss (m)	0.75
Delta EG (m)	2.30	Culv Entr Loss (m)	0.69
Delta WS (m)	2.31	Q Weir (m3/s)	0.28
E.G. IC (m)	198.58	Weir Sta Lft (m)	96.11
E.G. OC (m)	199.75	Weir Sta Rgt (m)	117.14
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	196.98	Weir Max Depth (m)	0.08
Culv WS Outlet (m)	196.92	Weir Avg Depth (m)	0.04
Culv Nml Depth (m)		Weir Flow Area (m2)	0.88
Culv Crt Depth (m)	1.65	Min El Weir Flow (m)	199.67

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	19.10	Culv Full Len (m)	52.00
# Barrels	1	Culv Vel US (m/s)	3.64
Q Barrel (m3/s)	19.10	Culv Vel DS (m/s)	3.64
E.G. US. (m)	200.99	Culv Inv El Up (m)	194.88
W.S. US. (m)	200.91	Culv Inv El Dn (m)	194.82
E.G. DS (m)	199.10	Culv Frctn Ls (m)	0.77
W.S. DS (m)	198.95	Culv Exit Loss (m)	0.52
Delta EG (m)	1.89	Culv Entr Loss (m)	0.61
Delta WS (m)	1.97	Q Weir (m3/s)	103.46
E.G. IC (m)	200.94	Weir Sta Lft (m)	22.23
E.G. OC (m)	200.99	Weir Sta Rgt (m)	173.77
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	196.98	Weir Max Depth (m)	1.33
Culv WS Outlet (m)	196.92	Weir Avg Depth (m)	0.67
Culv Nml Depth (m)		Weir Flow Area (m2)	75.53
Culv Crt Depth (m)	1.57	Min El Weir Flow (m)	199.67

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.141

INPUT
Description: Section 46.141 - Private Roadway - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 102

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.964	2.43	201.92	2.94	201.91	3.53	201.894	4.38	201.869
5.84	201.802	10.38	201.593	13.97	201.399	14.53	201.37	16.68	201.262
16.97	201.25	18.86	201.161	21.88	201.012	22.13	201.011	23.05	201.004
26.53	201	27.47	200.995	28.29	200.997	28.76	200.997	28.82	200.997
29.15	200.996	33.62	200.993	33.7	200.993	37.58	200.533	37.75	200.516
37.79	200.514	38.56	200.515	42.31	200.545	48.93	200.615	49.07	200.618
50.33	200.646	50.39	200.649	61.33	200.328	70.12	200.012	72.92	200.006
73.26	200.005	73.27	200.005	73.46	200.005	73.47	200.004	78.8	200.01
78.81	200.01	80.68	200	84.14	199.945	85.98	199.929	88.28	199.936
92.02	199.995	93.24	199.991	94.47	199.996	95.37	200	97.6	200.002
98.34	200.002	99.45	200.003	100.7	200.002	101.57	200.001	102.44	200
103.62	199.631	105.8	199	106.7	198.73	108.53	198.229	108.84	198.134
109.24	198	109.55	197.899	109.76	197.822	111.11	197	111.52	196.37
111.75	196	111.95	195.708	112.46	195	117.89	194.823	120.59	194.823
122.27	194.884	125.1	195	126.97	195.253	128.35	195.435	132.42	195.983
132.63	195.986	132.82	196	134.16	196.531	134.6	196.682	135.45	197
135.58	197.071	137.13	198	137.6	198.204	137.71	198.254	139.23	199
140.32	199.45	141.61	200	146.06	200.194	161.96	200.967	165.01	200.972
168.03	200.99	169.39	200.999	169.49	201	169.5	201.001	169.55	201.001
170.18	201.005	170.26	201.005	170.49	201.006	172.16	201.006	179.97	201.133
180.44	201.14	194	201.345						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	105.8	.08	112.46	.035	125.1	.08	139.23	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
112.46	125.1	30	25	20	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116.68	197	F
120.7	194	197	F

Left Levee Station= 50.33 Elevation= 200.65

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	197.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	197.43	Reach Len. (m)	30.00	25.00	20.00
Crit W.S. (m)	196.22	Flow Area (m2)	2.13	32.14	17.40
E.G. Slope (m/m)	0.000104	Area (m2)	2.13	32.14	17.40
Q Total (m3/s)	20.59	Flow (m3/s)	0.20	17.45	2.93
Top Width (m)	25.79	Top Width (m)	2.06	12.64	

11.09					
Vel Total (m/s)	0.40	Avg. Vel. (m/s)	0.10	0.54	
0.17					
Max Chl Dpth (m)	2.61	Hydr. Depth (m)	1.03	2.54	
1.57					
Conv. Total (m3/s)	2017.4	Conv. (m3/s)	20.0	1710.0	
287.3					
Length Wtd. (m)	24.73	Wetted Per. (m)	3.25	12.65	
11.46					
Min Ch El (m)	194.82	Shear (N/m2)	0.67	2.60	
1.55					
Alpha	1.60	Stream Power (N/m s)	0.06	1.41	
0.26					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	32.32	57.70	
29.24					
C & E Loss (m)	0.00	Cum SA (1000 m2)	33.52	21.17	
38.11					

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	199.10	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.15	Wt. n-Val.	0.080	0.035	
0.080					
W.S. Elev (m)	198.95	Reach Len. (m)	30.00	25.00	
20.00					
Crit W.S. (m)	197.00	Flow Area (m2)	8.15	51.27	
36.30					
E.G. Slope (m/m)	0.000693	Area (m2)	8.15	51.27	
36.30					
Q Total (m3/s)	122.56	Flow (m3/s)	2.73	98.06	
21.77					
Top Width (m)	33.15	Top Width (m)	6.49	12.64	
14.02					
Vel Total (m/s)	1.28	Avg. Vel. (m/s)	0.33	1.91	
0.60					
Max Chl Dpth (m)	4.12	Hydr. Depth (m)	1.26	4.06	
2.59					
Conv. Total (m3/s)	4654.5	Conv. (m3/s)	103.7	3724.1	
826.7					
Length Wtd. (m)	24.71	Wetted Per. (m)	7.94	12.65	
14.76					
Min Ch El (m)	194.82	Shear (N/m2)	6.98	27.57	
16.72					
Alpha	1.83	Stream Power (N/m s)	2.34	52.73	
10.03					
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	142.50	138.63	
177.87					
C & E Loss (m)	0.03	Cum SA (1000 m2)	74.93	21.17	
102.81					

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.14

INPUT
Description: Section 46.14 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 77

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.098	2.06	202	3.77	201.783	3.8	201.785	6.14	201.803
8.42	201.79	12.49	201.689	12.69	201.684	17.83	201.529	20.79	201.459
33.23	201.049	35.11	201.034	39.84	201.001	39.85	201.001	39.89	201.001
39.92	201.001	39.96	201.001	40.1	201	53.76	200.745	58.1	200.647
58.57	200.638	64.09	200.501	64.12	200.501	64.22	200.5	71.26	200.142
74.41	200	75.87	199.864	77.75	199.81	88.67	199.239	90.92	199.19
94.02	199.106	98.67	199.004	98.73	199.004	98.82	199.004	98.97	199.004
104.41	199	106.38	198.532	109.25	198	111.6	197.01	111.62	197
111.64	196.992	113.27	196.326	114.07	196	114.61	195.85	116.18	195.444
117.28	195	120.38	194.954	124.47	194.898	126.14	194.877	129.68	194.823
133.94	194.919	135.82	194.961	137.74	195	138.12	195.172	139.11	196
139.82	196.864	139.93	197	140.61	197.763	140.81	197.95	140.88	198
141	198.098	142.31	199	145.61	199.973	145.72	200	159.64	200.564
168.75	200.894	180.93	200.961	188.25	200.988	188.75	200.981	190	200.965
190.01	200.965	192.12	200.994	192.14	200.994	192.16	200.994	192.55	201
208.35	201.2341	216.71	201.358						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	104.41	.08	117.28	.035	137.74	.08	142.31	.025

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

117.28	137.74	37.5	37.5	37.5	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
145.61	208.35	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	197.44	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	197.44	Reach Len. (m)	37.50	37.50	37.50
Crit W.S. (m)		Flow Area (m2)	8.58	51.63	3.58
E.G. Slope (m/m)	0.000050	Area (m2)	8.58	51.63	3.58
Q Total (m3/s)	20.59	Flow (m3/s)	0.86	19.41	0.32
Top Width (m)	29.73	Top Width (m)	6.69	20.46	2.58
Vel Total (m/s)	0.32	Avg. Vel. (m/s)	0.10	0.38	0.09
Max Chl Dpth (m)	2.61	Hydr. Depth (m)	1.28	2.52	1.39
Conv. Total (m3/s)	2899.4	Conv. (m3/s)	121.2	2733.6	44.6
Length Wtd. (m)	37.50	Wetted Per. (m)	7.13	20.46	3.58
Min Ch El (m)	194.82	Shear (N/m2)	0.59	1.25	0.49

Alpha	1.28	Stream Power (N/m s)	0.06	0.47	0.04
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	32.16	56.66	29.03
C & E Loss (m)	0.05	Cum SA (1000 m2)	33.39	20.76	37.98

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	199.06	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	198.97	Reach Len. (m)	37.50	37.50	37.50
Crit W.S. (m)		Flow Area (m2)	22.93	83.00	8.88
E.G. Slope (m/m)	0.000346	Area (m2)	22.93	83.00	8.88
Q Total (m3/s)	122.56	Flow (m3/s)	7.63	112.26	2.66
Top Width (m)	37.73	Top Width (m)	12.74	20.46	4.53
Vel Total (m/s)	1.07	Avg. Vel. (m/s)	0.33	1.35	0.30
Max Chl Dpth (m)	4.15	Hydr. Depth (m)	1.80	4.06	1.96
Conv. Total (m3/s)	6585.2	Conv. (m3/s)	410.2	6031.9	143.1
Length Wtd. (m)	37.50	Wetted Per. (m)	13.40	20.46	6.07
Min Ch El (m)	194.82	Shear (N/m2)	5.81	13.78	4.97
Alpha	1.48	Stream Power (N/m s)	1.94	18.64	1.49
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	142.03	136.95	177.42
C & E Loss (m)	0.05	Cum SA (1000 m2)	74.64	20.76	102.62

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: RIVER-1

REACH: Reach-1 RS: 46.132

INPUT
Description: Section 46.132 - Private Driveway - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 158

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203.031	4.21	203	6.29	202.04	6.39	202	6.47	201.973
9.02	201	11.19	200.218	11.79	200	11.95	199.995	12.11	199.991
13.73	199.942	14.44	199.957	15.58	200	22.02	200.459	23.3	200.5
23.73	200.501	23.84	200.501	23.88	200.501	24.1	200.505	27.21	200.56
39.78	200.546	43.86	200.559	45.36	200.616	45.59	200.618	46.09	200.615
60.3	200.512	60.52	200.5	67.58	200.314	71.78	200.282	75.54	200.281
75.73	200.287	78.77	200	79.96	199.843	80.54	199.765	86.79	199
91.14	198.248	92.76	198	92.82	197.999	92.88	197.999	93.81	197.998
94.59	197.998	95.38	197.998	96.45	197.998	97.49	197.997	103.13	197.995
104.78	197.997	105.78	197.996	106.85	197.997	107.61	198	112.33	198.851
112.89	199	113.63	199	115.71	199.001	116.33	199.001	118.64	199
119.62	198.642	121.42	198	123.03	197.538	125.2	197.319	125.59	197.265
126.04	197.198	126.29	197.179	126.45	197.149	126.85	197.083	127.29	197.085
127.33	197.08	127.37	197.076	127.89	197.013	129.85	197.011	129.95	197.01
130.35	197.01	132.11	197.014	132.3	197.012	133.91	197.011	134.07	197.009
134.24	197.009	134.44	197.009	134.47	197.009	135.58	197.018	136.75	197.007
136.96	197.005	136.98	197.005	137.16	197.005	137.18	197.005	138.6	197.011
138.83	197.009	139.36	197.005	139.64	197.003	139.73	197	140.03	196.913
140.21	196.887	140.28	196.867	140.33	196.854	140.58	196.76	141.61	196.467
141.72	196.455	143.1	196	143.4	195.948	145.84	195	146.14	194.87
146.23	194.823	146.44	194.865	147.11	195	147.76	195.231	149.57	196
150.75	196.979	150.78	197	150.81	197.022	151.68	198	152.7	198.573
153.48	199	153.61	199.01	158.04	199.446	163.24	199.854	164.21	199.935
164.49	199.957	164.51	199.958	165.41	199.996	165.46	199.999	165.53	200
165.55	200.004	165.69	200.013	165.92	200.013	166.1	200.023	167.24	200.039
167.72	200.033	168.11	200.078	168.16	200.077	168.21	200.076	168.33	200.077
170.66	200.113	172.93	200.103	175.92	200.024	175.95	200.023	177.95	200.045
177.96	200.044	177.97	200.043	177.97	200.042	188.98	200.112	192.6	200.049
195.25	200	195.28	200	196.41	200	197.16	200	197.45	200
197.5	200	200.28	200	201.07	200	201.93	200	202.05	200
213.45	200.076	216.09	200.093	218.17	200.105	219.59	200.114	220.81	200.121
221.65	200.128	222.07	200.132	227.76	200.187				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	139.73	.08	145.84	.035	147.11	.08	151.68	.05

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
145.84 147.11 27.5 27.5 27.5 .3 .5
Left Levee Station= 118.64 Elevation= 199

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	197.38	Element	Left OB	Channel	Right OB
Vel Head (m)	0.54	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	196.84	Reach Len. (m)	27.50	27.50	27.50
Crit W.S. (m)	196.84	Flow Area (m2)	4.72	2.45	3.76
E.G. Slope (m/m)	0.010373	Area (m2)	4.72	2.45	3.76
Q Total (m3/s)	20.59	Flow (m3/s)	5.25	10.72	4.62

Top Width (m)	10.22	Top Width (m)	5.47	1.27	3.47
Vel Total (m/s)	1.88	Avg. Vel. (m/s)	1.11	4.38	1.23
Max Chl Dpth (m)	2.02	Hydr. Depth (m)	0.86	1.93	1.08
Conv. Total (m3/s)	202.2	Conv. (m3/s)	51.6	105.2	45.4
Length Wtd. (m)	27.50	Wetted Per. (m)	5.78	1.33	3.97
Min Ch El (m)	194.82	Shear (N/m2)	83.04	187.78	96.36
Alpha	3.00	Stream Power (N/m s)	92.33	822.29	118.32
Frctn Loss (m)	0.06	Cum Volume (1000 m3)	31.91	55.64	28.89
C & E Loss (m)	0.24	Cum SA (1000 m2)	33.16	20.35	37.86

Warning: The energy equation could not be 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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.97	Element	Left OB	Channel	Right OB
Vel Head (m)	0.61	Wt. n-Val.	0.061	0.035	0.080
W.S. Elev (m)	198.35	Reach Len. (m)	27.50	27.50	27.50
Crit W.S. (m)	198.35	Flow Area (m2)	36.11	4.37	10.17
E.G. Slope (m/m)	0.009790	Area (m2)	36.11	4.37	10.17
Q Total (m3/s)	122.56	Flow (m3/s)	76.73	27.32	18.52
Top Width (m)	31.87	Top Width (m)	25.40	1.27	5.19
Vel Total (m/s)	2.42	Avg. Vel. (m/s)	2.12	6.26	1.82
Max Chl Dpth (m)	3.53	Hydr. Depth (m)	1.42	3.44	1.96
Conv. Total (m3/s)	1238.7	Conv. (m3/s)	775.5	276.1	

187.1					
Length Wtd. (m)	27.50	Wetted Per. (m)	25.90	1.33	
6.29					
Min Ch El (m)	194.82	Shear (N/m2)	133.89	316.13	
155.28					
Alpha	2.06	Stream Power (N/m s)	284.46	1978.05	
282.66					
Frctn Loss (m)	0.07	Cum Volume (1000 m3)	140.93	135.31	
177.06					
C & E Loss (m)	0.25	Cum SA (1000 m2)	73.92	20.35	
102.44					

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 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: RIVER-1
REACH: Reach-1 RS: 46.13

INPUT
Description: Section 46.13 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 127

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203.03	.53	203	.96	202.775	2.6	202	4.3	201.009
4.31	201	4.46	200.95	7.15	200	9.26	199.922	13.37	199.838
14.21	199.82	16.49	199.886	21.16	199.987	21.18	200	21.39	200.001
21.4	200.001	21.83	200.002	29.6	200.151	34.56	200.228	35.93	200.238
37.21	200.246	37.34	200.247	39.62	200.26	42.15	200.288	44.35	200.296
46.4	200.303	51.59	200.321	52.9	200.324	54.35	200.328	55.76	200.33
57.13	200.323	58.65	200.312	59.48	200.303	60.41	200.293	60.51	200.291
60.64	200.291	60.78	200.29	60.92	200.29	61.05	200.289	62.88	200.27
65.13	200.241	68.92	200.17	71.75	200.101	75.66	200	75.68	200
76.81	199.771	77.55	199.623	80.95	199	83.24	198.448	85.09	198
86.6	197.995	87.61	197.991	98.22	197.954	101.88	197.965	111.06	198
112.99	198.592	115.45	198.783	118.53	198.292	118.71	198.22	118.81	198.215
119.38	198	122.2	197.044	122.33	197	122.49	196.957	126.05	196
126.98	195.7	127.15	195.657	128.79	195.261	129.74	195.021	129.84	195.018
129.93	195.011	129.96	195.01	130.02	195	131.97	194.859	144.15	194
145.77	193.62	148.15	193	148.36	192.929	148.69	192.82	149.6	192.963
149.87	193	150.14	193.206	150.99	194	151.39	194.702	151.52	195
151.69	195.371	152.08	196	152.24	196.027	152.47	196.039	152.56	196.043
152.62	196.045	152.67	196.044	152.68	196.044	152.79	196.042	152.82	196.041

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  152.98 196.035  154.35 196.467  155.01 196.685  155.45  196.85  155.58 196.893
  155.62 196.908  155.76 196.973  155.82     197  155.89 197.042  157.56     198
  161.85 198.688  163.59     199  164.11 199.021  168.85 199.177  171.26 199.182
  173.88 199.243  176.15 199.295  177.78  199.33  179.26 199.361  183.65 199.389
  188.79 199.423  194.86 199.511   194.9 199.511  201.21 199.575  206.07 199.623
  222.21     200  223.15  200.01  223.53  200.01  223.62  200.01  223.66  200.01
  224.17  200.01  236.77 200.272

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05  119.38     .08  148.15    .035  149.87     .08  157.56     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        148.15  149.87               25      25      25             .1       .3
Left Levee      Station=  115.45      Elevation= 198.783
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
     171     229     204

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           195.74    Element                Left OB    Channel
Right OB
  Vel Head (m)              0.06    Wt. n-Val.              0.080      0.035
0.080
  W.S. Elev (m)           195.67    Reach Len. (m)          25.00      25.00
25.00
  Crit W.S. (m)           194.77    Flow Area (m2)          26.30       4.75
3.20
  E.G. Slope (m/m)      0.000918    Area (m2)               26.30       4.75
3.20
  Q Total (m3/s)            20.59   Flow (m3/s)             11.46       7.97
1.17
  Top Width (m)             24.79   Top Width (m)           21.07       1.72
2.01
  Vel Total (m/s)           0.60    Avg. Vel. (m/s)          0.44       1.68
0.36
  Max Chl Dpth (m)          2.85    Hydr. Depth (m)          1.25       2.76
1.59
  Conv. Total (m3/s)       679.6    Conv. (m3/s)            378.2      262.9
38.5
  Length Wtd. (m)           25.00   Wetted Per. (m)         21.31       1.76
3.40
  Min Ch El (m)           192.82    Shear (N/m2)            11.11      24.26
8.48
  Alpha                     3.32    Stream Power (N/m s)     4.84      40.67
3.08
  Frctn Loss (m)            0.03    Cum Volume (1000 m3)    31.48      55.54
28.80
  C & E Loss (m)            0.01    Cum SA (1000 m2)        32.80      20.31
37.79



Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #Regional w red'n


  E.G. Elev (m)           198.50    Element                Left OB    Channel
Right OB
```

Vel Head (m)	0.12	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	198.38	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)	196.37	Flow Area (m2)	95.68	9.40	18.58
E.G. Slope (m/m)	0.001047	Area (m2)	95.68	9.40	18.58
Q Total (m3/s)	122.56	Flow (m3/s)	84.80	26.54	11.23
Top Width (m)	41.93	Top Width (m)	30.16	1.72	10.05
Vel Total (m/s)	0.99	Avg. Vel. (m/s)	0.89	2.82	0.60
Max Chl Dpth (m)	5.56	Hydr. Depth (m)	3.17	5.47	1.85
Conv. Total (m3/s)	3787.8	Conv. (m3/s)	2620.7	820.1	347.0
Length Wtd. (m)	25.00	Wetted Per. (m)	30.81	1.76	12.08
Min Ch El (m)	192.82	Shear (N/m2)	31.89	54.76	15.79
Alpha	2.34	Stream Power (N/m s)	28.26	154.56	9.54
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	139.11	135.12	176.67
C & E Loss (m)	0.00	Cum SA (1000 m2)	73.16	20.31	102.23

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.122

INPUT
Description: Section 46.122 - Peelar Road - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 153

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203.853	.23	203.855	.93	203.865	1.01	203.866	2.78	203.939
3.03	203.939	3.37	203.951	3.73	203.964	5.01	203.946	5.31	203.936
5.61	203.945	6.98	204	8.21	203.442	9.46	203	9.88	202.784
11.44	202	13.15	201.154	13.44	201	14.01	200.722	15.52	200
17.01	199.481	18.02	199	20.35	198.365	21.48	198.229	22.2	198.229
22.48	198.242	22.55	198.253	23.36	198.361	25.19	198.587	26.16	198.662
26.31	198.67	26.95	198.656	27.03	198.655	28	198.645	29.49	198.666
32.66	198.758	32.85	198.766	33.38	198.788	36.68	199	43.6	199.165
43.64	199.166	44.06	199.173	44.1	199.174	45.22	199.23	45.29	199.233
49.48	199.327	54.88	199.38	58.89	199.448	59.82	199.441	62.67	199.521
66.36	199.453	67.01	199.441	68.92	199.378	69.47	199.357	72.61	199.214
73.37	199.196	73.56	199.181	74.94	199	75.77	198.822	76.04	198.77
77.37	198.575	78.16	198.426	78.34	198.376	78.46	198.351	79.57	198
79.94	197.998	80.59	197.996	83.89	197.984	85.16	197.985	85.23	197.984
85.29	197.984	86.24	197.981	86.6	197.98	86.93	197.981	86.99	197.981
92.12	197.978	92.67	197.975	93.8	197.973	96.51	197.968	109.87	197.327
112.55	197.295	123.04	197.978	123.43	197.979	124.91	197.982	126.71	197.996
126.79	197.996	127.47	198	130.8	198	132.4	198	133.05	198

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  133.1     198  133.26     198  134.36     198  135.44     198  135.67     198
 136.01     198  136.06     198  136.92     198  136.94     198   138.2 197.725
 141.43     197  143.11 196.356  143.45 196.246  143.63 196.196  144.35     196
 145.45 195.701  148.42     195   151.6 194.377  153.04     194  154.48 193.345
 154.54 193.311  155.34     193  155.73 192.919  157.65  192.63  159.49 192.987
 159.52     193  159.55 193.013  161.56     194  162.02 194.215  163.58     195
 164.59 195.492  165.53     196  165.88  196.23  167.15     197  169.04 197.525
 170.01     198  170.48 198.005  171.29  198.01  171.61 198.012  176.33 198.211
  181.2 198.381  185.45 198.603  188.51  198.84  190.44 198.995  190.51     199
 192.15 199.001  192.24 199.001  192.28 199.001  192.41 199.001  192.81 199.001
  194.2 199.001  195.83 199.001  195.94 199.001  196.05 199.001  200.13 199.042
 211.06 199.149  222.84 199.423  229.22 199.464  230.38 199.482  231.47 199.497
 235.25 199.523  240.57 199.568  242.89 199.629

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05  155.34    .035  159.52     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        155.34  159.52               38      38      38             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0  155.42   196.7       F
  159.34  242.89   196.7       F
Left Levee      Station=  136.92      Elevation=     198

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           195.70    Element                 Left OB    Channel
Right OB
  Vel Head (m)              0.19    Wt. n-Val.                          0.035

  W.S. Elev (m)           195.50    Reach Len. (m)           38.00      38.00
38.00
  Crit W.S. (m)           194.21    Flow Area (m2)                      10.61

  E.G. Slope (m/m)      0.001248    Area (m2)                 9.67      11.27
6.39
  Q Total (m3/s)            20.59   Flow (m3/s)                         20.59

  Top Width (m)             18.32   Top Width (m)             9.05       4.18
5.09
  Vel Total (m/s)           1.94    Avg. Vel. (m/s)                      1.94

  Max Chl Dpth (m)          2.87    Hydr. Depth (m)                      2.71

  Conv. Total (m3/s)       582.8    Conv. (m3/s)                        582.8

  Length Wtd. (m)           38.00   Wetted Per. (m)                      3.98

  Min Ch El (m)           192.63    Shear (N/m2)                        32.62

  Alpha                     1.00    Stream Power (N/m s)                63.31

  Frctn Loss (m)                    Cum Volume (1000 m3)     31.03      55.34
28.68
  C & E Loss (m)                    Cum SA (1000 m2)         32.42      20.24
37.70


Note:    Multiple critical depths were found at this location.  The critical depth
```

with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.47	Element	Left OB	Channel	Right OB
Vel Head (m)	0.16	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	198.31	Reach Len. (m)	38.00	38.00	38.00
Crit W.S. (m)	196.70	Flow Area (m2)	78.09	23.01	30.08
E.G. Slope (m/m)	0.000790	Area (m2)	78.09	23.01	30.08
Q Total (m3/s)	122.56	Flow (m3/s)	44.00	57.01	21.55
Top Width (m)	102.88	Top Width (m)	78.97	4.18	19.73
Vel Total (m/s)	0.93	Avg. Vel. (m/s)	0.56	2.48	0.72
Max Chl Dpth (m)	5.68	Hydr. Depth (m)	0.99	5.50	1.52
Conv. Total (m3/s)	4359.4	Conv. (m3/s)	1564.9	2027.9	766.6
Length Wtd. (m)	38.00	Wetted Per. (m)	79.79	4.25	20.90
Min Ch El (m)	192.63	Shear (N/m2)	7.59	42.00	11.15
Alpha	3.51	Stream Power (N/m s)	4.27	104.06	7.99
Frctn Loss (m)		Cum Volume (1000 m3)	136.94	134.72	176.06
C & E Loss (m)		Cum SA (1000 m2)	71.80	20.24	101.86

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1215

INPUT
Description: Hum 13-3R. Peelar Road Culvert - 3.72 m W x 2.35 m H x 30 m L Corrugated Metal Pipe Arch Culvert. No drawings available. Size estimated from HEC-2 coding.

HEC-2 to HEC-RAS conversion
January 2004 by Acres included recoding of culvert to HEC-RAS format, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 3
Deck/Roadway Width = 30
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 157
Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord

0	198.649	1.52	198.401	2.47	198
2.8	198	2.85	198	3.5	198
3.74	198	4.59	198	13.86	198
15.45	198	15.74	198	17.17	198
18.02	197.999	19.18	197.875	22.99	197.861
24.53	197.999	28.09	197.999	28.15	197.999
28.28	197.999	28.43	197.999	28.64	197.999
29.19	197.999	31.03	197.999	31.34	197.999
32.15	197.999	32.89	197.999	34.84	197.999
34.92	197.999	37.18	197.998	37.71	197.998
38.66	197.998	41.94	197.997	43.56	197.997
44.75	197.997	45.96	197.997	46.74	197.997
49.78	197.996	50.07	197.995	52.53	197.995
54.64	197.995	55.11	197.995	55.42	197.995
55.76	197.995	57.94	197.995	59.43	197.994
60.73	197.994	61.45	197.993	62	197.993
64.12	197.992	64.22	197.992	64.28	197.992
65.61	197.989	67.27	197.991	68.33	197.991
71.97	197.999	72.26	198	73.27	198.017
76.65	198.059	77.23	198.092	78.18	198.119
80.03	198.063	81.1	198	81.68	197.998
81.8	197.997	82.79	197.994	83.16	197.992
83.96	197.989	86.33	197.985	91.22	197.968
99.31	197.849	99.61	197.847	100.72	197.846
105.6	197.845	107.24	197.851	115.83	197.928
117.78	197.909	118.71	197.903	119.04	197.903
119.4	197.899	121.59	197.885	122.03	197.885
124.28	197.863	124.74	197.388	125.47	197.26
125.59	197.264	125.6	197.264	127.02	197.214
127.16	197.211	127.78	197.201	139.62	197
140.18	196.992	140.89	196.988	141.46	196.989
142	196.987	142.75	196.987	143.84	196.986
143.94	196.986	150.74	196.962	158.29	196.957
158.39	196.957	160.98	196.955	164.67	196.924
165.88	196.912	167.31	196.935	168.65	196.948
168.79	196.948	168.84	196.949	169.49	196.951
170.16	196.951	171.53	196.952	172.2	196.956
172.58	196.955	172.76	196.956	172.87	196.955
172.93	196.955	174	196.962	174.57	196.956
175.1	196.959	175.75	196.962	178.58	196.956
180.14	196.971	182.32	196.983	182.65	196.984
182.82	196.987	183.42	196.997	183.61	197
186.18	197.165	192.25	197.667	192.7	197.681
193.37	197.689	193.89	197.919	194.46	197.92
195.12	197.925	196.24	197.935	198.9	197.945
202.32	197.938	208.58	197.985	210.37	197.994
210.52	198	211.83	198.115	211.87	198.116
222.47	198.877	223.67	198.88	226.51	198.911
228.79	198.924	230.7	198.93	232.45	198.935
237.16	198.966	237.24	198.966	237.7	198.968
238.12	198.971	239.89	198.978	239.96	198.978
240.04	198.979	240.24	198.978	240.47	198.98
240.87	199				

Upstream Bridge Cross Section Data
Station Elevation Data num= 153

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203.853	.23	203.855	.93	203.865	1.01	203.866	2.78	203.939
3.03	203.939	3.37	203.951	3.73	203.964	5.01	203.946	5.31	203.936
5.61	203.945	6.98	204	8.21	203.442	9.46	203	9.88	202.784
11.44	202	13.15	201.154	13.44	201	14.01	200.722	15.52	200
17.01	199.481	18.02	199	20.35	198.365	21.48	198.229	22.2	198.229
22.48	198.242	22.55	198.253	23.36	198.361	25.19	198.587	26.16	198.662

26.31	198.67	26.95	198.656	27.03	198.655	28	198.645	29.49	198.666
32.66	198.758	32.85	198.766	33.38	198.788	36.68	199	43.6	199.165
43.64	199.166	44.06	199.173	44.1	199.174	45.22	199.23	45.29	199.233
49.48	199.327	54.88	199.38	58.89	199.448	59.82	199.441	62.67	199.521
66.36	199.453	67.01	199.441	68.92	199.378	69.47	199.357	72.61	199.214
73.37	199.196	73.56	199.181	74.94	199	75.77	198.822	76.04	198.77
77.37	198.575	78.16	198.426	78.34	198.376	78.46	198.351	79.57	198
79.94	197.998	80.59	197.996	83.89	197.984	85.16	197.985	85.23	197.984
85.29	197.984	86.24	197.981	86.6	197.98	86.93	197.981	86.99	197.981
92.12	197.978	92.67	197.975	93.8	197.973	96.51	197.968	109.87	197.327
112.55	197.295	123.04	197.978	123.43	197.979	124.91	197.982	126.71	197.996
126.79	197.996	127.47	198	130.8	198	132.4	198	133.05	198
133.1	198	133.26	198	134.36	198	135.44	198	135.67	198
136.01	198	136.06	198	136.92	198	136.94	198	138.2	197.725
141.43	197	143.11	196.356	143.45	196.246	143.63	196.196	144.35	196
145.45	195.701	148.42	195	151.6	194.377	153.04	194	154.48	193.345
154.54	193.311	155.34	193	155.73	192.919	157.65	192.63	159.49	192.987
159.52	193	159.55	193.013	161.56	194	162.02	194.215	163.58	195
164.59	195.492	165.53	196	165.88	196.23	167.15	197	169.04	197.525
170.01	198	170.48	198.005	171.29	198.01	171.61	198.012	176.33	198.211
181.2	198.381	185.45	198.603	188.51	198.84	190.44	198.995	190.51	199
192.15	199.001	192.24	199.001	192.28	199.001	192.41	199.001	192.81	199.001
194.2	199.001	195.83	199.001	195.94	199.001	196.05	199.001	200.13	199.042
211.06	199.149	222.84	199.423	229.22	199.464	230.38	199.482	231.47	199.497
235.25	199.523	240.57	199.568	242.89	199.629				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	155.34	.035	159.52	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
155.34	159.52	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	155.42	196.7	F
159.34	242.89	196.7	F

Left Levee Station= 136.92 Elevation= 198

Downstream Deck/Roadway Coordinates

num= 157

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	198.649		1.52	198.401		2.47	198	
2.8	198		2.85	198		3.5	198	
3.74	198		4.59	198		13.86	198	
15.45	198		15.74	198		17.17	198	
18.02	197.999		19.18	197.875		22.99	197.861	
24.53	197.999		28.09	197.999		28.15	197.999	
28.28	197.999		28.43	197.999		28.64	197.999	
29.19	197.999		31.03	197.999		31.34	197.999	
32.15	197.999		32.89	197.999		34.84	197.999	
34.92	197.999		37.18	197.998		37.71	197.998	
38.66	197.998		41.94	197.997		43.56	197.997	
44.75	197.997		45.96	197.997		46.74	197.997	
49.78	197.996		50.07	197.995		52.53	197.995	
54.64	197.995		55.11	197.995		55.42	197.995	
55.76	197.995		57.94	197.995		59.43	197.994	
60.73	197.994		61.45	197.993		62	197.993	
64.12	197.992		64.22	197.992		64.28	197.992	
65.61	197.989		67.27	197.991		68.33	197.991	
71.97	197.999		72.26	198		73.27	198.017	
76.65	198.059		77.23	198.092		78.18	198.119	
80.03	198.063		81.1	198		81.68	197.998	
81.8	197.997		82.79	197.994		83.16	197.992	

83.96	197.989	86.33	197.985	91.22	197.968
99.31	197.849	99.61	197.847	100.72	197.846
105.6	197.845	107.24	197.851	115.83	197.928
117.78	197.909	118.71	197.903	119.04	197.903
119.4	197.899	121.59	197.885	122.03	197.885
124.28	197.863	124.74	197.388	125.47	197.26
125.59	197.264	125.6	197.264	127.02	197.214
127.16	197.211	127.78	197.201	139.62	197
140.18	196.992	140.89	196.988	141.46	196.989
142	196.987	142.75	196.987	143.84	196.986
143.94	196.986	150.74	196.962	158.29	196.957
158.39	196.957	160.98	196.955	164.67	196.924
165.88	196.912	167.31	196.935	168.65	196.948
168.79	196.948	168.84	196.949	169.49	196.951
170.16	196.951	171.53	196.952	172.2	196.956
172.58	196.955	172.76	196.956	172.87	196.955
172.93	196.955	174	196.962	174.57	196.956
175.1	196.959	175.75	196.962	178.58	196.956
180.14	196.971	182.32	196.983	182.65	196.984
182.82	196.987	183.42	196.997	183.61	197
186.18	197.165	192.25	197.667	192.7	197.681
193.37	197.689	193.89	197.919	194.46	197.92
195.12	197.925	196.24	197.935	198.9	197.945
202.32	197.938	208.58	197.985	210.37	197.994
210.52	198	211.83	198.115	211.87	198.116
222.47	198.877	223.67	198.88	226.51	198.911
228.79	198.924	230.7	198.93	232.45	198.935
237.16	198.966	237.24	198.966	237.7	198.968
238.12	198.971	239.89	198.978	239.96	198.978
240.04	198.979	240.24	198.978	240.47	198.98
240.87	199				

Downstream Bridge Cross Section Data

Station Elevation Data num= 193

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.116	.09	201.103	.16	201.086	2.46	201.134	2.97	201
4.37	200.471	4.61	200.366	5.6	200.081	5.84	200	5.96	199.911
5.99	199.908	6.02	199.896	6.07	199.878	6.15	199.835	7.19	199.231
7.68	199	8.13	198.755	8.5	198.631	8.62	198.603	9.26	198.509
9.72	198.47	10.14	198.456	10.23	198.452	10.32	198.448	11.96	198.458
17.93	198.627	18.79	198.683	20.17	198.853	21.45	198.905	21.67	198.908
22.9	198.868	23.49	198.882	23.72	198.871	24.78	198.788	24.93	198.787
28.22	198.487	32.27	198.564	32.41	198.559	32.55	198.553	32.7	198.554
34.55	198.443	36.02	198.405	47.41	198.657	48.15	198.664	48.64	198.668
48.8	198.663	49	198.655	56.83	198.515	56.94	198.515	57.21	198.506
57.47	198.5	59.64	198.564	60.7	198.535	64.04	198.604	69.34	198.85
70.1	198.861	70.3	198.882	70.32	198.882	71.57	199	74.15	199
75.35	199	76.07	199	76.75	199	77.12	199	78.35	199
79.35	199	79.82	199	81.11	199	81.15	199	81.23	199
81.33	199	81.52	199	84.17	199	85.18	199	86.83	199
86.9	199	86.98	199	91.42	199	92.96	199	96.93	199
97.22	199	97.61	199	98.45	199	98.47	199	98.92	199
99.22	199	101.39	199	102.08	199	102.12	199	102.14	199
103.01	199	103.02	199	106.1	198.877	110.03	198.634	110.07	198.631
110.12	198.629	110.16	198.627	112.11	198.13	112.47	198.125	114.53	198.075
115.89	198.061	116.61	198.058	116.85	198.054	117.55	198.032	119.12	198
121.6	197.696	125.61	197.384	130.31	197	130.42	196.977	131.19	196.835
134.73	196.198	135.06	196.126	135.92	196	136.57	195.912	137.53	195.823
137.73	195.805	139.61	195.582	141.72	195.474	142.72	195.431	142.83	195.423
146.3	195	146.85	194.937	146.93	194.922	147.7	194.851	147.91	194.818
150.84	194.094	151.01	194.05	151.08	194.036	151.14	194.027	151.23	194
151.49	193.87	152.54	193.041	152.6	193	152.61	192.999	152.94	192.956
153.08	192.961	153.39	192.841	153.59	192.827	154.01	192	154.29	191.839

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  154.31 191.823  154.36 191.841   154.5 191.889  154.85     192  155.27 192.599
  155.43 192.632  156.55 192.853   157.2 192.963  157.33     193  157.71   193.1
  157.92 193.149  158.07 193.188  158.44 193.273   159.2  193.41  159.73 193.495
  161.66     194  161.73 194.024   162.6 194.305  162.76 194.371   163.8     195
   164.8 195.636  165.37     196  166.09 196.414     167     197  168.71  197.76
  169.29     198   170.4 198.016  170.43 198.017  170.57 198.018  172.02 198.031
  174.94 198.052  176.13  198.07  176.47 198.141  179.95 198.291  191.32 198.853
  196.68     199  198.11 199.013  201.12 199.029  202.88 199.024  217.21 199.414
  218.54 199.448  219.63 199.477  219.66 199.478  219.79 199.484  219.93 199.488
  227.87 199.454  235.99 199.769  237.56 199.797   238.2   199.8  238.42 199.808
  238.61 199.813  239.21 199.826  239.73 199.834

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   152.6    .035  157.33     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
         152.6  157.33            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   152.9  196.51       F
  156.88  239.73  196.51       F
Left Levee      Station=  103.02      Elevation=     199

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     Pipe Arch    2.35    3.72
FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                 3      30     .024     .024        0                   .9
      1
Upstream   Elevation =  192.63
           Centerline Station =  157.4
Downstream Elevation =  192.37
           Centerline Station =  154.9

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      20.59    Culv Full Len (m)
  # Barrels                   1    Culv Vel US (m/s)         3.64
  Q Barrel (m3/s)          20.59    Culv Vel DS (m/s)         4.09
  E.G. US. (m)            195.70    Culv Inv El Up (m)      192.63
  W.S. US. (m)            195.50    Culv Inv El Dn (m)      192.37
  E.G. DS (m)             194.62    Culv Frctn Ls (m)         0.00
  W.S. DS (m)             193.92    Culv Exit Loss (m)        0.16
  Delta EG (m)              1.08    Culv Entr Loss (m)        0.61
  Delta WS (m)              1.58    Q Weir (m3/s)
  E.G. IC (m)             195.55    Weir Sta Lft (m)
  E.G. OC (m)             195.70    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
  Culv WS Inlet (m)       194.41    Weir Max Depth (m)
```

Culv WS Outlet (m)	193.92	Weir Avg Depth (m)	
Culv Nml Depth (m)	1.90	Weir Flow Area (m2)	
Culv Crt Depth (m)	1.53	Min El Weir Flow (m)	196.92

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	10.85	Culv Full Len (m)	30.00
# Barrels	1	Culv Vel US (m/s)	1.62
Q Barrel (m3/s)	10.85	Culv Vel DS (m/s)	1.62
E.G. US. (m)	198.47	Culv Inv El Up (m)	192.63
W.S. US. (m)	198.31	Culv Inv El Dn (m)	192.37
E.G. DS (m)	198.23	Culv Frctn Ls (m)	0.07
W.S. DS (m)	198.14	Culv Exit Loss (m)	0.04
Delta EG (m)	0.24	Culv Entr Loss (m)	0.12
Delta WS (m)	0.17	Q Weir (m3/s)	111.71
E.G. IC (m)	198.34	Weir Sta Lft (m)	19.96
E.G. OC (m)	198.47	Weir Sta Rgt (m)	182.92
Culvert Control	Outlet	Weir Submerg	0.64
Culv WS Inlet (m)	194.98	Weir Max Depth (m)	1.56
Culv WS Outlet (m)	194.72	Weir Avg Depth (m)	0.74
Culv Nml Depth (m)		Weir Flow Area (m2)	80.97
Culv Crt Depth (m)	1.08	Min El Weir Flow (m)	196.92

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.121

INPUT
Description: Section 46.121 - Peelar Road - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 193

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.116	.09	201.103	.16	201.086	2.46	201.134	2.97	201
4.37	200.471	4.61	200.366	5.6	200.081	5.84	200	5.96	199.911
5.99	199.908	6.02	199.896	6.07	199.878	6.15	199.835	7.19	199.231
7.68	199	8.13	198.755	8.5	198.631	8.62	198.603	9.26	198.509
9.72	198.47	10.14	198.456	10.23	198.452	10.32	198.448	11.96	198.458
17.93	198.627	18.79	198.683	20.17	198.853	21.45	198.905	21.67	198.908
22.9	198.868	23.49	198.882	23.72	198.871	24.78	198.788	24.93	198.787
28.22	198.487	32.27	198.564	32.41	198.559	32.55	198.553	32.7	198.554
34.55	198.443	36.02	198.405	47.41	198.657	48.15	198.664	48.64	198.668
48.8	198.663	49	198.655	56.83	198.515	56.94	198.515	57.21	198.506
57.47	198.5	59.64	198.564	60.7	198.535	64.04	198.604	69.34	198.85
70.1	198.861	70.3	198.882	70.32	198.882	71.57	199	74.15	199
75.35	199	76.07	199	76.75	199	77.12	199	78.35	199
79.35	199	79.82	199	81.11	199	81.15	199	81.23	199
81.33	199	81.52	199	84.17	199	85.18	199	86.83	199
86.9	199	86.98	199	91.42	199	92.96	199	96.93	199
97.22	199	97.61	199	98.45	199	98.47	199	98.92	199
99.22	199	101.39	199	102.08	199	102.12	199	102.14	199
103.01	199	103.02	199	106.1	198.877	110.03	198.634	110.07	198.631
110.12	198.629	110.16	198.627	112.11	198.13	112.47	198.125	114.53	198.075
115.89	198.061	116.61	198.058	116.85	198.054	117.55	198.032	119.12	198
121.6	197.696	125.61	197.384	130.31	197	130.42	196.977	131.19	196.835
134.73	196.198	135.06	196.126	135.92	196	136.57	195.912	137.53	195.823
137.73	195.805	139.61	195.582	141.72	195.474	142.72	195.431	142.83	195.423
146.3	195	146.85	194.937	146.93	194.922	147.7	194.851	147.91	194.818
150.84	194.094	151.01	194.05	151.08	194.036	151.14	194.027	151.23	194
151.49	193.87	152.54	193.041	152.6	193	152.61	192.999	152.94	192.956

153.08	192.961	153.39	192.841	153.59	192.827	154.01	192	154.29	191.839
154.31	191.823	154.36	191.841	154.5	191.889	154.85	192	155.27	192.599
155.43	192.632	156.55	192.853	157.2	192.963	157.33	193	157.71	193.1
157.92	193.149	158.07	193.188	158.44	193.273	159.2	193.41	159.73	193.495
161.66	194	161.73	194.024	162.6	194.305	162.76	194.371	163.8	195
164.8	195.636	165.37	196	166.09	196.414	167	197	168.71	197.76
169.29	198	170.4	198.016	170.43	198.017	170.57	198.018	172.02	198.031
174.94	198.052	176.13	198.07	176.47	198.141	179.95	198.291	191.32	198.853
196.68	199	198.11	199.013	201.12	199.029	202.88	199.024	217.21	199.414
218.54	199.448	219.63	199.477	219.66	199.478	219.79	199.484	219.93	199.488
227.87	199.454	235.99	199.769	237.56	199.797	238.2	199.8	238.42	199.808
238.61	199.813	239.21	199.826	239.73	199.834				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	152.6	.035	157.33	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
152.6	157.33	20	20	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	152.9	196.51	F
156.88	239.73	196.51	F

Left Levee Station= 103.02 Elevation= 199

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	194.62	Element	Left OB	Channel	Right OB
Vel Head (m)	0.69	Wt. n-Val.		0.035	
W.S. Elev (m)	193.92	Reach Len. (m)	20.00	20.00	20.00
Crit W.S. (m)	193.92	Flow Area (m2)		5.58	
E.G. Slope (m/m)	0.014163	Area (m2)	0.54	6.30	1.90
Q Total (m3/s)	20.59	Flow (m3/s)		20.59	
Top Width (m)	9.97	Top Width (m)	1.21	4.73	4.03
Vel Total (m/s)	3.69	Avg. Vel. (m/s)		3.69	
Max Chl Dpth (m)	2.10	Hydr. Depth (m)		1.40	
Conv. Total (m3/s)	173.0	Conv. (m3/s)		173.0	
Length Wtd. (m)	20.00	Wetted Per. (m)		4.93	
Min Ch El (m)	191.82	Shear (N/m2)		157.14	
Alpha	1.00	Stream Power (N/m s)		580.15	
Frctn Loss (m)	0.24	Cum Volume (1000 m3)	31.03	55.08	28.68
C & E Loss (m)	0.15	Cum SA (1000 m2)	32.22	20.07	37.53

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 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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.23	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	198.14	Reach Len. (m)	20.00	20.00	20.00
Crit W.S. (m)	196.51	Flow Area (m2)	68.57	26.25	37.11
E.G. Slope (m/m)	0.000574	Area (m2)	68.57	26.25	37.11
Q Total (m3/s)	122.56	Flow (m3/s)	46.17	49.79	26.60
Top Width (m)	64.38	Top Width (m)	40.52	4.73	19.13
Vel Total (m/s)	0.93	Avg. Vel. (m/s)	0.67	1.90	0.72
Max Chl Dpth (m)	6.32	Hydr. Depth (m)	1.69	5.55	1.94
Conv. Total (m3/s)	5115.7	Conv. (m3/s)	1927.2	2078.2	1110.4
Length Wtd. (m)	20.00	Wetted Per. (m)	41.16	5.69	20.27
Min Ch El (m)	191.82	Shear (N/m2)	9.38	25.96	10.30
Alpha	2.02	Stream Power (N/m s)	6.31	49.24	7.39
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	136.94	131.43	176.06
C & E Loss (m)	0.03	Cum SA (1000 m2)	69.53	20.07	101.12

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: RIVER-1
REACH: Reach-1 RS: 46.12

INPUT
Description: Section 46.12 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 121

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204.017	.64	204	1.57	203.584	2.88	203	4.16	202.234
4.52	202	5.56	201.407	6.37	201	10.22	201	14.03	201
15.11	201.341	17.03	201.774	17.39	201.08	19.08	201.047	20.72	201
24.05	200.087	24.34	200	25.06	199.958	40.15	199.007	40.26	199.007
42.43	199.003	42.76	199.003	45.21	199.27	45.36	199.272	47	199.255
47.99	199.251	57.78	199.012	58.42	199.012	60	199.011	66.24	199
66.68	199	66.83	199	67.45	199	68.32	199	70.6	199
78.32	199	82.38	198.38	85.31	198	86.68	197.459	88	197
88.9	197	89.01	197	89.06	197	89.47	197	90.05	197
90.13	197	90.19	197	92.58	197	93.92	197	95.28	197
98.06	197	98.16	197	98.96	197	104.19	196.364	106.24	196.391
109.27	196	109.29	195.994	109.82	195.992	109.83	195.992	110.07	195.99
110.19	195.988	111.79	195.978	112.9	195.816	112.97	195.809	116.66	195.626
117.36	195.562	117.5	195.552	118.97	195.46	120.07	195.413	121.94	195.336
125.09	195	127.14	194.798	128.66	194.593	128.86	194.565	129.9	194.436
130.12	194.409	133.39	194	134.46	193.993	134.62	193.992	134.65	193.992
134.67	193.992	136.01	193.914	142.87	193.531	143.04	193.525	143.27	193.512
144.35	193.401	148.02	193	149.07	192.548	150.54	192	150.66	191.955
150.99	191.823	151.13	191.883	151.39	192	153.89	192.96	154.01	193
154.32	193.077	156.61	193.626	157.62	193.852	158.11	194	159.55	194.326
162.27	195	164.16	195.858	164.18	195.863	164.2	195.868	164.23	195.877
164.52	196	165.52	196.466	165.69	196.535	166.77	196.945	166.9	197
167	197.043	168.84	198	179.75	198.43	194.54	199	199.89	199.172
218.12	199.701	222.85	199.836	227.56	199.963	228.52	200	228.56	200
228.84	200								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	148.02	.035	154.01	.05

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
148.02 154.01 35 38 40 .1 .3
Left Levee Station= 45.21 Elevation= 199.27

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	193.92	Element	Left OB	Channel	Right OB
Vel Head (m)	0.40	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	193.51	Reach Len. (m)	35.00	38.00	40.00
Crit W.S. (m)	193.51	Flow Area (m2)	1.22	6.62	0.55
E.G. Slope (m/m)	0.009935	Area (m2)	1.22	6.62	0.55
Q Total (m3/s)	20.59	Flow (m3/s)	0.97	19.19	0.43
Top Width (m)	12.93	Top Width (m)	4.80	5.99	2.14
Vel Total (m/s)	2.46	Avg. Vel. (m/s)	0.80	2.90	0.79
Max Chl Dpth (m)	1.69	Hydr. Depth (m)	0.25	1.10	0.26
Conv. Total (m3/s)	206.6	Conv. (m3/s)	9.7	192.5	4.3
Length Wtd. (m)	37.95	Wetted Per. (m)	4.83	6.44	2.20

Min Ch El (m)	191.82	Shear (N/m2)	24.55	100.14	24.27
Alpha	1.31	Stream Power (N/m s)	19.52	290.43	19.16
Frctn Loss (m)	0.15	Cum Volume (1000 m3)	31.02	54.95	28.65
C & E Loss (m)	0.07	Cum SA (1000 m2)	32.16	19.96	37.46

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 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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.19	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	198.17	Reach Len. (m)	35.00	38.00	40.00
Crit W.S. (m)	194.95	Flow Area (m2)	170.19	34.50	46.06
E.G. Slope (m/m)	0.000121	Area (m2)	170.19	34.50	46.06
Q Total (m3/s)	122.56	Flow (m3/s)	71.65	33.24	17.68
Top Width (m)	89.13	Top Width (m)	64.02	5.99	19.13
Vel Total (m/s)	0.49	Avg. Vel. (m/s)	0.42	0.96	0.38
Max Chl Dpth (m)	6.35	Hydr. Depth (m)	2.66	5.76	2.41
Conv. Total (m3/s)	11128.4	Conv. (m3/s)	6505.3	3018.1	1605.0
Length Wtd. (m)	37.26	Wetted Per. (m)	64.42	6.44	20.03
Min Ch El (m)	191.82	Shear (N/m2)	3.14	6.37	2.74
Alpha	1.58	Stream Power (N/m s)	1.32	6.14	1.05
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	134.55	130.82	175.23
C & E Loss (m)	0.05	Cum SA (1000 m2)	68.48	19.96	100.74

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.11

INPUT
Description: Station 46.11 - Highway 407 - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 157

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204.194	7.42	204	8.35	203.615	9.72	203	10.51	202.654
11.9	202	13.52	201.278	13.79	201.12	14.04	201	14.65	200.732
16.39	200	19.18	199.003	19.19	199	19.21	199	19.73	199
20.17	199	20.27	199	21.54	199.137	21.57	199.136	22.93	199.296
27.45	199.348	31.63	199.351	31.74	199.347	35.8	199.168	40.37	199.056
40.58	199.048	41.65	199	41.8	199	43.05	199	44.74	199
45.85	199	51.4	198.797	51.94	198.785	52.27	198.776	52.69	198.777
53.03	198.784	53.16	198.787	53.2	198.788	53.37	198.79	53.4	198.791
61.25	199	65.25	199	67.89	199	69.57	199	71.3	199
72.99	198.774	81.96	199	82.48	199	82.91	199	87.13	199
87.27	199	89.8	199.348	92.33	199.42	92.43	199.422	92.63	199.428
92.82	199.435	93.33	199.424	96.19	199	96.38	199	96.8	199
96.94	199	97.06	198.997	97.07	198.997	97.08	198.997	97.09	198.997
97.3	198.997	98.11	198.973	108.25	198.335	110.22	198.302	111.36	198.277
114.19	198.195	116.72	198.145	119.02	198.024	119.8	198.022	120.85	198.023
124.59	198.036	124.96	198.033	126.47	198.02	128.17	198.004	128.71	198.001
128.74	198	129.24	197.91	129.28	197.902	129.33	197.895	131.38	197.515
132.26	197.384	132.42	197.378	134.55	197.078	134.78	197.085	136.08	197.005
136.09	197.005	136.2	197	137.94	196.567	140.2	196	140.31	195.965
140.65	195.808	142.27	195.002	142.28	195	142.86	194.747	143.59	194.559
143.95	194.432	145.52	194	147.05	193.476	147.49	193.353	148.41	193
149.22	192.702	149.63	192.585	149.8	192	150	191.725	153.14	191.725
153.57	191.725	156	191.725	156.2	192	156.84	193	157.12	193.11
157.35	193.215	158.69	194	160.15	194.705	160.84	195	161.92	195.417
163.52	196	165.53	196.656	166.54	197	169.15	197.405	171.98	197.769
172.73	197.841	173.74	198	174.74	198.01	174.77	198.01	175.33	198.016
176.17	198.026	176.63	198.028	178.63	198.05	178.89	198.05	193.15	198.522
195.72	198.556	198.31	198.69	202.36	198.883	204.46	199	222.27	199.574
235.58	200	245.55	200.352	249	200.514	250.09	200.573	255.18	200.87
257.13	200.961	257.34	200.963	257.9	200.992	261.45	200.989	261.74	200.99
264.23	200.975	264.53	200.978	266.78	200.994	266.87	201	268.79	201.048
272.01	201.138	283.95	201.338						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	149.8	.035	156.2	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
149.8	156.2	235	235	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	149.5	200.65	F

156.5 283.95 200.5 F
Left Levee Station= 92.82 Elevation= 199.435

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	193.64	Element	Left OB	Channel	Right OB
Vel Head (m)	0.16	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	193.48	Reach Len. (m)	235.00	235.00	235.00
Crit W.S. (m)	192.75	Flow Area (m2)	0.32	11.17	0.37
E.G. Slope (m/m)	0.002016	Area (m2)	1.36	11.17	0.88
Q Total (m3/s)	20.59	Flow (m3/s)	0.16	20.17	0.26
Top Width (m)	10.76	Top Width (m)	2.76	6.40	1.60
Vel Total (m/s)	1.74	Avg. Vel. (m/s)	0.51	1.81	0.69
Max Chl Dpth (m)	1.75	Hydr. Depth (m)	1.05	1.74	1.24
Conv. Total (m3/s)	458.6	Conv. (m3/s)	3.6	449.3	5.7
Length Wtd. (m)	235.00	Wetted Per. (m)	0.74	6.68	0.56
Min Ch El (m)	191.73	Shear (N/m2)	8.37	33.04	13.26
Alpha	1.06	Stream Power (N/m s)	4.24	59.70	9.12
Frctn Loss (m)		Cum Volume (1000 m3)	30.97	54.61	28.63
C & E Loss (m)		Cum SA (1000 m2)	32.03	19.73	37.39

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.13	Element	Left OB	Channel	Right OB
Vel Head (m)	0.49	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	197.64	Reach Len. (m)	235.00	235.00	235.00
Crit W.S. (m)	195.01	Flow Area (m2)	1.56	37.83	1.62
E.G. Slope (m/m)	0.001191	Area (m2)	40.24	37.83	28.33
Q Total (m3/s)	122.56	Flow (m3/s)	1.77	118.50	2.29
Top Width (m)	40.33	Top Width (m)	19.12	6.40	14.81
Vel Total (m/s)	2.99	Avg. Vel. (m/s)	1.13	3.13	1.41
Max Chl Dpth (m)	5.92	Hydr. Depth (m)	5.22	5.91	5.41

Conv. Total (m3/s)	3551.8	Conv. (m3/s)	51.4	3434.2	66.3
Length Wtd. (m)	235.00	Wetted Per. (m)	0.74	6.68	0.56
Min Ch El (m)	191.73	Shear (N/m2)	24.55	66.13	34.06
Alpha	1.07	Stream Power (N/m s)	27.80	207.16	47.99
Frctn Loss (m)		Cum Volume (1000 m3)	130.87	129.45	173.74
C & E Loss (m)		Cum SA (1000 m2)	67.03	19.73	100.06

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1015

INPUT
Description: Hum 13-2R. Highway 407 Culvert - 6.0 m W x 4.3 m H x 215 m L Concrete Box Culvert. Drawings by MTO (WP 140-87-08, Sheet 76, 1993) used to code in new culvert not previously coded in HEC-2.

HEC-2 to HEC-RAS conversion January 2004 by Acres
included coding of culvert to HEC-RAS format, including adjustments to roadway coding and hydraulic loss coefficients.
Distance from Upstream XS = 12
Deck/Roadway Width = 215
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 146

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	204.208		4.75	204.007		4.97	204.007	
5.27	204.006		5.82	204.006		6.46	204.006	
7.86	204.005		8.62	204.005		8.71	204.005	
8.78	204.005		15.85	204.005		16.29	204.005	
17.76	204.004		17.9	204.004		18.19	204.004	
18.94	204.004		19.1	204.004		19.28	204.004	
20.12	204.004		21.34	204.004		21.76	204.004	
23.12	204.003		23.2	204.003		23.24	204.003	
23.33	204.003		23.38	204.003		23.44	204.003	
23.71	204.003		26.02	204.003		26.83	204.003	
28.53	204.003		34.85	204.001		37.83	204	
37.89	204		37.96	204		37.98	204	
38.02	204		43.02	203.56		47.14	203.538	
50.92	203.25		56.58	203.216		56.61	203.216	
56.64	203.216		56.83	203.213		57.93	203.201	
60.55	203.159		62.45	203.15		64.39	203.13	
64.6	203.129		64.76	203.127		69.02	203.102	
72.02	203.093		74.17	203.074		74.23	203.074	
75.29	203.068		75.83	203.062		76.16	203.061	
76.51	203.057		76.78	203.053		83.95	203	
84.95	202.936		85.88	202.932		86.17	202.919	
91.34	202.663		92.19	202.66		93.67	202.607	
93.81	202.601		95.31	202.52		102.69	202.429	
106.82	202.107		109.74	202.092		114.1	202.071	

117.19	202.043	117.24	202.043	117.39	202.042
117.45	202.041	118.91	202.033	121.76	202
126.9	201.626	135.34	201.601	138.96	201.498
146.46	201.017	146.74	201.017	147.02	201.017
147.32	201.017	148.59	201.016	150.04	201.016
150.78	201.016	152	201.015	152.08	201.014
152.54	201.014	153.09	201.014	153.16	201.014
157.65	201.014	158.63	201.014	159.79	201.014
159.86	201.014	159.95	201.014	163.62	201.013
167.46	201.011	171.93	201.294	176.54	201.237
179.73	201.007	180.03	201.007	180.13	201.007
182.08	201.007	183.45	201.007	196.02	201.006
199.93	201.005	200.98	201.005	201.21	201.005
203.84	201.005	219.13	201.005	223.98	201.005
224.97	201.005	225.02	201.005	225.67	201.005
226.17	201.005	226.62	201.005	226.68	201.005
228.24	201.005	228.93	201.005	238.94	201.006
244.81	201.005	246.52	201.005	249.44	201.005
251.75	201.154	255.03	201.173	256.62	201.006
259.78	201.005	260.65	201.005	262.23	201.005
262.29	201.005	262.38	201.005	265.7	201.004
265.92	201.004	266.14	201.004	266.66	201.004
268.21	201.004	270.47	201.004	270.83	201.004
271.72	201.005	271.99	201.005	272.99	201.005
279.13	201.004	279.54	201.004		

Upstream Bridge Cross Section Data
Station Elevation Data num= 157

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204.194	7.42	204	8.35	203.615	9.72	203	10.51	202.654
11.9	202	13.52	201.278	13.79	201.12	14.04	201	14.65	200.732
16.39	200	19.18	199.003	19.19	199	19.21	199	19.73	199
20.17	199	20.27	199	21.54	199.137	21.57	199.136	22.93	199.296
27.45	199.348	31.63	199.351	31.74	199.347	35.8	199.168	40.37	199.056
40.58	199.048	41.65	199	41.8	199	43.05	199	44.74	199
45.85	199	51.4	198.797	51.94	198.785	52.27	198.776	52.69	198.777
53.03	198.784	53.16	198.787	53.2	198.788	53.37	198.79	53.4	198.791
61.25	199	65.25	199	67.89	199	69.57	199	71.3	199
72.99	198.774	81.96	199	82.48	199	82.91	199	87.13	199
87.27	199	89.8	199.348	92.33	199.42	92.43	199.422	92.63	199.428
92.82	199.435	93.33	199.424	96.19	199	96.38	199	96.8	199
96.94	199	97.06	198.997	97.07	198.997	97.08	198.997	97.09	198.997
97.3	198.997	98.11	198.973	108.25	198.335	110.22	198.302	111.36	198.277
114.19	198.195	116.72	198.145	119.02	198.024	119.8	198.022	120.85	198.023
124.59	198.036	124.96	198.033	126.47	198.02	128.17	198.004	128.71	198.001
128.74	198	129.24	197.91	129.28	197.902	129.33	197.895	131.38	197.515
132.26	197.384	132.42	197.378	134.55	197.078	134.78	197.085	136.08	197.005
136.09	197.005	136.2	197	137.94	196.567	140.2	196	140.31	195.965
140.65	195.808	142.27	195.002	142.28	195	142.86	194.747	143.59	194.559
143.95	194.432	145.52	194	147.05	193.476	147.49	193.353	148.41	193
149.22	192.702	149.63	192.585	149.8	192	150	191.725	153.14	191.725
153.57	191.725	156	191.725	156.2	192	156.84	193	157.12	193.11
157.35	193.215	158.69	194	160.15	194.705	160.84	195	161.92	195.417
163.52	196	165.53	196.656	166.54	197	169.15	197.405	171.98	197.769
172.73	197.841	173.74	198	174.74	198.01	174.77	198.01	175.33	198.016
176.17	198.026	176.63	198.028	178.63	198.05	178.89	198.05	193.15	198.522
195.72	198.556	198.31	198.69	202.36	198.883	204.46	199	222.27	199.574
235.58	200	245.55	200.352	249	200.514	250.09	200.573	255.18	200.87
257.13	200.961	257.34	200.963	257.9	200.992	261.45	200.989	261.74	200.99
264.23	200.975	264.53	200.978	266.78	200.994	266.87	201	268.79	201.048
272.01	201.138	283.95	201.338						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	149.8	.035	156.2	.05

Bank Sta: Left Right Coeff Contr. Expan.
149.8 156.2 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	149.5	200.65	F
156.5	283.95	200.5	F

Left Levee Station= 92.82 Elevation= 199.435

Downstream Deck/Roadway Coordinates
num= 146

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	204.208		4.75	204.007		4.97	204.007	
5.27	204.006		5.82	204.006		6.46	204.006	
7.86	204.005		8.62	204.005		8.71	204.005	
8.78	204.005		15.85	204.005		16.29	204.005	
17.76	204.004		17.9	204.004		18.19	204.004	
18.94	204.004		19.1	204.004		19.28	204.004	
20.12	204.004		21.34	204.004		21.76	204.004	
23.12	204.003		23.2	204.003		23.24	204.003	
23.33	204.003		23.38	204.003		23.44	204.003	
23.71	204.003		26.02	204.003		26.83	204.003	
28.53	204.003		34.85	204.001		37.83	204	
37.89	204		37.96	204		37.98	204	
38.02	204		43.02	203.56		47.14	203.538	
50.92	203.25		56.58	203.216		56.61	203.216	
56.64	203.216		56.83	203.213		57.93	203.201	
60.55	203.159		62.45	203.15		64.39	203.13	
64.6	203.129		64.76	203.127		69.02	203.102	
72.02	203.093		74.17	203.074		74.23	203.074	
75.29	203.068		75.83	203.062		76.16	203.061	
76.51	203.057		76.78	203.053		83.95	203	
84.95	202.936		85.88	202.932		86.17	202.919	
91.34	202.663		92.19	202.66		93.67	202.607	
93.81	202.601		95.31	202.52		102.69	202.429	
106.82	202.107		109.74	202.092		114.1	202.071	
117.19	202.043		117.24	202.043		117.39	202.042	
117.45	202.041		118.91	202.033		121.76	202	
126.9	201.626		135.34	201.601		138.96	201.498	
146.46	201.017		146.74	201.017		147.02	201.017	
147.32	201.017		148.59	201.016		150.04	201.016	
150.78	201.016		152	201.015		152.08	201.014	
152.54	201.014		153.09	201.014		153.16	201.014	
157.65	201.014		158.63	201.014		159.79	201.014	
159.86	201.014		159.95	201.014		163.62	201.013	
167.46	201.011		171.93	201.294		176.54	201.237	
179.73	201.007		180.03	201.007		180.13	201.007	
182.08	201.007		183.45	201.007		196.02	201.006	
199.93	201.005		200.98	201.005		201.21	201.005	
203.84	201.005		219.13	201.005		223.98	201.005	
224.97	201.005		225.02	201.005		225.67	201.005	
226.17	201.005		226.62	201.005		226.68	201.005	
228.24	201.005		228.93	201.005		238.94	201.006	
244.81	201.005		246.52	201.005		249.44	201.005	
251.75	201.154		255.03	201.173		256.62	201.006	
259.78	201.005		260.65	201.005		262.23	201.005	
262.29	201.005		262.38	201.005		265.7	201.004	
265.92	201.004		266.14	201.004		266.66	201.004	
268.21	201.004		270.47	201.004		270.83	201.004	
271.72	201.005		271.99	201.005		272.99	201.005	
279.13	201.004		279.54	201.004				

Downstream Bridge Cross Section Data
Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.016	1.7	202.008	3.31	202	6.36	201.056	6.55	201
9.56	200.072	9.81	200	10.8	199.702	11.4	199.711	13.91	199.257
20.78	199.071	21.41	199.041	21.73	199.035	22.13	199.012	28.32	199.055
30.43	199.043	30.53	199.043	30.61	199	34.33	198.39	36.83	198
38.26	197.761	38.91	197.735	42.59	197.626	45.28	197.715	49.27	197.928
49.51	197.912	49.64	197.913	50.24	198	54.26	198.904	54.69	199
55.54	199.006	55.6	199.007	56.47	199.015	56.56	199.016	58.01	199.028
58.36	199.031	64.08	199.075	66.11	199.058	71.53	199.016	73.74	199
78.09	198.205	79.43	198	80.3	197.717	82.64	197	84.16	196.504
85.78	196	87.38	195.494	88.82	195	90.55	194.411	91.82	194
93.73	193.361	95.06	193	96.61	192.832	96.99	192.821	97.75	192.766
99.02	192.647	104.34	192.001	104.36	192.001	104.39	192	107.5	192
108	191.6	114	191.6	114.5	192	116.67	192	119.53	192.809
120.23	193	120.93	193.226	123.26	194	125.52	194.789	126.17	195
129.05	195.811	130	196	130.82	196.156	134.81	197	136.27	197.006
139.91	197.009	140.26	197.01	149.58	197.28	159.19	197.543	159.78	197.568
160.61	197.581	161.67	197.609	161.81	197.612	162.94	197.638	163.7	197.652
169.85	197.681	172.35	197.776	174.11	197.816	175.39	197.838	176.32	197.837
176.8	197.835	177.83	197.831	178.38	197.827	178.95	197.822	180.79	197.795
184.91	197.765	186.04	197.738	186.65	197.724	187.33	197.708	192.06	197.647
192.56	197.637	195.08	197.575	199.98	197.49	201.37	197.459	203.14	197.409
207.72	197.255	214.28	197.01	214.52	197	219.09	196.443	220.61	196.279
221.92	196.225	229.69	196.45	231.97	196.372	232.71	196.357	233.41	196.345
235.42	196.321	237.27	196.318	238.24	196.334	239.43	196.362	242.98	196.554
248.74	196.965	250.8	197						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	107.5	.035	114.5	.05

Bank Sta: Left Right Coeff Contr. Expan.
107.5 114.5 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	107.5	200	F
114.5	250.8	200	F

Left Levee Station= 64.08 Elevation= 199.075
Right Levee Station= 175.39 Elevation= 197.838

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 4.3 6
FHWA Chart # 58- Rectangular concrete
FHWA Scale # 2 - Side tapered; More favorable edges
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	12	215	.015	.015	0	.5	1

Upstream Elevation = 191.725

Centerline Station = 153
Downstream Elevation = 191.6
Centerline Station = 111

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	20.59	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	2.24
Q Barrel (m3/s)	20.59	Culv Vel DS (m/s)	3.23
E.G. US. (m)	193.64	Culv Inv El Up (m)	191.73
W.S. US. (m)	193.48	Culv Inv El Dn (m)	191.60
E.G. DS (m)	193.07	Culv Frctn Ls (m)	0.00
W.S. DS (m)	192.59	Culv Exit Loss (m)	0.13
Delta EG (m)	0.57	Culv Entr Loss (m)	0.13
Delta WS (m)	0.89	Q Weir (m3/s)	
E.G. IC (m)	193.62	Weir Sta Lft (m)	
E.G. OC (m)	193.64	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	193.26	Weir Max Depth (m)	
Culv WS Outlet (m)	192.66	Weir Avg Depth (m)	
Culv Nml Depth (m)	1.92	Weir Flow Area (m2)	
Culv Crt Depth (m)	1.06	Min El Weir Flow (m)	201.01

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	122.56	Culv Full Len (m)	119.53
# Barrels	1	Culv Vel US (m/s)	4.75
Q Barrel (m3/s)	122.56	Culv Vel DS (m/s)	5.85
E.G. US. (m)	198.13	Culv Inv El Up (m)	191.73
W.S. US. (m)	197.64	Culv Inv El Dn (m)	191.60
E.G. DS (m)	196.35	Culv Frctn Ls (m)	0.45
W.S. DS (m)	194.78	Culv Exit Loss (m)	0.48
Delta EG (m)	1.78	Culv Entr Loss (m)	0.58
Delta WS (m)	2.86	Q Weir (m3/s)	
E.G. IC (m)	198.26	Weir Sta Lft (m)	
E.G. OC (m)	198.13	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	196.03	Weir Max Depth (m)	
Culv WS Outlet (m)	195.09	Weir Avg Depth (m)	
Culv Nml Depth (m)	4.30	Weir Flow Area (m2)	
Culv Crt Depth (m)	3.49	Min El Weir Flow (m)	201.01

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.
Note: During supercritical analysis, the culvert direct step method went to critical depth. The program then assumed critical depth at the outlet.
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: 46.10

INPUT
Description: Station 46.10 - Highway 407 - D/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.016	1.7	202.008	3.31	202	6.36	201.056	6.55	201
9.56	200.072	9.81	200	10.8	199.702	11.4	199.711	13.91	199.257
20.78	199.071	21.41	199.041	21.73	199.035	22.13	199.012	28.32	199.055
30.43	199.043	30.53	199.043	30.61	199	34.33	198.39	36.83	198
38.26	197.761	38.91	197.735	42.59	197.626	45.28	197.715	49.27	197.928
49.51	197.912	49.64	197.913	50.24	198	54.26	198.904	54.69	199
55.54	199.006	55.6	199.007	56.47	199.015	56.56	199.016	58.01	199.028
58.36	199.031	64.08	199.075	66.11	199.058	71.53	199.016	73.74	199
78.09	198.205	79.43	198	80.3	197.717	82.64	197	84.16	196.504
85.78	196	87.38	195.494	88.82	195	90.55	194.411	91.82	194
93.73	193.361	95.06	193	96.61	192.832	96.99	192.821	97.75	192.766
99.02	192.647	104.34	192.001	104.36	192.001	104.39	192	107.5	192
108	191.6	114	191.6	114.5	192	116.67	192	119.53	192.809
120.23	193	120.93	193.226	123.26	194	125.52	194.789	126.17	195
129.05	195.811	130	196	130.82	196.156	134.81	197	136.27	197.006
139.91	197.009	140.26	197.01	149.58	197.28	159.19	197.543	159.78	197.568
160.61	197.581	161.67	197.609	161.81	197.612	162.94	197.638	163.7	197.652
169.85	197.681	172.35	197.776	174.11	197.816	175.39	197.838	176.32	197.837
176.8	197.835	177.83	197.831	178.38	197.827	178.95	197.822	180.79	197.795
184.91	197.765	186.04	197.738	186.65	197.724	187.33	197.708	192.06	197.647
192.56	197.637	195.08	197.575	199.98	197.49	201.37	197.459	203.14	197.409
207.72	197.255	214.28	197.01	214.52	197	219.09	196.443	220.61	196.279
221.92	196.225	229.69	196.45	231.97	196.372	232.71	196.357	233.41	196.345
235.42	196.321	237.27	196.318	238.24	196.334	239.43	196.362	242.98	196.554
248.74	196.965	250.8	197						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	107.5	.035	114.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
107.5	114.5	130	200	160	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	107.5	200	F
114.5	250.8	200	F

Left Levee Station= 64.08 Elevation= 199.075
Right Levee Station= 175.39 Elevation= 197.838

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	193.07	Element	Left OB	Channel	Right OB
Vel Head (m)	0.48	Wt. n-Val.		0.035	
W.S. Elev (m)	192.59	Reach Len. (m)	130.00	200.00	160.00
Crit W.S. (m)	192.59	Flow Area (m2)		6.72	
E.G. Slope (m/m)	0.012821	Area (m2)	3.28	6.72	1.89
Q Total (m3/s)	20.59	Flow (m3/s)		20.59	
Top Width (m)	19.24	Top Width (m)	7.99	7.00	4.25
Vel Total (m/s)	3.07	Avg. Vel. (m/s)		3.07	

Max Chl Dpth (m)	0.99	Hydr. Depth (m)			0.96
Conv. Total (m3/s)	181.8	Conv. (m3/s)			181.8
Length Wtd. (m)	199.34	Wetted Per. (m)			7.28
Min Ch El (m)	191.60	Shear (N/m2)			115.98
Alpha	1.00	Stream Power (N/m s)			355.55
Frctn Loss (m)	1.06	Cum Volume (1000 m3)	30.97	52.54	28.63
C & E Loss (m)	0.13	Cum SA (1000 m2)	30.77	18.15	36.70

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 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, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	196.35	Element	Left OB	Channel	Right OB
Vel Head (m)	1.57	Wt. n-Val.		0.035	
W.S. Elev (m)	194.78	Reach Len. (m)	130.00	200.00	160.00
Crit W.S. (m)	194.78	Flow Area (m2)		22.09	
E.G. Slope (m/m)	0.008591	Area (m2)	34.85	22.09	18.94
Q Total (m3/s)	122.56	Flow (m3/s)		122.56	
Top Width (m)	36.05	Top Width (m)	18.04	7.00	11.00
Vel Total (m/s)	5.55	Avg. Vel. (m/s)		5.55	
Max Chl Dpth (m)	3.18	Hydr. Depth (m)		3.16	
Conv. Total (m3/s)	1322.3	Conv. (m3/s)		1322.3	
Length Wtd. (m)	184.22	Wetted Per. (m)		7.28	
Min Ch El (m)	191.60	Shear (N/m2)		255.57	

Alpha	1.00	Stream Power (N/m s)			1418.26
Frctn Loss (m)	0.11	Cum Volume (1000 m3)	130.87	122.47	173.74
C & E Loss (m)	0.77	Cum SA (1000 m2)	62.66	18.15	97.02

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, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.09

INPUT
Description: Section 46.09 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	199.5	20	198	60	198	92	191	93	190
95	189	99	189	100	190	102	191	146	192
173	194	210	196	255	197				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	93	.035	100	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
93	100	80	95	125	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	191.07	Element	Left OB	Channel	Right OB
Vel Head (m)	0.22	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	190.85	Reach Len. (m)	80.00	95.00	125.00
Crit W.S. (m)		Flow Area (m2)	0.36	11.45	0.72
E.G. Slope (m/m)	0.003188	Area (m2)	0.36	11.45	

0.72					
Q Total (m3/s)	24.80	Flow (m3/s)	0.18	24.18	
0.43					
Top Width (m)	9.55	Top Width (m)	0.85	7.00	
1.70					
Vel Total (m/s)	1.98	Avg. Vel. (m/s)	0.51	2.11	
0.59					
Max Chl Dpth (m)	1.85	Hydr. Depth (m)	0.43	1.64	
0.43					
Conv. Total (m3/s)	439.2	Conv. (m3/s)	3.2	428.3	
7.6					
Length Wtd. (m)	95.20	Wetted Per. (m)	1.20	7.65	
1.90					
Min Ch El (m)	189.00	Shear (N/m2)	9.40	46.80	
11.89					
Alpha	1.11	Stream Power (N/m s)	4.77	98.81	
7.05					
Frctn Loss (m)	0.21	Cum Volume (1000 m3)	30.73	50.72	
28.42					
C & E Loss (m)	0.02	Cum SA (1000 m2)	30.19	16.75	
36.23					

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	194.31	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	
0.050					
W.S. Elev (m)	194.28	Reach Len. (m)	80.00	95.00	
125.00					
Crit W.S. (m)		Flow Area (m2)	28.44	35.49	
165.48					
E.G. Slope (m/m)	0.000218	Area (m2)	28.44	35.49	
165.48					
Q Total (m3/s)	133.76	Flow (m3/s)	11.93	41.61	
80.23					
Top Width (m)	101.27	Top Width (m)	16.01	7.00	
78.25					
Vel Total (m/s)	0.58	Avg. Vel. (m/s)	0.42	1.17	
0.48					
Max Chl Dpth (m)	5.28	Hydr. Depth (m)	1.78	5.07	
2.11					
Conv. Total (m3/s)	9065.7	Conv. (m3/s)	808.3	2820.1	
5437.3					
Length Wtd. (m)	115.54	Wetted Per. (m)	16.78	7.65	
78.58					
Min Ch El (m)	189.00	Shear (N/m2)	3.62	9.90	
4.50					
Alpha	1.72	Stream Power (N/m s)	1.52	11.61	
2.18					
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	126.76	116.71	
158.99					
C & E Loss (m)	0.01	Cum SA (1000 m2)	60.44	16.75	
89.88					

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: RIVER-1
REACH: Reach-1 RS: 46.082

INPUT
Description: Section 46.082 - Jane Steet - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	196	50	195	94	194	116	192	122	189
123	188.7	129	188.7	129.5	189	132	189.5	175	190
192	191	220	192	225	193	267	194	300	195

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	122	.035	129.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
122	129.5	75	75	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	122.5	196.5	F
129.5	300	193.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	190.84	Element	Left OB	Channel	Right OB
Vel Head (m)	0.17	Wt. n-Val.		0.035	
W.S. Elev (m)	190.68	Reach Len. (m)	75.00	75.00	75.00
Crit W.S. (m)	189.80	Flow Area (m2)		13.72	
E.G. Slope (m/m)	0.001663	Area (m2)	2.81	14.60	47.27
Q Total (m3/s)	24.80	Flow (m3/s)		24.80	
Top Width (m)	67.85	Top Width (m)	3.35	7.50	56.99
Vel Total (m/s)	1.81	Avg. Vel. (m/s)		1.81	
Max Chl Dpth (m)	1.98	Hydr. Depth (m)		1.96	
Conv. Total (m3/s)	607.9	Conv. (m3/s)		607.9	
Length Wtd. (m)	75.00	Wetted Per. (m)		7.11	
Min Ch El (m)	188.70	Shear (N/m2)		31.50	
Alpha	1.00	Stream Power (N/m s)		56.93	
Frctn Loss (m)		Cum Volume (1000 m3)	30.61	49.48	25.42
C & E Loss (m)		Cum SA (1000 m2)	30.03	16.06	32.56

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	194.30	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.035	0.050
W.S. Elev (m)	194.29	Reach Len. (m)	75.00	75.00	75.00
Crit W.S. (m)	192.06	Flow Area (m2)		39.01	393.75
E.G. Slope (m/m)	0.000051	Area (m2)	52.93	41.70	393.75
Q Total (m3/s)	133.76	Flow (m3/s)		24.89	108.87
Top Width (m)	195.26	Top Width (m)	40.72	7.50	147.04
Vel Total (m/s)	0.31	Avg. Vel. (m/s)		0.64	0.28
Max Chl Dpth (m)	5.59	Hydr. Depth (m)		5.57	2.68
Conv. Total (m3/s)	18640.6	Conv. (m3/s)		3469.1	15171.5
Length Wtd. (m)	75.00	Wetted Per. (m)		7.11	147.25
Min Ch El (m)	188.70	Shear (N/m2)		2.77	1.35
Alpha	1.44	Stream Power (N/m s)		1.77	0.37
Frctn Loss (m)		Cum Volume (1000 m3)	123.50	113.05	124.03
C & E Loss (m)		Cum SA (1000 m2)	58.18	16.06	75.80

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.0815

INPUT
Description: Hum 13-1R. Jane Street. 6.0 m W x 4.3 m H x 65 m L Concrete Box Culvert. Previous drawings by Ducan Hopper (1964) are out of date. Culvert modified as part of Highway 407, but no drawings available. Field observations used to update previous HEC-2 coding.

HEC-2 to HEC-RAS conversion January 2004 by Acres
included recoding of culvert to HEC-RAS format, including adjustments to roadway coding and hydraulic loss coefficients.
Distance from Upstream XS = 5
Deck/Roadway Width = 65
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 5

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	200	126	196.5	235	193.5
267	194	300	195		

Upstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	196	50	195	94	194	116	192	122	189
123	188.7	129	188.7	129.5	189	132	189.5	175	190
192	191	220	192	225	193	267	194	300	195

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	122	.035	129.5	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
122	129.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	122.5	196.5	F
129.5	300	193.5	F

Downstream Deck/Roadway Coordinates
num= 5

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	200	126	196.5	235	193.5
267	194	300	195		

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	196	50	195	94	194	116	192	122	189
123	188.7	129	188.7	129.5	189	132	189.5	175	190
192	191	220	192	225	193	267	194	300	195

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	122	.035	129.5	.08	225	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
122	129.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	122.5	196.5	F
129.5	300	191.8	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 = 193.5
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	4.3	6

FHWA Chart # 58- Rectangular concrete
FHWA Scale # 2 - Side tapered; More favorable edges
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef

```
                5      65     .015     .015        0                    .5
      1
Upstream   Elevation =  188.7
           Centerline Station =  126
Downstream Elevation =  188.7
           Centerline Station =  126

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      24.80    Culv Full Len (m)
  # Barrels                   1    Culv Vel US (m/s)         2.57
  Q Barrel (m3/s)          24.80    Culv Vel DS (m/s)         3.02
  E.G. US. (m)            190.84    Culv Inv El Up (m)      188.70
  W.S. US. (m)            190.68    Culv Inv El Dn (m)      188.70
  E.G. DS (m)             190.42    Culv Frctn Ls (m)         0.00
  W.S. DS (m)             190.07    Culv Exit Loss (m)        0.12
  Delta EG (m)              0.43    Culv Entr Loss (m)        0.20
  Delta WS (m)              0.61    Q Weir (m3/s)
  E.G. IC (m)             190.84    Weir Sta Lft (m)
  E.G. OC (m)             190.81    Weir Sta Rgt (m)
  Culvert Control          Inlet    Weir Submerg
  Culv WS Inlet (m)       190.31    Weir Max Depth (m)
  Culv WS Outlet (m)      190.07    Weir Avg Depth (m)
  Culv Nml Depth (m)                Weir Flow Area (m2)
  Culv Crt Depth (m)        1.20    Min El Weir Flow (m)    193.50


CULVERT OUTPUT  Profile #Regional w red'n  Culv Group:  Culvert #1

  Q Culv Group (m3/s)     104.27    Culv Full Len (m)
  # Barrels                   1    Culv Vel US (m/s)         4.54
  Q Barrel (m3/s)         104.27    Culv Vel DS (m/s)         5.54
  E.G. US. (m)            194.30    Culv Inv El Up (m)      188.70
  W.S. US. (m)            194.29    Culv Inv El Dn (m)      188.70
  E.G. DS (m)             191.93    Culv Frctn Ls (m)         0.06
  W.S. DS (m)             191.80    Culv Exit Loss (m)        1.47
  Delta EG (m)              2.37    Culv Entr Loss (m)        0.72
  Delta WS (m)              2.49    Q Weir (m3/s)            29.50
  E.G. IC (m)             194.30    Weir Sta Lft (m)        205.90
  E.G. OC (m)             194.25    Weir Sta Rgt (m)        276.93
  Culvert Control          Inlet    Weir Submerg              0.00
  Culv WS Inlet (m)       192.53    Weir Max Depth (m)        0.80
  Culv WS Outlet (m)      191.83    Weir Avg Depth (m)        0.43
  Culv Nml Depth (m)                Weir Flow Area (m2)      30.77
  Culv Crt Depth (m)        3.13    Min El Weir Flow (m)    193.50


CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 46.081

INPUT
Description: Section 46.081 - Jane Steet - D/S Bounding Section - J.D. Barnes
             2003 topo mapping
Station Elevation Data    num=      15
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0     196      50     195      94     194     116     192     122     189
     123   188.7     129   188.7   129.5     189     132   189.5     175     190
     192     191     220     192     225     193     267     194     300     195

Manning's n Values        num=       4
```

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	122	.035	129.5	.08	225	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
122	129.5	185	175	145	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	122.5	196.5	F
129.5	300	191.8	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	190.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.		0.035	
W.S. Elev (m)	190.07	Reach Len. (m)	185.00	175.00	145.00
Crit W.S. (m)	189.80	Flow Area (m2)		9.46	
E.G. Slope (m/m)	0.005752	Area (m2)	1.14	10.03	15.71
Q Total (m3/s)	24.80	Flow (m3/s)		24.80	
Top Width (m)	56.27	Top Width (m)	2.13	7.50	46.64
Vel Total (m/s)	2.62	Avg. Vel. (m/s)		2.62	
Max Chl Dpth (m)	1.37	Hydr. Depth (m)		1.35	
Conv. Total (m3/s)	326.9	Conv. (m3/s)		326.9	
Length Wtd. (m)	166.20	Wetted Per. (m)		7.11	
Min Ch El (m)	188.70	Shear (N/m2)		75.07	
Alpha	1.00	Stream Power (N/m s)		196.84	
Frctn Loss (m)	1.19	Cum Volume (1000 m3)	30.61	48.52	25.42
C & E Loss (m)	0.11	Cum SA (1000 m2)	29.82	15.50	28.67

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.93	Element	Left OB	Channel	Right OB
Vel Head (m)	0.13	Wt. n-Val.		0.035	0.080
W.S. Elev (m)	191.80	Reach Len. (m)	185.00	175.00	

145.00					
Crit W.S. (m)	191.80	Flow Area (m2)			21.59
125.59					
E.G. Slope (m/m)	0.001613	Area (m2)		7.84	23.03
125.59					
Q Total (m3/s)	133.76	Flow (m3/s)			51.97
81.79					
Top Width (m)	98.00	Top Width (m)		5.60	7.50
84.90					
Vel Total (m/s)	0.91	Avg. Vel. (m/s)			2.41
0.65					
Max Chl Dpth (m)	3.10	Hydr. Depth (m)			3.08
1.48					
Conv. Total (m3/s)	3330.5	Conv. (m3/s)			1294.0
2036.5					
Length Wtd. (m)	155.29	Wetted Per. (m)			7.11
85.00					
Min Ch El (m)	188.70	Shear (N/m2)			48.07
23.37					
Alpha	3.04	Stream Power (N/m s)			115.71
15.22					
Frctn Loss (m)	0.24	Cum Volume (1000 m3)		123.50	106.93
124.03					
C & E Loss (m)	0.04	Cum SA (1000 m2)		56.44	15.50
67.10					

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.07

INPUT
Description: Section 46.07 - J.D. Barnes 2003 topo mapping
Section 46.06
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	193	15	190	20	189	24	188	25	188
25	187.7	27	187.7	27	188	30	188	64	189
70	190	102	193	146	193	157	194		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	25	.035	27	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
25	27	95	165	125	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	189.12	Element	Left OB	Channel	Right OB
Vel Head (m)	0.13	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	188.99	Reach Len. (m)	95.00	165.00	125.00
Crit W.S. (m)		Flow Area (m2)	2.93	2.57	19.49
E.G. Slope (m/m)	0.009195	Area (m2)	2.93	2.57	19.49
Q Total (m3/s)	24.80	Flow (m3/s)	2.44	7.00	15.36
Top Width (m)	43.47	Top Width (m)	4.94	2.00	36.52
Vel Total (m/s)	0.99	Avg. Vel. (m/s)	0.83	2.72	0.79
Max Chl Dpth (m)	1.29	Hydr. Depth (m)	0.59	1.29	0.53
Conv. Total (m3/s)	258.6	Conv. (m3/s)	25.4	73.0	160.2
Length Wtd. (m)	133.79	Wetted Per. (m)	5.07	2.60	36.54
Min Ch El (m)	187.70	Shear (N/m2)	52.17	89.20	48.09
Alpha	2.58	Stream Power (N/m s)	43.42	242.64	37.91
Frctn Loss (m)	1.22	Cum Volume (1000 m3)	30.23	47.42	22.87
C & E Loss (m)	0.01	Cum SA (1000 m2)	29.16	14.67	22.64

Warning: The energy loss was 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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.31	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	191.26	Reach Len. (m)	95.00	165.00	125.00
Crit W.S. (m)		Flow Area (m2)	27.00	7.11	122.40
E.G. Slope (m/m)	0.001526	Area (m2)	27.00	7.11	122.40
Q Total (m3/s)	133.76	Flow (m3/s)	18.22	15.53	100.02
Top Width (m)	74.67	Top Width (m)	16.28	2.00	56.39
Vel Total (m/s)	0.85	Avg. Vel. (m/s)	0.67	2.18	0.82
Max Chl Dpth (m)	3.56	Hydr. Depth (m)	1.66	3.56	2.17
Conv. Total (m3/s)	3423.9	Conv. (m3/s)	466.3	397.4	

2560.2					
Length Wtd. (m)	117.48	Wetted Per. (m)	16.62	2.60	56.55
Min Ch El (m)	187.70	Shear (N/m2)	24.31	40.94	32.40
Alpha	1.53	Stream Power (N/m s)	16.40	89.38	26.47
Frctn Loss (m)	0.05	Cum Volume (1000 m3)	120.28	104.29	106.05
C & E Loss (m)	0.01	Cum SA (1000 m2)	54.41	14.67	56.86

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: RIVER-1
REACH: Reach-1 RS: 46.06

INPUT
Description: Section 46.06 - J.D. Barnes 2003 topo mapping
Section 46.06
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	192	25	191	47	190	55	188	114	187
118	186.9	119	186.4	121	186.4	122	186.9	125	187
142	192	187	192	217	192	222	191	255	191
257	192	275	193						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	118	.035	122	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
118	122	130	165	145	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
142	275	192.1	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	187.89	Element	Left OB	Channel	Right OB
Vel Head (m)	0.23	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	187.66	Reach Len. (m)	130.00	165.00	145.00
Crit W.S. (m)	187.66	Flow Area (m2)	15.80	4.55	2.88
E.G. Slope (m/m)	0.008997	Area (m2)	15.80	4.55	2.88
Q Total (m3/s)	24.80	Flow (m3/s)	9.60	12.93	2.27
Top Width (m)	52.35	Top Width (m)	43.09	4.00	5.25
Vel Total (m/s)	1.07	Avg. Vel. (m/s)	0.61	2.84	0.79

Max Chl Dpth (m)	1.26	Hydr. Depth (m)	0.37	1.14	0.55
Conv. Total (m3/s)	261.4	Conv. (m3/s)	101.2	136.3	23.9
Length Wtd. (m)	156.17	Wetted Per. (m)	43.10	4.24	5.35
Min Ch El (m)	186.40	Shear (N/m2)	32.35	94.77	47.56
Alpha	3.88	Stream Power (N/m s)	19.65	269.37	37.36
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	29.34	46.83	21.47
C & E Loss (m)	0.07	Cum SA (1000 m2)	26.88	14.17	20.03

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 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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.25	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	191.23	Reach Len. (m)	130.00	165.00	145.00
Crit W.S. (m)		Flow Area (m2)	271.80	18.82	43.27
E.G. Slope (m/m)	0.000217	Area (m2)	271.80	18.82	51.07
Q Total (m3/s)	133.76	Flow (m3/s)	98.07	21.40	14.29
Top Width (m)	154.77	Top Width (m)	98.77	4.00	52.00
Vel Total (m/s)	0.40	Avg. Vel. (m/s)	0.36	1.14	0.33
Max Chl Dpth (m)	4.83	Hydr. Depth (m)	2.75	4.71	2.49
Conv. Total (m3/s)	9083.5	Conv. (m3/s)	6659.4	1453.4	970.7
Length Wtd. (m)	148.83	Wetted Per. (m)	99.05	4.24	18.00
Min Ch El (m)	186.40	Shear (N/m2)	5.84	9.45	5.11
Alpha	1.96	Stream Power (N/m s)	2.11	10.75	

1.69					
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	106.09	102.15	95.21
C & E Loss (m)	0.00	Cum SA (1000 m2)	48.95	14.17	50.09

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.05

INPUT
Description: Section 46.05 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	193	30	192	72	191	90	186	93	185
95	184.8	100	184.5	123	184.5	128	184.8	150	189
170	190	190	191	210	192	217	191	260	190
280	190	292	193						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	95	.035	128	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
95	128	70	70	65	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
210	292	192.1	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	187.52	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	187.52	Reach Len. (m)	70.00	70.00	65.00
Crit W.S. (m)	184.93	Flow Area (m2)	15.47	98.20	19.40
E.G. Slope (m/m)	0.000015	Area (m2)	15.47	98.20	19.40
Q Total (m3/s)	24.80	Flow (m3/s)	0.96	22.69	1.15
Top Width (m)	57.73	Top Width (m)	10.48	33.00	14.25
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.06	0.23	0.06
Max Chl Dpth (m)	3.02	Hydr. Depth (m)	1.48	2.98	1.36
Conv. Total (m3/s)	6342.1	Conv. (m3/s)	245.0	5802.9	294.2
Length Wtd. (m)	69.23	Wetted Per. (m)	10.86	33.02	14.51

Min Ch El (m)	184.50	Shear (N/m2)	0.21	0.45	0.20
Alpha	1.42	Stream Power (N/m s)	0.01	0.10	0.01
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	27.31	38.36	19.85
C & E Loss (m)	0.00	Cum SA (1000 m2)	23.40	11.12	18.62

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.24	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	191.23	Reach Len. (m)	70.00	70.00	65.00
Crit W.S. (m)	185.72	Flow Area (m2)	79.98	220.47	144.74
E.G. Slope (m/m)	0.000024	Area (m2)	79.98	220.47	203.68
Q Total (m3/s)	133.76	Flow (m3/s)	8.82	110.04	14.90
Top Width (m)	201.52	Top Width (m)	32.51	33.00	136.02
Vel Total (m/s)	0.30	Avg. Vel. (m/s)	0.11	0.50	0.10
Max Chl Dpth (m)	6.73	Hydr. Depth (m)	2.46	6.68	2.18
Conv. Total (m3/s)	27150.8	Conv. (m3/s)	1790.8	22336.0	3024.0
Length Wtd. (m)	68.38	Wetted Per. (m)	33.36	33.02	66.98
Min Ch El (m)	184.50	Shear (N/m2)	0.57	1.59	0.51
Alpha	2.29	Stream Power (N/m s)	0.06	0.79	0.05
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	83.22	82.41	76.74
C & E Loss (m)	0.00	Cum SA (1000 m2)	40.42	11.12	36.45

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.04

INPUT
Description: Section 46.04 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	192	38	192	65	191	107	190	120	189
126	185	127	184	130	184	131	184.5	135	185
148	189	190	189.5	205	189	220	189	232	192

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	126	.035	131	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
126	131	115	100	70	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
190	232	190	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	187.52	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	187.48	Reach Len. (m)	115.00	100.00	70.00
Crit W.S. (m)	185.46	Flow Area (m2)	4.60	16.64	20.88
E.G. Slope (m/m)	0.000306	Area (m2)	4.60	16.64	20.88
Q Total (m3/s)	24.80	Flow (m3/s)	1.03	17.32	6.44
Top Width (m)	20.77	Top Width (m)	3.72	5.00	12.05
Vel Total (m/s)	0.59	Avg. Vel. (m/s)	0.22	1.04	0.31
Max Chl Dpth (m)	3.48	Hydr. Depth (m)	1.24	3.33	1.73
Conv. Total (m3/s)	1417.3	Conv. (m3/s)	58.7	990.2	368.4
Length Wtd. (m)	98.06	Wetted Per. (m)	4.47	5.53	12.45
Min Ch El (m)	184.00	Shear (N/m2)	3.09	9.03	5.03
Alpha	2.26	Stream Power (N/m s)	0.69	9.40	1.55
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	26.61	34.34	18.54
C & E Loss (m)	0.00	Cum SA (1000 m2)	22.90	9.79	17.76

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.23	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	191.19	Reach Len. (m)	115.00	100.00	70.00
Crit W.S. (m)	187.49	Flow Area (m2)	76.88	35.22	233.69
E.G. Slope (m/m)	0.000190	Area (m2)	76.88	35.22	233.69
Q Total (m3/s)	133.76	Flow (m3/s)	14.46	47.70	71.61
Top Width (m)	169.03	Top Width (m)	66.26	5.00	97.78
Vel Total (m/s)	0.39	Avg. Vel. (m/s)	0.19	1.35	0.31
Max Chl Dpth (m)	7.19	Hydr. Depth (m)	1.16	7.04	2.39
Conv. Total (m3/s)	9694.4	Conv. (m3/s)	1047.8	3457.0	5189.6
Length Wtd. (m)	95.43	Wetted Per. (m)	67.52	5.53	98.69
Min Ch El (m)	184.00	Shear (N/m2)	2.13	11.89	4.42
Alpha	4.73	Stream Power (N/m s)	0.40	16.10	1.35
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	77.73	73.46	62.53
C & E Loss (m)	0.01	Cum SA (1000 m2)	36.96	9.79	28.86

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: RIVER-1
REACH: Reach-1 RS: 46.032

INPUT
Description: Section 46.032 - CNR - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	191.25	6	191	9.7	190	13.7	189.8	58	189
88.3	188	109.3	185	121.7	184.2	125	184	181.4	182.6
195.4	182.6	209	184	287.6	185	289.7	187	297.1	188
316	189	328	189	334	185.4	350	192		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	125	.035	209	.08

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

```
          125     209                50      50      50              .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   182.9   189.8       F
   193.9     350   191.5       F
```

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	187.49	Element	Left OB	Channel	Right OB
Vel Head (m)	0.08	Wt. n-Val.		0.035	
W.S. Elev (m)	187.41	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	184.15	Flow Area (m2)		52.87	
E.G. Slope (m/m)	0.000242	Area (m2)	65.97	354.71	240.20
Q Total (m3/s)	66.97	Flow (m3/s)		66.97	
Top Width (m)	208.45	Top Width (m)	32.54	84.00	91.91
Vel Total (m/s)	1.27	Avg. Vel. (m/s)		1.27	
Max Chl Dpth (m)	4.81	Hydr. Depth (m)		4.81	
Conv. Total (m3/s)	4301.8	Conv. (m3/s)		4301.8	
Length Wtd. (m)	50.00	Wetted Per. (m)		11.00	
Min Ch El (m)	182.60	Shear (N/m2)		11.42	
Alpha	1.00	Stream Power (N/m s)		14.47	
Frctn Loss (m)		Cum Volume (1000 m3)	22.55	15.77	9.41
C & E Loss (m)		Cum SA (1000 m2)	20.82	5.34	14.12

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.22	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035	
W.S. Elev (m)	191.22	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	185.84	Flow Area (m2)	375.67	554.11	
E.G. Slope (m/m)	0.000007	Area (m2)	375.67	674.68	709.24
Q Total (m3/s)	200.64	Flow (m3/s)	26.82	173.83	
Top Width (m)	347.26	Top Width (m)	124.16	84.00	139.10
Vel Total (m/s)	0.22	Avg. Vel. (m/s)	0.07	0.31	

Max Chl Dpth (m)	8.62	Hydr. Depth (m)	3.03	8.04
Conv. Total (m3/s)	73340.5	Conv. (m3/s)	9801.9	63538.5
Length Wtd. (m)	50.00	Wetted Per. (m)	124.57	68.92
Min Ch El (m)	182.60	Shear (N/m2)	0.22	0.59
Alpha	1.85	Stream Power (N/m s)	0.02	0.19
Frctn Loss (m)		Cum Volume (1000 m3)	51.71	37.97
29.53				
C & E Loss (m)		Cum SA (1000 m2)	26.01	5.34
20.57				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.0315

INPUT
Description: Hum 13-1RR. CNR Culvert. Twin 3.0 m W x 3.5 m H x 32 m L
Structural Steel Plate Arch Culverts. No drawings available.
Size estimated from HEC-2 coding.

HEC-2 to HEC-RAS conversion
January 2004 by Acres included recoding of culvert to HEC-RAS format, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 13
Deck/Roadway Width = 32
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 10

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	191.2		5	191		8.7	190	
12.7	189.8		16.6	190		25	190.3	
115.5	191		274.1	192		335	192.5	
350	192.65							

Upstream Bridge Cross Section Data
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	191.25	6	191	9.7	190	13.7	189.8	58	189
88.3	188	109.3	185	121.7	184.2	125	184	181.4	182.6
195.4	182.6	209	184	287.6	185	289.7	187	297.1	188
316	189	328	189	334	185.4	350	192		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	125	.035	209	.08

Bank Sta: Left Right Coeff Contr. Expan.
125 209 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent

```
      0   182.9   189.8       F
  193.9     350   191.5       F

Downstream  Deck/Roadway Coordinates
    num=      10
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0   191.2               5     191             8.7     190
    12.7   189.8            16.6     190              25   190.3
   115.5     191           274.1     192             335   192.5
     350  192.65

Downstream Bridge Cross Section Data
Station Elevation Data    num=      15
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   191.2       6     191     9.7     190    13.7   189.8      58     189
    88.3     188   109.3     185   121.7   184.2     125     184     170   183.2
     171   182.6     180   182.6     181   183.2     195     184     310     190

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .08     170    .035     181     .08

Bank Sta: Left   Right    Coeff Contr.   Expan.
          170     181            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     170     187       F
     181     310     187       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         =   190.5
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       Ellipse     3.5       3
FHWA Chart # 30- Vertical Ellipse; Concrete
FHWA Scale # 1 - Square edge with headwall
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                13      32     .024     .024        0                   .7
      1
Number of Barrels =  2
Upstream   Elevation =  182.6
Centerline Stations
    Sta.    Sta.
   185.4   191.4
Downstream Elevation =  182.6
Centerline Stations
    Sta.    Sta.
     172     178

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      66.97    Culv Full Len (m)
  # Barrels                   2    Culv Vel US (m/s)        4.07
  Q Barrel (m3/s)          33.49    Culv Vel DS (m/s)        5.02
```

E.G. US. (m)	187.49	Culv Inv El Up (m)	182.60
W.S. US. (m)	187.41	Culv Inv El Dn (m)	182.60
E.G. DS (m)	184.99	Culv Frctn Ls (m)	0.00
W.S. DS (m)	184.22	Culv Exit Loss (m)	1.53
Delta EG (m)	2.50	Culv Entr Loss (m)	0.59
Delta WS (m)	3.19	Q Weir (m3/s)	
E.G. IC (m)	187.09	Weir Sta Lft (m)	
E.G. OC (m)	187.49	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	186.05	Weir Max Depth (m)	
Culv WS Outlet (m)	185.24	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	2.64	Min El Weir Flow (m)	190.50

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	112.90	Culv Full Len (m)	29.43
# Barrels	2	Culv Vel US (m/s)	6.84
Q Barrel (m3/s)	56.45	Culv Vel DS (m/s)	7.01
E.G. US. (m)	191.22	Culv Inv El Up (m)	182.60
W.S. US. (m)	191.22	Culv Inv El Dn (m)	182.60
E.G. DS (m)	187.51	Culv Frctn Ls (m)	1.06
W.S. DS (m)	185.89	Culv Exit Loss (m)	0.89
Delta EG (m)	3.71	Culv Entr Loss (m)	1.67
Delta WS (m)	5.32	Q Weir (m3/s)	87.74
E.G. IC (m)	191.21	Weir Sta Lft (m)	0.68
E.G. OC (m)	191.22	Weir Sta Rgt (m)	150.71
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	186.10	Weir Max Depth (m)	1.40
Culv WS Outlet (m)	185.89	Weir Avg Depth (m)	0.51
Culv Nml Depth (m)		Weir Flow Area (m2)	76.97
Culv Crt Depth (m)	3.25	Min El Weir Flow (m)	190.50

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.031

INPUT
Description: Section 46.031 - CNR - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	191.2	6	191	9.7	190	13.7	189.8	58	189
88.3	188	109.3	185	121.7	184.2	125	184	170	183.2
171	182.6	180	182.6	181	183.2	195	184	310	190

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	170	.035	181	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
170	181	90	110	75	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	170	187	F
181	310	187	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	184.99	Element	Left OB	Channel	Right OB
Vel Head (m)	0.77	Wt. n-Val.		0.035	
W.S. Elev (m)	184.22	Reach Len. (m)	90.00	110.00	75.00
Crit W.S. (m)	184.22	Flow Area (m2)		17.18	
E.G. Slope (m/m)	0.010691	Area (m2)	28.11	17.18	9.07
Q Total (m3/s)	66.97	Flow (m3/s)		66.97	
Top Width (m)	77.69	Top Width (m)	48.55	11.00	18.14
Vel Total (m/s)	3.90	Avg. Vel. (m/s)		3.90	
Max Chl Dpth (m)	1.62	Hydr. Depth (m)		1.56	
Conv. Total (m3/s)	647.7	Conv. (m3/s)		647.7	
Length Wtd. (m)	102.88	Wetted Per. (m)		11.33	
Min Ch El (m)	182.60	Shear (N/m2)		158.94	
Alpha	1.00	Stream Power (N/m s)		619.61	
Frctn Loss (m)	0.24	Cum Volume (1000 m3)	22.55	6.82	9.41
C & E Loss (m)	0.37	Cum SA (1000 m2)	18.79	2.97	11.37

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 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, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	187.51	Element	Left OB	Channel	Right OB
Vel Head (m)	1.62	Wt. n-Val.		0.035	
W.S. Elev (m)	185.89	Reach Len. (m)	90.00	110.00	75.00

Crit W.S. (m)	185.89	Flow Area (m2)		35.64	
E.G. Slope (m/m)	0.008428	Area (m2)	128.00	35.64	66.50
Q Total (m3/s)	200.64	Flow (m3/s)		200.64	
Top Width (m)	128.26	Top Width (m)	66.96	11.00	50.30
Vel Total (m/s)	5.63	Avg. Vel. (m/s)		5.63	
Max Chl Dpth (m)	3.29	Hydr. Depth (m)		3.24	
Conv. Total (m3/s)	2185.5	Conv. (m3/s)		2185.5	
Length Wtd. (m)	101.96	Wetted Per. (m)		11.33	
Min Ch El (m)	182.60	Shear (N/m2)		259.91	
Alpha	1.00	Stream Power (N/m s)		1463.36	
Frctn Loss (m)	0.23	Cum Volume (1000 m3)	51.71	11.26	29.53
C & E Loss (m)	0.78	Cum SA (1000 m2)	21.23	2.97	15.83

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 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, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.03

INPUT
Description: Section 46.03 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	189	17	183	34	182.3	35	182	39	182
40	182.3	43	183	88	182.5	89	181.5	93	181.5
94	182.5	96	183	100	184	103	185	138	187
187	188								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	88	.035	94	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
88	94	185	205	150	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	43	183.1	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	184.04	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	184.00	Reach Len. (m)	185.00	205.00	150.00
Crit W.S. (m)	183.28	Flow Area (m2)	96.30	14.00	4.49
E.G. Slope (m/m)	0.000995	Area (m2)	96.30	14.00	4.49
Q Total (m3/s)	66.97	Flow (m3/s)	45.19	20.35	1.43
Top Width (m)	85.83	Top Width (m)	73.83	6.00	6.00
Vel Total (m/s)	0.58	Avg. Vel. (m/s)	0.47	1.45	0.32
Max Chl Dpth (m)	2.50	Hydr. Depth (m)	1.30	2.33	0.75
Conv. Total (m3/s)	2122.9	Conv. (m3/s)	1432.3	645.2	45.4
Length Wtd. (m)	184.84	Wetted Per. (m)	74.19	6.83	6.18
Min Ch El (m)	181.50	Shear (N/m2)	12.67	20.00	7.10
Alpha	2.33	Stream Power (N/m s)	5.94	29.09	2.26
Frctn Loss (m)	0.32	Cum Volume (1000 m3)	16.95	5.11	8.90
C & E Loss (m)	0.01	Cum SA (1000 m2)	13.29	2.03	10.47

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	185.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	185.39	Reach Len. (m)	185.00	205.00	150.00
Crit W.S. (m)	183.85	Flow Area (m2)	201.48	22.32	16.79

E.G. Slope (m/m)	0.000999	Area (m2)	201.48	22.32	16.79
Q Total (m3/s)	200.64	Flow (m3/s)	149.42	44.40	6.81
Top Width (m)	99.53	Top Width (m)	77.76	6.00	15.77
Vel Total (m/s)	0.83	Avg. Vel. (m/s)	0.74	1.99	0.41
Max Chl Dpth (m)	3.89	Hydr. Depth (m)	2.59	3.72	1.06
Conv. Total (m3/s)	6347.1	Conv. (m3/s)	4726.9	1404.7	215.6
Length Wtd. (m)	181.78	Wetted Per. (m)	78.36	6.83	16.13
Min Ch El (m)	181.50	Shear (N/m2)	25.20	32.03	10.20
Alpha	1.86	Stream Power (N/m s)	18.69	63.72	4.14
Frctn Loss (m)	0.29	Cum Volume (1000 m3)	36.88	8.07	26.40
C & E Loss (m)	0.01	Cum SA (1000 m2)	14.72	2.03	13.35

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: RIVER-1
REACH: Reach-1 RS: 46.02

INPUT
Description: Section 46.02 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	189	18	183	41	182	44	181.7	44	181
46	181	47	181.7	50	182	70	183	78	185
90	186	120	187	150	188				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	44	.035	47	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
44	47	110	120	110	.1 .3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	183.71	Element	Left OB	Channel	Right OB
Vel Head (m)	0.13	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	183.57	Reach Len. (m)	110.00	120.00	110.00
Crit W.S. (m)		Flow Area (m2)	30.30	7.36	27.25
E.G. Slope (m/m)	0.003860	Area (m2)	30.30	7.36	27.25

Q Total (m3/s)	66.97	Flow (m3/s)	24.89	19.90	22.18
Top Width (m)	56.00	Top Width (m)	27.71	3.00	25.29
Vel Total (m/s)	1.03	Avg. Vel. (m/s)	0.82	2.70	0.81
Max Chl Dpth (m)	2.57	Hydr. Depth (m)	1.09	2.45	1.08
Conv. Total (m3/s)	1077.9	Conv. (m3/s)	400.7	320.3	356.9
Length Wtd. (m)	113.76	Wetted Per. (m)	27.84	3.92	25.40
Min Ch El (m)	181.00	Shear (N/m2)	41.19	71.11	40.62
Alpha	2.48	Stream Power (N/m s)	33.85	192.16	33.06
Frctn Loss (m)	0.34	Cum Volume (1000 m3)	5.24	2.92	6.52
C & E Loss (m)	0.00	Cum SA (1000 m2)	3.89	1.11	8.12

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	185.15	Element	Left OB	Channel	Right OB
Vel Head (m)	0.16	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	184.99	Reach Len. (m)	110.00	120.00	110.00
Crit W.S. (m)		Flow Area (m2)	72.73	11.63	67.24
E.G. Slope (m/m)	0.003026	Area (m2)	72.73	11.63	67.24
Q Total (m3/s)	200.64	Flow (m3/s)	85.86	37.73	77.05
Top Width (m)	65.95	Top Width (m)	31.98	3.00	30.97
Vel Total (m/s)	1.32	Avg. Vel. (m/s)	1.18	3.24	1.15
Max Chl Dpth (m)	3.99	Hydr. Depth (m)	2.27	3.88	2.17
Conv. Total (m3/s)	3647.3	Conv. (m3/s)	1560.7	685.9	1400.7
Length Wtd. (m)	112.32	Wetted Per. (m)	32.34	3.92	31.26
Min Ch El (m)	181.00	Shear (N/m2)	66.75	88.03	63.84
Alpha	1.76	Stream Power (N/m s)	78.79	285.62	73.15
Frctn Loss (m)	0.25	Cum Volume (1000 m3)	11.52	4.59	20.10
C & E Loss (m)	0.01	Cum SA (1000 m2)	4.57	1.11	9.85

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.01

INPUT
Description: Section 46.01 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	189	14	188	20	182	33	181	34	180.4
37	180.4	38	182	87	183	98	185	106	186
126	187	180	188						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	33	.035	38	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
33	38	95	105	95	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	183.36	Element	Left OB	Channel	Right OB
Vel Head (m)	0.14	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	183.22	Reach Len. (m)	95.00	105.00	95.00
Crit W.S. (m)		Flow Area (m2)	23.16	13.02	35.59
E.G. Slope (m/m)	0.002412	Area (m2)	23.16	13.02	35.59
Q Total (m3/s)	66.97	Flow (m3/s)	19.18	30.43	17.36
Top Width (m)	69.45	Top Width (m)	14.22	5.00	50.23
Vel Total (m/s)	0.93	Avg. Vel. (m/s)	0.83	2.34	0.49
Max Chl Dpth (m)	2.82	Hydr. Depth (m)	1.63	2.60	0.71
Conv. Total (m3/s)	1363.7	Conv. (m3/s)	390.6	619.7	353.4
Length Wtd. (m)	100.25	Wetted Per. (m)	14.77	6.05	50.26
Min Ch El (m)	180.40	Shear (N/m2)	37.08	50.86	16.75
Alpha	3.15	Stream Power (N/m s)	30.72	118.91	8.17
Frctn Loss (m)	0.19	Cum Volume (1000 m3)	2.30	1.70	3.06
C & E Loss (m)	0.00	Cum SA (1000 m2)	1.59	0.63	3.97

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	184.89	Element	Left OB	Channel	Right OB
Vel Head (m)	0.13	Wt. n-Val.	0.080	0.035	

0.080					
W.S. Elev (m)	184.76	Reach Len. (m)	95.00	105.00	95.00
Crit W.S. (m)		Flow Area (m2)	46.23	20.71	119.40
E.G. Slope (m/m)	0.001702	Area (m2)	46.23	20.71	119.40
Q Total (m3/s)	200.64	Flow (m3/s)	46.54	55.43	98.67
Top Width (m)	79.46	Top Width (m)	15.76	5.00	58.69
Vel Total (m/s)	1.08	Avg. Vel. (m/s)	1.01	2.68	0.83
Max Chl Dpth (m)	4.36	Hydr. Depth (m)	2.93	4.14	2.03
Conv. Total (m3/s)	4863.7	Conv. (m3/s)	1128.2	1343.8	2391.7
Length Wtd. (m)	98.47	Wetted Per. (m)	16.95	6.05	58.86
Min Ch El (m)	180.40	Shear (N/m2)	45.53	57.11	33.85
Alpha	2.20	Stream Power (N/m s)	45.84	152.85	27.97
Frctn Loss (m)	0.16	Cum Volume (1000 m3)	4.97	2.65	9.84
C & E Loss (m)	0.01	Cum SA (1000 m2)	1.94	0.63	4.92

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.00

INPUT
Description: Section 46.00 - J.D. Barnes 2003 topo mapping (This section location corresponds to D/S HEC-RAS model section 475.53)

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	188	20	187	40	182	55	181	57	180
60	180	62	181	73	182	95	183	103	184
110	185	123	187	180	187				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	55	.035	62	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
55	62	0	0	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	183.18	Element	Left OB	Channel	Right OB
Vel Head (m)	0.14	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	183.04	Reach Len. (m)			
Crit W.S. (m)	182.26	Flow Area (m2)	25.26	19.28	28.83

E.G. Slope (m/m)	0.001480	Area (m2)	25.26	19.28	28.83
Q Total (m3/s)	66.97	Flow (m3/s)	14.53	39.87	12.57
Top Width (m)	59.48	Top Width (m)	19.16	7.00	33.32
Vel Total (m/s)	0.91	Avg. Vel. (m/s)	0.58	2.07	0.44
Max Chl Dpth (m)	3.04	Hydr. Depth (m)	1.32	2.75	0.87
Conv. Total (m3/s)	1740.6	Conv. (m3/s)	377.6	1036.3	326.7
Length Wtd. (m)		Wetted Per. (m)	19.32	7.47	33.39
Min Ch El (m)	180.00	Shear (N/m2)	18.98	37.46	12.53
Alpha	3.19	Stream Power (N/m s)	10.92	77.47	5.47
Frctn Loss (m)		Cum Volume (1000 m3)			
C & E Loss (m)		Cum SA (1000 m2)			

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	184.73	Element	Left OB	Channel	Right OB
Vel Head (m)	0.19	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	184.54	Reach Len. (m)			
Crit W.S. (m)	183.38	Flow Area (m2)	58.50	29.78	87.66
E.G. Slope (m/m)	0.001535	Area (m2)	58.50	29.78	87.66
Q Total (m3/s)	200.64	Flow (m3/s)	49.83	83.80	67.01
Top Width (m)	76.94	Top Width (m)	25.16	7.00	44.78
Vel Total (m/s)	1.14	Avg. Vel. (m/s)	0.85	2.81	0.76
Max Chl Dpth (m)	4.54	Hydr. Depth (m)	2.33	4.25	1.96
Conv. Total (m3/s)	5120.9	Conv. (m3/s)	1271.8	2138.8	1710.3
Length Wtd. (m)		Wetted Per. (m)	25.51	7.47	44.95
Min Ch El (m)	180.00	Shear (N/m2)	34.53	60.00	29.36
Alpha	2.83	Stream Power (N/m s)	29.41	168.84	22.44
Frctn Loss (m)		Cum Volume (1000 m3)			
C & E Loss (m)		Cum SA (1000 m2)			

SUMMARY OF MANNING'S N VALUES

River:RIVER-1

Reach	River Sta.	n1	n2	n3	n4	n5	n6	n7
Reach-1	46.45	.05	.035	.08				
Reach-1	46.44	.05	.035	.05				
Reach-1	46.43	.05	.08	.035	.08	.05		
Reach-1	46.42	.05	.08	.035	.08	.05		
Reach-1	46.413	.05	.08	.035	.08	.05		
Reach-1	46.4125	Inl Struct						
Reach-1	46.412	.05	.08	.035	.08	.05		
Reach-1	46.4115	Culvert						
Reach-1	46.411	.05	.08	.035	.08	.05		
Reach-1	46.41	.05	.08	.035	.08	.035	.08	.05
Reach-1	46.402	.05	.08	.035	.08	.05		
Reach-1	46.4015	Culvert						
Reach-1	46.401	.05	.08	.035	.08	.05		
Reach-1	46.392	.05	.025	.05	.08	.035	.08	.05
Reach-1	46.3915	Mult Open						
Reach-1	46.391	.05	.025	.05	.08	.05		
Reach-1	46.39	.05	.025	.05	.08	.035	.08	.05
Reach-1	46.382	.025	.08	.035	.08	.05		
Reach-1	46.3815	Culvert						
Reach-1	46.381	.025	.05	.08	.035	.08	.05	
Reach-1	46.36	.025	.05	.08	.035	.08	.05	
Reach-1	46.35	.025	.05	.08	.035	.08	.05	
Reach-1	46.34	.025	.05	.08	.035	.08	.05	
Reach-1	46.33	.05	.08	.035	.08	.05		
Reach-1	46.322	.05	.08	.035	.08	.05		
Reach-1	46.3215	Culvert						
Reach-1	46.321	.05	.08	.035	.08	.05		

Reach-1	46.32		.05	.08	.035	.08	.05
Reach-1	46.312		.05	.08	.035	.08	.05
Reach-1	46.3115	Culvert					
Reach-1	46.311		.05	.08	.035	.08	.05
Reach-1	46.31		.05	.08	.035	.08	.05
Reach-1	46.30		.05	.08	.035	.08	.025
.05							
Reach-1	46.292		.05	.08	.035	.08	.05
Reach-1	46.2915	Culvert					
Reach-1	46.291		.05	.08	.035	.08	.05
Reach-1	46.29		.05	.08	.035	.08	.05
Reach-1	46.282		.05	.08	.035	.08	.05
.025	.05						
Reach-1	46.2815	Culvert					
Reach-1	46.281		.05	.08	.035	.08	.05
.025	.05						
Reach-1	46.28		.05	.08	.035	.08	.05
.025	.05						
Reach-1	46.274		.05	.08	.035	.08	.05
Reach-1	46.2735	Bridge					
Reach-1	46.273		.05	.08	.035	.08	.05
Reach-1	46.272		.05	.08	.035	.08	.05
Reach-1	46.2715	Culvert					
Reach-1	46.271		.05	.05	.08	.035	.08
.05							
Reach-1	46.27		.08	.035	.08		
Reach-1	46.26		.05	.08	.035	.08	.05
Reach-1	46.25		.05	.08	.035	.08	.05
Reach-1	46.24		.05	.08	.035	.08	.05
Reach-1	46.2375		.05	.08	.035	.08	.05
Reach-1	46.2325		.05	.08	.035	.08	.05
Reach-1	46.23		.05	.08	.035	.08	.05
Reach-1	46.22		.08	.035	.08	.035	.05
Reach-1	46.214		.05	.035	.08		
Reach-1	46.2135	Inl Struct					
Reach-1	46.213		.05	.035	.08		
Reach-1	46.212		.05	.035	.08		

Reach-1	46.2115	Culvert					
Reach-1	46.211		.05	.035	.08		
Reach-1	46.21		.05	.035	.05		
Reach-1	46.202		.05	.035	.05		
Reach-1	46.2015	Culvert					
Reach-1	46.201		.05	.035	.05		
Reach-1	46.192		.05	.035	.05		
Reach-1	46.1915	Culvert					
Reach-1	46.191		.05	.035	.05		
Reach-1	46.19		.05	.025	.05	.035	.05
Reach-1	46.182		.05	.025	.05	.035	.05
Reach-1	46.1815	Culvert					
Reach-1	46.181		.05	.025	.05	.035	.05
Reach-1	46.18		.05	.035	.05		
Reach-1	46.172		.05	.035	.05		
Reach-1	46.1715	Culvert					
Reach-1	46.171		.05	.035	.05	.025	
Reach-1	46.17		.05	.035	.05	.025	
Reach-1	46.162		.05	.035	.05		
Reach-1	46.1615	Culvert					
Reach-1	46.161		.05	.035	.05		
Reach-1	46.15		.05	.08	.035	.08	.025
Reach-1	46.142		.05	.08	.035	.08	.025
Reach-1	46.1415	Culvert					
Reach-1	46.141		.05	.08	.035	.08	.025
Reach-1	46.14		.05	.08	.035	.08	.025
Reach-1	46.132		.05	.08	.035	.08	.05
Reach-1	46.13		.05	.08	.035	.08	.05
Reach-1	46.122		.05	.035	.05		
Reach-1	46.1215	Culvert					
Reach-1	46.121		.05	.035	.05		

Reach-1	46.12	.05	.035	.05	
Reach-1	46.11	.05	.035	.05	
Reach-1	46.1015	Culvert			
Reach-1	46.10	.05	.035	.05	
Reach-1	46.09	.05	.035	.05	
Reach-1	46.082	.05	.035	.05	
Reach-1	46.0815	Culvert			
Reach-1	46.081	.08	.035	.08	.05
Reach-1	46.07	.08	.035	.08	
Reach-1	46.06	.08	.035	.08	
Reach-1	46.05	.08	.035	.08	
Reach-1	46.04	.08	.035	.08	
Reach-1	46.032	.08	.035	.08	
Reach-1	46.0315	Culvert			
Reach-1	46.031	.08	.035	.08	
Reach-1	46.03	.08	.035	.08	
Reach-1	46.02	.08	.035	.08	
Reach-1	46.01	.08	.035	.08	
Reach-1	46.00	.08	.035	.08	

SUMMARY OF REACH LENGTHS

River: RIVER-1

Reach	River Sta.	Left	Channel	Right
Reach-1	46.45	180	180	170
Reach-1	46.44	130	130	125
Reach-1	46.43	100	100	95
Reach-1	46.42	295	240	190
Reach-1	46.413	5	5	5
Reach-1	46.4125	Inl Struct		
Reach-1	46.412	45	45	45
Reach-1	46.4115	Culvert		
Reach-1	46.411	80	80	90
Reach-1	46.41	140	140	120
Reach-1	46.402	100	100	100
Reach-1	46.4015	Culvert		
Reach-1	46.401	80	95	100
Reach-1	46.392	70	70	70

Reach-1	46.3915	Mult Open			
Reach-1	46.391		45	35	25
Reach-1	46.39		50	35	25
Reach-1	46.382		45	45	45
Reach-1	46.3815	Culvert			
Reach-1	46.381		260	275	290
Reach-1	46.36		150	150	150
Reach-1	46.35		120	120	120
Reach-1	46.34		225	205	190
Reach-1	46.33		130	130	130
Reach-1	46.322		50	50	50
Reach-1	46.3215	Culvert			
Reach-1	46.321		50	50	50
Reach-1	46.32		110	110	110
Reach-1	46.312		60	60	60
Reach-1	46.3115	Culvert			
Reach-1	46.311		150	150	150
Reach-1	46.31		150	150	150
Reach-1	46.30		110	110	110
Reach-1	46.292		55	55	55
Reach-1	46.2915	Culvert			
Reach-1	46.291		145	150	155
Reach-1	46.29		135	145	150
Reach-1	46.282		50	50	50
Reach-1	46.2815	Culvert			
Reach-1	46.281		40	40	40
Reach-1	46.28		50	50	50
Reach-1	46.274		1	1	1
Reach-1	46.2735	Bridge			
Reach-1	46.273		4	4	4
Reach-1	46.272		100	80	60
Reach-1	46.2715	Culvert			
Reach-1	46.271		55	60	70
Reach-1	46.27		100	110	120
Reach-1	46.26		115	120	120
Reach-1	46.25		140	130	125
Reach-1	46.24		54	51	45
Reach-1	46.2375		30	30	30
Reach-1	46.2325		94	94	94
Reach-1	46.23		101	95	89
Reach-1	46.22		125	140	115
Reach-1	46.214		1	1	1
Reach-1	46.2135	Inl Struct			
Reach-1	46.213		15	15	15
Reach-1	46.212		55	45	10
Reach-1	46.2115	Culvert			
Reach-1	46.211		10	10	10
Reach-1	46.21		30	30	30
Reach-1	46.202		70	70	70
Reach-1	46.2015	Culvert			
Reach-1	46.201		20	25	30
Reach-1	46.192		25	25	25
Reach-1	46.1915	Culvert			
Reach-1	46.191		50	50	50
Reach-1	46.19		45	45	45
Reach-1	46.182		30	30	30
Reach-1	46.1815	Culvert			
Reach-1	46.181		10	10	10
Reach-1	46.18		25	25	25
Reach-1	46.172		40	40	40
Reach-1	46.1715	Culvert			
Reach-1	46.171		20	20	20
Reach-1	46.17		25	25	25

Reach-1	46.162	30	30	30
Reach-1	46.1615	Culvert		
Reach-1	46.161	115	115	110
Reach-1	46.15	50	50	50
Reach-1	46.142	60	60	60
Reach-1	46.1415	Culvert		
Reach-1	46.141	30	25	20
Reach-1	46.14	37.5	37.5	37.5
Reach-1	46.132	27.5	27.5	27.5
Reach-1	46.13	25	25	25
Reach-1	46.122	38	38	38
Reach-1	46.1215	Culvert		
Reach-1	46.121	20	20	20
Reach-1	46.12	35	38	40
Reach-1	46.11	235	235	235
Reach-1	46.1015	Culvert		
Reach-1	46.10	130	200	160
Reach-1	46.09	80	95	125
Reach-1	46.082	75	75	75
Reach-1	46.0815	Culvert		
Reach-1	46.081	185	175	145
Reach-1	46.07	95	165	125
Reach-1	46.06	130	165	145
Reach-1	46.05	70	70	65
Reach-1	46.04	115	100	70
Reach-1	46.032	50	50	50
Reach-1	46.0315	Culvert		
Reach-1	46.031	90	110	75
Reach-1	46.03	185	205	150
Reach-1	46.02	110	120	110
Reach-1	46.01	95	105	95
Reach-1	46.00	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: RIVER-1

Reach	River Sta.	Contr.	Expan.
Reach-1	46.45	.1	.3
Reach-1	46.44	.1	.3
Reach-1	46.43	.1	.3
Reach-1	46.42	.1	.3
Reach-1	46.413	.3	.5
Reach-1	46.4125	Inl Struct	
Reach-1	46.412	.3	.5
Reach-1	46.4115	Culvert	
Reach-1	46.411	.3	.5
Reach-1	46.41	.1	.3
Reach-1	46.402	.3	.5
Reach-1	46.4015	Culvert	
Reach-1	46.401	.3	.5
Reach-1	46.392	.3	.5
Reach-1	46.3915	Mult Open	
Reach-1	46.391	.3	.5
Reach-1	46.39	.1	.3
Reach-1	46.382	.3	.5
Reach-1	46.3815	Culvert	
Reach-1	46.381	.3	.5
Reach-1	46.36	.1	.3

Reach-1	46.35	.1	.3
Reach-1	46.34	.1	.3
Reach-1	46.33	.1	.3
Reach-1	46.322	.3	.5
Reach-1	46.3215	Culvert	
Reach-1	46.321	.3	.5
Reach-1	46.32	.1	.3
Reach-1	46.312	.3	.5
Reach-1	46.3115	Culvert	
Reach-1	46.311	.3	.5
Reach-1	46.31	.1	.3
Reach-1	46.30	.1	.3
Reach-1	46.292	.3	.5
Reach-1	46.2915	Culvert	
Reach-1	46.291	.3	.5
Reach-1	46.29	.1	.3
Reach-1	46.282	.3	.5
Reach-1	46.2815	Culvert	
Reach-1	46.281	.3	.5
Reach-1	46.28	.1	.3
Reach-1	46.274	.3	.5
Reach-1	46.2735	Bridge	
Reach-1	46.273	.3	.5
Reach-1	46.272	.3	.5
Reach-1	46.2715	Culvert	
Reach-1	46.271	.3	.5
Reach-1	46.27	.1	.3
Reach-1	46.26	.1	.3
Reach-1	46.25	.1	.3
Reach-1	46.24	.1	.3
Reach-1	46.2375	.1	.3
Reach-1	46.2325	.1	.3
Reach-1	46.23	.1	.3
Reach-1	46.22	.1	.3
Reach-1	46.214	.3	.5
Reach-1	46.2135	Inl Struct	
Reach-1	46.213	.3	.5
Reach-1	46.212	.3	.5
Reach-1	46.2115	Culvert	
Reach-1	46.211	.3	.5
Reach-1	46.21	.1	.3
Reach-1	46.202	.3	.5
Reach-1	46.2015	Culvert	
Reach-1	46.201	.3	.5
Reach-1	46.192	.3	.5
Reach-1	46.1915	Culvert	
Reach-1	46.191	.3	.5
Reach-1	46.19	.1	.3
Reach-1	46.182	.3	.5
Reach-1	46.1815	Culvert	
Reach-1	46.181	.3	.5
Reach-1	46.18	.1	.3
Reach-1	46.172	.3	.5
Reach-1	46.1715	Culvert	
Reach-1	46.171	.3	.5
Reach-1	46.17	.1	.3
Reach-1	46.162	.3	.5
Reach-1	46.1615	Culvert	
Reach-1	46.161	.3	.5
Reach-1	46.15	.1	.3
Reach-1	46.142	.3	.5
Reach-1	46.1415	Culvert	
Reach-1	46.141	.3	.5

Reach-1	46.14	.1	.3
Reach-1	46.132	.3	.5
Reach-1	46.13	.1	.3
Reach-1	46.122	.3	.5
Reach-1	46.1215	Culvert	
Reach-1	46.121	.3	.5
Reach-1	46.12	.1	.3
Reach-1	46.11	.3	.5
Reach-1	46.1015	Culvert	
Reach-1	46.10	.3	.5
Reach-1	46.09	.1	.3
Reach-1	46.082	.3	.5
Reach-1	46.0815	Culvert	
Reach-1	46.081	.3	.5
Reach-1	46.07	.1	.3
Reach-1	46.06	.1	.3
Reach-1	46.05	.1	.3
Reach-1	46.04	.1	.3
Reach-1	46.032	.3	.5
Reach-1	46.0315	Culvert	
Reach-1	46.031	.3	.5
Reach-1	46.03	.1	.3
Reach-1	46.02	.1	.3
Reach-1	46.01	.1	.3
Reach-1	46.00	.1	.3

HEC-RAS HEC-RAS 5.0.0 February 2016
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

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

PROJECT DATA
Project Title: Black Creek Update (2016-02-26)
Project File : BlackCreekUpdate.prj
Run Date and Time: 6/30/2016 3:28:32 PM

Project in SI units

Project Description:
Main Humber River and Tributaries Digital Flood Plain Mapping
Hec-Ras File:
Black Creek Geometry.gxx covers Sheets HUM 13 (Converted Hec-2 file 46f1tbc.dat using new mapping), HUM 13A, HUM 13B & HUM 13C (New HEC-RAS based on new mapping)

PLAN DATA

Plan Title: Portage Parkway (Feb 2016 Alternative#1)
Plan File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.p05

Geometry Title: BlackCreek-PortageAlternative#1-Feb2016
Geometry File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.g03

Flow Title : Black Creek EXISTING Flows - April '10
Flow File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.f04

Plan Summary Information:

Number of: Cross Sections	=	86	Multiple Openings	=	1
Culverts	=	20	Inline Structures	=	2
Bridges	=	1	Lateral Structures	=	0

Computational Information
Water surface calculation tolerance = 0.003
Critical depth calculation tolerance = 0.003
Maximum number of iterations = 20

Maximum difference tolerance = 0.1
Flow tolerance factor = 0.001

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

FLOW DATA

Flow Title: Black Creek EXISTING Flows - April '10
Flow File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.f04

Flow Data (m3/s)

River	Reach	RS	2-year	5-year	10-year	25-year	50-year	100-year	Aug. 19th	Regional w red'n
RIVER-1	Reach-1	46.45	3.729	4.826	5.609	6.57	7.342	7.79	16.701	42.698
RIVER-1	Reach-1	46.413	1.611	2.011	2.244	2.66	3.591	4.753	10.797	42.698
RIVER-1	Reach-1	46.41	3.066	4.074	4.85	5.926	6.831	7.624	17.745	47.801
RIVER-1	Reach-1	46.36	6.209	8.542	10.169	12.321	14.297	16.307	41.071	66.485
RIVER-1	Reach-1	46.33	8.661	12.09	14.453	17.546	20.243	22.971	57.024	74.783
RIVER-1	Reach-1	46.30	10.769	15.139	18.134	22.036	25.353	28.697	70.731	81.913
RIVER-1	Reach-1	46.274	8.055	11.399	13.737	17.024	19.57	22.105	52.858	81.913
RIVER-1	Reach-1	46.25	15.029	21.487	25.936	31.807	36.287	40.806	96.524	108.096
RIVER-1	Reach-1	46.214	3.775	6.823	9.185	12.675	15.796	19.055	49.3	108.096
RIVER-1	Reach-1	46.21	7.789	11.08	13.186	15.823	17.823	20.589	50.389	122.563
RIVER-1	Reach-1	46.09	8.997	12.899	15.58	19.072	21.783	24.795	62.776	133.764
RIVER-1	Reach-1	46.032	19.481	29.214	36.46	51.57	58.851	66.972	191.204	200.643

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
RIVER-1	Reach-1	2-year		
Known WS = 181.99				
RIVER-1	Reach-1	5-year		
Known WS = 182.42				
RIVER-1	Reach-1	10-year		
Known WS = 182.66				
RIVER-1	Reach-1	25-year		
Known WS = 182.73				
RIVER-1	Reach-1	50-year		
Known WS = 182.89				
RIVER-1	Reach-1	100-year		
Known WS = 183.04				
RIVER-1	Reach-1	Aug. 19th		
Known WS = 184.54				
RIVER-1	Reach-1	Regional w red'n		
Known WS = 184.54				

GEOMETRY DATA

Geometry Title: BlackCreek-PortageAlternative#1-Feb2016
Geometry File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.g03

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.45

INPUT
Description: Section 46.45 - J.D. Barnes 2003 topo mapping - U/S Study Limit
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	209	30	208	75	207.5	84	206.5	85	206.5
90	207.5	130	208	136	209				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	75	.035	90	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
75	90	180	180	170	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	207.38	Element	Left OB	Channel	Right OB
Vel Head (m)	0.19	Wt. n-Val.		0.035	

W.S. Elev (m)	207.19	Reach Len. (m)	180.00	180.00
170.00				
Crit W.S. (m)	207.19	Flow Area (m2)		4.02
E.G. Slope (m/m)	0.017095	Area (m2)		4.02
Q Total (m3/s)	7.79	Flow (m3/s)		7.79
Top Width (m)	10.66	Top Width (m)		10.66
Vel Total (m/s)	1.94	Avg. Vel. (m/s)		1.94
Max Chl Dpth (m)	0.69	Hydr. Depth (m)		0.38
Conv. Total (m3/s)	59.6	Conv. (m3/s)		59.6
Length Wtd. (m)	179.49	Wetted Per. (m)		10.76
Min Ch El (m)	206.50	Shear (N/m2)		62.62
Alpha	1.00	Stream Power (N/m s)		121.33
Frctn Loss (m)	0.16	Cum Volume (1000 m3)	119.72	216.54
77.08				
C & E Loss (m)	0.05	Cum SA (1000 m2)	121.79	84.02
93.84				

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 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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	208.17	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.22	Wt. n-Val.	0.050	0.035	
0.080					
W.S. Elev (m)	207.95	Reach Len. (m)	180.00	180.00	
170.00					
Crit W.S. (m)	207.95	Flow Area (m2)	8.94	14.69	
7.94					
E.G. Slope (m/m)	0.006925	Area (m2)	8.94	14.69	
7.94					
Q Total (m3/s)	42.70	Flow (m3/s)	5.47	34.19	
3.04					
Top Width (m)	90.74	Top Width (m)	40.10	15.00	

35.64					
Vel Total (m/s)	1.35	Avg. Vel. (m/s)	0.61	2.33	
0.38					
Max Chl Dpth (m)	1.45	Hydr. Depth (m)	0.22	0.98	
0.22					
Conv. Total (m3/s)	513.1	Conv. (m3/s)	65.7	410.9	
36.5					
Length Wtd. (m)	177.73	Wetted Per. (m)	40.10	15.15	
35.65					
Min Ch El (m)	206.50	Shear (N/m2)	15.13	65.81	
15.13					
Alpha	2.40	Stream Power (N/m s)	9.26	153.23	
5.79					
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	452.03	444.74	
389.77					
C & E Loss (m)	0.07	Cum SA (1000 m2)	336.40	84.42	
333.56					

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 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: RIVER-1
REACH: Reach-1 RS: 46.44

INPUT
Description: Section 46.44 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	209	84	208	118	205	126	204	129	203.7
131	203.7	132	204	136	205	139	206	216	207
224	208	300	209						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	126	.035	132	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
126	132	130	130	125	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	205.29	Element	Left OB	Channel

Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	205.28	Reach Len. (m)	130.00	130.00	125.00
Crit W.S. (m)		Flow Area (m2)	6.69	8.88	3.24
E.G. Slope (m/m)	0.000274	Area (m2)	6.69	8.88	3.24
Q Total (m3/s)	7.79	Flow (m3/s)	1.57	5.42	0.80
Top Width (m)	22.02	Top Width (m)	11.18	6.00	4.84
Vel Total (m/s)	0.41	Avg. Vel. (m/s)	0.23	0.61	0.25
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.60	1.48	0.67
Conv. Total (m3/s)	470.5	Conv. (m3/s)	94.6	327.5	48.4
Length Wtd. (m)	129.13	Wetted Per. (m)	11.25	6.06	5.01
Min Ch El (m)	203.70	Shear (N/m2)	1.60	3.94	1.74
Alpha	1.61	Stream Power (N/m s)	0.37	2.41	0.43
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	119.12	215.38	76.81
C & E Loss (m)	0.00	Cum SA (1000 m2)	120.79	82.52	93.43

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.46	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	207.46	Reach Len. (m)	130.00	130.00	125.00
Crit W.S. (m)		Flow Area (m2)	57.86	21.94	92.22
E.G. Slope (m/m)	0.000074	Area (m2)	57.86	21.94	92.22
Q Total (m3/s)	42.70	Flow (m3/s)	13.64	12.70	16.35
Top Width (m)	129.50	Top Width (m)	35.84	6.00	87.66
Vel Total (m/s)	0.25	Avg. Vel. (m/s)	0.24	0.58	0.18
Max Chl Dpth (m)	3.76	Hydr. Depth (m)	1.61	3.66	1.05
Conv. Total (m3/s)	4969.1	Conv. (m3/s)	1587.5	1478.4	1903.2
Length Wtd. (m)	128.13	Wetted Per. (m)	36.02	6.06	87.98
Min Ch El (m)	203.70	Shear (N/m2)	1.16	2.62	0.76

Alpha	2.10	Stream Power (N/m s)	0.27	1.52
0.13				
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	446.02	441.44
381.25				
C & E Loss (m)	0.00	Cum SA (1000 m2)	329.56	82.53
323.08				

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.43

INPUT
Description: Section 46.43 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	95	210	95	208.3	105	208	116	205
143	204	145	203.5	149	203.5	150	204	177	205
180	206	187	207	231	208	310	208.6		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	105	.08	143	.035	150	.08	177	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
143	150	100	100	95	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	205.27	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035
0.080				
W.S. Elev (m)	205.27	Reach Len. (m)	100.00	100.00
95.00				
Crit W.S. (m)		Flow Area (m2)	20.95	11.65
20.93				
E.G. Slope (m/m)	0.000076	Area (m2)	20.95	11.65
20.93				
Q Total (m3/s)	7.79	Flow (m3/s)	1.88	4.00
1.91				
Top Width (m)	62.81	Top Width (m)	27.99	7.00
27.81				
Vel Total (m/s)	0.15	Avg. Vel. (m/s)	0.09	0.34
0.09				
Max Chl Dpth (m)	1.77	Hydr. Depth (m)	0.75	1.66
0.75				
Conv. Total (m3/s)	894.4	Conv. (m3/s)	215.7	459.5
219.3				
Length Wtd. (m)	99.26	Wetted Per. (m)	28.05	7.18
27.88				
Min Ch El (m)	203.50	Shear (N/m2)	0.56	1.21
0.56				
Alpha	3.05	Stream Power (N/m s)	0.05	0.41
0.05				
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	117.32	214.05
75.30				
C & E Loss (m)	0.00	Cum SA (1000 m2)	118.24	81.68
91.39				

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.46	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035	0.077
W.S. Elev (m)	207.45	Reach Len. (m)	100.00	100.00	95.00
Crit W.S. (m)		Flow Area (m2)	90.70	26.91	96.67
E.G. Slope (m/m)	0.000047	Area (m2)	90.70	26.91	96.67
Q Total (m3/s)	42.70	Flow (m3/s)	14.32	12.73	15.65
Top Width (m)	99.83	Top Width (m)	35.99	7.00	56.85
Vel Total (m/s)	0.20	Avg. Vel. (m/s)	0.16	0.47	0.16
Max Chl Dpth (m)	3.95	Hydr. Depth (m)	2.52	3.84	1.70
Conv. Total (m3/s)	6221.5	Conv. (m3/s)	2086.2	1854.9	2280.4
Length Wtd. (m)	98.70	Wetted Per. (m)	36.33	7.18	57.10
Min Ch El (m)	203.50	Shear (N/m2)	1.15	1.73	0.78
Alpha	2.13	Stream Power (N/m s)	0.18	0.82	0.13
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	436.37	438.27	369.45
C & E Loss (m)	0.00	Cum SA (1000 m2)	324.89	81.69	314.05

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.42

INPUT
Description: Section 46.42 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208.5	13	208	29	207	31	206	52	205
64	204	66	203.3	70	203.3	74	204	80	205
84	206	105	207	215	208	231	208.3		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	29	.08	64	.035	74	.08	105	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
64	74	295	240	190	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	205.27	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	205.26	Reach Len. (m)	295.00	240.00	190.00
Crit W.S. (m)		Flow Area (m2)	9.83	17.50	4.69
E.G. Slope (m/m)	0.000085	Area (m2)	9.83	17.50	4.69
Q Total (m3/s)	7.79	Flow (m3/s)	0.77	6.61	0.41
Top Width (m)	34.50	Top Width (m)	17.46	10.00	7.04
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.08	0.38	0.09
Max Chl Dpth (m)	1.96	Hydr. Depth (m)	0.56	1.75	0.67
Conv. Total (m3/s)	845.3	Conv. (m3/s)	83.6	717.4	44.3
Length Wtd. (m)	241.75	Wetted Per. (m)	17.51	10.18	7.15
Min Ch El (m)	203.30	Shear (N/m2)	0.47	1.43	0.55
Alpha	2.06	Stream Power (N/m s)	0.04	0.54	0.05
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	115.78	212.59	74.08
C & E Loss (m)	0.00	Cum SA (1000 m2)	115.97	80.83	89.73

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.077
W.S. Elev (m)	207.44	Reach Len. (m)	295.00	240.00	190.00
Crit W.S. (m)		Flow Area (m2)	79.45	39.30	55.78
E.G. Slope (m/m)	0.000067	Area (m2)	79.45	39.30	55.78
Q Total (m3/s)	42.70	Flow (m3/s)	13.58	22.59	6.53
Top Width (m)	131.42	Top Width (m)	42.04	10.00	79.38
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.17	0.57	0.12
Max Chl Dpth (m)	4.14	Hydr. Depth (m)	1.89	3.93	0.70
Conv. Total (m3/s)	5223.7	Conv. (m3/s)	1661.7	2763.2	798.8
Length Wtd. (m)	248.69	Wetted Per. (m)	42.35	10.18	79.62
Min Ch El (m)	203.30	Shear (N/m2)	1.23	2.53	

0.46					
Alpha	3.11	Stream Power (N/m s)	0.21	1.45	
0.05					
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	427.86	434.96	
362.21					
C & E Loss (m)	0.00	Cum SA (1000 m2)	320.99	80.84	
307.58					

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: RIVER-1
REACH: Reach-1 RS: 46.413

INPUT
Description: Section 46.413 - Creditview Road - Inline Weir Section
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	203.05	144.7	203.05	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
128	146	5	5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	129.7	207.11	F
144.7	352	207.4	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	205.26	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.00	Wt. n-Val.		0.035	
W.S. Elev (m)	205.26	Reach Len. (m)	5.00	5.00	
5.00					
Crit W.S. (m)	203.27	Flow Area (m2)		33.11	
E.G. Slope (m/m)	0.000009	Area (m2)	29.76	39.05	
14.63					
Q Total (m3/s)	4.75	Flow (m3/s)		4.75	
Top Width (m)	52.28	Top Width (m)	22.19	18.00	
12.09					
Vel Total (m/s)	0.14	Avg. Vel. (m/s)		0.14	
Max Chl Dpth (m)	2.21	Hydr. Depth (m)		2.21	
Conv. Total (m3/s)	1603.4	Conv. (m3/s)		1603.4	
Length Wtd. (m)	5.00	Wetted Per. (m)		15.00	

Min Ch El (m)	203.05	Shear (N/m2)		0.19
Alpha	1.00	Stream Power (N/m s)		0.03
Frctn Loss (m)		Cum Volume (1000 m3)	109.94	205.80
72.24				
C & E Loss (m)		Cum SA (1000 m2)	110.12	77.47
87.92				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.44	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.00	Wt. n-Val.	0.079	0.035	
0.080					
W.S. Elev (m)	207.44	Reach Len. (m)	5.00	5.00	
5.00					
Crit W.S. (m)	203.99	Flow Area (m2)	93.26	78.25	
48.66					
E.G. Slope (m/m)	0.000021	Area (m2)	93.26	78.25	
48.66					
Q Total (m3/s)	42.70	Flow (m3/s)	10.48	27.13	
5.09					
Top Width (m)	99.98	Top Width (m)	62.82	18.00	
19.16					
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.11	0.35	
0.10					
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.48	4.35	
2.54					
Conv. Total (m3/s)	9326.4	Conv. (m3/s)	2288.6	5926.3	
1111.4					
Length Wtd. (m)	5.00	Wetted Per. (m)	63.27	18.13	
19.70					
Min Ch El (m)	203.05	Shear (N/m2)	0.30	0.89	
0.51					
Alpha	2.15	Stream Power (N/m s)	0.03	0.31	
0.05					
Frctn Loss (m)		Cum Volume (1000 m3)	402.38	420.85	
352.29					
C & E Loss (m)		Cum SA (1000 m2)	305.53	77.48	
298.22					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

INLINE STRUCTURE

RIVER: RIVER-1
REACH: Reach-1 RS: 46.4125

INPUT
Description: Hum 13B-4R. Creditview Road - 4 Cell - 3.0 m W x 1.5 m H x 41 m L Concrete Box Culverts and 6.5 m W Weir with Drop Inlet Structure.

Drawings by Urban Ecosystems Ltd. (DT-2 & G-4), 1999.

New
HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 1
Deck/Roadway Width = .5
Weir Coefficient = 1.75
Weir Embankment Coordinates num = 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	129.75	207.11	129.75	207	133.95	207
133.95	204.7	137.2	204.7	140.45	204.7	140.45	207	144.65	207
144.65	207.4	205	207.79	305	208.3	352	208.6		

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 =
Weir crest shape = Broad Crested

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.412

INPUT
Description: Section 46.412 - Creditview Road - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	203.05	144.7	203.05	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
128	146	45	45	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	129.7	207.11	F
144.7	352	207.4	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.92	Element	Left OB	Channel
Vel Head (m)	0.01	Wt. n-Val.		0.035
W.S. Elev (m)	203.91	Reach Len. (m)	45.00	45.00
Crit W.S. (m)	203.27	Flow Area (m2)		12.94
E.G. Slope (m/m)	0.000201	Area (m2)	3.07	14.85
Q Total (m3/s)	4.75	Flow (m3/s)		4.75

Top Width (m)	39.46	Top Width (m)	14.86	18.00 6.60
Vel Total (m/s)	0.37	Avg. Vel. (m/s)		0.37
Max Chl Dpth (m)	0.86	Hydr. Depth (m)		0.86
Conv. Total (m3/s)	334.9	Conv. (m3/s)		334.9
Length Wtd. (m)	45.00	Wetted Per. (m)		15.00
Min Ch El (m)	203.05	Shear (N/m2)		1.70
Alpha	1.00	Stream Power (N/m s)		0.63
Frctn Loss (m)		Cum Volume (1000 m3)	109.94	205.61 72.24
C & E Loss (m)		Cum SA (1000 m2)	110.03	77.38 87.87

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.37	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	
W.S. Elev (m)	207.37	Reach Len. (m)	45.00	45.00	45.00
Crit W.S. (m)	203.99	Flow Area (m2)	89.20	71.72	
E.G. Slope (m/m)	0.000032	Area (m2)	89.20	77.04	47.37
Q Total (m3/s)	42.70	Flow (m3/s)	12.31	30.39	
Top Width (m)	94.35	Top Width (m)	57.41	18.00	18.94
Vel Total (m/s)	0.27	Avg. Vel. (m/s)	0.14	0.42	
Max Chl Dpth (m)	4.32	Hydr. Depth (m)	1.55	4.29	
Conv. Total (m3/s)	7588.4	Conv. (m3/s)	2187.2	5401.2	
Length Wtd. (m)	45.00	Wetted Per. (m)	57.86	16.76	
Min Ch El (m)	203.05	Shear (N/m2)	0.48	1.33	
Alpha	1.89	Stream Power (N/m s)	0.07	0.56	
Frctn Loss (m)		Cum Volume (1000 m3)	402.38	420.27	352.29
C & E Loss (m)		Cum SA (1000 m2)	305.22	77.39	298.12

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.4115

INPUT
Description: Hum 13B-4R. Creditview Road - 4 Cell - 3.0 m W x 1.5 m H x 45 m L
Concrete Box Culverts and 6.5 m W Weir with Drop Inlet Structure.
Drawings by Urban Ecosystems Ltd. (DT-2 & G-4), 1999.

New
HEC-RAS coding January 2004 by Acres included coding of culvert
in HEC-RAS, including adjustments to roadway coding and hydraulic
loss coefficients.

Distance from Upstream XS = 10
Deck/Roadway Width = 25
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 11

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	208		60	207.5		129.7	207.11	
129.7	208.5		137.2	208.5		144.7	208.5	
144.7	207.4		205	207.79		265	208	
305	208.3		352	208.6				

Upstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	203.05	144.7	203.05	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
128	146	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	129.7	207.11	F
144.7	352	207.4	F

Downstream Deck/Roadway Coordinates
num= 11

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	208		60	207.5		129.7	207.11	
129.7	208.5		137.2	208.5		144.7	208.5	
144.7	207.4		205	207.79		265	208	
305	208.3		352	208.6				

Downstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	202.96	144.7	202.96	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

```
Bank Sta: Left   Right    Coeff Contr.   Expan.
          128     146            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   129.7   206.8       F
   144.7     352   206.8       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           Box     1.5       3
FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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      41     .015     .015        0                   .5
      1
Number of Barrels =  4
Upstream   Elevation =  203.05
Centerline Stations
    Sta.    Sta.    Sta.    Sta.
   132.1   135.5   138.9   142.3
Downstream Elevation =  202.96
Centerline Stations
    Sta.    Sta.    Sta.    Sta.
   132.1   135.5   138.9   142.3

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       4.75    Culv Full Len (m)
  # Barrels                    4    Culv Vel US (m/s)         0.46
  Q Barrel (m3/s)           1.19    Culv Vel DS (m/s)         0.42
  E.G. US. (m)            203.92    Culv Inv El Up (m)      203.05
  W.S. US. (m)            203.91    Culv Inv El Dn (m)      202.96
  E.G. DS (m)             203.91    Culv Frctn Ls (m)         0.01
  W.S. DS (m)             203.90    Culv Exit Loss (m)        0.00
  Delta EG (m)              0.01    Culv Entr Loss (m)        0.01
  Delta WS (m)              0.01    Q Weir (m3/s)
  E.G. IC (m)             203.46    Weir Sta Lft (m)
  E.G. OC (m)             203.92    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
  Culv WS Inlet (m)       203.90    Weir Max Depth (m)
  Culv WS Outlet (m)      203.90    Weir Avg Depth (m)
  Culv Nml Depth (m)        0.31    Weir Flow Area (m2)
  Culv Crt Depth (m)        0.25    Min El Weir Flow (m)    207.11


CULVERT OUTPUT  Profile #Regional w red'n  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      39.14    Culv Full Len (m)        41.00
  # Barrels                   4     Culv Vel US (m/s)         2.17
  Q Barrel (m3/s)           9.79    Culv Vel DS (m/s)         2.17
  E.G. US. (m)            207.37    Culv Inv El Up (m)      203.05
  W.S. US. (m)            207.37    Culv Inv El Dn (m)      202.96
```

E.G. DS (m)	206.91	Culv Frctn Ls (m)	0.11
W.S. DS (m)	206.90	Culv Exit Loss (m)	0.24
Delta EG (m)	0.47	Culv Entr Loss (m)	0.12
Delta WS (m)	0.46	Q Weir (m3/s)	3.55
E.G. IC (m)	204.84	Weir Sta Lft (m)	82.56
E.G. OC (m)	207.37	Weir Sta Rgt (m)	129.70
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	204.55	Weir Max Depth (m)	0.26
Culv WS Outlet (m)	204.46	Weir Avg Depth (m)	0.13
Culv Nml Depth (m)		Weir Flow Area (m2)	6.21
Culv Crt Depth (m)	1.03	Min El Weir Flow (m)	207.11

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.411

INPUT
Description: Section 46.411 - Creditview Road - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	202.96	144.7	202.96	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
128	146	80	80	90	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	129.7	206.8	F
144.7	352	206.8	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.91	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.035	
W.S. Elev (m)	203.90	Reach Len. (m)	80.00	80.00	90.00
Crit W.S. (m)	203.18	Flow Area (m2)		14.12	
E.G. Slope (m/m)	0.000151	Area (m2)	2.90	16.13	1.29
Q Total (m3/s)	4.75	Flow (m3/s)		4.75	
Top Width (m)	38.86	Top Width (m)	14.44	18.00	6.42
Vel Total (m/s)	0.34	Avg. Vel. (m/s)		0.34	
Max Chl Dpth (m)	0.94	Hydr. Depth (m)		0.94	

Conv. Total (m3/s)	387.4	Conv. (m3/s)			387.4
Length Wtd. (m)	80.76	Wetted Per. (m)			15.00
Min Ch El (m)	202.96	Shear (N/m2)			1.39
Alpha	1.00	Stream Power (N/m s)			0.47
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	109.94	205.43	72.24
C & E Loss (m)	0.00	Cum SA (1000 m2)	109.37	76.57	87.58

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.91	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	206.90	Reach Len. (m)	80.00	80.00	90.00
Crit W.S. (m)	203.90	Flow Area (m2)	70.79	70.16	38.91
E.G. Slope (m/m)	0.000033	Area (m2)	70.79	70.16	38.91
Q Total (m3/s)	42.70	Flow (m3/s)	9.47	28.50	4.72
Top Width (m)	63.11	Top Width (m)	27.68	18.00	17.43
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.13	0.41	0.12
Max Chl Dpth (m)	3.94	Hydr. Depth (m)	2.56	3.90	2.23
Conv. Total (m3/s)	7384.4	Conv. (m3/s)	1638.0	4929.7	816.7
Length Wtd. (m)	81.46	Wetted Per. (m)	28.11	18.19	17.89
Min Ch El (m)	202.96	Shear (N/m2)	0.83	1.26	0.71
Alpha	2.05	Stream Power (N/m s)	0.11	0.51	0.09
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	402.38	419.16	352.29
C & E Loss (m)	0.00	Cum SA (1000 m2)	303.31	76.58	297.30

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: RIVER-1
REACH: Reach-1 RS: 46.41

INPUT
Description: Section 46.41 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207.5	71	207	83	204	84	203.56	123	203.56
126	205	136	205	140	204	156	203.1	161	202.5
164	202.5	166	203	195	204	206	208	234	208.2

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	71	.08	83	.035	126	.08	156	.035
166	.08	195	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
156	166	140	140	120	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.90	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.043	0.035	0.080
W.S. Elev (m)	203.89	Reach Len. (m)	140.00	140.00	120.00
Crit W.S. (m)		Flow Area (m2)	18.71	11.91	11.52
E.G. Slope (m/m)	0.000126	Area (m2)	18.71	11.91	11.52
Q Total (m3/s)	7.62	Flow (m3/s)	2.41	4.27	0.94
Top Width (m)	90.35	Top Width (m)	54.51	10.00	25.85
Vel Total (m/s)	0.18	Avg. Vel. (m/s)	0.13	0.36	0.08
Max Chl Dpth (m)	1.39	Hydr. Depth (m)	0.34	1.19	0.45
Conv. Total (m3/s)	678.5	Conv. (m3/s)	214.6	379.9	84.0
Length Wtd. (m)	138.76	Wetted Per. (m)	54.67	10.10	25.86
Min Ch El (m)	202.50	Shear (N/m2)	0.42	1.46	0.55
Alpha	2.38	Stream Power (N/m s)	0.05	0.52	0.05
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	109.08	204.31	71.67
C & E Loss (m)	0.00	Cum SA (1000 m2)	106.61	75.45	86.13

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.91	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.044	0.035	0.077
W.S. Elev (m)	206.90	Reach Len. (m)	140.00	140.00	120.00
Crit W.S. (m)		Flow Area (m2)	240.60	42.04	110.32
E.G. Slope (m/m)	0.000008	Area (m2)	240.60	42.04	110.32
Q Total (m3/s)	47.80	Flow (m3/s)	30.75	8.57	8.48
Top Width (m)	131.60	Top Width (m)	84.62	10.00	36.99
Vel Total (m/s)	0.12	Avg. Vel. (m/s)	0.13	0.20	0.08
Max Chl Dpth (m)	4.40	Hydr. Depth (m)	2.84	4.20	2.98
Conv. Total (m3/s)	17337.4	Conv. (m3/s)	11152.2	3108.6	3076.7
Length Wtd. (m)	135.44	Wetted Per. (m)	85.54	10.10	37.51
Min Ch El (m)	202.50	Shear (N/m2)	0.21	0.31	0.22
Alpha	1.28	Stream Power (N/m s)	0.03	0.06	0.02
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	389.93	414.67	345.57
C & E Loss (m)	0.00	Cum SA (1000 m2)	298.82	75.46	294.86

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: RIVER-1
REACH: Reach-1 RS: 46.402

INPUT
Description: Section 46.402 - Highway 400 - U/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	212	21	206	97	205	104	203	105	202.4
115	202.4	116	203	125	205	136	206	187	206
250	206	270	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	97	.08	104	.035	116	.08	136	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
104	116	100	100	100	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	106	206.7	F
114.5	270	206.7	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.87	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.85	Reach Len. (m)	100.00	100.00	100.00
Crit W.S. (m)	202.83	Flow Area (m2)		12.31	
E.G. Slope (m/m)	0.000286	Area (m2)	1.26	16.78	1.62
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	18.79	Top Width (m)	2.97	12.00	3.82
Vel Total (m/s)	0.62	Avg. Vel. (m/s)		0.62	
Max Chl Dpth (m)	1.45	Hydr. Depth (m)		1.45	
Conv. Total (m3/s)	450.4	Conv. (m3/s)		450.4	
Length Wtd. (m)	100.00	Wetted Per. (m)		8.50	
Min Ch El (m)	202.40	Shear (N/m2)		4.07	
Alpha	1.00	Stream Power (N/m s)		2.52	
Frctn Loss (m)		Cum Volume (1000 m3)	107.68	202.30	70.88
C & E Loss (m)		Cum SA (1000 m2)	102.59	73.91	84.35

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.90	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.055	0.035	0.059
W.S. Elev (m)	206.90	Reach Len. (m)	100.00	100.00	100.00
Crit W.S. (m)	203.88	Flow Area (m2)	128.12	53.40	148.16
E.G. Slope (m/m)	0.000023	Area (m2)	128.12	53.40	148.16
Q Total (m3/s)	47.80	Flow (m3/s)	15.09	19.42	13.30
Top Width (m)	241.15	Top Width (m)	86.15	12.00	143.00
Vel Total (m/s)	0.14	Avg. Vel. (m/s)	0.12	0.36	0.09
Max Chl Dpth (m)	4.50	Hydr. Depth (m)	1.49	4.45	

1.04					
Conv. Total (m3/s)	9978.9	Conv. (m3/s)	3149.8	4053.4	2775.8
Length Wtd. (m)	100.00	Wetted Per. (m)	86.56	12.33	143.31
Min Ch El (m)	202.40	Shear (N/m2)	0.33	0.97	0.23
Alpha	2.87	Stream Power (N/m s)	0.04	0.35	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	364.12	407.99	330.06
C & E Loss (m)		Cum SA (1000 m2)	286.87	73.92	284.06

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.4015

INPUT
Description: Hum 13B-3R. Highway 400 - 3 Cell - 2.4 m W x 2.4 m H x 80 m L Concrete Box Culverts. Drawings by McCormick Rankin (Sheet 40 & 47, no date) used to code culvert in HEC-RAS format.

New
HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 14
Deck/Roadway Width = 80
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	206.5		189	207		270	207.8	

Upstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	212	21	206	97	205	104	203	105	202.4
115	202.4	116	203	125	205	136	206	187	206
250	206	270	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	97	.08	104	.035	116	.08	136	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
104	116	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	106	206.7	F
114.5	270	206.7	F

Downstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord

```
       0   206.5             189     207             270   207.8

Downstream Bridge Cross Section Data
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0     212      21     206      97     205     104     203     105   202.4
     115   202.4     116     203     125     205     136     206     187     206
     270   206.5

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05      21     .08     104    .035     116     .08     136     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
           104     116            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     106     206       F
   114.5     270     206       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           Box     2.4     2.4
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
                14      80     .015     .015        0                    .4
      1
Number of Barrels =  3
Upstream   Elevation =  202.4
Centerline Stations
    Sta.    Sta.    Sta.
   107.5   110.2   112.9
Downstream Elevation =  202.4
Centerline Stations
    Sta.    Sta.    Sta.
   107.5   110.2   112.9

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       7.62    Culv Full Len (m)
  # Barrels                    3    Culv Vel US (m/s)         0.74
  Q Barrel (m3/s)           2.54    Culv Vel DS (m/s)         0.75
  E.G. US. (m)            203.87    Culv Inv El Up (m)      202.40
  W.S. US. (m)            203.85    Culv Inv El Dn (m)      202.40
  E.G. DS (m)             203.83    Culv Frctn Ls (m)         0.01
  W.S. DS (m)             203.81    Culv Exit Loss (m)        0.01
  Delta EG (m)              0.04    Culv Entr Loss (m)        0.01
  Delta WS (m)              0.04    Q Weir (m3/s)
  E.G. IC (m)             203.16    Weir Sta Lft (m)
  E.G. OC (m)             203.87    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
```

Culv WS Inlet (m)	203.83	Weir Max Depth (m)	
Culv WS Outlet (m)	203.81	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.49	Min El Weir Flow (m)	206.70

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	31.75	Culv Full Len (m)	80.00
# Barrels	3	Culv Vel US (m/s)	1.84
Q Barrel (m3/s)	10.58	Culv Vel DS (m/s)	1.84
E.G. US. (m)	206.90	Culv Inv El Up (m)	202.40
W.S. US. (m)	206.90	Culv Inv El Dn (m)	202.40
E.G. DS (m)	206.55	Culv Frctn Ls (m)	0.12
W.S. DS (m)	206.54	Culv Exit Loss (m)	0.16
Delta EG (m)	0.35	Culv Entr Loss (m)	0.07
Delta WS (m)	0.36	Q Weir (m3/s)	16.05
E.G. IC (m)	205.08	Weir Sta Lft (m)	17.83
E.G. OC (m)	206.90	Weir Sta Rgt (m)	153.01
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	204.80	Weir Max Depth (m)	0.35
Culv WS Outlet (m)	204.80	Weir Avg Depth (m)	0.18
Culv Nml Depth (m)		Weir Flow Area (m2)	23.95
Culv Crt Depth (m)	1.26	Min El Weir Flow (m)	206.70

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.401

INPUT
Description: Section 46.401 - Highway 400 - D/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	212	21	206	97	205	104	203	105	202.4
115	202.4	116	203	125	205	136	206	187	206
270	206.5								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	21	.08	104	.035	116	.08	136	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
104	116	80	95	100	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	106	206	F
114.5	270	206	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.83	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	

W.S. Elev (m)	203.81	Reach Len. (m)	80.00	95.00	100.00
Crit W.S. (m)	202.83	Flow Area (m2)		11.99	
E.G. Slope (m/m)	0.000313	Area (m2)	1.15	16.33	1.48
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	18.49	Top Width (m)	2.84	12.00	3.65
Vel Total (m/s)	0.64	Avg. Vel. (m/s)		0.64	
Max Chl Dpth (m)	1.41	Hydr. Depth (m)		1.41	
Conv. Total (m3/s)	430.9	Conv. (m3/s)		430.9	
Length Wtd. (m)	95.00	Wetted Per. (m)		8.50	
Min Ch El (m)	202.40	Shear (N/m2)		4.33	
Alpha	1.00	Stream Power (N/m s)		2.75	
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	107.68	201.70	70.88
C & E Loss (m)	0.00	Cum SA (1000 m2)	102.29	72.71	83.97

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.55	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.066
W.S. Elev (m)	206.54	Reach Len. (m)	80.00	95.00	100.00
Crit W.S. (m)	203.88	Flow Area (m2)	97.50	49.10	86.22
E.G. Slope (m/m)	0.000063	Area (m2)	97.50	49.10	86.22
Q Total (m3/s)	47.80	Flow (m3/s)	10.67	27.93	9.20
Top Width (m)	250.90	Top Width (m)	84.90	12.00	154.00
Vel Total (m/s)	0.21	Avg. Vel. (m/s)	0.11	0.57	0.11
Max Chl Dpth (m)	4.14	Hydr. Depth (m)	1.15	4.09	0.56
Conv. Total (m3/s)	6031.7	Conv. (m3/s)	1346.0	3524.5	1161.2
Length Wtd. (m)	90.36	Wetted Per. (m)	85.26	12.33	154.31
Min Ch El (m)	202.40	Shear (N/m2)	0.70	2.45	0.34
Alpha	4.60	Stream Power (N/m s)	0.08	1.39	0.04
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	364.12	400.58	330.06

C & E Loss (m)	0.00	Cum SA (1000 m2)	278.31	72.72
269.21				

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: RIVER-1
REACH: Reach-1 RS: 46.392

INPUT
Description: Section 46.392 - Langstaff Road - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	15	206	30	206	103	206	106	205
130	205	135	203	136	202.5	145	202.5	147	203
153	205	175	205	191	210	203	210		

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.025	103	.05	130	.08	135	.035
147	.08	153	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
135	147	70	70	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	136.4	206.2	F
145	203	212.9	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.77	Reach Len. (m)	70.00	70.00	70.00
Crit W.S. (m)	202.93	Flow Area (m2)		10.93	
E.G. Slope (m/m)	0.000434	Area (m2)	0.74	14.49	0.89
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	16.24	Top Width (m)	1.93	12.00	2.31
Vel Total (m/s)	0.70	Avg. Vel. (m/s)		0.70	
Max Chl Dpth (m)	1.27	Hydr. Depth (m)		1.27	
Conv. Total (m3/s)	366.2	Conv. (m3/s)		366.2	
Length Wtd. (m)	70.00	Wetted Per. (m)		8.60	
Min Ch El (m)	202.50	Shear (N/m2)		5.40	

Alpha	1.00	Stream Power (N/m s)		3.77
Frctn Loss (m)		Cum Volume (1000 m3)	107.60	200.24
70.76				
C & E Loss (m)		Cum SA (1000 m2)	102.10	71.57
83.67				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.54	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.01	Wt. n-Val.	0.043	0.035
W.S. Elev (m)	206.53	Reach Len. (m)	70.00	70.00
70.00				
Crit W.S. (m)	203.97	Flow Area (m2)	99.87	40.07
E.G. Slope (m/m)	0.000081	Area (m2)	99.87	47.63
52.65				
Q Total (m3/s)	47.80	Flow (m3/s)	21.97	25.84
Top Width (m)	166.90	Top Width (m)	121.99	12.00
32.90				
Vel Total (m/s)	0.34	Avg. Vel. (m/s)	0.22	0.64
Max Chl Dpth (m)	4.03	Hydr. Depth (m)	0.82	4.01
Conv. Total (m3/s)	5302.3	Conv. (m3/s)	2436.5	2865.8
Length Wtd. (m)	70.00	Wetted Per. (m)	122.61	10.12
Min Ch El (m)	202.50	Shear (N/m2)	0.65	3.16
Alpha	2.12	Stream Power (N/m s)	0.14	2.04
Frctn Loss (m)		Cum Volume (1000 m3)	356.22	395.98
323.12				
C & E Loss (m)		Cum SA (1000 m2)	270.04	71.58
259.86				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

MULTIPLE OPENING

RIVER: RIVER-1
REACH: Reach-1 RS: 46.3915

INPUT
Description: Hum 13B-2R. Langstaff Road - 3 Cell - 2.4 m W x 2.4 m H x 60 m L Concrete Box Culverts. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004 by Acres
included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 60
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 9

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	212.8		8	213	212	28	213.2	212.3
73	213.82	212.82	103	213.4	212.4	103	213.4	206
142	213		182	212		203	211.5	

Upstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	15	206	30	206	103	206	106	205
130	205	135	203	136	202.5	145	202.5	147	203
153	205	175	205	191	210	203	210		

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.025	103	.05	130	.08	135	.035
147	.08	153	.05						

Bank Sta: Left Right Coeff Contr. Expan.
135 147 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	136.4	206.2	F
145	203	212.9	F

Downstream Deck/Roadway Coordinates
num= 9

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	212.8		8	213	212	28	213.2	212.3
73	213.82	212.82	103	213.4	212.4	103	213.4	206
142	213		182	212		203	211.5	

Downstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	15	206	30	206	103	206	106	205
130	205	135	203	136	202.4	145	202.4	147	203
153	205	175	205	191	210	203	210		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.025	103	.05	130	.08	153	.05

Bank Sta: Left Right Coeff Contr. Expan.
135 147 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	136.4	206	F
145	203	211	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 Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Box	2.4	2.4

FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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
	5	60	.015	.015	0	.5	1

Number of Barrels = 3
Upstream Elevation = 202.5
Centerline Stations

Sta.	Sta.	Sta.
138	140.7	143.4

Downstream Elevation = 202.4
Centerline Stations

Sta.	Sta.	Sta.
138	140.7	143.4

Multiple Opening Stagnation Limits

	Upstream		Downstream	
Opening Type	Sta. Left	Sta. Right	Sta. Left	Sta. Right
Bridge	0	120	0	120
Culvert Group	120	203	120	203

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.391

INPUT
Description: Section 46.391 - Langstaff Road - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	15	206	30	206	103	206	106	205
130	205	135	203	136	202.4	145	202.4	147	203
153	205	175	205	191	210	203	210		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.025	103	.05	130	.08	153	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
135	147	45	35	25	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	136.4	206	F
145	203	211	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.75	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.080	
W.S. Elev (m)	203.73	Reach Len. (m)	45.00	35.00	25.00
Crit W.S. (m)	202.83	Flow Area (m2)		11.41	
E.G. Slope (m/m)	0.001959	Area (m2)	0.66	15.02	0.79
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	16.00	Top Width (m)	1.82	12.00	2.18
Vel Total (m/s)	0.67	Avg. Vel. (m/s)		0.67	
Max Chl Dpth (m)	1.33	Hydr. Depth (m)		1.33	
Conv. Total (m3/s)	172.2	Conv. (m3/s)		172.2	
Length Wtd. (m)	35.03	Wetted Per. (m)		8.60	
Min Ch El (m)	202.40	Shear (N/m2)		25.49	
Alpha	1.00	Stream Power (N/m s)		17.03	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	107.60	200.24	70.76
C & E Loss (m)	0.01	Cum SA (1000 m2)	101.97	70.73	83.52

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.045	0.080	
W.S. Elev (m)	206.44	Reach Len. (m)	45.00	35.00	25.00

Crit W.S. (m)	203.87	Flow Area (m2)	89.26	40.15
E.G. Slope (m/m)	0.000212	Area (m2)	89.26	47.64
49.80				
Q Total (m3/s)	47.80	Flow (m3/s)	29.55	18.25
Top Width (m)	166.29	Top Width (m)	121.67	12.00
32.62				
Vel Total (m/s)	0.37	Avg. Vel. (m/s)	0.33	0.45
Max Chl Dpth (m)	4.04	Hydr. Depth (m)	0.73	4.01
Conv. Total (m3/s)	3284.6	Conv. (m3/s)	2030.7	1253.9
Length Wtd. (m)	38.91	Wetted Per. (m)	122.27	10.17
Min Ch El (m)	202.40	Shear (N/m2)	1.52	8.20
Alpha	1.07	Stream Power (N/m s)	0.50	3.73
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	356.22	395.98
323.12				
C & E Loss (m)	0.00	Cum SA (1000 m2)	261.51	70.74
257.57				

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: RIVER-1
REACH: Reach-1 RS: 46.39

INPUT
Description: Section 46.39 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	20	205	45	205	51	206.5	133	206.3
142	206	152	205	161	204	185	204	193	203
195	202.4	204	202.4	206	203	212	204	236	205
268	210								

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	51	.025	142	.05	185	.08	193	.035
206	.08	212	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
193	206	50	35	25	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	51	206.6	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.73	Element	Left OB	Channel

Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.72	Reach Len. (m)	50.00	35.00	25.00
Crit W.S. (m)	202.80	Flow Area (m2)	2.06	15.92	1.54
E.G. Slope (m/m)	0.000200	Area (m2)	2.06	15.92	1.54
Q Total (m3/s)	7.62	Flow (m3/s)	0.18	7.30	0.14
Top Width (m)	23.04	Top Width (m)	5.74	13.00	4.30
Vel Total (m/s)	0.39	Avg. Vel. (m/s)	0.09	0.46	0.09
Max Chl Dpth (m)	1.32	Hydr. Depth (m)	0.36	1.22	0.36
Conv. Total (m3/s)	538.7	Conv. (m3/s)	12.9	516.1	9.6
Length Wtd. (m)	35.09	Wetted Per. (m)	5.78	13.18	4.36
Min Ch El (m)	202.40	Shear (N/m2)	0.70	2.37	0.69
Alpha	1.32	Stream Power (N/m s)	0.06	1.09	0.06
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	107.54	199.70	70.73
C & E Loss (m)	0.00	Cum SA (1000 m2)	101.80	70.29	83.44

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.055	0.035	0.057
W.S. Elev (m)	206.44	Reach Len. (m)	50.00	35.00	25.00
Crit W.S. (m)	203.62	Flow Area (m2)	116.10	51.38	71.01
E.G. Slope (m/m)	0.000029	Area (m2)	166.82	51.38	71.01
Q Total (m3/s)	47.80	Flow (m3/s)	18.06	19.51	10.23
Top Width (m)	216.72	Top Width (m)	164.48	13.00	39.24
Vel Total (m/s)	0.20	Avg. Vel. (m/s)	0.16	0.38	0.14
Max Chl Dpth (m)	4.04	Hydr. Depth (m)	0.97	3.95	1.81
Conv. Total (m3/s)	8912.1	Conv. (m3/s)	3367.6	3636.6	1907.9
Length Wtd. (m)	40.73	Wetted Per. (m)	119.43	13.18	39.46

Min Ch El (m)	202.40	Shear (N/m2)	0.27	1.10	0.51
Alpha	1.80	Stream Power (N/m s)	0.04	0.42	0.07
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	350.46	394.25	321.61
C & E Loss (m)	0.00	Cum SA (1000 m2)	255.07	70.30	256.67

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: RIVER-1
REACH: Reach-1 RS: 46.382

INPUT
Description: Section 46.382 - Hwy 400 / Langstaff Rd Ramp - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	50	206.5	95	205	220	204	227	203
235	202.4	244	202.4	247	203	252	204	257	205
269	206	300	206	300	209.5				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	50	.08	227	.035	247	.08	257	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
227	247	45	45	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235.2	206.38	F
243.8	300	207.55	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.72	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.69	Reach Len. (m)	45.00	45.00	45.00
Crit W.S. (m)	202.83	Flow Area (m2)		11.11	
E.G. Slope (m/m)	0.000410	Area (m2)	1.68	22.55	1.20
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	28.31	Top Width (m)	4.85	20.00	3.46
Vel Total (m/s)	0.69	Avg. Vel. (m/s)		0.69	
Max Chl Dpth (m)	1.29	Hydr. Depth (m)		1.29	
Conv. Total (m3/s)	376.7	Conv. (m3/s)		376.7	

Length Wtd. (m)	45.00	Wetted Per. (m)		8.60
Min Ch El (m)	202.40	Shear (N/m2)		5.19
Alpha	1.00	Stream Power (N/m s)		3.56
Frctn Loss (m)		Cum Volume (1000 m3)	107.45	199.03 70.70
C & E Loss (m)		Cum SA (1000 m2)	101.54	69.71 83.34

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.45	Element	Left OB	Channel Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035
W.S. Elev (m)	206.44	Reach Len. (m)	45.00	45.00 45.00
Crit W.S. (m)	203.86	Flow Area (m2)	294.86	65.54
E.G. Slope (m/m)	0.000024	Area (m2)	294.86	77.58 49.52
Q Total (m3/s)	47.80	Flow (m3/s)	25.30	22.51
Top Width (m)	248.32	Top Width (m)	175.32	20.00 53.00
Vel Total (m/s)	0.13	Avg. Vel. (m/s)	0.09	0.34
Max Chl Dpth (m)	4.04	Hydr. Depth (m)	1.68	3.90
Conv. Total (m3/s)	9846.7	Conv. (m3/s)	5210.7	4636.0
Length Wtd. (m)	45.00	Wetted Per. (m)	175.42	16.82
Min Ch El (m)	202.40	Shear (N/m2)	0.39	0.90
Alpha	3.38	Stream Power (N/m s)	0.03	0.31
Frctn Loss (m)		Cum Volume (1000 m3)	338.92	391.99 320.10
C & E Loss (m)		Cum SA (1000 m2)	246.58	69.72 255.52

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.3815

INPUT

Description: Hum 13B-1R. Hwy 400 / Langstaff Rd Ramp - 3 Cell - 2.4 m W x 2.4 m H x 38 m L Concrete Box Culverts. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004
by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 2
Deck/Roadway Width = 38
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	207		130	206.38		200	206	
230	207		260	208		285	209	
300	209.5							

Upstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	50	206.5	95	205	220	204	227	203
235	202.4	244	202.4	247	203	252	204	257	205
269	206	300	206	300	209.5				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	50	.08	227	.035	247	.08	257	.05

Bank Sta: Left Right Coeff Contr. Expan.
227 247 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235.2	206.38	F
243.8	300	207.55	F

Downstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	207		130	206.38		200	206	
230	207		260	208		285	209	
300	209.5							

Downstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	50	206.5	95	205	220	204	227	203
235	202.3	244	202.3	247	203	252	204	257	205
269	206	300	206	300	209.5				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	50	.05	220	.08	227	.035	247	.08
257	.05								

Bank Sta: Left Right Coeff Contr. Expan.
227 247 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235.2	205.5	F
243.8	300	205.5	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           Box     2.4     2.4
FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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
                 2      38     .015     .015        0                    .7
      1
Number of Barrels =  3
Upstream   Elevation =  202.4
Centerline Stations
    Sta.    Sta.    Sta.
   236.9   239.5   242.1
Downstream Elevation =  202.3
Centerline Stations
    Sta.    Sta.    Sta.
   236.9   239.5   242.1

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       7.62    Culv Full Len (m)
  # Barrels                    3    Culv Vel US (m/s)         0.84
  Q Barrel (m3/s)           2.54    Culv Vel DS (m/s)         0.78
  E.G. US. (m)            203.72    Culv Inv El Up (m)      202.40
  W.S. US. (m)            203.69    Culv Inv El Dn (m)      202.30
  E.G. DS (m)             203.67    Culv Frctn Ls (m)         0.01
  W.S. DS (m)             203.65    Culv Exit Loss (m)        0.01
  Delta EG (m)              0.05    Culv Entr Loss (m)        0.03
  Delta WS (m)              0.04    Q Weir (m3/s)
  E.G. IC (m)             203.19    Weir Sta Lft (m)
  E.G. OC (m)             203.72    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
  Culv WS Inlet (m)       203.65    Weir Max Depth (m)
  Culv WS Outlet (m)      203.65    Weir Avg Depth (m)
  Culv Nml Depth (m)        0.58    Weir Flow Area (m2)
  Culv Crt Depth (m)        0.49    Min El Weir Flow (m)    206.38


CULVERT OUTPUT  Profile #Regional w red'n  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      32.67    Culv Full Len (m)        38.00
  # Barrels                   3     Culv Vel US (m/s)         1.89
  Q Barrel (m3/s)          10.89    Culv Vel DS (m/s)         1.89
  E.G. US. (m)            206.45    Culv Inv El Up (m)      202.40
  W.S. US. (m)            206.44    Culv Inv El Dn (m)      202.30
  E.G. DS (m)             206.08    Culv Frctn Ls (m)         0.06
  W.S. DS (m)             206.08    Culv Exit Loss (m)        0.18
  Delta EG (m)              0.37    Culv Entr Loss (m)        0.13
  Delta WS (m)              0.37    Q Weir (m3/s)            15.13
  E.G. IC (m)             205.10    Weir Sta Lft (m)        116.36
  E.G. OC (m)             206.45    Weir Sta Rgt (m)        213.35
  Culvert Control         Outlet    Weir Submerg              0.00
  Culv WS Inlet (m)       204.80    Weir Max Depth (m)        0.45
  Culv WS Outlet (m)      204.70    Weir Avg Depth (m)        0.22
```

Culv Nml Depth (m)		Weir Flow Area (m2)	21.27
Culv Crt Depth (m)	1.28	Min El Weir Flow (m)	206.38

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.381

INPUT
Description: Section 46.381 - Hwy 400 / Langstaff Rd Ramp - D/S Bounding
Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	50	206.5	95	205	220	204	227	203
235	202.3	244	202.3	247	203	252	204	257	205
269	206	300	206	300	209.5				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	50	.05	220	.08	227	.035	247	.08
257	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
227	247	260	275	290	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235.2	205.5	F
243.8	300	205.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.67	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.65	Reach Len. (m)	260.00	275.00	290.00
Crit W.S. (m)	202.73	Flow Area (m2)		11.60	
E.G. Slope (m/m)	0.000355	Area (m2)	1.47	23.13	1.05
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	27.79	Top Width (m)	4.54	20.00	3.25
Vel Total (m/s)	0.66	Avg. Vel. (m/s)		0.66	
Max Chl Dpth (m)	1.35	Hydr. Depth (m)		1.35	
Conv. Total (m3/s)	404.7	Conv. (m3/s)		404.7	
Length Wtd. (m)	275.05	Wetted Per. (m)		8.60	
Min Ch El (m)	202.30	Shear (N/m2)		4.70	
Alpha	1.00	Stream Power (N/m s)		3.09	

Frctn Loss (m)	0.11	Cum Volume (1000 m3)	107.45	198.85	70.70
C & E Loss (m)	0.00	Cum SA (1000 m2)	101.33	68.81	83.19

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.052	0.035	0.076
W.S. Elev (m)	206.08	Reach Len. (m)	260.00	275.00	290.00
Crit W.S. (m)	203.77	Flow Area (m2)	232.32	71.66	30.00
E.G. Slope (m/m)	0.000019	Area (m2)	232.32	71.66	30.00
Q Total (m3/s)	47.80	Flow (m3/s)	24.84	20.86	2.11
Top Width (m)	237.27	Top Width (m)	164.27	20.00	53.00
Vel Total (m/s)	0.14	Avg. Vel. (m/s)	0.11	0.29	0.07
Max Chl Dpth (m)	3.78	Hydr. Depth (m)	1.41	3.58	0.57
Conv. Total (m3/s)	10946.7	Conv. (m3/s)	5687.6	4776.3	482.9
Length Wtd. (m)	272.95	Wetted Per. (m)	164.36	20.11	53.32
Min Ch El (m)	202.30	Shear (N/m2)	0.26	0.67	0.11
Alpha	2.10	Stream Power (N/m s)	0.03	0.19	0.01
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	338.92	390.07	320.10
C & E Loss (m)	0.01	Cum SA (1000 m2)	238.93	68.82	253.13

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: RIVER-1
REACH: Reach-1 RS: 46.36

INPUT

Description: Section 46.36 - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207.4	29	207	39	205	50	202	52	201.6
57	201.6	59	202	71	205	130	205.8		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	29	.05	39	.08	50	.035	59	.08
71	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
50	59	150	150	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
110	130	208	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.56	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.52	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)		Flow Area (m2)	4.25	16.50	4.63
E.G. Slope (m/m)	0.000423	Area (m2)	4.25	16.50	4.63
Q Total (m3/s)	16.31	Flow (m3/s)	0.89	14.44	0.97
Top Width (m)	20.67	Top Width (m)	5.58	9.00	6.09
Vel Total (m/s)	0.64	Avg. Vel. (m/s)	0.21	0.88	0.21
Max Chl Dpth (m)	1.92	Hydr. Depth (m)	0.76	1.83	0.76
Conv. Total (m3/s)	792.7	Conv. (m3/s)	43.2	702.2	47.3
Length Wtd. (m)	150.00	Wetted Per. (m)	5.79	9.08	6.28
Min Ch El (m)	201.60	Shear (N/m2)	3.05	7.54	3.06
Alpha	1.66	Stream Power (N/m s)	0.64	6.60	0.64
Frctn Loss (m)	0.05	Cum Volume (1000 m3)	106.70	193.40	69.87
C & E Loss (m)	0.00	Cum SA (1000 m2)	100.01	64.83	81.83

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.05	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.079	0.035	0.068
W.S. Elev (m)	206.02	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)		Flow Area (m2)	30.26	38.95	

59.53					
E.G. Slope (m/m)	0.000195	Area (m2)	30.26	38.95	
66.57					
Q Total (m3/s)	66.49	Flow (m3/s)	9.17	40.99	
16.32					
Top Width (m)	96.08	Top Width (m)	16.08	9.00	
71.00					
Vel Total (m/s)	0.52	Avg. Vel. (m/s)	0.30	1.05	
0.27					
Max Chl Dpth (m)	4.42	Hydr. Depth (m)	1.88	4.33	
1.17					
Conv. Total (m3/s)	4765.1	Conv. (m3/s)	657.5	2938.1	
1169.5					
Length Wtd. (m)	150.00	Wetted Per. (m)	16.58	9.08	
51.37					
Min Ch El (m)	201.60	Shear (N/m2)	3.48	8.19	
2.21					
Alpha	2.68	Stream Power (N/m s)	1.06	8.62	
0.61					
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	304.78	374.86	
306.10					
C & E Loss (m)	0.00	Cum SA (1000 m2)	215.49	64.83	
235.15					

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.35

INPUT
Description: Section 46.35 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	206.8	29	206.5	35	206	49	202	52	201.4
56	201.4	59	202	79	205	100	205.5	100	208
139	208								

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	29	.05	35	.08	49	.035	59	.08
79	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
49	59	120	120	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.50	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	
0.080					
W.S. Elev (m)	203.48	Reach Len. (m)	120.00	120.00	
120.00					
Crit W.S. (m)		Flow Area (m2)	3.81	18.95	
7.25					
E.G. Slope (m/m)	0.000305	Area (m2)	3.81	18.95	

7.25					
Q Total (m3/s)	16.31	Flow (m3/s)	0.66	14.36	
1.28					
Top Width (m)	25.00	Top Width (m)	5.16	10.00	
9.83					
Vel Total (m/s)	0.54	Avg. Vel. (m/s)	0.17	0.76	
0.18					
Max Chl Dpth (m)	2.08	Hydr. Depth (m)	0.74	1.90	
0.74					
Conv. Total (m3/s)	933.9	Conv. (m3/s)	37.8	822.7	
73.4					
Length Wtd. (m)	120.00	Wetted Per. (m)	5.37	10.12	
9.94					
Min Ch El (m)	201.40	Shear (N/m2)	2.12	5.60	
2.18					
Alpha	1.73	Stream Power (N/m s)	0.37	4.24	
0.39					
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	106.10	190.74	
68.98					
C & E Loss (m)	0.00	Cum SA (1000 m2)	99.21	63.40	
80.64					

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.03	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	
0.075					
W.S. Elev (m)	205.99	Reach Len. (m)	120.00	120.00	
120.00					
Crit W.S. (m)		Flow Area (m2)	27.92	44.14	
65.51					
E.G. Slope (m/m)	0.000158	Area (m2)	27.92	44.14	
65.51					
Q Total (m3/s)	66.49	Flow (m3/s)	6.77	42.26	
17.46					
Top Width (m)	64.98	Top Width (m)	13.98	10.00	
41.00					
Vel Total (m/s)	0.48	Avg. Vel. (m/s)	0.24	0.96	
0.27					
Max Chl Dpth (m)	4.59	Hydr. Depth (m)	2.00	4.41	
1.60					
Conv. Total (m3/s)	5297.1	Conv. (m3/s)	539.1	3367.1	
1390.9					
Length Wtd. (m)	120.00	Wetted Per. (m)	14.54	10.12	
41.72					
Min Ch El (m)	201.40	Shear (N/m2)	2.97	6.74	
2.43					
Alpha	2.60	Stream Power (N/m s)	0.72	6.45	
0.65					
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	300.42	368.63	
296.19					
C & E Loss (m)	0.00	Cum SA (1000 m2)	213.23	63.41	
226.75					

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.34

INPUT
Description: Section 46.34 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	206.4	30	206.4	36	206	46	202	51	201.2
53	201.2	58	202	68	205	144	205.4		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	30	.05	36	.08	46	.035	58	.08
68	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
46	58	225	205	190	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
100	144	208	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.47	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.45	Reach Len. (m)	225.00	205.00	190.00
Crit W.S. (m)		Flow Area (m2)	2.61	22.95	3.48
E.G. Slope (m/m)	0.000236	Area (m2)	2.61	22.95	3.48
Q Total (m3/s)	16.31	Flow (m3/s)	0.38	15.40	0.52
Top Width (m)	20.43	Top Width (m)	3.61	12.00	4.82
Vel Total (m/s)	0.56	Avg. Vel. (m/s)	0.15	0.67	0.15
Max Chl Dpth (m)	2.25	Hydr. Depth (m)	0.72	1.91	0.72
Conv. Total (m3/s)	1062.5	Conv. (m3/s)	25.0	1003.3	34.1
Length Wtd. (m)	204.98	Wetted Per. (m)	3.89	12.13	5.03
Min Ch El (m)	201.20	Shear (N/m2)	1.55	4.37	1.60
Alpha	1.35	Stream Power (N/m s)	0.23	2.93	0.24
Frctn Loss (m)	0.07	Cum Volume (1000 m3)	105.72	188.23	68.34
C & E Loss (m)	0.00	Cum SA (1000 m2)	98.68	62.08	79.76

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.01	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	

0.065					
W.S. Elev (m)	205.97	Reach Len. (m)	225.00	205.00	190.00
Crit W.S. (m)		Flow Area (m2)	19.74	53.29	53.22
E.G. Slope (m/m)	0.000144	Area (m2)	19.74	53.29	83.57
Q Total (m3/s)	66.49	Flow (m3/s)	4.46	49.09	12.94
Top Width (m)	107.94	Top Width (m)	9.94	12.00	86.00
Vel Total (m/s)	0.53	Avg. Vel. (m/s)	0.23	0.92	0.24
Max Chl Dpth (m)	4.77	Hydr. Depth (m)	1.99	4.44	1.27
Conv. Total (m3/s)	5532.4	Conv. (m3/s)	371.2	4084.6	1076.6
Length Wtd. (m)	205.80	Wetted Per. (m)	10.70	12.13	42.44
Min Ch El (m)	201.20	Shear (N/m2)	2.61	6.22	1.78
Alpha	2.31	Stream Power (N/m s)	0.59	5.73	0.43
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	297.56	362.78	287.25
C & E Loss (m)	0.00	Cum SA (1000 m2)	211.80	62.09	219.13

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.33

INPUT
Description: Section 46.33 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	67	205	75	202	78	201	83	201
86	202	97	205	115	205	115	208	180	208

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	67	.08	75	.035	86	.08	97	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
75	86	130	130	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.40	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.35	Reach Len. (m)	130.00	130.00	130.00
Crit W.S. (m)		Flow Area (m2)	2.44	22.89	

3.36				
E.G. Slope (m/m)	0.000436	Area (m2)	2.44	22.89
3.36				
Q Total (m3/s)	22.97	Flow (m3/s)	0.47	21.84
0.66				
Top Width (m)	19.57	Top Width (m)	3.61	11.00
4.96				
Vel Total (m/s)	0.80	Avg. Vel. (m/s)	0.19	0.95
0.20				
Max Chl Dpth (m)	2.35	Hydr. Depth (m)	0.68	2.08
0.68				
Conv. Total (m3/s)	1099.5	Conv. (m3/s)	22.5	1045.4
31.6				
Length Wtd. (m)	130.00	Wetted Per. (m)	3.85	11.32
5.14				
Min Ch El (m)	201.00	Shear (N/m2)	2.71	8.65
2.79				
Alpha	1.35	Stream Power (N/m s)	0.52	8.25
0.55				
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	105.15	183.53
67.69				
C & E Loss (m)	0.00	Cum SA (1000 m2)	97.87	59.72
78.83				

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.98	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.03	Wt. n-Val.	0.058	0.035
0.070				
W.S. Elev (m)	205.95	Reach Len. (m)	130.00	130.00
130.00				
Crit W.S. (m)		Flow Area (m2)	83.34	51.46
44.08				
E.G. Slope (m/m)	0.000128	Area (m2)	83.34	51.46
44.08				
Q Total (m3/s)	74.78	Flow (m3/s)	18.67	45.71
10.40				
Top Width (m)	115.00	Top Width (m)	75.00	11.00
29.00				
Vel Total (m/s)	0.42	Avg. Vel. (m/s)	0.22	0.89
0.24				
Max Chl Dpth (m)	4.95	Hydr. Depth (m)	1.11	4.68
1.52				
Conv. Total (m3/s)	6600.0	Conv. (m3/s)	1647.8	4033.9
918.3				
Length Wtd. (m)	130.00	Wetted Per. (m)	76.50	11.32
30.35				
Min Ch El (m)	201.00	Shear (N/m2)	1.37	5.72
1.83				
Alpha	2.88	Stream Power (N/m s)	0.31	5.08
0.43				
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	285.96	352.05
275.12				
C & E Loss (m)	0.00	Cum SA (1000 m2)	202.24	59.73
208.21				

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

water surface.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.322

INPUT
Description: Section 46.322 - Applewod Crescent - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	58	208	58	205.5	66	205.5	78.5	201.8
79.15	201	91	201	91.5	201.8	100.5	205.7	115	205.7
115	208	175	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	66	.08	78.5	.035	91.5	.08	100.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
78.5	91.5	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	78.5	205.6	F
91.5	175	205.6	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.35	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.035	
W.S. Elev (m)	203.32	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	201.71	Flow Area (m2)		29.70	
E.G. Slope (m/m)	0.000264	Area (m2)	3.90	29.70	2.67
Q Total (m3/s)	22.97	Flow (m3/s)		22.97	
Top Width (m)	21.64	Top Width (m)	5.13	13.00	3.51
Vel Total (m/s)	0.77	Avg. Vel. (m/s)		0.77	
Max Chl Dpth (m)	2.32	Hydr. Depth (m)		2.28	
Conv. Total (m3/s)	1412.6	Conv. (m3/s)		1412.6	
Length Wtd. (m)	50.00	Wetted Per. (m)		13.82	
Min Ch El (m)	201.00	Shear (N/m2)		5.57	
Alpha	1.00	Stream Power (N/m s)		4.31	
Frctn Loss (m)		Cum Volume (1000 m3)	104.73	180.11	67.29
C & E Loss (m)		Cum SA (1000 m2)	97.30	58.16	78.28

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.96	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.078	0.035	0.078
W.S. Elev (m)	205.92	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	202.54	Flow Area (m2)	31.66	63.45	22.63
E.G. Slope (m/m)	0.000153	Area (m2)	31.66	63.45	22.63
Q Total (m3/s)	74.78	Flow (m3/s)	7.79	61.95	5.04
Top Width (m)	57.00	Top Width (m)	20.50	13.00	23.50
Vel Total (m/s)	0.64	Avg. Vel. (m/s)	0.25	0.98	0.22
Max Chl Dpth (m)	4.92	Hydr. Depth (m)	1.54	4.88	0.96
Conv. Total (m3/s)	6044.8	Conv. (m3/s)	630.0	5007.1	407.7
Length Wtd. (m)	50.00	Wetted Per. (m)	21.45	13.82	24.53
Min Ch El (m)	201.00	Shear (N/m2)	2.22	6.89	1.39
Alpha	1.98	Stream Power (N/m s)	0.55	6.73	0.31
Frctn Loss (m)		Cum Volume (1000 m3)	278.49	344.58	270.78
C & E Loss (m)		Cum SA (1000 m2)	196.04	58.17	204.79

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.3215

INPUT
Description: Hum 13A-4R. Applewood Crescent - Twin Cell - 4.3 m W x 2.4 m H x 30 m L Concrete Box Culverts. Based on Drawings - July 2010

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.
Distance from Upstream XS = 10
Deck/Roadway Width = 30
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 2
Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord

58	205.6	115	205.6

Upstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	58	208	58	205.5	66	205.5	78.5	201.8
79.15	201	91	201	91.5	201.8	100.5	205.7	115	205.7
115	208	175	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	66	.08	78.5	.035	91.5	.08	100.5	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
78.5	91.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	78.5	205.6	F
91.5	175	205.6	F

Downstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
58	205.6	115	205.6

Downstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	58	208	58	205.5	66	205.5	78.5	201.8
79.15	200.6	91	200.6	91.5	201.8	100.5	205.7	115	205.7
115	208	175	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	66	.08	78.5	.035	91.5	.08	100.5	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
78.5	91.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	78.5	205	F
91.5	175	205	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	Box	2.44	4.27

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
10	30	.015	.015	0	.4	1

Number of Barrels = 2

Upstream Elevation = 201
Centerline Stations
Sta. Sta.
82.5 87.5
Downstream Elevation = 200.6
Centerline Stations
Sta. Sta.
82.5 87.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	22.97	Culv Full Len (m)	16.19
# Barrels	2	Culv Vel US (m/s)	1.20
Q Barrel (m3/s)	11.49	Culv Vel DS (m/s)	1.10
E.G. US. (m)	203.35	Culv Inv El Up (m)	201.00
W.S. US. (m)	203.32	Culv Inv El Dn (m)	200.60
E.G. DS (m)	203.27	Culv Frctn Ls (m)	0.01
W.S. DS (m)	203.25	Culv Exit Loss (m)	0.04
Delta EG (m)	0.08	Culv Entr Loss (m)	0.03
Delta WS (m)	0.07	Q Weir (m3/s)	
E.G. IC (m)	202.42	Weir Sta Lft (m)	
E.G. OC (m)	203.35	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	203.25	Weir Max Depth (m)	
Culv WS Outlet (m)	203.04	Weir Avg Depth (m)	
Culv Nml Depth (m)	0.59	Weir Flow Area (m2)	
Culv Crt Depth (m)	0.90	Min El Weir Flow (m)	205.60

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	58.89	Culv Full Len (m)	30.00
# Barrels	2	Culv Vel US (m/s)	2.83
Q Barrel (m3/s)	29.45	Culv Vel DS (m/s)	2.83
E.G. US. (m)	205.96	Culv Inv El Up (m)	201.00
W.S. US. (m)	205.92	Culv Inv El Dn (m)	200.60
E.G. DS (m)	205.36	Culv Frctn Ls (m)	0.08
W.S. DS (m)	205.31	Culv Exit Loss (m)	0.35
Delta EG (m)	0.59	Culv Entr Loss (m)	0.16
Delta WS (m)	0.60	Q Weir (m3/s)	15.89
E.G. IC (m)	204.55	Weir Sta Lft (m)	58.00
E.G. OC (m)	205.96	Weir Sta Rgt (m)	115.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	203.44	Weir Max Depth (m)	0.36
Culv WS Outlet (m)	203.04	Weir Avg Depth (m)	0.33
Culv Nml Depth (m)		Weir Flow Area (m2)	18.98
Culv Crt Depth (m)	1.69	Min El Weir Flow (m)	205.60

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.321

INPUT
Description: Section 46.322 - Applewod Crescent - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	58	208	58	205.5	66	205.5	78.5	201.8
79.15	200.6	91	200.6	91.5	201.8	100.5	205.7	115	205.7
115	208	175	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	66	.08	78.5	.035	91.5	.08	100.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
78.5	91.5	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	78.5	205	F
91.5	175	205	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.27	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.25	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	201.32	Flow Area (m2)		33.76	
E.G. Slope (m/m)	0.000184	Area (m2)	3.55	33.76	2.42
Q Total (m3/s)	22.97	Flow (m3/s)		22.97	
Top Width (m)	21.24	Top Width (m)	4.90	13.00	3.35
Vel Total (m/s)	0.68	Avg. Vel. (m/s)		0.68	
Max Chl Dpth (m)	2.65	Hydr. Depth (m)		2.60	
Conv. Total (m3/s)	1692.9	Conv. (m3/s)		1692.9	
Length Wtd. (m)	50.00	Wetted Per. (m)		14.51	
Min Ch El (m)	200.60	Shear (N/m2)		4.20	
Alpha	1.00	Stream Power (N/m s)		2.86	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	104.73	179.35	67.29
C & E Loss (m)	0.02	Cum SA (1000 m2)	97.05	57.51	78.11

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.36	Element	Left OB	Channel	Right OB

Vel Head (m)	0.05	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	205.31	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	202.15	Flow Area (m2)	20.83	60.56	14.23
E.G. Slope (m/m)	0.000215	Area (m2)	20.83	60.56	14.23
Q Total (m3/s)	74.78	Flow (m3/s)	5.41	65.79	3.59
Top Width (m)	32.97	Top Width (m)	11.86	13.00	8.10
Vel Total (m/s)	0.78	Avg. Vel. (m/s)	0.26	1.09	0.25
Max Chl Dpth (m)	4.71	Hydr. Depth (m)	1.76	4.66	1.76
Conv. Total (m3/s)	5097.4	Conv. (m3/s)	368.5	4484.6	244.4
Length Wtd. (m)	50.00	Wetted Per. (m)	12.37	14.51	8.83
Min Ch El (m)	200.60	Shear (N/m2)	3.55	8.81	3.40
Alpha	1.71	Stream Power (N/m s)	0.92	9.57	0.86
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	278.49	342.22	270.78
C & E Loss (m)	0.02	Cum SA (1000 m2)	195.23	57.52	204.00

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: RIVER-1
REACH: Reach-1 RS: 46.32

INPUT
Description: Section 46.32 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	45	208	45	205.5	52	205	66	201
68	200.6	69	200.6	71	201	84	205	102	206
102	208	152	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	52	.08	66	.035	71	.08	84	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
66	71	110	110	110	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.24	Element	Left OB	Channel	Right OB

Vel Head (m)	0.08	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.16	Reach Len. (m)	110.00	110.00	110.00
Crit W.S. (m)		Flow Area (m2)	8.15	11.99	7.57
E.G. Slope (m/m)	0.000808	Area (m2)	8.15	11.99	7.57
Q Total (m3/s)	22.97	Flow (m3/s)	2.97	17.26	2.74
Top Width (m)	19.57	Top Width (m)	7.55	5.00	7.01
Vel Total (m/s)	0.83	Avg. Vel. (m/s)	0.36	1.44	0.36
Max Chl Dpth (m)	2.56	Hydr. Depth (m)	1.08	2.40	1.08
Conv. Total (m3/s)	808.3	Conv. (m3/s)	104.4	607.4	96.5
Length Wtd. (m)	110.00	Wetted Per. (m)	7.85	5.08	7.34
Min Ch El (m)	200.60	Shear (N/m2)	8.22	18.70	8.17
Alpha	2.31	Stream Power (N/m s)	2.99	26.91	2.96
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	104.44	178.20	67.04
C & E Loss (m)	0.02	Cum SA (1000 m2)	96.74	57.06	77.85

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.12	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	205.21	Reach Len. (m)	110.00	110.00	110.00
Crit W.S. (m)		Flow Area (m2)	31.25	22.25	29.13
E.G. Slope (m/m)	0.000649	Area (m2)	31.25	22.25	29.13
Q Total (m3/s)	74.78	Flow (m3/s)	16.32	43.36	15.11
Top Width (m)	38.72	Top Width (m)	16.94	5.00	16.78
Vel Total (m/s)	0.91	Avg. Vel. (m/s)	0.52	1.95	0.52
Max Chl Dpth (m)	4.61	Hydr. Depth (m)	1.84	4.45	1.74
Conv. Total (m3/s)	2935.7	Conv. (m3/s)	640.6	1702.1	593.0
Length Wtd. (m)	110.00	Wetted Per. (m)	17.51	5.08	17.39
Min Ch El (m)	200.60	Shear (N/m2)	11.36	27.88	10.66
Alpha	2.83	Stream Power (N/m s)	5.93	54.32	

5.53					
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	277.19	340.15	269.70
C & E Loss (m)	0.02	Cum SA (1000 m2)	194.51	57.07	203.38

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: RIVER-1
REACH: Reach-1 RS: 46.312

INPUT
Description: Section 46.312 - Edgeley Blvd - U/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	43	207	43	204.6	49	204.6	52	204.1
60.5	201.1	61.15	200.6	72.85	200.6	73.5	201.1	82	204.1
84	204.7	90	204.7	90	207	150	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	49	.08	60.5	.035	73.5	.08	84	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
60.5	73.5	60	60	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	60.5	204.7	F
73.5	150	204.7	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.19	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.16	Reach Len. (m)	60.00	60.00	60.00
Crit W.S. (m)	201.31	Flow Area (m2)		32.97	
E.G. Slope (m/m)	0.000178	Area (m2)	6.02	32.97	6.02
Q Total (m3/s)	22.97	Flow (m3/s)		22.97	
Top Width (m)	24.68	Top Width (m)	5.84	13.00	5.84
Vel Total (m/s)	0.70	Avg. Vel. (m/s)		0.70	
Max Chl Dpth (m)	2.56	Hydr. Depth (m)		2.54	
Conv. Total (m3/s)	1722.0	Conv. (m3/s)		1722.0	
Length Wtd. (m)	60.00	Wetted Per. (m)		13.34	

Min Ch El (m)	200.60	Shear (N/m2)			4.31
Alpha	1.00	Stream Power (N/m s)			3.00
Frctn Loss (m)		Cum Volume (1000 m3)	103.66	175.73	66.30
C & E Loss (m)		Cum SA (1000 m2)	96.00	56.07	77.14

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.27	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.077	0.035	0.078
W.S. Elev (m)	205.23	Reach Len. (m)	60.00	60.00	60.00
Crit W.S. (m)	202.13	Flow Area (m2)	28.78	59.87	27.20
E.G. Slope (m/m)	0.000169	Area (m2)	28.78	59.87	27.20
Q Total (m3/s)	74.78	Flow (m3/s)	7.28	60.47	7.04
Top Width (m)	47.00	Top Width (m)	17.50	13.00	16.50
Vel Total (m/s)	0.65	Avg. Vel. (m/s)	0.25	1.01	0.26
Max Chl Dpth (m)	4.63	Hydr. Depth (m)	1.64	4.61	1.65
Conv. Total (m3/s)	5755.8	Conv. (m3/s)	560.1	4654.1	541.6
Length Wtd. (m)	60.00	Wetted Per. (m)	18.69	13.34	17.63
Min Ch El (m)	200.60	Shear (N/m2)	2.55	7.43	2.55
Alpha	2.01	Stream Power (N/m s)	0.64	7.50	0.66
Frctn Loss (m)		Cum Volume (1000 m3)	273.89	335.64	266.60
C & E Loss (m)		Cum SA (1000 m2)	192.61	56.08	201.55

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.3115

INPUT
Description: Hum 13A-3R. Edgeley Blvd - Twin Cell - 4.3 m W x 2.4 m H x 35 m L Concrete Box Culverts. July 2010

Drawing by Ander Engineering Ltd. (Dwg No. 88-150-7, October 1989) used to recode culvert in HEC-RAS format.

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 10
Deck/Roadway Width = 35
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
43	204.7	90	204.7

Upstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	43	207	43	204.6	49	204.6	52	204.1
60.5	201.1	61.15	200.6	72.85	200.6	73.5	201.1	82	204.1
84	204.7	90	204.7	90	207	150	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	49	.08	60.5	.035	73.5	.08	84	.05

Bank Sta: Left Right Coeff Contr. Expan.
60.5 73.5 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	60.5	204.7	F
73.5	150	204.7	F

Downstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
43	204.7	90	204.7

Downstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	43	207	43	204.6	49	204.6	52	204.1
60.5	201.1	61.15	200.5	72.85	200.5	73.5	201.1	82	204.1
84	204.7	90	204.7	90	207	150	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	49	.08	60.5	.035	73.5	.08	84	.05

Bank Sta: Left Right Coeff Contr. Expan.
60.5 73.5 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	60.5	203.5	F
73.5	150	203.5	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	Box	2.44	4.27

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
10	35	.015	.015	0	.4	1

Number of Barrels = 2
Upstream Elevation = 200.6
Centerline Stations

Sta.	Sta.
64.5	69.5

Downstream Elevation = 200.5
Centerline Stations

Sta.	Sta.
64.5	69.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	22.97	Culv Full Len (m)	35.00
# Barrels	2	Culv Vel US (m/s)	1.10
Q Barrel (m3/s)	11.49	Culv Vel DS (m/s)	1.10
E.G. US. (m)	203.19	Culv Inv El Up (m)	200.60
W.S. US. (m)	203.16	Culv Inv El Dn (m)	200.50
E.G. DS (m)	203.11	Culv Frctn Ls (m)	0.01
W.S. DS (m)	203.09	Culv Exit Loss (m)	0.04
Delta EG (m)	0.08	Culv Entr Loss (m)	0.02
Delta WS (m)	0.08	Q Weir (m3/s)	
E.G. IC (m)	202.03	Weir Sta Lft (m)	
E.G. OC (m)	203.19	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	203.04	Weir Max Depth (m)	
Culv WS Outlet (m)	202.94	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.90	Min El Weir Flow (m)	204.70

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	45.47	Culv Full Len (m)	35.00
# Barrels	2	Culv Vel US (m/s)	2.18
Q Barrel (m3/s)	22.74	Culv Vel DS (m/s)	2.18
E.G. US. (m)	205.27	Culv Inv El Up (m)	200.60
W.S. US. (m)	205.23	Culv Inv El Dn (m)	200.50
E.G. DS (m)	204.93	Culv Frctn Ls (m)	0.05
W.S. DS (m)	204.88	Culv Exit Loss (m)	0.19
Delta EG (m)	0.34	Culv Entr Loss (m)	0.10
Delta WS (m)	0.35	Q Weir (m3/s)	29.31
E.G. IC (m)	204.16	Weir Sta Lft (m)	43.00
E.G. OC (m)	205.27	Weir Sta Rgt (m)	90.00
Culvert Control	Outlet	Weir Submerg	0.32
Culv WS Inlet (m)	203.04	Weir Max Depth (m)	0.57
Culv WS Outlet (m)	202.94	Weir Avg Depth (m)	0.57
Culv Nml Depth (m)		Weir Flow Area (m2)	26.89
Culv Crt Depth (m)	1.42	Min El Weir Flow (m)	204.70

Warning: During the culvert inlet control computations, the program could not

balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.311

INPUT
Description: Section 46.311 - Edgeley Blvd - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	43	207	43	204.6	49	204.6	52	204.1
60.5	201.1	61.15	200.5	72.85	200.5	73.5	201.1	82	204.1
84	204.7	90	204.7	90	207	150	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	49	.08	60.5	.035	73.5	.08	84	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
60.5	73.5	150	150	150	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	60.5	203.5	F
73.5	150	203.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.11	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.09	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)	201.21	Flow Area (m2)		33.23	
E.G. Slope (m/m)	0.000176	Area (m2)	5.59	33.23	5.59
Q Total (m3/s)	22.97	Flow (m3/s)		22.97	
Top Width (m)	24.25	Top Width (m)	5.63	13.00	5.63
Vel Total (m/s)	0.69	Avg. Vel. (m/s)		0.69	
Max Chl Dpth (m)	2.59	Hydr. Depth (m)		2.56	
Conv. Total (m3/s)	1733.2	Conv. (m3/s)		1733.2	
Length Wtd. (m)	150.00	Wetted Per. (m)		13.47	
Min Ch El (m)	200.50	Shear (N/m2)		4.25	
Alpha	1.00	Stream Power (N/m s)		2.94	
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	103.66	174.81	66.30
C & E Loss (m)	0.00	Cum SA (1000 m2)	95.65	55.29	76.80

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.93	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.079	0.035	0.079
W.S. Elev (m)	204.88	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)	202.03	Flow Area (m2)	22.66	56.56	21.43
E.G. Slope (m/m)	0.000225	Area (m2)	22.66	56.56	21.43
Q Total (m3/s)	74.78	Flow (m3/s)	5.90	63.07	5.81
Top Width (m)	47.00	Top Width (m)	17.50	13.00	16.50
Vel Total (m/s)	0.74	Avg. Vel. (m/s)	0.26	1.12	0.27
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.29	4.35	1.30
Conv. Total (m3/s)	4987.1	Conv. (m3/s)	393.4	4206.1	387.7
Length Wtd. (m)	150.00	Wetted Per. (m)	18.34	13.47	17.28
Min Ch El (m)	200.50	Shear (N/m2)	2.73	9.26	2.73
Alpha	1.92	Stream Power (N/m s)	0.71	10.33	0.74
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	273.89	332.80	266.60
C & E Loss (m)	0.00	Cum SA (1000 m2)	191.56	55.30	200.56

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.31

INPUT
Description: Section 46.31 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	40	207	40	204.5	46	204.5	49	204
58	201	61	200.4	67	200.4	70	201	81	204
85	204.6	107	204.6	107	207	148	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	46	.08	58	.035	70	.08	85	.05

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

58 70 150 150 150 .1 .3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.06	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)		Flow Area (m2)	6.37	30.13	7.79
E.G. Slope (m/m)	0.000171	Area (m2)	6.37	30.13	7.79
Q Total (m3/s)	22.97	Flow (m3/s)	1.03	20.68	1.27
Top Width (m)	25.74	Top Width (m)	6.18	12.00	7.56
Vel Total (m/s)	0.52	Avg. Vel. (m/s)	0.16	0.69	0.16
Max Chl Dpth (m)	2.66	Hydr. Depth (m)	1.03	2.51	1.03
Conv. Total (m3/s)	1755.6	Conv. (m3/s)	78.5	1580.2	97.0
Length Wtd. (m)	150.00	Wetted Per. (m)	6.52	12.12	7.83
Min Ch El (m)	200.40	Shear (N/m2)	1.64	4.17	1.67
Alpha	1.59	Stream Power (N/m s)	0.26	2.86	0.27
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	102.77	170.06	65.29
C & E Loss (m)	0.00	Cum SA (1000 m2)	94.77	53.42	75.81

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.90	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.079	0.035	0.078
W.S. Elev (m)	204.85	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)		Flow Area (m2)	24.98	51.55	33.40
E.G. Slope (m/m)	0.000235	Area (m2)	24.98	51.55	33.40
Q Total (m3/s)	74.78	Flow (m3/s)	6.86	59.30	8.62
Top Width (m)	67.00	Top Width (m)	18.00	12.00	37.00
Vel Total (m/s)	0.68	Avg. Vel. (m/s)	0.27	1.15	0.26
Max Chl Dpth (m)	4.45	Hydr. Depth (m)	1.39	4.30	0.90
Conv. Total (m3/s)	4876.6	Conv. (m3/s)	447.7	3866.8	562.1
Length Wtd. (m)	150.00	Wetted Per. (m)	18.87	12.12	37.69

Min Ch El (m)	200.40	Shear (N/m2)	3.05	9.81	2.04
Alpha	2.30	Stream Power (N/m s)	0.84	11.28	0.53
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	270.31	324.69	262.49
C & E Loss (m)	0.00	Cum SA (1000 m2)	188.90	53.43	196.55

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.30

INPUT
Description: Section 46.30 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	20	207	20	205	46	205	56	201
59	200.3	65	200.3	68	201	80	204	83	204.7
119	205	119	207	146	207				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	46	.08	56	.035	68	.08	83	.025
119	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
56	68	110	110	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.05	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.02	Reach Len. (m)	110.00	110.00	110.00
Crit W.S. (m)		Flow Area (m2)	5.08	30.48	8.12
E.G. Slope (m/m)	0.000264	Area (m2)	5.08	30.48	8.12
Q Total (m3/s)	28.70	Flow (m3/s)	0.99	26.09	1.62
Top Width (m)	25.10	Top Width (m)	5.04	12.00	8.06
Vel Total (m/s)	0.66	Avg. Vel. (m/s)	0.19	0.86	0.20
Max Chl Dpth (m)	2.72	Hydr. Depth (m)	1.01	2.54	1.01
Conv. Total (m3/s)	1767.7	Conv. (m3/s)	60.7	1607.0	100.0
Length Wtd. (m)	110.00	Wetted Per. (m)	5.43	12.16	8.31
Min Ch El (m)	200.30	Shear (N/m2)	2.42	6.48	2.53
Alpha	1.55	Stream Power (N/m s)	0.47	5.54	0.50
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	101.91	165.51	

64.10
  C & E Loss (m) 0.00 Cum SA (1000 m2) 93.93 51.62
74.64

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.86	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	204.79	Reach Len. (m)	110.00	110.00	110.00
Crit W.S. (m)		Flow Area (m2)	17.94	51.76	29.24
E.G. Slope (m/m)	0.000296	Area (m2)	17.94	51.76	29.24
Q Total (m3/s)	81.91	Flow (m3/s)	5.63	66.87	9.42
Top Width (m)	47.08	Top Width (m)	9.47	12.00	25.60
Vel Total (m/s)	0.83	Avg. Vel. (m/s)	0.31	1.29	0.32
Max Chl Dpth (m)	4.49	Hydr. Depth (m)	1.89	4.31	1.14
Conv. Total (m3/s)	4757.6	Conv. (m3/s)	326.7	3884.1	546.9
Length Wtd. (m)	110.00	Wetted Per. (m)	10.20	12.16	26.05
Min Ch El (m)	200.30	Shear (N/m2)	5.11	12.37	3.26
Alpha	2.02	Stream Power (N/m s)	1.60	15.98	1.05
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	267.09	316.94	257.79
C & E Loss (m)	0.01	Cum SA (1000 m2)	186.84	51.63	191.85

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.292

INPUT
Description: Section 46.292 - Millway Avenue - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	25	207	25	204	40	204	50	201
50.5	200.3	63	200.3	64	201	72	204	75	204.5
85	204.7	85	207	142	207				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	40	.08	50	.035	64	.08	72	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
50	64	55	55	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	50.5	204.1	F
63	142	204.1	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.02	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.		0.035	
W.S. Elev (m)	202.98	Reach Len. (m)	55.00	55.00	55.00
Crit W.S. (m)	201.11	Flow Area (m2)		33.55	
E.G. Slope (m/m)	0.000240	Area (m2)	6.56	37.05	5.25
Q Total (m3/s)	28.70	Flow (m3/s)		28.70	
Top Width (m)	25.90	Top Width (m)	6.61	14.00	5.29
Vel Total (m/s)	0.86	Avg. Vel. (m/s)		0.86	
Max Chl Dpth (m)	2.68	Hydr. Depth (m)		2.68	
Conv. Total (m3/s)	1851.4	Conv. (m3/s)		1851.4	
Length Wtd. (m)	55.00	Wetted Per. (m)		12.50	
Min Ch El (m)	200.30	Shear (N/m2)		6.32	
Alpha	1.00	Stream Power (N/m s)		5.41	
Frctn Loss (m)		Cum Volume (1000 m3)	101.27	161.80	63.37
C & E Loss (m)		Cum SA (1000 m2)	93.29	50.19	73.91

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.83	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.071	0.035	0.078
W.S. Elev (m)	204.78	Reach Len. (m)	55.00	55.00	55.00
Crit W.S. (m)	201.94	Flow Area (m2)	34.43	62.16	21.57
E.G. Slope (m/m)	0.000203	Area (m2)	34.43	62.16	21.57
Q Total (m3/s)	81.91	Flow (m3/s)	9.55	66.60	5.77
Top Width (m)	60.00	Top Width (m)	25.00	14.00	21.00
Vel Total (m/s)	0.69	Avg. Vel. (m/s)	0.28	1.07	0.27

Max Chl Dpth (m)	4.48	Hydr. Depth (m)	1.38	4.44	1.03
Conv. Total (m3/s)	5742.2	Conv. (m3/s)	669.3	4668.8	404.2
Length Wtd. (m)	55.00	Wetted Per. (m)	26.22	14.58	21.66
Min Ch El (m)	200.30	Shear (N/m2)	2.62	8.51	1.99
Alpha	1.97	Stream Power (N/m s)	0.73	9.11	0.53
Frctn Loss (m)		Cum Volume (1000 m3)	264.21	310.68	255.00
C & E Loss (m)		Cum SA (1000 m2)	184.95	50.20	189.29

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2915

INPUT
Description: Hum 13A-2RR. Millway Avenue Culvert - Twin Cell - 4.3 m W x 2.4 m H x 30 m L Concrete Box Culverts. Based on drawings - July 2010

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 15
Deck/Roadway Width = 30
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
25	204.1		75	204.1		85	204.7	

Upstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	25	207	25	204	40	204	50	201
50.5	200.3	63	200.3	64	201	72	204	75	204.5
85	204.7	85	207	142	207				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	40	.08	50	.035	64	.08	72	.05

Bank Sta: Left Right Coeff Contr. Expan.
50 64 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	50.5	204.1	F
63	142	204.1	F

Downstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord

25	204.1	75	204.1	85	204.7

Downstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	25	207	25	204	40	204	50	201
50.5	200.2	63	200.2	64	201	72	204	75	204.5
85	204.7	85	207	142	207				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	40	.08	50	.035	64	.08	72	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
50	64	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	50.5	203.4	F
63	142	203.4	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	Box	2.44	4.27

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
	15	30	.015	.015	0	.4	1

Number of Barrels = 2
Upstream Elevation = 200.3
Centerline Stations

Sta.	Sta.
54.3	59.3

Downstream Elevation = 200.2
Centerline Stations

Sta.	Sta.
54.3	59.3

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	28.70	Culv Full Len (m)	30.00
# Barrels	2	Culv Vel US (m/s)	1.38
Q Barrel (m3/s)	14.35	Culv Vel DS (m/s)	1.38
E.G. US. (m)	203.02	Culv Inv El Up (m)	200.30
W.S. US. (m)	202.98	Culv Inv El Dn (m)	200.20
E.G. DS (m)	202.91	Culv Frctn Ls (m)	0.02
W.S. DS (m)	202.87	Culv Exit Loss (m)	0.06
Delta EG (m)	0.12	Culv Entr Loss (m)	0.04
Delta WS (m)	0.12	Q Weir (m3/s)	
E.G. IC (m)	201.97	Weir Sta Lft (m)	
E.G. OC (m)	203.02	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	

Culv WS Inlet (m)	202.74	Weir Max Depth (m)	
Culv WS Outlet (m)	202.64	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	1.05	Min El Weir Flow (m)	204.10

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	36.65	Culv Full Len (m)	30.00
# Barrels	2	Culv Vel US (m/s)	1.76
Q Barrel (m3/s)	18.33	Culv Vel DS (m/s)	1.76
E.G. US. (m)	204.83	Culv Inv El Up (m)	200.30
W.S. US. (m)	204.78	Culv Inv El Dn (m)	200.20
E.G. DS (m)	204.63	Culv Frctn Ls (m)	0.03
W.S. DS (m)	204.58	Culv Exit Loss (m)	0.10
Delta EG (m)	0.19	Culv Entr Loss (m)	0.06
Delta WS (m)	0.20	Q Weir (m3/s)	45.26
E.G. IC (m)	204.15	Weir Sta Lft (m)	25.00
E.G. OC (m)	204.83	Weir Sta Rgt (m)	85.00
Culvert Control	Outlet	Weir Submerg	0.63
Culv WS Inlet (m)	202.74	Weir Max Depth (m)	0.73
Culv WS Outlet (m)	202.64	Weir Avg Depth (m)	0.63
Culv Nml Depth (m)		Weir Flow Area (m2)	38.06
Culv Crt Depth (m)	1.23	Min El Weir Flow (m)	204.10

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.291

INPUT
Description: Section 46.291 - Millway Avenue - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	25	207	25	204	40	204	50	201
50.5	200.2	63	200.2	64	201	72	204	75	204.5
85	204.7	85	207	142	207				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	40	.08	50	.035	64	.08	72	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
50	64	145	150	155	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	50.5	203.4	F
63	142	203.4	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.91	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.		0.035	

W.S. Elev (m)	202.87	Reach Len. (m)	145.00	150.00	155.00
Crit W.S. (m)	201.01	Flow Area (m2)		33.35	
E.G. Slope (m/m)	0.000245	Area (m2)	5.82	36.76	4.65
Q Total (m3/s)	28.70	Flow (m3/s)		28.70	
Top Width (m)	25.21	Top Width (m)	6.23	14.00	4.98
Vel Total (m/s)	0.86	Avg. Vel. (m/s)		0.86	
Max Chl Dpth (m)	2.67	Hydr. Depth (m)		2.67	
Conv. Total (m3/s)	1833.2	Conv. (m3/s)		1833.2	
Length Wtd. (m)	149.98	Wetted Per. (m)		12.50	
Min Ch El (m)	200.20	Shear (N/m2)		6.41	
Alpha	1.00	Stream Power (N/m s)		5.52	
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	101.27	160.60	63.37
C & E Loss (m)	0.00	Cum SA (1000 m2)	92.93	49.42	73.62

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.63	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.073	0.035	0.079
W.S. Elev (m)	204.58	Reach Len. (m)	145.00	150.00	155.00
Crit W.S. (m)	201.84	Flow Area (m2)	29.40	60.66	17.73
E.G. Slope (m/m)	0.000238	Area (m2)	29.40	60.66	17.73
Q Total (m3/s)	81.91	Flow (m3/s)	8.13	68.70	5.09
Top Width (m)	53.78	Top Width (m)	25.00	14.00	14.78
Vel Total (m/s)	0.76	Avg. Vel. (m/s)	0.28	1.13	0.29
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.18	4.33	1.20
Conv. Total (m3/s)	5311.0	Conv. (m3/s)	526.9	4454.2	330.0
Length Wtd. (m)	149.85	Wetted Per. (m)	26.02	14.72	15.37
Min Ch El (m)	200.20	Shear (N/m2)	2.64	9.61	2.69
Alpha	1.88	Stream Power (N/m s)	0.73	10.88	0.77
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	264.21	306.72	255.00

C & E Loss (m)	0.00	Cum SA (1000 m2)	183.57	49.43	188.31

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.29

INPUT
Description: Section 46.29 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	30	207	30	204.5	54	204	64	201
71	200.2	78	201	86	204	110	205	156	205

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	54	.08	64	.035	78	.08	86	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
64	78	135	145	150	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.86	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.83	Reach Len. (m)	135.00	145.00	150.00
Crit W.S. (m)		Flow Area (m2)	5.57	31.20	4.46
E.G. Slope (m/m)	0.000311	Area (m2)	5.57	31.20	4.46
Q Total (m3/s)	28.70	Flow (m3/s)	1.12	26.69	0.89
Top Width (m)	24.97	Top Width (m)	6.09	14.00	4.88
Vel Total (m/s)	0.70	Avg. Vel. (m/s)	0.20	0.86	0.20
Max Chl Dpth (m)	2.63	Hydr. Depth (m)	0.91	2.23	0.91
Conv. Total (m3/s)	1628.1	Conv. (m3/s)	63.7	1514.1	50.2
Length Wtd. (m)	144.88	Wetted Per. (m)	6.36	14.09	5.21
Min Ch El (m)	200.20	Shear (N/m2)	2.67	6.75	2.61
Alpha	1.41	Stream Power (N/m s)	0.54	5.77	0.52
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	100.44	155.50	62.66
C & E Loss (m)	0.00	Cum SA (1000 m2)	92.04	47.32	72.86

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.59	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.076	0.035	0.078
W.S. Elev (m)	204.52	Reach Len. (m)	135.00	145.00	150.00
Crit W.S. (m)		Flow Area (m2)	26.73	54.90	19.44
E.G. Slope (m/m)	0.000308	Area (m2)	26.73	54.90	19.44
Q Total (m3/s)	81.91	Flow (m3/s)	7.85	68.17	5.90
Top Width (m)	68.52	Top Width (m)	34.00	14.00	20.52
Vel Total (m/s)	0.81	Avg. Vel. (m/s)	0.29	1.24	0.30
Max Chl Dpth (m)	4.32	Hydr. Depth (m)	0.79	3.92	0.95
Conv. Total (m3/s)	4667.0	Conv. (m3/s)	447.1	3883.9	335.9
Length Wtd. (m)	144.53	Wetted Per. (m)	34.47	14.09	21.07
Min Ch El (m)	200.20	Shear (N/m2)	2.34	11.77	2.79
Alpha	1.98	Stream Power (N/m s)	0.69	14.61	0.85
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	260.15	298.06	252.12
C & E Loss (m)	0.01	Cum SA (1000 m2)	179.29	47.33	185.57

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.282

INPUT
Description: Section 46.282 - Pennsylvania Avenue - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	60	207	60	204	73	204	81	201
83	200.4	84	199.9	96	199.9	97	200.4	99	202
101	203	103	204	118	204	145	204	180	204.64
225	204.64								

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	83	.035	97	.08	103	.05
118	.025	145	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
83	97	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	83.5	204.1	F

96.5 225 204.05 F
Right Levee Station= 180 Elevation= 207

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.83	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.035	
W.S. Elev (m)	202.80	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	200.70	Flow Area (m2)		37.56	
E.G. Slope (m/m)	0.000176	Area (m2)	8.51	40.08	3.84
Q Total (m3/s)	28.70	Flow (m3/s)		28.70	
Top Width (m)	24.39	Top Width (m)	6.80	14.00	3.60
Vel Total (m/s)	0.76	Avg. Vel. (m/s)		0.76	
Max Chl Dpth (m)	2.90	Hydr. Depth (m)		2.89	
Conv. Total (m3/s)	2163.6	Conv. (m3/s)		2163.6	
Length Wtd. (m)	50.00	Wetted Per. (m)		13.12	
Min Ch El (m)	199.90	Shear (N/m2)		4.94	
Alpha	1.00	Stream Power (N/m s)		3.77	
Frctn Loss (m)		Cum Volume (1000 m3)	99.49	150.33	62.04
C & E Loss (m)		Cum SA (1000 m2)	91.17	45.29	72.22

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.55	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.076	0.035	0.048
W.S. Elev (m)	204.51	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	201.50	Flow Area (m2)	30.24	63.99	40.91
E.G. Slope (m/m)	0.000169	Area (m2)	30.24	63.99	40.91
Q Total (m3/s)	81.91	Flow (m3/s)	7.62	64.76	9.54
Top Width (m)	112.68	Top Width (m)	23.00	14.00	75.68
Vel Total (m/s)	0.61	Avg. Vel. (m/s)	0.25	1.01	0.23
Max Chl Dpth (m)	4.61	Hydr. Depth (m)	1.31	4.57	0.54

Conv. Total (m3/s)	6298.1	Conv. (m3/s)	585.7	4979.0	733.4
Length Wtd. (m)	50.00	Wetted Per. (m)	24.14	14.24	76.72
Min Ch El (m)	199.90	Shear (N/m2)	2.08	7.46	0.88
Alpha	2.24	Stream Power (N/m s)	0.52	7.55	0.21
Frctn Loss (m)		Cum Volume (1000 m3)	256.30	289.44	247.59
C & E Loss (m)		Cum SA (1000 m2)	175.45	45.30	178.35

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2815

INPUT
Description: Hum 13A-2R. Pennsylvania Avenue Culvert - Twin Cell - 5.7 m W x 2.4 m H x 40 m L Concrete Box Culverts. Drawing by Ander Engineering Ltd. (Dwg No. 85-102-9, December 1989) shows 4 Cell Culvert, but only two cells observed in field.

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 40
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 6

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	205	103	204	133	203.53
145	204	180	204	225	204

Upstream Bridge Cross Section Data
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	60	207	60	204	73	204	81	201
83	200.4	84	199.9	96	199.9	97	200.4	99	202
101	203	103	204	118	204	145	204	180	204.64
225	204.64								

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	83	.035	97	.08	103	.05
118	.025	145	.05						

Bank Sta: Left	Right	Coeff Contr.	Expan.
83	97	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	83.5	204.1	F
96.5	225	204.05	F

Right Levee Station= 180 Elevation= 207

Downstream Deck/Roadway Coordinates
num= 5

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	205	103	204	133	203.53
160	204	200	204		

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	73	204	81	201	83	200.4	84	199.8
96	199.8	97	200.4	99	202	101	203	103	204
118	204	145	204	160	204	200	204	200	206

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	83	.035	97	.08	103	.05
118	.025	145	.05						

Bank Sta: Left	Right	Coeff Contr.	Expan.
83	97	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	83.5	203.4	F
96.5	200	203.4	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	Box	3.05	4.57

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	40	.015	.015	0	.4	1

Number of Barrels = 2
Upstream Elevation = 199.3
Centerline Stations

Sta.	Sta.
87.5	92.5

Downstream Elevation = 199.2
Centerline Stations

Sta.	Sta.
87.5	92.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	28.70	Culv Full Len (m)	40.00
# Barrels	2	Culv Vel US (m/s)	1.03
Q Barrel (m3/s)	14.35	Culv Vel DS (m/s)	1.03
E.G. US. (m)	202.83	Culv Inv El Up (m)	199.30
W.S. US. (m)	202.80	Culv Inv El Dn (m)	199.20
E.G. DS (m)	202.77	Culv Frctn Ls (m)	0.01

W.S. DS (m)	202.74	Culv Exit Loss (m)	0.03
Delta EG (m)	0.06	Culv Entr Loss (m)	0.02
Delta WS (m)	0.06	Q Weir (m3/s)	
E.G. IC (m)	200.88	Weir Sta Lft (m)	
E.G. OC (m)	202.83	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	202.35	Weir Max Depth (m)	
Culv WS Outlet (m)	202.25	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	1.00	Min El Weir Flow (m)	204.05

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	38.81	Culv Full Len (m)	40.00
# Barrels	2	Culv Vel US (m/s)	1.39
Q Barrel (m3/s)	19.40	Culv Vel DS (m/s)	1.39
E.G. US. (m)	204.55	Culv Inv El Up (m)	199.30
W.S. US. (m)	204.51	Culv Inv El Dn (m)	199.20
E.G. DS (m)	204.43	Culv Frctn Ls (m)	0.02
W.S. DS (m)	204.39	Culv Exit Loss (m)	0.05
Delta EG (m)	0.11	Culv Entr Loss (m)	0.04
Delta WS (m)	0.12	Q Weir (m3/s)	43.11
E.G. IC (m)	202.56	Weir Sta Lft (m)	60.00
E.G. OC (m)	204.55	Weir Sta Rgt (m)	174.87
Culvert Control	Outlet	Weir Submerg	0.62
Culv WS Inlet (m)	202.35	Weir Max Depth (m)	0.55
Culv WS Outlet (m)	202.25	Weir Avg Depth (m)	0.40
Culv Nml Depth (m)		Weir Flow Area (m2)	45.61
Culv Crt Depth (m)	1.22	Min El Weir Flow (m)	204.05

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.281

INPUT
Description: Section 46.281 - Pennsylvania Avenue - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	73	204	81	201	83	200.4	84	199.8
96	199.8	97	200.4	99	202	101	203	103	204
118	204	145	204	160	204	200	204	200	206

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	83	.035	97	.08	103	.05
118	.025	145	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
83	97	40	40	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	83.5	203.4	F
96.5	200	203.4	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.77	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.035	
W.S. Elev (m)	202.74	Reach Len. (m)	40.00	40.00	40.00
Crit W.S. (m)	200.60	Flow Area (m2)		38.10	
E.G. Slope (m/m)	0.000169	Area (m2)	8.13	40.59	3.64
Q Total (m3/s)	28.70	Flow (m3/s)		28.70	
Top Width (m)	24.13	Top Width (m)	6.65	14.00	3.48
Vel Total (m/s)	0.75	Avg. Vel. (m/s)		0.75	
Max Chl Dpth (m)	2.94	Hydr. Depth (m)		2.93	
Conv. Total (m3/s)	2210.3	Conv. (m3/s)		2210.3	
Length Wtd. (m)	40.00	Wetted Per. (m)		13.17	
Min Ch El (m)	199.80	Shear (N/m2)		4.78	
Alpha	1.00	Stream Power (N/m s)		3.60	
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	99.49	149.44	62.04
C & E Loss (m)	0.01	Cum SA (1000 m2)	90.83	44.59	72.05

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.43	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.078	0.035	0.051
W.S. Elev (m)	204.39	Reach Len. (m)	40.00	40.00	40.00
Crit W.S. (m)	201.40	Flow Area (m2)	27.99	63.63	49.60
E.G. Slope (m/m)	0.000178	Area (m2)	27.99	63.63	49.60
Q Total (m3/s)	81.91	Flow (m3/s)	6.67	65.58	9.66
Top Width (m)	155.35	Top Width (m)	38.35	14.00	103.00
Vel Total (m/s)	0.58	Avg. Vel. (m/s)	0.24	1.03	0.19
Max Chl Dpth (m)	4.59	Hydr. Depth (m)	0.73	4.55	0.48

Conv. Total (m3/s)	6134.9	Conv. (m3/s)	499.9	4911.4	723.6
Length Wtd. (m)	40.00	Wetted Per. (m)	38.98	14.33	104.42
Min Ch El (m)	199.80	Shear (N/m2)	1.26	7.76	0.83
Alpha	2.55	Stream Power (N/m s)	0.30	8.00	0.16
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	256.30	286.08	247.59
C & E Loss (m)	0.02	Cum SA (1000 m2)	173.91	44.60	173.89

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: RIVER-1
REACH: Reach-1 RS: 46.28

INPUT
Description: Section 46.28 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	73	204	83	201	87	200	89	199.8
91	199.8	93	200	95	201	98	202	101	203
103	204	117	204	142	204	173	204	173	206

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	87	.035	93	.08	103	.05
117	.025	142	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
87	93	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.75	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.69	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)		Flow Area (m2)	13.49	16.92	8.65
E.G. Slope (m/m)	0.000497	Area (m2)	13.49	16.92	8.65
Q Total (m3/s)	28.70	Flow (m3/s)	4.59	21.47	2.63
Top Width (m)	22.69	Top Width (m)	9.62	6.00	7.06
Vel Total (m/s)	0.73	Avg. Vel. (m/s)	0.34	1.27	0.30
Max Chl Dpth (m)	2.89	Hydr. Depth (m)	1.40	2.82	

1.22					
Conv. Total (m3/s)	1287.3	Conv. (m3/s)	206.1	963.2	118.1
Length Wtd. (m)	50.00	Wetted Per. (m)	10.00	6.02	7.57
Min Ch El (m)	199.80	Shear (N/m2)	6.58	13.70	5.56
Alpha	2.28	Stream Power (N/m s)	2.24	17.38	1.69
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	99.06	148.29	61.79
C & E Loss (m)	0.01	Cum SA (1000 m2)	90.51	44.19	71.84

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.40	Element	Left OB	Channel	Right OB
Vel Head (m)	0.10	Wt. n-Val.	0.079	0.035	0.065
W.S. Elev (m)	204.31	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)		Flow Area (m2)	36.71	26.64	44.49
E.G. Slope (m/m)	0.000537	Area (m2)	36.71	26.64	44.49
Q Total (m3/s)	81.91	Flow (m3/s)	17.18	47.54	17.19
Top Width (m)	122.35	Top Width (m)	36.35	6.00	80.00
Vel Total (m/s)	0.76	Avg. Vel. (m/s)	0.47	1.78	0.39
Max Chl Dpth (m)	4.51	Hydr. Depth (m)	1.01	4.44	0.56
Conv. Total (m3/s)	3534.3	Conv. (m3/s)	741.5	2051.1	741.8
Length Wtd. (m)	50.00	Wetted Per. (m)	36.91	6.02	81.10
Min Ch El (m)	199.80	Shear (N/m2)	5.24	23.31	2.89
Alpha	3.34	Stream Power (N/m s)	2.45	41.60	1.12
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	255.01	284.28	245.71
C & E Loss (m)	0.02	Cum SA (1000 m2)	172.42	44.20	170.23

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: RIVER-1
REACH: Reach-1 RS: 46.274

INPUT
Description: Section 46.274 - Jane Street - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	76	204	83	201	90	200
94	199.34	98	199.34	102	200	106	201	116	204
130	204	205	204	205	206				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	76	.08	90	.035	106	.08	116	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	102	1	1	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	89	203.21	F
103	205	203.21	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.73	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.035
W.S. Elev (m)	202.71	Reach Len. (m)	0.50	0.50	0.50
Crit W.S. (m)	200.27	Flow Area (m2)	2.64	37.83	2.59
E.G. Slope (m/m)	0.000078	Area (m2)	18.91	37.83	13.74
Q Total (m3/s)	22.11	Flow (m3/s)	0.55	20.35	1.20
Top Width (m)	32.70	Top Width (m)	11.00	12.00	9.71
Vel Total (m/s)	0.51	Avg. Vel. (m/s)	0.21	0.54	0.46
Max Chl Dpth (m)	3.37	Hydr. Depth (m)	2.64	3.15	2.59
Conv. Total (m3/s)	2508.9	Conv. (m3/s)	62.7	2309.7	136.5
Length Wtd. (m)	0.50	Wetted Per. (m)	1.01	12.11	1.03
Min Ch El (m)	199.34	Shear (N/m2)	1.99	2.38	1.91
Alpha	1.06	Stream Power (N/m s)	0.42	1.28	0.89
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	98.25	146.92	61.23
C & E Loss (m)	0.04	Cum SA (1000 m2)	89.99	43.74	71.42

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.37	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.076	0.035	0.047
W.S. Elev (m)	204.35	Reach Len. (m)	0.50	0.50	0.50
Crit W.S. (m)	201.18	Flow Area (m2)	56.08	57.42	64.56
E.G. Slope (m/m)	0.000121	Area (m2)	56.08	57.42	64.56
Q Total (m3/s)	81.91	Flow (m3/s)	12.28	50.97	18.66
Top Width (m)	182.08	Top Width (m)	67.09	12.00	103.00
Vel Total (m/s)	0.46	Avg. Vel. (m/s)	0.22	0.89	0.29
Max Chl Dpth (m)	5.01	Hydr. Depth (m)	0.84	4.79	0.63
Conv. Total (m3/s)	7442.7	Conv. (m3/s)	1115.9	4630.9	1695.9
Length Wtd. (m)	0.50	Wetted Per. (m)	67.78	12.11	103.91
Min Ch El (m)	199.34	Shear (N/m2)	0.98	5.63	0.74
Alpha	2.44	Stream Power (N/m s)	0.22	5.00	0.21
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	252.69	282.17	242.98
C & E Loss (m)	0.02	Cum SA (1000 m2)	169.83	43.75	165.65

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.

BRIDGE

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2735

INPUT
Description: Hum 13A-1R. Jane Street Culverts - Upstream In-Line Weir Coded as Bridge. Weir is 25 m L. Drawings by Ander Engineering Ltd. (85-101-7 & 85-101-1) 1985.

New HEC-RAS coding January 2004 by
Acres included coding of in-line weir (as a bridge) and culverts in HEC-RAS.
Distance from Upstream XS = .5
Deck/Roadway Width = .25
Weir Coefficient = 1.72
Upstream Deck/Roadway Coordinates
num= 8

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
76	204	204	83.5	204		83.5	203.21	
90	203.21	200.7	102	203.21	200.7	108.5	203.21	
108.5	204		116	204				

Upstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	76	204	83	201	90	200
94	199.34	98	199.34	102	200	106	201	116	204
130	204	205	204	205	206				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	76	.08	90	.035	106	.08	116	.05

Bank Sta: Left Right Coeff Contr. Expan.
90 102 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	89	203.21	F
103	205	203.21	F

Downstream Deck/Roadway Coordinates
num= 8

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
76	204	204	83.5	204		83.5	203.21	
90	203.21	200.7	102	203.21	200.7	108.5	203.21	
108.5	204		116	204				

Downstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	76	204	83	201	90	200
94	199.34	98	199.34	102	200	106	201	116	204
130	204	205	204	205	206				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	76	.08	90	.035	106	.08	116	.05

Bank Sta: Left Right Coeff Contr. Expan.
90 102 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	89	203.2	F
103	205	203.2	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 Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method

Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT Profile #100-year

E.G. US. (m)	202.73	Element	Inside BR US	Inside BR DS
W.S. US. (m)	202.71	E.G. Elev (m)	202.69	202.69
Q Total (m3/s)	22.11	W.S. Elev (m)	202.56	202.56
Q Bridge (m3/s)	22.11	Crit W.S. (m)	200.26	200.26
Q Weir (m3/s)		Max Chl Dpth (m)	3.22	3.22
Weir Sta Lft (m)		Vel Total (m/s)	1.62	1.62
Weir Sta Rgt (m)		Flow Area (m2)	13.69	13.69
Weir Submerg		Froude # Chl	0.29	0.29
Weir Max Depth (m)		Specif Force (m3)	37.16	37.14
Min El Weir Flow (m)	203.21	Hydr Depth (m)		
Min El Prs (m)	200.70	W.P. Total (m)	25.52	25.52
Delta EG (m)	0.10	Conv. Total (m3/s)	267.9	267.9
Delta WS (m)	0.10	Top Width (m)		
BR Open Area (m2)	13.69	Frctn Loss (m)	0.00	0.00
BR Open Vel (m/s)	1.62	C & E Loss (m)	0.00	0.06
BR Sluice Coef		Shear Total (N/m2)	35.80	35.80
BR Sel Method	Energy only	Power Total (N/m s)	57.81	57.81

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
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.

BRIDGE OUTPUT Profile #Regional w red'n

E.G. US. (m)	204.37	Element	Inside BR US	Inside BR DS
W.S. US. (m)	204.35	E.G. Elev (m)	204.35	

Q Total (m3/s)	81.91	W.S. Elev (m)	204.26
Q Bridge (m3/s)	19.02	Crit W.S. (m)	203.76
Q Weir (m3/s)		Max Chl Dpth (m)	4.92
Weir Sta Lft (m)		Vel Total (m/s)	1.04
Weir Sta Rgt (m)		Flow Area (m2)	78.91
Weir Submerg		Froude # Chl	0.19
Weir Max Depth (m)		Specif Force (m3)	86.06
Min El Weir Flow (m)	203.21	Hydr Depth (m)	0.44
Min El Prs (m)	200.70	W.P. Total (m)	206.49
Delta EG (m)	0.05	Conv. Total (m3/s)	1121.0
Delta WS (m)	0.05	Top Width (m)	179.12
BR Open Area (m2)	13.69	Frctn Loss (m)	0.00
BR Open Vel (m/s)	1.39	C & E Loss (m)	0.00
BR Sluice Coef		Shear Total (N/m2)	20.01
BR Sel Method	Energy only	Power Total (N/m s)	20.77

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
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: RIVER-1
REACH: Reach-1 RS: 46.273

INPUT
Description: Section 46.273 - Jane Street - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	76	204	83	201	90	200
94	199.34	98	199.34	102	200	106	201	116	204
130	204	205	204	205	206				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	76	.08	90	.035	106	.08	116	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	102	4	4	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	89	203.2	F
103	205	203.2	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.63	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.035
W.S. Elev (m)	202.61	Reach Len. (m)	4.00	4.00	4.00
Crit W.S. (m)	200.27	Flow Area (m2)	2.54	36.66	2.49
E.G. Slope (m/m)	0.000086	Area (m2)	17.85	36.66	12.81
Q Total (m3/s)	22.11	Flow (m3/s)	0.55	20.37	1.19
Top Width (m)	32.15	Top Width (m)	10.77	12.00	9.38
Vel Total (m/s)	0.53	Avg. Vel. (m/s)	0.21	0.56	0.48
Max Chl Dpth (m)	3.27	Hydr. Depth (m)	2.54	3.05	2.49
Conv. Total (m3/s)	2378.9	Conv. (m3/s)	58.8	2191.9	128.1
Length Wtd. (m)	4.00	Wetted Per. (m)	1.01	12.11	1.03
Min Ch El (m)	199.34	Shear (N/m2)	2.13	2.56	2.05
Alpha	1.06	Stream Power (N/m s)	0.46	1.42	0.98
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	98.24	146.90	61.23
C & E Loss (m)	0.01	Cum SA (1000 m2)	89.99	43.73	71.41

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.32	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.077	0.035	0.046
W.S. Elev (m)	204.29	Reach Len. (m)	4.00	4.00	4.00
Crit W.S. (m)	201.19	Flow Area (m2)	52.47	56.77	58.95
E.G. Slope (m/m)	0.000131	Area (m2)	52.47	56.77	58.95
Q Total (m3/s)	81.91	Flow (m3/s)	11.96	51.90	18.04
Top Width (m)	180.18	Top Width (m)	65.18	12.00	

103.00					
Vel Total (m/s)	0.49	Avg. Vel. (m/s)	0.23	0.91	
0.31					
Max Chl Dpth (m)	4.95	Hydr. Depth (m)	0.81	4.73	
0.57					
Conv. Total (m3/s)	7170.2	Conv. (m3/s)	1047.3	4543.3	
1579.5					
Length Wtd. (m)	4.00	Wetted Per. (m)	65.87	12.11	
103.85					
Min Ch El (m)	199.34	Shear (N/m2)	1.02	6.00	
0.73					
Alpha	2.35	Stream Power (N/m s)	0.23	5.49	
0.22					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	252.65	282.14	
242.94					
C & E Loss (m)	0.01	Cum SA (1000 m2)	169.77	43.73	
165.55					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.272

INPUT
Description: Section 46.272 - Jane Street - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	80	204	90	201	91	200
92	199.34	100	199.34	101	200	102	201	105	202
115	203	120	204	130	204	205	204	205	206

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	80	.08	91	.035	102	.08	120	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
91	101	100	80	60	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	92	204	F
100	205	204	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.62	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.04	Wt. n-Val.		0.035	
W.S. Elev (m)	202.59	Reach Len. (m)	100.00	80.00	
60.00					
Crit W.S. (m)	200.26	Flow Area (m2)		25.97	
E.G. Slope (m/m)	0.000185	Area (m2)	6.28	31.80	
7.06					
Q Total (m3/s)	22.11	Flow (m3/s)		22.11	

Top Width (m)	26.15	Top Width (m)	6.29	10.00
9.86				
Vel Total (m/s)	0.85	Avg. Vel. (m/s)		0.85
Max Chl Dpth (m)	3.25	Hydr. Depth (m)		3.25
Conv. Total (m3/s)	1626.6	Conv. (m3/s)		1626.6
Length Wtd. (m)	80.00	Wetted Per. (m)		8.00
Min Ch El (m)	199.34	Shear (N/m2)		5.88
Alpha	1.00	Stream Power (N/m s)		5.00
Frctn Loss (m)		Cum Volume (1000 m3)	98.19	146.76
61.19				
C & E Loss (m)		Cum SA (1000 m2)	89.95	43.69
71.37				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.31	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.06	Wt. n-Val.	0.074	0.035	
0.064					
W.S. Elev (m)	204.25	Reach Len. (m)	100.00	80.00	
60.00					
Crit W.S. (m)	201.54	Flow Area (m2)	33.56	48.43	
54.45					
E.G. Slope (m/m)	0.000246	Area (m2)	33.56	48.43	
54.45					
Q Total (m3/s)	81.91	Flow (m3/s)	7.59	60.53	
13.79					
Top Width (m)	178.73	Top Width (m)	64.73	10.00	
104.00					
Vel Total (m/s)	0.60	Avg. Vel. (m/s)	0.23	1.25	
0.25					
Max Chl Dpth (m)	4.91	Hydr. Depth (m)	0.52	4.84	
0.52					
Conv. Total (m3/s)	5223.6	Conv. (m3/s)	484.0	3860.1	
879.5					
Length Wtd. (m)	80.00	Wetted Per. (m)	65.59	10.40	
104.97					
Min Ch El (m)	199.34	Shear (N/m2)	1.23	11.23	
1.25					
Alpha	3.25	Stream Power (N/m s)	0.28	14.04	
0.32					
Frctn Loss (m)		Cum Volume (1000 m3)	252.48	281.93	
242.71					
C & E Loss (m)		Cum SA (1000 m2)	169.51	43.69	
165.14					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2715

INPUT
Description: Hum 13A-1R. Jane Street Culverts - Twin Cell - 2.44 m W x 2.135 m H x 59 m L Concrete Box Culverts and Single Cel 2.44 W x 1.22 m H x 59 m L. Drawings by Ander Engineering Ltd. (85-101-7 & 85-101-1) 1985.

New HEC-RAS coding January 2004 by Acres
included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.
Distance from Upstream XS = 5
Deck/Roadway Width = 59
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	204	173	204

Upstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	80	204	90	201	91	200
92	199.34	100	199.34	101	200	102	201	105	202
115	203	120	204	130	204	205	204	205	206

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	80	.08	91	.035	102	.08	120	.05

Bank Sta: Left Right Coeff Contr. Expan.
91 101 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	92	204	F
100	205	204	F

Downstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	204	173	204

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	3	204	30	204	67	204	71	203
74	201	77	200	79	198.983	91	198.983	93	200
97	201	105	202	106	203	107	203.6	165	203.8

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.05	71	.08	77	.035	93	.08
106	.05								

Bank Sta: Left Right Coeff Contr. Expan.
77 93 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent

0	81	202.5	F
89	165	202.5	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 = 2

Culvert Name	Shape	Rise	Span
Culvert #1	Box	2.135	2.44

FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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
5	59	.015	.015	0	.5	1

Number of Barrels = 2
Upstream Elevation = 200.78
Centerline Stations

Sta.	Sta.
93.6	98.4

Downstream Elevation = 200.403
Centerline Stations

Sta.	Sta.
82.6	87.4

Culvert Name	Shape	Rise	Span
Culvert #2	Box	1.22	2.44

FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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
5	59	.015	.015	0	.5	1

Upstream Elevation = 199.34
Centerline Station = 96
Downstream Elevation = 198.983
Centerline Station = 85

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	16.49	Culv Full Len (m)	
# Barrels	2	Culv Vel US (m/s)	2.42
Q Barrel (m3/s)	8.24	Culv Vel DS (m/s)	1.89
E.G. US. (m)	202.62	Culv Inv El Up (m)	200.78
W.S. US. (m)	202.59	Culv Inv El Dn (m)	200.40
E.G. DS (m)	202.23	Culv Frctn Ls (m)	0.03
W.S. DS (m)	202.19	Culv Exit Loss (m)	0.14
Delta EG (m)	0.39	Culv Entr Loss (m)	0.15
Delta WS (m)	0.39	Q Weir (m3/s)	
E.G. IC (m)	202.50	Weir Sta Lft (m)	
E.G. OC (m)	202.62	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	202.18	Weir Max Depth (m)	
Culv WS Outlet (m)	202.19	Weir Avg Depth (m)	
Culv Nml Depth (m)	0.96	Weir Flow Area (m2)	

Culv Crt Depth (m)	1.05	Min El Weir Flow (m)	204.00

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	29.88	Culv Full Len (m)	59.00
# Barrels	2	Culv Vel US (m/s)	2.87
Q Barrel (m3/s)	14.94	Culv Vel DS (m/s)	2.87
E.G. US. (m)	204.31	Culv Inv El Up (m)	200.78
W.S. US. (m)	204.25	Culv Inv El Dn (m)	200.40
E.G. DS (m)	203.50	Culv Frctn Ls (m)	0.23
W.S. DS (m)	203.45	Culv Exit Loss (m)	0.37
Delta EG (m)	0.81	Culv Entr Loss (m)	0.21
Delta WS (m)	0.80	Q Weir (m3/s)	44.10
E.G. IC (m)	203.36	Weir Sta Lft (m)	24.01
E.G. OC (m)	204.31	Weir Sta Rgt (m)	205.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	202.92	Weir Max Depth (m)	0.31
Culv WS Outlet (m)	202.54	Weir Avg Depth (m)	0.30
Culv Nml Depth (m)		Weir Flow Area (m2)	55.12
Culv Crt Depth (m)	1.56	Min El Weir Flow (m)	204.00

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #2

Q Culv Group (m3/s)	5.62	Culv Full Len (m)	59.00
# Barrels	1	Culv Vel US (m/s)	1.89
Q Barrel (m3/s)	5.62	Culv Vel DS (m/s)	1.89
E.G. US. (m)	202.62	Culv Inv El Up (m)	199.34
W.S. US. (m)	202.59	Culv Inv El Dn (m)	198.98
E.G. DS (m)	202.23	Culv Frctn Ls (m)	0.16
W.S. DS (m)	202.19	Culv Exit Loss (m)	0.14
Delta EG (m)	0.39	Culv Entr Loss (m)	0.09
Delta WS (m)	0.39	Q Weir (m3/s)	
E.G. IC (m)	200.68	Weir Sta Lft (m)	
E.G. OC (m)	202.62	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	200.56	Weir Max Depth (m)	
Culv WS Outlet (m)	200.20	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.81	Min El Weir Flow (m)	204.00

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #2

Q Culv Group (m3/s)	7.93	Culv Full Len (m)	59.00
# Barrels	1	Culv Vel US (m/s)	2.66
Q Barrel (m3/s)	7.93	Culv Vel DS (m/s)	2.66
E.G. US. (m)	204.31	Culv Inv El Up (m)	199.34
W.S. US. (m)	204.25	Culv Inv El Dn (m)	198.98
E.G. DS (m)	203.50	Culv Frctn Ls (m)	0.31
W.S. DS (m)	203.45	Culv Exit Loss (m)	0.32
Delta EG (m)	0.81	Culv Entr Loss (m)	0.18
Delta WS (m)	0.80	Q Weir (m3/s)	44.10
E.G. IC (m)	201.18	Weir Sta Lft (m)	24.01
E.G. OC (m)	204.31	Weir Sta Rgt (m)	205.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	200.56	Weir Max Depth (m)	0.31
Culv WS Outlet (m)	200.20	Weir Avg Depth (m)	0.30
Culv Nml Depth (m)		Weir Flow Area (m2)	55.12
Culv Crt Depth (m)	1.03	Min El Weir Flow (m)	204.00

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.271

INPUT
Description: Section 46.271 - Jane Street - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	3	204	30	204	67	204	71	203
74	201	77	200	79	198.983	91	198.983	93	200
97	201	105	202	106	203	107	203.6	165	203.8

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.05	71	.08	77	.035	93	.08
106	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
77	93	55	60	70	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	81	202.5	F
89	165	202.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.23	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.		0.035	
W.S. Elev (m)	202.19	Reach Len. (m)	55.00	60.00	70.00
Crit W.S. (m)	199.90	Flow Area (m2)		25.68	
E.G. Slope (m/m)	0.000192	Area (m2)	6.14	49.32	12.33
Q Total (m3/s)	22.11	Flow (m3/s)		22.11	
Top Width (m)	32.98	Top Width (m)	4.79	16.00	12.19
Vel Total (m/s)	0.86	Avg. Vel. (m/s)		0.86	
Max Chl Dpth (m)	3.21	Hydr. Depth (m)		3.21	
Conv. Total (m3/s)	1596.4	Conv. (m3/s)		1596.4	
Length Wtd. (m)	61.12	Wetted Per. (m)		8.00	
Min Ch El (m)	198.98	Shear (N/m2)		6.03	
Alpha	1.00	Stream Power (N/m s)		5.20	
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	98.19	146.10	61.19
C & E Loss (m)	0.00	Cum SA (1000 m2)	89.40	42.65	70.71

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	203.50	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.45	Reach Len. (m)	55.00	60.00	70.00
Crit W.S. (m)	201.18	Flow Area (m2)	13.62	69.47	28.55
E.G. Slope (m/m)	0.000185	Area (m2)	13.62	69.47	28.55
Q Total (m3/s)	81.91	Flow (m3/s)	3.55	70.47	7.90
Top Width (m)	37.56	Top Width (m)	7.81	16.00	13.75
Vel Total (m/s)	0.73	Avg. Vel. (m/s)	0.26	1.01	0.28
Max Chl Dpth (m)	4.47	Hydr. Depth (m)	1.74	4.34	2.08
Conv. Total (m3/s)	6019.3	Conv. (m3/s)	260.9	5178.1	580.3
Length Wtd. (m)	61.18	Wetted Per. (m)	8.63	16.49	14.48
Min Ch El (m)	198.98	Shear (N/m2)	2.87	7.65	3.58
Alpha	1.66	Stream Power (N/m s)	0.75	7.76	0.99
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	252.48	277.19	242.71
C & E Loss (m)	0.05	Cum SA (1000 m2)	165.88	42.65	161.60

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.27

INPUT
Description: Section 46.27 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	10	204	40	204	63	206	73	206
78	204	90	203	100	200	103	199	104	198.9
105	198.9	106	199	112	200	120	203	147	203.5

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	103	.035	106	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
103	106	100	110	120	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.21	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.18	Reach Len. (m)	100.00	110.00	120.00
Crit W.S. (m)		Flow Area (m2)	15.98	9.75	22.44
E.G. Slope (m/m)	0.000294	Area (m2)	15.98	9.75	22.44
Q Total (m3/s)	22.11	Flow (m3/s)	4.46	10.46	7.19
Top Width (m)	25.09	Top Width (m)	10.27	3.00	11.82
Vel Total (m/s)	0.46	Avg. Vel. (m/s)	0.28	1.07	0.32
Max Chl Dpth (m)	3.28	Hydr. Depth (m)	1.56	3.25	1.90
Conv. Total (m3/s)	1288.5	Conv. (m3/s)	260.1	609.4	418.9
Length Wtd. (m)	110.31	Wetted Per. (m)	10.76	3.01	12.30
Min Ch El (m)	198.90	Shear (N/m2)	4.29	9.35	5.27
Alpha	2.82	Stream Power (N/m s)	1.20	10.03	1.69
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	97.58	144.33	59.97
C & E Loss (m)	0.00	Cum SA (1000 m2)	88.99	42.08	69.87

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	203.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.22	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.20	Reach Len. (m)	100.00	110.00	120.00
Crit W.S. (m)		Flow Area (m2)	28.32	12.80	36.85
E.G. Slope (m/m)	0.001568	Area (m2)	28.32	12.80	36.85
Q Total (m3/s)	81.91	Flow (m3/s)	20.52	38.00	23.40
Top Width (m)	43.13	Top Width (m)	15.39	3.00	24.74

Vel Total (m/s)	1.05	Avg. Vel. (m/s)	0.72	2.97	0.63
Max Chl Dpth (m)	4.30	Hydr. Depth (m)	1.84	4.27	1.49
Conv. Total (m3/s)	2068.4	Conv. (m3/s)	518.1	959.4	590.9
Length Wtd. (m)	110.26	Wetted Per. (m)	16.00	3.01	25.37
Min Ch El (m)	198.90	Shear (N/m2)	27.23	65.38	22.34
Alpha	3.93	Stream Power (N/m s)	19.72	194.15	14.19
Frctn Loss (m)	0.09	Cum Volume (1000 m3)	251.33	274.72	240.42
C & E Loss (m)	0.04	Cum SA (1000 m2)	165.24	42.08	160.26

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: RIVER-1
REACH: Reach-1 RS: 46.26

INPUT
Description: Section 46.26 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	15	204	24	200	30	199	32	198.8
34	198.8	36	199	47	202	54	202.5	64	202.5
64	205	109	205						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	15	.08	30	.035	36	.08	54	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
30	36	115	120	120	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.19	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.17	Reach Len. (m)	115.00	120.00	120.00
Crit W.S. (m)		Flow Area (m2)	21.32	19.82	18.57
E.G. Slope (m/m)	0.000130	Area (m2)	21.32	19.82	18.57
Q Total (m3/s)	22.11	Flow (m3/s)	4.60	14.28	3.23
Top Width (m)	30.26	Top Width (m)	10.88	6.00	13.38
Vel Total (m/s)	0.37	Avg. Vel. (m/s)	0.22	0.72	0.17

Max Chl Dpth (m)	3.37	Hydr. Depth (m)	1.96	3.30	1.39
Conv. Total (m3/s)	1940.4	Conv. (m3/s)	403.9	1253.3	283.2
Length Wtd. (m)	119.30	Wetted Per. (m)	11.43	6.02	13.79
Min Ch El (m)	198.80	Shear (N/m2)	2.37	4.19	1.71
Alpha	2.55	Stream Power (N/m s)	0.51	3.02	0.30
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	95.72	142.70	57.51
C & E Loss (m)	0.00	Cum SA (1000 m2)	87.93	41.58	68.36

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	203.29	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Val.	0.080	0.035	0.076
W.S. Elev (m)	203.19	Reach Len. (m)	115.00	120.00	120.00
Crit W.S. (m)		Flow Area (m2)	33.65	25.97	43.21
E.G. Slope (m/m)	0.000536	Area (m2)	33.65	25.97	43.21
Q Total (m3/s)	81.91	Flow (m3/s)	17.51	45.51	18.89
Top Width (m)	47.19	Top Width (m)	13.19	6.00	28.00
Vel Total (m/s)	0.80	Avg. Vel. (m/s)	0.52	1.75	0.44
Max Chl Dpth (m)	4.39	Hydr. Depth (m)	2.55	4.33	1.54
Conv. Total (m3/s)	3539.1	Conv. (m3/s)	756.7	1966.3	816.1
Length Wtd. (m)	119.19	Wetted Per. (m)	13.95	6.02	29.11
Min Ch El (m)	198.80	Shear (N/m2)	12.67	22.66	7.80
Alpha	2.85	Stream Power (N/m s)	6.60	39.71	3.41
Frctn Loss (m)	0.06	Cum Volume (1000 m3)	248.23	272.59	235.62
C & E Loss (m)	0.00	Cum SA (1000 m2)	163.81	41.58	157.09

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: RIVER-1
REACH: Reach-1 RS: 46.25

INPUT
Description: Section 46.25 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	26	203	36	200	40	199	44	198.6
46	198.6	50	199	68	202	84	203	154	204

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	26	.08	40	.035	50	.08	68	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
40	50	140	130	125	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.17	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.14	Reach Len. (m)	140.00	130.00	125.00
Crit W.S. (m)		Flow Area (m2)	18.17	33.78	29.63
E.G. Slope (m/m)	0.000187	Area (m2)	18.17	33.78	29.63
Q Total (m3/s)	40.81	Flow (m3/s)	4.20	29.65	6.95
Top Width (m)	41.33	Top Width (m)	11.13	10.00	20.21
Vel Total (m/s)	0.50	Avg. Vel. (m/s)	0.23	0.88	0.23
Max Chl Dpth (m)	3.54	Hydr. Depth (m)	1.63	3.38	1.47
Conv. Total (m3/s)	2981.9	Conv. (m3/s)	307.0	2167.0	507.9
Length Wtd. (m)	130.56	Wetted Per. (m)	11.56	10.04	20.46
Min Ch El (m)	198.60	Shear (N/m2)	2.89	6.18	2.66
Alpha	2.30	Stream Power (N/m s)	0.67	5.42	0.62
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	93.45	139.49	54.62
C & E Loss (m)	0.00	Cum SA (1000 m2)	86.66	40.62	66.34

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	203.23	Element	Left OB	Channel	Right OB
Vel Head (m)	0.08	Wt. n-Val.	0.080	0.035	0.077
W.S. Elev (m)	203.14	Reach Len. (m)	140.00	130.00	125.00

Crit W.S. (m)		Flow Area (m2)	31.30	43.85	58.66
E.G. Slope (m/m)	0.000425	Area (m2)	31.30	43.85	58.66
Q Total (m3/s)	108.10	Flow (m3/s)	13.26	69.02	25.82
Top Width (m)	71.91	Top Width (m)	17.77	10.00	44.15
Vel Total (m/s)	0.81	Avg. Vel. (m/s)	0.42	1.57	0.44
Max Chl Dpth (m)	4.54	Hydr. Depth (m)	1.76	4.38	1.33
Conv. Total (m3/s)	5242.5	Conv. (m3/s)	643.1	3347.2	1252.1
Length Wtd. (m)	130.65	Wetted Per. (m)	18.33	10.04	44.43
Min Ch El (m)	198.60	Shear (N/m2)	7.12	18.21	5.50
Alpha	2.53	Stream Power (N/m s)	3.02	28.66	2.42
Frctn Loss (m)	0.07	Cum Volume (1000 m3)	244.49	268.40	229.51
C & E Loss (m)	0.01	Cum SA (1000 m2)	162.03	40.62	152.76

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.24

INPUT
Description: Section 46.24 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	13	203	30	200	34	199	36	198.4
38	198.4	43	199	52	202	60	203	80	204

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	13	.08	34	.035	43	.08	60	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
34	43	54	51	45	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.14	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.10	Reach Len. (m)	54.00	51.00	45.00
Crit W.S. (m)		Flow Area (m2)	22.84	31.17	14.41
E.G. Slope (m/m)	0.000245	Area (m2)	22.84	31.17	14.41
Q Total (m3/s)	40.81	Flow (m3/s)	5.63	31.64	3.54
Top Width (m)	34.66	Top Width (m)	15.88	9.00	

9.77					
Vel Total (m/s)	0.60	Avg. Vel. (m/s)	0.25	1.02	
0.25					
Max Chl Dpth (m)	3.70	Hydr. Depth (m)	1.44	3.46	
1.47					
Conv. Total (m3/s)	2605.1	Conv. (m3/s)	359.3	2020.1	
225.8					
Length Wtd. (m)	50.93	Wetted Per. (m)	16.19	9.12	
10.27					
Min Ch El (m)	198.40	Shear (N/m2)	3.40	8.22	
3.38					
Alpha	2.29	Stream Power (N/m s)	0.84	8.34	
0.83					
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	90.58	135.27	
51.86					
C & E Loss (m)	0.01	Cum SA (1000 m2)	84.77	39.39	
64.47					

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	203.15	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.14	Wt. n-Val.	0.080	0.035	
0.080					
W.S. Elev (m)	203.01	Reach Len. (m)	54.00	51.00	
45.00					
Crit W.S. (m)		Flow Area (m2)	39.73	39.40	
26.69					
E.G. Slope (m/m)	0.000670	Area (m2)	39.73	39.40	
26.69					
Q Total (m3/s)	108.10	Flow (m3/s)	19.43	77.25	
11.42					
Top Width (m)	47.36	Top Width (m)	21.14	9.00	
17.22					
Vel Total (m/s)	1.02	Avg. Vel. (m/s)	0.49	1.96	
0.43					
Max Chl Dpth (m)	4.61	Hydr. Depth (m)	1.88	4.38	
1.55					
Conv. Total (m3/s)	4176.5	Conv. (m3/s)	750.5	2984.8	
441.1					
Length Wtd. (m)	50.94	Wetted Per. (m)	21.53	9.12	
17.77					
Min Ch El (m)	198.40	Shear (N/m2)	12.12	28.37	
9.87					
Alpha	2.69	Stream Power (N/m s)	5.93	55.62	
4.22					
Frctn Loss (m)	0.07	Cum Volume (1000 m3)	239.52	262.99	
224.17					
C & E Loss (m)	0.08	Cum SA (1000 m2)	159.31	39.39	
148.93					

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: RIVER-1
REACH: Reach-1 RS: 46.2375

INPUT
Description: Based on Bridge Section US
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-1380	205.2	-1375	205.1	-1370	204.5	-1360	204.5	-1340	204.4
-1330	204.2	-1320	204.4	-1318	204	-1310	203	-1305	202
-1300	201	-1295	200	-1290	199.3	-1288	199.2	-1287	198.8
-1285	198.6	-1284	198.6	-1282	199.2	-1280	199.4	-1275	200
-1270	201	-1260	201.3	-1250	202	-1242	203	-1240	204.3
-1236	204.6	-1233	204.7	-1230	204.5	-1220	204.6	-1215	205
-1200	205								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-1380	.05	-1320	.08	-1288	.035	-1282	.08	-1233	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-1288	-1282	30	30	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-1380	-1290.25	204	T
-1280.75	-1200	204	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.11	Element	Left OB	Channel	Right OB
Vel Head (m)	0.14	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	201.97	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)	200.33	Flow Area (m2)	6.09	19.00	3.38
E.G. Slope (m/m)	0.000877	Area (m2)	26.68	19.00	35.33
Q Total (m3/s)	40.81	Flow (m3/s)	4.38	34.01	2.42
Top Width (m)	54.35	Top Width (m)	16.83	6.00	31.52
Vel Total (m/s)	1.43	Avg. Vel. (m/s)	0.72	1.79	0.72
Max Chl Dpth (m)	3.37	Hydr. Depth (m)	2.71	3.17	2.70
Conv. Total (m3/s)	1378.1	Conv. (m3/s)	147.8	1148.6	81.7
Length Wtd. (m)	30.00	Wetted Per. (m)	2.25	6.18	1.26
Min Ch El (m)	198.60	Shear (N/m2)	23.24	26.45	23.13
Alpha	1.34	Stream Power (N/m s)	16.69	47.34	16.56
Frctn Loss (m)		Cum Volume (1000 m3)	89.24	133.99	

50.75					
C & E Loss (m)		Cum SA (1000 m2)	83.89	39.01	
63.54					

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	203.00	Element	Left OB	Channel	Right OB
Vel Head (m)	0.90	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.10	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)	201.58	Flow Area (m2)	6.40	19.82	3.55
E.G. Slope (m/m)	0.005327	Area (m2)	29.01	19.82	39.72
Q Total (m3/s)	108.10	Flow (m3/s)	11.71	89.92	6.47
Top Width (m)	56.33	Top Width (m)	17.51	6.00	32.82
Vel Total (m/s)	3.63	Avg. Vel. (m/s)	1.83	4.54	1.82
Max Chl Dpth (m)	3.50	Hydr. Depth (m)	2.85	3.30	2.84
Conv. Total (m3/s)	1481.1	Conv. (m3/s)	160.4	1232.0	88.7
Length Wtd. (m)	30.00	Wetted Per. (m)	2.25	6.18	1.26
Min Ch El (m)	198.60	Shear (N/m2)	148.30	167.63	147.62
Alpha	1.34	Stream Power (N/m s)	271.25	760.48	269.20
Frctn Loss (m)		Cum Volume (1000 m3)	237.66	261.48	222.68
C & E Loss (m)		Cum SA (1000 m2)	158.27	39.01	147.80

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.235

INPUT
Description: Proposed Portage Parkway Extension
Distance from Upstream XS = 1
Deck/Roadway Width = 25.7
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 5

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-1400	205.3		-1380	205		-1310	204.5	
-1220	205		-1190	205.2				

Upstream Bridge Cross Section Data
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-1380	205.2	-1375	205.1	-1370	204.5	-1360	204.5	-1340	204.4

```
   -1330   204.2   -1320   204.4   -1318     204   -1310     203   -1305     202
   -1300     201   -1295     200   -1290   199.3   -1288   199.2   -1287   198.8
   -1285   198.6   -1284   198.6   -1282   199.2   -1280   199.4   -1275     200
   -1270     201   -1260   201.3   -1250     202   -1242     203   -1240   204.3
   -1236   204.6   -1233   204.7   -1230   204.5   -1220   204.6   -1215     205
   -1200     205

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
   -1380     .05   -1320     .08   -1288    .035   -1282     .08   -1233     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
         -1288   -1282            .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -1380-1290.25     204       T
-1280.75   -1200     204       T

Downstream  Deck/Roadway Coordinates
    num=       5
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
   -1400   205.3           -1380     205           -1310   204.5
   -1220     205           -1190   205.2

Downstream Bridge Cross Section Data
Station Elevation Data    num=      31
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   -1380   205.2   -1375   205.1   -1370   204.5   -1360   204.5   -1340   204.4
   -1330   204.2   -1320   204.4   -1318     204   -1310     203   -1305     202
   -1300     201   -1295     200   -1290   199.3   -1288   199.2   -1287   198.8
   -1285   198.6   -1284   198.6   -1282   199.2   -1280   199.4   -1275     200
   -1270     201   -1260   201.3   -1250     202   -1242     203   -1240   204.3
   -1236   204.6   -1233   204.7   -1230   204.5   -1220   204.6   -1215     205
   -1200     205

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
   -1380     .05   -1320     .08   -1288    .035   -1282     .08   -1233     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
         -1288   -1282            .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -1380-1290.25     204       T
-1280.75   -1200     204       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 =     .98
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 =  4

Culvert Name     Shape      Rise    Span
Culvert #1           Box     2.5     4.5
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    25.7     .013     .013        0                   .5
      1
Upstream   Elevation =  201
           Centerline Station = -1298
Downstream Elevation =  201
           Centerline Station = -1298

Culvert Name     Shape      Rise    Span
Culvert #2           Box       5     4.5
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    25.7     .013     .013        0                   .5
      1
Upstream   Elevation =  198.6
           Centerline Station = -1288
Downstream Elevation =  198.6
           Centerline Station = -1288

Culvert Name     Shape      Rise    Span
Culvert #3           Box       5     4.5
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    25.7     .013     .013        0                   .5
      1
Upstream   Elevation =  198.6
           Centerline Station = -1283
Downstream Elevation =  198.6
           Centerline Station = -1283

Culvert Name     Shape      Rise    Span
Culvert #4           Box     2.5     4.5
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    25.7     .013     .013        0                   .5
      1
Upstream   Elevation =  201
           Centerline Station = -1262
Downstream Elevation =  201
           Centerline Station = -1262

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       4.82    Culv Full Len (m)
  # Barrels                    1    Culv Vel US (m/s)         1.04
  Q Barrel (m3/s)           4.82    Culv Vel DS (m/s)         1.05
  E.G. US. (m)            202.11    Culv Inv El Up (m)      201.00
  W.S. US. (m)            201.97    Culv Inv El Dn (m)      201.00
  E.G. DS (m)             202.08    Culv Frctn Ls (m)         0.03
  W.S. DS (m)             201.93    Culv Exit Loss (m)        0.00
  Delta EG (m)              0.03    Culv Entr Loss (m)        0.03
  Delta WS (m)              0.03    Q Weir (m3/s)
  E.G. IC (m)             201.77    Weir Sta Lft (m)
  E.G. OC (m)             202.11    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
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Culv WS Inlet (m)	202.03	Weir Max Depth (m)	
Culv WS Outlet (m)	202.02	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.49	Min El Weir Flow (m)	204.50

Warning: During subcritical analysis, with the exit loss set =1.0, the projected WSEL in culvert has a lower energy than the
downstream energy. Most likely, the downstream cross section blocks part of the culvert or the ineffective area is
set too far in. Instead of projecting the WSEL, the program did an energy balance to get the WSEL inside the
culvert at the downstream end.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	15.61	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	2.06
Q Barrel (m3/s)	15.61	Culv Vel DS (m/s)	2.09
E.G. US. (m)	203.01	Culv Inv El Up (m)	201.00
W.S. US. (m)	202.10	Culv Inv El Dn (m)	201.00
E.G. DS (m)	202.88	Culv Frctn Ls (m)	0.13
W.S. DS (m)	201.58	Culv Exit Loss (m)	0.00
Delta EG (m)	0.13	Culv Entr Loss (m)	0.11
Delta WS (m)	0.52	Q Weir (m3/s)	
E.G. IC (m)	202.71	Weir Sta Lft (m)	
E.G. OC (m)	203.01	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	202.69	Weir Max Depth (m)	
Culv WS Outlet (m)	202.66	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	1.07	Min El Weir Flow (m)	204.50

Warning: During subcritical analysis, with the exit loss set =1.0, the projected WSEL in culvert has a lower energy than the
downstream energy. Most likely, the downstream cross section blocks part of the culvert or the ineffective area is
set too far in. Instead of projecting the WSEL, the program did an energy balance to get the WSEL inside the
culvert at the downstream end.

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #2

Q Culv Group (m3/s)	15.58	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	1.01
Q Barrel (m3/s)	15.58	Culv Vel DS (m/s)	1.01
E.G. US. (m)	202.11	Culv Inv El Up (m)	198.60
W.S. US. (m)	201.97	Culv Inv El Dn (m)	198.60
E.G. DS (m)	202.08	Culv Frctn Ls (m)	0.13
W.S. DS (m)	201.93	Culv Exit Loss (m)	0.00
Delta EG (m)	0.03	Culv Entr Loss (m)	0.03
Delta WS (m)	0.03	Q Weir (m3/s)	
E.G. IC (m)	200.28	Weir Sta Lft (m)	
E.G. OC (m)	202.11	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	202.03	Weir Max Depth (m)	
Culv WS Outlet (m)	202.02	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	1.07	Min El Weir Flow (m)	204.50

Warning: During subcritical analysis, with the exit loss set =1.0, the projected

WSEL in culvert has a lower energy than the
downstream energy. Most likely, the downstream cross section blocks part of the culvert or the ineffective area is
set too far in. Instead of projecting the WSEL, the program did an energy balance to get the WSEL inside the
culvert at the downstream end.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #2

Q Culv Group (m3/s)	38.97	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	2.13
Q Barrel (m3/s)	38.97	Culv Vel DS (m/s)	2.14
E.G. US. (m)	203.01	Culv Inv El Up (m)	198.60
W.S. US. (m)	202.10	Culv Inv El Dn (m)	198.60
E.G. DS (m)	202.88	Culv Frctn Ls (m)	0.39
W.S. DS (m)	201.58	Culv Exit Loss (m)	0.00
Delta EG (m)	0.13	Culv Entr Loss (m)	0.12
Delta WS (m)	0.52	Q Weir (m3/s)	
E.G. IC (m)	201.74	Weir Sta Lft (m)	
E.G. OC (m)	203.01	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	202.66	Weir Max Depth (m)	
Culv WS Outlet (m)	202.65	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	1.97	Min El Weir Flow (m)	204.50

Warning: During subcritical analysis, with the exit loss set =1.0, the projected WSEL in culvert has a lower energy than the
downstream energy. Most likely, the downstream cross section blocks part of the culvert or the ineffective area is
set too far in. Instead of projecting the WSEL, the program did an energy balance to get the WSEL inside the
culvert at the downstream end.

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #3

Q Culv Group (m3/s)	15.58	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	1.01
Q Barrel (m3/s)	15.58	Culv Vel DS (m/s)	1.01
E.G. US. (m)	202.11	Culv Inv El Up (m)	198.60
W.S. US. (m)	201.97	Culv Inv El Dn (m)	198.60
E.G. DS (m)	202.08	Culv Frctn Ls (m)	0.00
W.S. DS (m)	201.93	Culv Exit Loss (m)	0.00
Delta EG (m)	0.03	Culv Entr Loss (m)	0.03
Delta WS (m)	0.03	Q Weir (m3/s)	
E.G. IC (m)	200.28	Weir Sta Lft (m)	
E.G. OC (m)	202.11	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	202.03	Weir Max Depth (m)	
Culv WS Outlet (m)	202.02	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	1.07	Min El Weir Flow (m)	204.50

Warning: During subcritical analysis, with the exit loss set =1.0, the projected WSEL in culvert has a lower energy than the
downstream energy. Most likely, the downstream cross section blocks part of the culvert or the ineffective area is
set too far in. Instead of projecting the WSEL, the program did an energy balance to get the WSEL inside the
culvert at the downstream end.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #3

Q Culv Group (m3/s)	37.90	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	2.07
Q Barrel (m3/s)	37.90	Culv Vel DS (m/s)	2.07
E.G. US. (m)	203.01	Culv Inv El Up (m)	198.60
W.S. US. (m)	202.10	Culv Inv El Dn (m)	198.60
E.G. DS (m)	202.88	Culv Frctn Ls (m)	0.00
W.S. DS (m)	201.58	Culv Exit Loss (m)	0.00
Delta EG (m)	0.13	Culv Entr Loss (m)	0.11
Delta WS (m)	0.52	Q Weir (m3/s)	
E.G. IC (m)	201.68	Weir Sta Lft (m)	
E.G. OC (m)	203.00	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	202.67	Weir Max Depth (m)	
Culv WS Outlet (m)	202.66	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	1.93	Min El Weir Flow (m)	204.50

Warning: During subcritical analysis, with the exit loss set =1.0, the projected WSEL in culvert has a lower energy than the
downstream energy. Most likely, the downstream cross section blocks part of the culvert or the ineffective area is
set too far in. Instead of projecting the WSEL, the program did an energy balance to get the WSEL inside the
culvert at the downstream end.

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #4

Q Culv Group (m3/s)	4.82	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	1.04
Q Barrel (m3/s)	4.82	Culv Vel DS (m/s)	1.05
E.G. US. (m)	202.11	Culv Inv El Up (m)	201.00
W.S. US. (m)	201.97	Culv Inv El Dn (m)	201.00
E.G. DS (m)	202.08	Culv Frctn Ls (m)	0.00
W.S. DS (m)	201.93	Culv Exit Loss (m)	0.00
Delta EG (m)	0.03	Culv Entr Loss (m)	0.03
Delta WS (m)	0.03	Q Weir (m3/s)	
E.G. IC (m)	201.77	Weir Sta Lft (m)	
E.G. OC (m)	202.11	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	202.03	Weir Max Depth (m)	
Culv WS Outlet (m)	202.02	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.49	Min El Weir Flow (m)	204.50

Warning: During subcritical analysis, with the exit loss set =1.0, the projected WSEL in culvert has a lower energy than the
downstream energy. Most likely, the downstream cross section blocks part of the culvert or the ineffective area is
set too far in. Instead of projecting the WSEL, the program did an energy balance to get the WSEL inside the
culvert at the downstream end.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #4

Q Culv Group (m3/s)	15.61	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	2.06
Q Barrel (m3/s)	15.61	Culv Vel DS (m/s)	2.09
E.G. US. (m)	203.01	Culv Inv El Up (m)	201.00
W.S. US. (m)	202.10	Culv Inv El Dn (m)	201.00

E.G. DS (m)	202.88	Culv Frctn Ls (m)	0.00
W.S. DS (m)	201.58	Culv Exit Loss (m)	0.00
Delta EG (m)	0.13	Culv Entr Loss (m)	0.11
Delta WS (m)	0.52	Q Weir (m3/s)	
E.G. IC (m)	202.71	Weir Sta Lft (m)	
E.G. OC (m)	203.01	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	202.69	Weir Max Depth (m)	
Culv WS Outlet (m)	202.66	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	1.07	Min El Weir Flow (m)	204.50

Warning: During subcritical analysis, with the exit loss set =1.0, the projected WSEL in culvert has a lower energy than the
downstream energy. Most likely, the downstream cross section blocks part of the culvert or the ineffective area is
set too far in. Instead of projecting the WSEL, the program did an energy balance to get the WSEL inside the
culvert at the downstream end.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2325

INPUT
Description: Based on Bridge Section DS
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-1380	205.2	-1375	205.1	-1370	204.5	-1360	204.5	-1340	204.4
-1330	204.2	-1320	204.4	-1318	204	-1310	203	-1305	202
-1300	201	-1295	200	-1290	199.3	-1288	199.2	-1287	198.8
-1285	198.6	-1284	198.6	-1282	199.2	-1280	199.4	-1275	200
-1270	201	-1260	201.3	-1250	202	-1242	203	-1240	204.3
-1236	204.6	-1233	204.7	-1230	204.5	-1220	204.6	-1215	205
-1200	205								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-1380	.05	-1320	.08	-1288	.035	-1282	.08	-1233	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-1288	-1282	94	94	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-1380	-1290.25	204	T
-1280.75	-1200	204	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.14	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	201.93	Reach Len. (m)	94.00	94.00	94.00
Crit W.S. (m)		Flow Area (m2)	6.02	18.80	3.34
E.G. Slope (m/m)	0.000910	Area (m2)	26.11	18.80	34.28

Q Total (m3/s)	40.81	Flow (m3/s)	4.37	34.03	2.41
Top Width (m)	53.70	Top Width (m)	16.66	6.00	31.04
Vel Total (m/s)	1.45	Avg. Vel. (m/s)	0.73	1.81	0.72
Max Chl Dpth (m)	3.33	Hydr. Depth (m)	2.68	3.13	2.67
Conv. Total (m3/s)	1353.1	Conv. (m3/s)	144.8	1128.3	80.0
Length Wtd. (m)	94.00	Wetted Per. (m)	2.25	6.18	1.26
Min Ch El (m)	198.60	Shear (N/m2)	23.81	27.15	23.70
Alpha	1.34	Stream Power (N/m s)	17.27	49.14	17.14
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	89.24	132.84	50.75
C & E Loss (m)	0.04	Cum SA (1000 m2)	83.39	38.83	62.60

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.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.88	Element	Left OB	Channel	Right OB
Vel Head (m)	1.30	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	201.58	Reach Len. (m)	94.00	94.00	94.00
Crit W.S. (m)	201.58	Flow Area (m2)	5.23	16.69	2.90
E.G. Slope (m/m)	0.009613	Area (m2)	20.56	16.69	24.23
Q Total (m3/s)	108.10	Flow (m3/s)	11.22	90.68	6.20
Top Width (m)	46.91	Top Width (m)	14.90	6.00	26.01
Vel Total (m/s)	4.36	Avg. Vel. (m/s)	2.15	5.43	2.14
Max Chl Dpth (m)	2.98	Hydr. Depth (m)	2.32	2.78	2.32
Conv. Total (m3/s)	1102.5	Conv. (m3/s)	114.4	924.9	63.2
Length Wtd. (m)	94.00	Wetted Per. (m)	2.25	6.18	1.26
Min Ch El (m)	198.60	Shear (N/m2)	218.52	254.69	217.44
Alpha	1.34	Stream Power (N/m s)	469.07	1384.01	465.22
Frctn Loss (m)	0.05	Cum Volume (1000 m3)	237.66	260.02	222.68
C & E Loss (m)	0.38	Cum SA (1000 m2)	157.78	38.83	146.92

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: 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: RIVER-1
REACH: Reach-1 RS: 46.23

INPUT
Description: Section 46.23 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	38	204	52	201	63	200	90	199
100	198.2	113	199	118	200	126	204	160	204
160	206	210	206						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	38	.08	90	.035	113	.08	126	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	113	101	95	89	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.03	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.02	Reach Len. (m)	101.00	95.00	89.00
Crit W.S. (m)		Flow Area (m2)	87.23	78.68	16.69
E.G. Slope (m/m)	0.000033	Area (m2)	87.23	78.68	16.69
Q Total (m3/s)	40.81	Flow (m3/s)	9.99	29.10	1.72
Top Width (m)	74.81	Top Width (m)	42.76	23.00	9.04
Vel Total (m/s)	0.22	Avg. Vel. (m/s)	0.11	0.37	0.10
Max Chl Dpth (m)	3.82	Hydr. Depth (m)	2.04	3.42	1.85
Conv. Total (m3/s)	7145.7	Conv. (m3/s)	1748.9	5095.6	301.2
Length Wtd. (m)	97.05	Wetted Per. (m)	42.94	23.06	

9.62					
Min Ch El (m)	198.20	Shear (N/m2)	0.65	1.09	
0.55					
Alpha	2.03	Stream Power (N/m s)	0.07	0.40	
0.06					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	83.91	128.25	
48.35					
C & E Loss (m)	0.00	Cum SA (1000 m2)	80.59	37.46	
60.72					

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.43	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	
0.080					
W.S. Elev (m)	202.40	Reach Len. (m)	101.00	95.00	
89.00					
Crit W.S. (m)		Flow Area (m2)	103.96	87.50	
20.30					
E.G. Slope (m/m)	0.000152	Area (m2)	103.96	87.50	
20.30					
Q Total (m3/s)	108.10	Flow (m3/s)	28.13	75.09	
4.87					
Top Width (m)	77.36	Top Width (m)	44.55	23.00	
9.81					
Vel Total (m/s)	0.51	Avg. Vel. (m/s)	0.27	0.86	
0.24					
Max Chl Dpth (m)	4.20	Hydr. Depth (m)	2.33	3.80	
2.07					
Conv. Total (m3/s)	8755.4	Conv. (m3/s)	2278.8	6082.1	
394.4					
Length Wtd. (m)	97.07	Wetted Per. (m)	44.77	23.06	
10.47					
Min Ch El (m)	198.20	Shear (N/m2)	3.47	5.67	
2.90					
Alpha	2.05	Stream Power (N/m s)	0.94	4.87	
0.69					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	231.81	255.12	
220.59					
C & E Loss (m)	0.01	Cum SA (1000 m2)	154.99	37.46	
145.24					

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: RIVER-1
REACH: Reach-1 RS: 46.22

INPUT

Description: Section 46.22 - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	12	201	22	200	36	199	52	198
72	197.5	77	198	79	199	87	203	102	203
112	199	114	198	132	197.5	146	198	152	199
172	202	175	203	192	204				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	36	.035	79	.08	112	.035	152	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
112	152	125	140	115	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.02	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.039	0.035	0.050
W.S. Elev (m)	202.02	Reach Len. (m)	125.00	140.00	115.00
Crit W.S. (m)		Flow Area (m2)	243.50	164.94	30.47
E.G. Slope (m/m)	0.000002	Area (m2)	243.50	164.94	30.47
Q Total (m3/s)	40.81	Flow (m3/s)	20.86	18.71	1.24
Top Width (m)	144.77	Top Width (m)	84.70	40.00	20.07
Vel Total (m/s)	0.09	Avg. Vel. (m/s)	0.09	0.11	0.04
Max Chl Dpth (m)	4.52	Hydr. Depth (m)	2.87	4.12	1.52
Conv. Total (m3/s)	26284.7	Conv. (m3/s)	13434.2	12051.5	799.0
Length Wtd. (m)	133.79	Wetted Per. (m)	86.51	40.33	20.30
Min Ch El (m)	197.50	Shear (N/m2)	0.07	0.10	0.04
Alpha	1.12	Stream Power (N/m s)	0.01	0.01	0.00
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	67.21	116.68	46.25
C & E Loss (m)	0.00	Cum SA (1000 m2)	74.16	34.47	59.42

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.040	0.035	0.050
W.S. Elev (m)	202.42	Reach Len. (m)	125.00	140.00	115.00
Crit W.S. (m)		Flow Area (m2)	277.60	180.74	

38.63					
E.G. Slope (m/m)	0.000012	Area (m2)	277.60	180.74	
38.63					
Q Total (m3/s)	108.10	Flow (m3/s)	55.43	48.71	
3.96					
Top Width (m)	149.31	Top Width (m)	88.06	40.00	
21.26					
Vel Total (m/s)	0.22	Avg. Vel. (m/s)	0.20	0.27	
0.10					
Max Chl Dpth (m)	4.92	Hydr. Depth (m)	3.15	4.52	
1.82					
Conv. Total (m3/s)	31148.0	Conv. (m3/s)	15972.4	14035.5	
1140.2					
Length Wtd. (m)	134.82	Wetted Per. (m)	90.08	40.33	
21.55					
Min Ch El (m)	197.50	Shear (N/m2)	0.36	0.53	
0.21					
Alpha	1.13	Stream Power (N/m s)	0.07	0.14	
0.02					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	212.54	242.38	
217.97					
C & E Loss (m)	0.00	Cum SA (1000 m2)	148.29	34.47	
143.85					

Warning: Divided flow computed for this cross-section.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.214

INPUT
Description: Section 46.214 - Jane St & Hwy 7 Pond Outlet - In-Line Weir - U/S
Bounding Section
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	37	202	100	202	122	201	132	200
133	199	134	198	140	196.7	172	196.7	180	198
207	202	273	203	303	204				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	134	.035	180	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
134	180	1	1	1 .3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	123	202	F
190	303	202	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.02	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	
0.080					
W.S. Elev (m)	202.02	Reach Len. (m)	1.00	1.00	
1.00					

Crit W.S. (m)	197.02	Flow Area (m2)	34.28	235.78	54.65
E.G. Slope (m/m)	0.000001	Area (m2)	34.28	235.78	54.65
Q Total (m3/s)	19.06	Flow (m3/s)	0.30	17.82	0.93
Top Width (m)	172.41	Top Width (m)	97.87	46.00	28.55
Vel Total (m/s)	0.06	Avg. Vel. (m/s)	0.01	0.08	0.02
Max Chl Dpth (m)	5.32	Hydr. Depth (m)	0.35	5.13	1.91
Conv. Total (m3/s)	21341.3	Conv. (m3/s)	338.6	19956.5	1046.2
Length Wtd. (m)	1.00	Wetted Per. (m)	98.77	46.24	28.84
Min Ch El (m)	196.70	Shear (N/m2)	0.00	0.04	0.01
Alpha	1.56	Stream Power (N/m s)	0.00	0.00	0.00
Frctn Loss (m)		Cum Volume (1000 m3)	49.85	88.63	41.36
C & E Loss (m)		Cum SA (1000 m2)	62.75	28.45	56.63

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

			Left OB	Channel	Right OB
E.G. Elev (m)	202.42	Element			
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	202.41	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	197.69	Flow Area (m2)	75.06	253.64	70.71
E.G. Slope (m/m)	0.000019	Area (m2)	75.06	253.64	70.71
Q Total (m3/s)	108.10	Flow (m3/s)	4.99	98.51	4.60
Top Width (m)	212.40	Top Width (m)	112.23	46.00	54.17
Vel Total (m/s)	0.27	Avg. Vel. (m/s)	0.07	0.39	0.07
Max Chl Dpth (m)	5.71	Hydr. Depth (m)	0.67	5.51	1.31
Conv. Total (m3/s)	24731.7	Conv. (m3/s)	1141.8	22538.2	1051.7
Length Wtd. (m)	1.00	Wetted Per. (m)	113.14	46.24	54.47
Min Ch El (m)	196.70	Shear (N/m2)	0.12	1.03	0.24
Alpha	1.88	Stream Power (N/m s)	0.01	0.40	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	190.50	211.97	211.68
C & E Loss (m)		Cum SA (1000 m2)	135.77	28.45	139.52

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

INLINE STRUCTURE

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2135

INPUT
Description: Hum 13-5R. Jane St. & Hwy 7 Pond Outlet Weir x 45 m Drawings by Ander Engineering Ltd. (Dwg No. 85-101-5, 1986 & Figure 1, date/source unknown).

New HEC-RAS coding January 2004 by Acres
included coding of in-line in HEC-RAS.
Distance from Upstream XS = .5
Deck/Roadway Width = .25
Weir Coefficient = 1.72
Weir Embankment Coordinates num = 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
100	202	123	202	123.75	201.95	137.75	201.95	153	201.95
153	200.9	161	200.9	161	201.95	175.3	201.95	189.3	201.95
190	202	207	202						

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 =
Weir crest shape = Broad Crested

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.213

INPUT
Description: Section 46.213 - Jane St. & Hwy 7 Pond Outlet - In-Line Weir - D/S Bounding Section
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	37	202	100	202	122	201	132	200
133	199	134	198	140	196.7	172	196.7	180	198
207	202	273	203	303	204				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	134	.035	180	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
134	180	15	15	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	123	202	F
190	303	202	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.73	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	200.73	Reach Len. (m)	15.00	15.00	15.00
Crit W.S. (m)	197.02	Flow Area (m2)	6.12	176.25	19.89
E.G. Slope (m/m)	0.000002	Area (m2)	6.12	176.25	25.14
Q Total (m3/s)	19.06	Flow (m3/s)	0.13	18.34	0.58
Top Width (m)	73.71	Top Width (m)	9.29	46.00	18.42
Vel Total (m/s)	0.09	Avg. Vel. (m/s)	0.02	0.10	0.03
Max Chl Dpth (m)	4.03	Hydr. Depth (m)	0.66	3.83	1.99
Conv. Total (m3/s)	12764.2	Conv. (m3/s)	87.3	12286.7	390.2
Length Wtd. (m)	15.00	Wetted Per. (m)	10.16	46.24	10.11
Min Ch El (m)	196.70	Shear (N/m2)	0.01	0.08	0.04
Alpha	1.18	Stream Power (N/m s)	0.00	0.01	0.00
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	49.85	88.50	41.36
C & E Loss (m)	0.00	Cum SA (1000 m2)	62.69	28.41	56.61

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	202.32	Reach Len. (m)	15.00	15.00	15.00
Crit W.S. (m)	197.69	Flow Area (m2)	65.09	249.49	66.09
E.G. Slope (m/m)	0.000021	Area (m2)	65.09	249.49	66.09
Q Total (m3/s)	108.10	Flow (m3/s)	4.16	99.34	4.60
Top Width (m)	203.12	Top Width (m)	108.90	46.00	48.22
Vel Total (m/s)	0.28	Avg. Vel. (m/s)	0.06	0.40	0.07
Max Chl Dpth (m)	5.62	Hydr. Depth (m)	0.60	5.42	1.37
Conv. Total (m3/s)	23861.5	Conv. (m3/s)	918.7	21927.6	1015.2

Length Wtd. (m)	15.00	Wetted Per. (m)	109.80	46.24	48.52
Min Ch El (m)	196.70	Shear (N/m2)	0.12	1.09	0.27
Alpha	1.81	Stream Power (N/m s)	0.01	0.43	0.02
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	190.50	211.77	211.68
C & E Loss (m)	0.00	Cum SA (1000 m2)	135.66	28.41	139.47

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: RIVER-1
REACH: Reach-1 RS: 46.212

INPUT
Description: Section 46.212 - Jane St. & Hwy 7 Pond Outlet - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	37	202	100	202	122	201	132	200
133	199	134	198	140	196.6	172	196.6	180	198
207	199	252	199.5	273	203	303	204		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	133	.035	207	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
133	207	55	45	10	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	149.5	202	F
160.5	303	202	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.73	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.035	
W.S. Elev (m)	200.72	Reach Len. (m)	55.00	45.00	10.00
Crit W.S. (m)	197.27	Flow Area (m2)		45.30	
E.G. Slope (m/m)	0.000033	Area (m2)	3.80	241.75	70.52
Q Total (m3/s)	19.06	Flow (m3/s)		19.06	
Top Width (m)	134.49	Top Width (m)	8.18	74.00	52.31
Vel Total (m/s)	0.42	Avg. Vel. (m/s)		0.42	

Max Chl Dpth (m)	4.12	Hydr. Depth (m)			4.12
Conv. Total (m3/s)	3325.3	Conv. (m3/s)			3325.3
Length Wtd. (m)	45.00	Wetted Per. (m)			11.00
Min Ch El (m)	196.60	Shear (N/m2)			1.33
Alpha	1.00	Stream Power (N/m s)			0.56
Frctn Loss (m)		Cum Volume (1000 m3)	49.78	85.36	40.64
C & E Loss (m)		Cum SA (1000 m2)	62.56	27.51	56.07

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	202.32	Reach Len. (m)	55.00	45.00	10.00
Crit W.S. (m)	198.74	Flow Area (m2)	61.49	360.55	162.22
E.G. Slope (m/m)	0.000010	Area (m2)	61.49	360.55	162.22
Q Total (m3/s)	108.10	Flow (m3/s)	2.67	93.24	12.18
Top Width (m)	243.91	Top Width (m)	107.97	74.00	61.94
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.04	0.26	0.08
Max Chl Dpth (m)	5.72	Hydr. Depth (m)	0.57	4.87	2.62
Conv. Total (m3/s)	34102.2	Conv. (m3/s)	842.4	29416.7	3843.1
Length Wtd. (m)	45.00	Wetted Per. (m)	108.46	74.72	62.18
Min Ch El (m)	196.60	Shear (N/m2)	0.06	0.48	0.26
Alpha	1.71	Stream Power (N/m s)	0.00	0.12	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	189.55	207.19	209.97
C & E Loss (m)		Cum SA (1000 m2)	134.03	27.51	138.64

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2115

INPUT
Description: Hum 13-5R. Jane St & Hwy 7 Pond Outlet Culverts - Triple Cell - 3.0 m W x 1.5 m H x 23.2 m L Concrete Box Culverts. No drawings available (some info on Ander Eng Ltd Dwg 85-101-5, 1986) and York Regional Municipal Culvert Sheet.

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 10
Deck/Roadway Width = 23.2
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	202	303	202

Upstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	37	202	100	202	122	201	132	200
133	199	134	198	140	196.6	172	196.6	180	198
207	199	252	199.5	273	203	303	204		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	133	.035	207	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
133	207	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	149.5	202	F
160.5	303	202	F

Downstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	202	303	202

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	47	201	103	200	150	200	152	199
160	198	162	197	163	196.4	175	196.4	178	197
181	200	185	201	201	201	261	202	306	203

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	162	.035	178	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
162	178	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	163	200.6	F
175	306	200.6	F

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical

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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     1.5       3
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
                10    23.2     .015     .015        0                   .9
      1
Number of Barrels =  3
Upstream   Elevation =  196.6
Centerline Stations
    Sta.    Sta.    Sta.
   151.5  154.85   158.5
Downstream Elevation =  196.4
Centerline Stations
    Sta.    Sta.    Sta.
   165.5  168.85   172.5

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      19.06    Culv Full Len (m)        23.20
  # Barrels                   3     Culv Vel US (m/s)         1.41
  Q Barrel (m3/s)           6.35    Culv Vel DS (m/s)         1.41
  E.G. US. (m)            200.73    Culv Inv El Up (m)      196.60
  W.S. US. (m)            200.72    Culv Inv El Dn (m)      196.40
  E.G. DS (m)             200.52    Culv Frctn Ls (m)         0.03
  W.S. DS (m)             200.51    Culv Exit Loss (m)        0.09
  Delta EG (m)              0.21    Culv Entr Loss (m)        0.09
  Delta WS (m)              0.21    Q Weir (m3/s)
  E.G. IC (m)             197.94    Weir Sta Lft (m)
  E.G. OC (m)             200.73    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
  Culv WS Inlet (m)       198.10    Weir Max Depth (m)
  Culv WS Outlet (m)      197.90    Weir Avg Depth (m)
  Culv Nml Depth (m)                Weir Flow Area (m2)
  Culv Crt Depth (m)        0.77    Min El Weir Flow (m)    202.00


CULVERT OUTPUT  Profile #Regional w red'n  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      43.23    Culv Full Len (m)        23.20
  # Barrels                   3     Culv Vel US (m/s)         3.20
  Q Barrel (m3/s)          14.41    Culv Vel DS (m/s)         3.20
  E.G. US. (m)            202.33    Culv Inv El Up (m)      196.60
  W.S. US. (m)            202.32    Culv Inv El Dn (m)      196.40
  E.G. DS (m)             201.23    Culv Frctn Ls (m)         0.13
  W.S. DS (m)             201.20    Culv Exit Loss (m)        0.49
  Delta EG (m)              1.09    Culv Entr Loss (m)        0.47
  Delta WS (m)              1.13    Q Weir (m3/s)            64.87
  E.G. IC (m)             202.20    Weir Sta Lft (m)         24.70
  E.G. OC (m)             202.33    Weir Sta Rgt (m)        268.99
  Culvert Control         Outlet    Weir Submerg              0.00
  Culv WS Inlet (m)       198.10    Weir Max Depth (m)        0.33
  Culv WS Outlet (m)      197.90    Weir Avg Depth (m)        0.32
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Culv Nml Depth (m)		Weir Flow Area (m2)	78.79
Culv Crt Depth (m)	1.33	Min El Weir Flow (m)	202.00

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.211

INPUT
Description: Section 46.211 - Jane St. & Hwy 7 Pond Outlet - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	47	201	103	200	150	200	152	199
160	198	162	197	163	196.4	175	196.4	178	197
181	200	185	201	201	201	261	202	306	203

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	162	.035	178	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
162	178	10	10	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	163	200.6	F
175	306	200.6	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.52	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.035	
W.S. Elev (m)	200.51	Reach Len. (m)	10.00	10.00	10.00
Crit W.S. (m)	197.04	Flow Area (m2)		49.29	
E.G. Slope (m/m)	0.000028	Area (m2)	55.19	64.53	6.54
Q Total (m3/s)	19.06	Flow (m3/s)		19.06	
Top Width (m)	108.47	Top Width (m)	87.44	16.00	5.03
Vel Total (m/s)	0.39	Avg. Vel. (m/s)		0.39	
Max Chl Dpth (m)	4.11	Hydr. Depth (m)		4.11	
Conv. Total (m3/s)	3612.6	Conv. (m3/s)		3612.6	
Length Wtd. (m)	10.00	Wetted Per. (m)		12.00	
Min Ch El (m)	196.40	Shear (N/m2)		1.12	
Alpha	1.00	Stream Power (N/m s)		0.43	
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	49.78	82.05	40.64
C & E Loss (m)	0.00	Cum SA (1000 m2)	59.93	25.48	55.79

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.23	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	201.20	Reach Len. (m)	10.00	10.00	10.00
Crit W.S. (m)	198.42	Flow Area (m2)	128.26	75.57	15.24
E.G. Slope (m/m)	0.000151	Area (m2)	128.26	75.57	15.24
Q Total (m3/s)	108.10	Flow (m3/s)	32.87	73.91	1.31
Top Width (m)	170.55	Top Width (m)	119.66	16.00	34.89
Vel Total (m/s)	0.49	Avg. Vel. (m/s)	0.26	0.98	0.09
Max Chl Dpth (m)	4.80	Hydr. Depth (m)	1.07	4.72	0.44
Conv. Total (m3/s)	8807.5	Conv. (m3/s)	2678.6	6022.0	106.9
Length Wtd. (m)	10.00	Wetted Per. (m)	120.21	16.23	36.26
Min Ch El (m)	196.40	Shear (N/m2)	1.58	6.88	0.62
Alpha	2.77	Stream Power (N/m s)	0.40	6.73	0.05
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	189.55	198.58	209.97
C & E Loss (m)	0.01	Cum SA (1000 m2)	127.77	25.48	138.15

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: RIVER-1
REACH: Reach-1 RS: 46.21

INPUT
Description: Section 46.21 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	0	201	40	200	76	200	82	199
91	197	91.5	196.3	92.5	196.3	93	197	97	198

108	201	124	202	186	202	230	203

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	91	.035	93	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
91	93	30	30	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.51	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	200.51	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)		Flow Area (m2)	52.06	8.07	23.56
E.G. Slope (m/m)	0.000106	Area (m2)	52.06	8.07	23.56
Q Total (m3/s)	20.59	Flow (m3/s)	8.69	4.91	7.00
Top Width (m)	86.51	Top Width (m)	71.32	2.00	13.20
Vel Total (m/s)	0.25	Avg. Vel. (m/s)	0.17	0.61	0.30
Max Chl Dpth (m)	4.21	Hydr. Depth (m)	0.73	4.03	1.79
Conv. Total (m3/s)	1995.5	Conv. (m3/s)	841.8	475.7	678.0
Length Wtd. (m)	30.00	Wetted Per. (m)	71.62	2.72	13.65
Min Ch El (m)	196.30	Shear (N/m2)	0.76	3.10	1.80
Alpha	2.15	Stream Power (N/m s)	0.13	1.88	0.53
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	49.24	81.69	40.49
C & E Loss (m)	0.00	Cum SA (1000 m2)	59.14	25.39	55.70

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.22	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.17	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)		Flow Area (m2)	107.13	9.38	33.22
E.G. Slope (m/m)	0.000946	Area (m2)	107.13	9.38	33.22
Q Total (m3/s)	122.56	Flow (m3/s)	73.21	18.82	

30.52					
Top Width (m)	110.66	Top Width (m)	91.00	2.00	
17.66					
Vel Total (m/s)	0.82	Avg. Vel. (m/s)	0.68	2.01	
0.92					
Max Chl Dpth (m)	4.87	Hydr. Depth (m)	1.18	4.69	
1.88					
Conv. Total (m3/s)	3985.0	Conv. (m3/s)	2380.5	612.0	
992.5					
Length Wtd. (m)	30.00	Wetted Per. (m)	91.48	2.72	
18.19					
Min Ch El (m)	196.30	Shear (N/m2)	10.86	32.00	
16.94					
Alpha	1.65	Stream Power (N/m s)	7.42	64.19	
15.57					
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	188.38	198.16	
209.72					
C & E Loss (m)	0.00	Cum SA (1000 m2)	126.72	25.39	
137.89					

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: RIVER-1
REACH: Reach-1 RS: 46.202

INPUT
Description: Section 46.202 - Highway 7 - U/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	50	200	111	200	113	199	115.5	197
116	196	123	196	123.5	197	129	200	227	202
272	203								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	115.5	.035	123.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
115.5	123.5	70	70	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116	200.23	F
123	272	200.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.51	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	
0.050					
W.S. Elev (m)	200.51	Reach Len. (m)	70.00	70.00	
70.00					
Crit W.S. (m)	196.96	Flow Area (m2)	45.47	35.54	
17.28					

E.G. Slope (m/m)	0.000039	Area (m2)	45.47	35.54	17.28
Q Total (m3/s)	20.59	Flow (m3/s)	3.56	15.57	1.46
Top Width (m)	129.01	Top Width (m)	90.76	8.00	30.25
Vel Total (m/s)	0.21	Avg. Vel. (m/s)	0.08	0.44	0.08
Max Chl Dpth (m)	4.51	Hydr. Depth (m)	0.50	4.44	0.57
Conv. Total (m3/s)	3297.3	Conv. (m3/s)	569.7	2493.6	234.0
Length Wtd. (m)	70.00	Wetted Per. (m)	91.70	9.24	31.02
Min Ch El (m)	196.00	Shear (N/m2)	0.19	1.47	0.21
Alpha	3.34	Stream Power (N/m s)	0.01	0.64	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	47.78	81.04	39.88
C & E Loss (m)		Cum SA (1000 m2)	56.71	25.24	55.05

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.20	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.14	Reach Len. (m)	70.00	70.00	70.00
Crit W.S. (m)	199.15	Flow Area (m2)	112.34	40.60	46.19
E.G. Slope (m/m)	0.000409	Area (m2)	112.34	40.60	46.19
Q Total (m3/s)	122.56	Flow (m3/s)	44.31	62.91	15.34
Top Width (m)	184.72	Top Width (m)	115.50	8.00	61.22
Vel Total (m/s)	0.62	Avg. Vel. (m/s)	0.39	1.55	0.33
Max Chl Dpth (m)	5.14	Hydr. Depth (m)	0.97	5.07	0.75
Conv. Total (m3/s)	6063.7	Conv. (m3/s)	2192.0	3112.5	759.1
Length Wtd. (m)	70.00	Wetted Per. (m)	116.58	9.24	62.00
Min Ch El (m)	196.00	Shear (N/m2)	3.86	17.61	2.98
Alpha	3.44	Stream Power (N/m s)	1.52	27.29	0.99
Frctn Loss (m)		Cum Volume (1000 m3)	185.08	197.41	208.53
C & E Loss (m)		Cum SA (1000 m2)	123.62	25.24	136.71

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2015

INPUT
Description: Hum 13-4RR. Highway 7 Culvert - 3.7 m W x 1.5 m H x 64 m L
Concrete Box Culvert. Based on drawings. July 2010

New HEC-RAS
coding January 2004 by Acres included coding of culvert in
HEC-RAS, including adjustments to roadway coding and hydraulic
loss coefficients.
Distance from Upstream XS = 5
Deck/Roadway Width = 64
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201		50	200.45		95	200.23	
168	201		216	202		227	202.5	
272	203.5							

Upstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	50	200	111	200	113	199	115.5	197
116	196	123	196	123.5	197	129	200	227	202
272	203								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	115.5	.035	123.5	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
115.5	123.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116	200.23	F
123	272	200.5	F

Downstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201		50	200.45		95	200.23	
168	201		216	202		227	202.5	
272	203.5							

Downstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	50	200	111	200	113	199	115.5	197
116	196	123	196	123.5	197	129	200	227	202
272	203								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	115.5	.035	123.5	.05

```
Bank Sta: Left   Right    Coeff Contr.   Expan.
         115.5   123.5            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     116     199       F
     123     272     199       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           Box    1.52    3.66
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
                 5      64     .015     .015        0                   .5
      1
Upstream   Elevation =  196
           Centerline Station =  119.5
Downstream Elevation =  196
           Centerline Station =  119.5

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      14.09    Culv Full Len (m)        64.00
  # Barrels                   1     Culv Vel US (m/s)         2.53
  Q Barrel (m3/s)          14.09    Culv Vel DS (m/s)         2.53
  E.G. US. (m)            200.51    Culv Inv El Up (m)      196.00
  W.S. US. (m)            200.51    Culv Inv El Dn (m)      196.00
  E.G. DS (m)             199.83    Culv Frctn Ls (m)         0.21
  W.S. DS (m)             199.81    Culv Exit Loss (m)        0.31
  Delta EG (m)              0.69    Culv Entr Loss (m)        0.16
  Delta WS (m)              0.69    Q Weir (m3/s)             6.50
  E.G. IC (m)             199.01    Weir Sta Lft (m)         44.67
  E.G. OC (m)             200.51    Weir Sta Rgt (m)        121.40
  Culvert Control         Outlet    Weir Submerg              0.00
  Culv WS Inlet (m)       197.52    Weir Max Depth (m)        0.28
  Culv WS Outlet (m)      197.52    Weir Avg Depth (m)        0.15
  Culv Nml Depth (m)                Weir Flow Area (m2)      11.41
  Culv Crt Depth (m)        1.15    Min El Weir Flow (m)    200.23


Warning: During the culvert inlet control computations, the program could not
balance the culvert/weir flow.  The reported
         inlet energy grade answer may not be valid.

CULVERT OUTPUT  Profile #Regional w red'n  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       2.55    Culv Full Len (m)        64.00
  # Barrels                    1    Culv Vel US (m/s)         0.46
  Q Barrel (m3/s)           2.55    Culv Vel DS (m/s)         0.46
  E.G. US. (m)            201.20    Culv Inv El Up (m)      196.00
  W.S. US. (m)            201.14    Culv Inv El Dn (m)      196.00
```

E.G. DS (m)	201.19	Culv Frctn Ls (m)	0.01
W.S. DS (m)	201.12	Culv Exit Loss (m)	0.00
Delta EG (m)	0.01	Culv Entr Loss (m)	0.01
Delta WS (m)	0.01	Q Weir (m3/s)	120.02
E.G. IC (m)	201.19	Weir Sta Lft (m)	0.00
E.G. OC (m)	201.20	Weir Sta Rgt (m)	178.47
Culvert Control	Outlet	Weir Submerg	0.87
Culv WS Inlet (m)	197.52	Weir Max Depth (m)	0.99
Culv WS Outlet (m)	197.52	Weir Avg Depth (m)	0.61
Culv Nml Depth (m)		Weir Flow Area (m2)	109.34
Culv Crt Depth (m)	0.37	Min El Weir Flow (m)	200.23

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.201

INPUT
Description: Section 46.201 - Highway 7 - D/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	50	200	111	200	113	199	115.5	197
116	196	123	196	123.5	197	129	200	227	202
272	203								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	115.5	.035	123.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
115.5	123.5	20	25	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116	199	F
123	272	199	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.83	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.81	Reach Len. (m)	20.00	25.00	30.00
Crit W.S. (m)	196.96	Flow Area (m2)	5.18	29.98	7.24
E.G. Slope (m/m)	0.000092	Area (m2)	5.18	29.98	7.24
Q Total (m3/s)	20.59	Flow (m3/s)	1.01	17.98	1.59
Top Width (m)	17.27	Top Width (m)	4.12	8.00	5.15
Vel Total (m/s)	0.49	Avg. Vel. (m/s)	0.20	0.60	0.22
Max Chl Dpth (m)	3.81	Hydr. Depth (m)	1.26	3.75	

1.41					
Conv. Total (m3/s)	2150.8	Conv. (m3/s)	106.0	1878.2	166.6
Length Wtd. (m)	25.07	Wetted Per. (m)	5.01	9.24	5.87
Min Ch El (m)	196.00	Shear (N/m2)	0.93	2.92	1.11
Alpha	1.36	Stream Power (N/m s)	0.18	1.75	0.24
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	47.78	79.37	39.88
C & E Loss (m)	0.00	Cum SA (1000 m2)	53.39	24.68	53.81

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.19	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.12	Reach Len. (m)	20.00	25.00	30.00
Crit W.S. (m)	199.00	Flow Area (m2)	110.67	40.48	45.31
E.G. Slope (m/m)	0.000421	Area (m2)	110.67	40.48	45.31
Q Total (m3/s)	122.56	Flow (m3/s)	43.85	63.52	15.19
Top Width (m)	184.01	Top Width (m)	115.50	8.00	60.51
Vel Total (m/s)	0.62	Avg. Vel. (m/s)	0.40	1.57	0.34
Max Chl Dpth (m)	5.12	Hydr. Depth (m)	0.96	5.06	0.75
Conv. Total (m3/s)	5976.8	Conv. (m3/s)	2138.2	3097.8	740.8
Length Wtd. (m)	23.94	Wetted Per. (m)	116.57	9.24	61.29
Min Ch El (m)	196.00	Shear (N/m2)	3.92	18.08	3.05
Alpha	3.46	Stream Power (N/m s)	1.55	28.36	1.02
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	185.08	188.48	208.53
C & E Loss (m)	0.02	Cum SA (1000 m2)	115.54	24.68	132.45

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.192

INPUT
Description: Section 46.192 - Private Driveway - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	5	200	30	199	56	199	60	197
61.5	195.9	65.5	195.9	67	197	85	200	95	200
95	203	135	203						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	60	.035	67	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
60	67	25	25	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	61.5	199	F
65.5	135	199.3	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.82	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.81	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)	197.29	Flow Area (m2)	36.67	25.75	23.75
E.G. Slope (m/m)	0.000053	Area (m2)	36.67	25.75	23.75
Q Total (m3/s)	20.59	Flow (m3/s)	4.30	11.98	4.31
Top Width (m)	74.22	Top Width (m)	50.34	7.00	16.88
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.12	0.47	0.18
Max Chl Dpth (m)	3.91	Hydr. Depth (m)	0.73	3.68	1.41
Conv. Total (m3/s)	2822.8	Conv. (m3/s)	590.1	1641.9	590.9
Length Wtd. (m)	25.00	Wetted Per. (m)	50.82	7.72	17.11
Min Ch El (m)	195.90	Shear (N/m2)	0.38	1.74	0.72
Alpha	2.38	Stream Power (N/m s)	0.04	0.81	0.13
Frctn Loss (m)		Cum Volume (1000 m3)	47.36	78.68	39.41
C & E Loss (m)		Cum SA (1000 m2)	52.84	24.49	53.48

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.17	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.13	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)	199.36	Flow Area (m2)	112.00	34.98	58.73
E.G. Slope (m/m)	0.000236	Area (m2)	112.00	34.98	58.73
Q Total (m3/s)	122.56	Flow (m3/s)	51.81	42.09	28.66
Top Width (m)	95.00	Top Width (m)	60.00	7.00	28.00
Vel Total (m/s)	0.60	Avg. Vel. (m/s)	0.46	1.20	0.49
Max Chl Dpth (m)	5.23	Hydr. Depth (m)	1.87	5.00	2.10
Conv. Total (m3/s)	7969.8	Conv. (m3/s)	3368.7	2737.1	1864.0
Length Wtd. (m)	25.00	Wetted Per. (m)	60.72	7.72	29.38
Min Ch El (m)	195.90	Shear (N/m2)	4.28	10.51	4.64
Alpha	1.81	Stream Power (N/m s)	1.98	12.64	2.26
Frctn Loss (m)		Cum Volume (1000 m3)	182.86	187.54	206.97
C & E Loss (m)		Cum SA (1000 m2)	113.78	24.49	131.12

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1915

INPUT
Description: Hum-MM. Private Driveway Culvert - 3.75m x 1.5m Box culvert - sizes determined from Site visit - July 2010

New HEC-RAS coding
January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 4
Deck/Roadway Width = 17
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 3

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
30	199	56	199	85	200

Upstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	5	200	30	199	56	199	60	197
61.5	195.9	65.5	195.9	67	197	85	200	95	200

```
      95     203     135     203

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05      60    .035      67     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
            60      67             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    61.5     199       F
    65.5     135   199.3       F

Downstream  Deck/Roadway Coordinates
    num=       3
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
      30     199              56     199              85     200

Downstream Bridge Cross Section Data
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0     201       5     200      30     199      56     199      60     197
    61.5   195.9    65.5   195.9      67     197      85     200      95     200
      95     203     135     203

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05      60    .035      67     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
            60      67             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    61.5   198.5       F
    65.5     135   198.5       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           Box     1.5    3.75
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
                4      17     .013     .024        0                    .5
      1
Upstream   Elevation =  195.9
           Centerline Station =  63.5
Downstream Elevation =  195.9
           Centerline Station =  63.5

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       2.16    Culv Full Len (m)        17.00
```

# Barrels	1	Culv Vel US (m/s)	0.38
Q Barrel (m3/s)	2.16	Culv Vel DS (m/s)	0.38
E.G. US. (m)	199.82	Culv Inv El Up (m)	195.90
W.S. US. (m)	199.81	Culv Inv El Dn (m)	195.90
E.G. DS (m)	199.81	Culv Frctn Ls (m)	0.00
W.S. DS (m)	199.81	Culv Exit Loss (m)	0.00
Delta EG (m)	0.01	Culv Entr Loss (m)	0.00
Delta WS (m)	0.01	Q Weir (m3/s)	18.43
E.G. IC (m)	198.86	Weir Sta Lft (m)	9.51
E.G. OC (m)	199.82	Weir Sta Rgt (m)	79.76
Culvert Control	Outlet	Weir Submerg	0.99
Culv WS Inlet (m)	197.40	Weir Max Depth (m)	0.82
Culv WS Outlet (m)	197.40	Weir Avg Depth (m)	0.56
Culv Nml Depth (m)		Weir Flow Area (m2)	39.44
Culv Crt Depth (m)	0.32	Min El Weir Flow (m)	199.00

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	1.13	Culv Full Len (m)	17.00
# Barrels	1	Culv Vel US (m/s)	0.20
Q Barrel (m3/s)	1.13	Culv Vel DS (m/s)	0.20
E.G. US. (m)	201.17	Culv Inv El Up (m)	195.90
W.S. US. (m)	201.13	Culv Inv El Dn (m)	195.90
E.G. DS (m)	201.17	Culv Frctn Ls (m)	0.00
W.S. DS (m)	201.13	Culv Exit Loss (m)	0.00
Delta EG (m)	0.00	Culv Entr Loss (m)	0.00
Delta WS (m)	0.00	Q Weir (m3/s)	121.43
E.G. IC (m)	201.17	Weir Sta Lft (m)	0.00
E.G. OC (m)	201.17	Weir Sta Rgt (m)	95.00
Culvert Control	Outlet	Weir Submerg	0.99
Culv WS Inlet (m)	197.40	Weir Max Depth (m)	2.18
Culv WS Outlet (m)	197.40	Weir Avg Depth (m)	1.71
Culv Nml Depth (m)		Weir Flow Area (m2)	162.42
Culv Crt Depth (m)	0.21	Min El Weir Flow (m)	199.00

Warning: The weir over culvert is submerged.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.191

INPUT
Description: Section 46.191 - Private Driveway - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	5	200	30	199	56	199	60	197
61.5	195.9	65.5	195.9	67	197	85	200	95	200
95	203	135	203						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	60	.035	67	.05

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
60 67 50 50 50 .3 .5
Ineffective Flow num= 2
Sta L Sta R Elev Permanent
0 61.5 198.5 F
65.5 135 198.5 F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.81	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.81	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	197.29	Flow Area (m2)	36.37	25.70	23.64
E.G. Slope (m/m)	0.000054	Area (m2)	36.37	25.70	23.64
Q Total (m3/s)	20.59	Flow (m3/s)	4.28	12.01	4.31
Top Width (m)	74.03	Top Width (m)	50.18	7.00	16.84
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.12	0.47	0.18
Max Chl Dpth (m)	3.91	Hydr. Depth (m)	0.72	3.67	1.40
Conv. Total (m3/s)	2807.9	Conv. (m3/s)	583.1	1637.3	587.5
Length Wtd. (m)	50.00	Wetted Per. (m)	50.67	7.72	17.08
Min Ch El (m)	195.90	Shear (N/m2)	0.38	1.76	0.73
Alpha	2.38	Stream Power (N/m s)	0.04	0.82	0.13
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	47.36	77.39	39.41
C & E Loss (m)	0.00	Cum SA (1000 m2)	51.59	24.32	53.05

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.17	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.13	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	199.36	Flow Area (m2)	111.98	34.98	58.72
E.G. Slope (m/m)	0.000237	Area (m2)	111.98	34.98	58.72
Q Total (m3/s)	122.56	Flow (m3/s)	51.80	42.10	28.66
Top Width (m)	95.00	Top Width (m)	60.00	7.00	28.00

Vel Total (m/s)	0.60	Avg. Vel. (m/s)	0.46	1.20	0.49
Max Chl Dpth (m)	5.23	Hydr. Depth (m)	1.87	5.00	2.10
Conv. Total (m3/s)	7968.1	Conv. (m3/s)	3367.7	2736.8	1863.5
Length Wtd. (m)	50.00	Wetted Per. (m)	60.72	7.72	29.38
Min Ch El (m)	195.90	Shear (N/m2)	4.28	10.51	4.64
Alpha	1.81	Stream Power (N/m s)	1.98	12.65	2.26
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	182.86	183.19	206.97
C & E Loss (m)	0.01	Cum SA (1000 m2)	112.28	24.32	130.42

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.19

INPUT
Description: Section 46.19 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	0	201	8	201	50	201	58	200
63	199	94	199	104	196.5	105	195.5	106	195.5
107	196.5	114	198	119	198.7	143	198.7	143	203
169	203								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	8	.025	50	.05	104	.035	107	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
104	107	45	45	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.81	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.81	Reach Len. (m)	45.00	45.00	45.00
Crit W.S. (m)		Flow Area (m2)	47.20	11.92	51.74
E.G. Slope (m/m)	0.000048	Area (m2)	47.20	11.92	51.74
Q Total (m3/s)	20.59	Flow (m3/s)	6.69	5.01	8.89
Top Width (m)	84.03	Top Width (m)	45.03	3.00	36.00
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.14	0.42	0.17

Max Chl Dpth (m)	4.31	Hydr. Depth (m)	1.05	3.97	1.44
Conv. Total (m3/s)	2981.7	Conv. (m3/s)	968.6	726.2	1286.8
Length Wtd. (m)	45.00	Wetted Per. (m)	45.42	3.83	37.31
Min Ch El (m)	195.50	Shear (N/m2)	0.49	1.46	0.65
Alpha	1.81	Stream Power (N/m s)	0.07	0.61	0.11
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	45.27	76.45	37.53
C & E Loss (m)	0.00	Cum SA (1000 m2)	49.21	24.07	51.73

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.15	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.13	Reach Len. (m)	45.00	45.00	45.00
Crit W.S. (m)		Flow Area (m2)	119.45	15.89	99.36
E.G. Slope (m/m)	0.000201	Area (m2)	119.45	15.89	99.36
Q Total (m3/s)	122.56	Flow (m3/s)	53.01	16.63	52.92
Top Width (m)	143.00	Top Width (m)	104.00	3.00	36.00
Vel Total (m/s)	0.52	Avg. Vel. (m/s)	0.44	1.05	0.53
Max Chl Dpth (m)	5.63	Hydr. Depth (m)	1.15	5.30	2.76
Conv. Total (m3/s)	8638.4	Conv. (m3/s)	3736.2	1172.4	3729.8
Length Wtd. (m)	45.00	Wetted Per. (m)	104.60	3.83	38.64
Min Ch El (m)	195.50	Shear (N/m2)	2.25	8.19	5.08
Alpha	1.31	Stream Power (N/m s)	1.00	8.58	2.70
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	177.07	181.92	203.02
C & E Loss (m)	0.00	Cum SA (1000 m2)	108.18	24.07	128.82

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.182

INPUT
Description: Section 46.182 - Private Driveway - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 47

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.972	.42	201.961	.55	201.96	1.85	201.935	8.17	201.804
21.62	201.526	31.13	201.301	35.82	201.196	38.11	201.147	43.98	201
47.21	201	54.76	201	59.23	201.022	59.93	201.025	61.24	201.019
63.83	201.008	65.54	201	67.48	200.312	68.6	200	69.51	199.67
71.2	199	80.47	198.706	97.37	198.231	101.25	198.152	103.18	198.11
108.63	198	109.89	197.509	111.25	197	113.61	196.424	114.44	196
115	195.5	117	195.5	119.57	196.761	120.39	197	120.93	197.262
122.38	198	123.56	198.575	124.53	199	125.86	199.005	126.15	199.005
126.32	199.005	128.81	199.016	129.09	199.016	133.53	199.074	152.28	199.311
155.51	199.353	179.8	199.659						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	43.98	.025	65.54	.05	111.25	.035	120.39	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
111.25	120.39	30	30	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	114	197.8	F
118	179.8	198.1	F

Left Levee Station= 59.93 Elevation= 201.025

Blocked Obstructions num= 1

Sta L	Sta R	Elev
143.39	178.45	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.81	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.80	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)	197.06	Flow Area (m2)	57.30	33.00	21.18
E.G. Slope (m/m)	0.000028	Area (m2)	57.30	33.00	21.18
Q Total (m3/s)	20.59	Flow (m3/s)	7.39	11.17	2.03
Top Width (m)	75.60	Top Width (m)	42.11	9.14	24.35
Vel Total (m/s)	0.18	Avg. Vel. (m/s)	0.13	0.34	0.10
Max Chl Dpth (m)	4.30	Hydr. Depth (m)	1.36	3.61	0.87
Conv. Total (m3/s)	3897.4	Conv. (m3/s)	1399.5	2114.3	383.6
Length Wtd. (m)	30.00	Wetted Per. (m)	42.46	9.83	25.73
Min Ch El (m)	195.50	Shear (N/m2)	0.37	0.92	0.23
Alpha	2.02	Stream Power (N/m s)	0.05	0.31	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	42.92	75.43	35.89
C & E Loss (m)		Cum SA (1000 m2)	47.24	23.79	50.38

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.14	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.11	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)	198.95	Flow Area (m2)	117.48	44.95	53.01
E.G. Slope (m/m)	0.000169	Area (m2)	117.48	44.95	53.01
Q Total (m3/s)	122.56	Flow (m3/s)	55.11	46.00	21.45
Top Width (m)	105.23	Top Width (m)	71.74	9.14	24.35
Vel Total (m/s)	0.57	Avg. Vel. (m/s)	0.47	1.02	0.40
Max Chl Dpth (m)	5.61	Hydr. Depth (m)	1.64	4.92	2.18
Conv. Total (m3/s)	9427.7	Conv. (m3/s)	4239.3	3538.4	1650.0
Length Wtd. (m)	30.00	Wetted Per. (m)	72.29	9.83	29.65
Min Ch El (m)	195.50	Shear (N/m2)	2.69	7.58	2.96
Alpha	1.61	Stream Power (N/m s)	1.26	7.76	1.20
Frctn Loss (m)		Cum Volume (1000 m3)	171.74	180.55	199.59
C & E Loss (m)		Cum SA (1000 m2)	104.23	23.79	127.46

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1815

INPUT
Description: Hum-LL - Private Driveway Culvert - 3.23 m W x 2.1 m H x 20 m L Corrugated Metal Pipe Arch Culvert. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004
by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 20
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 68

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.814		8.43	201.594		9.83	201.579	

23.38	201.318	38.06	201.013	38.92	201.052
39.19	201.044	39.55	201.046	40.67	201.053
44.98	201.024	45.55	201	48.21	201
51.41	201	53.82	201	57.05	201.013
59.14	201.02	61.55	201.011	63.08	201.006
64.24	201	66.61	200.06	66.78	200
66.95	199.933	69.25	199	73.56	198.862
78.46	198.707	78.57	198.703	91.01	198.328
92.38	198.309	94.38	198.276	94.4	198.275
94.48	198.274	104.2	198.082	107.92	198.006
108.02	198.006	108.27	198.006	108.69	198.005
109.45	198.005	110.23	198.004	110.59	198.004
111.09	198.004	112.19	198.004	112.58	198.004
113.44	198.003	114.64	198.003	115.23	198.003
115.68	198.003	116.18	198.002	116.54	198.038
119.63	198.468	121.93	198.762	122.56	198.775
123.93	198.92	125.6	198.914	126.73	198.921
128.12	198.95	128.92	198.942	130.41	198.978
130.95	199	130.96	199	131.04	199
131.13	199	131.47	199.005	131.56	199.007
133.71	199.023	134.52	199.03	136.57	199.051
136.8	199.053	177.16	199.555		

Upstream Bridge Cross Section Data
Station Elevation Data num= 47

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.972	.42	201.961	.55	201.96	1.85	201.935	8.17	201.804
21.62	201.526	31.13	201.301	35.82	201.196	38.11	201.147	43.98	201
47.21	201	54.76	201	59.23	201.022	59.93	201.025	61.24	201.019
63.83	201.008	65.54	201	67.48	200.312	68.6	200	69.51	199.67
71.2	199	80.47	198.706	97.37	198.231	101.25	198.152	103.18	198.11
108.63	198	109.89	197.509	111.25	197	113.61	196.424	114.44	196
115	195.5	117	195.5	119.57	196.761	120.39	197	120.93	197.262
122.38	198	123.56	198.575	124.53	199	125.86	199.005	126.15	199.005
126.32	199.005	128.81	199.016	129.09	199.016	133.53	199.074	152.28	199.311
155.51	199.353	179.8	199.659						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	43.98	.025	65.54	.05	111.25	.035	120.39	.05

Bank Sta: Left Right Coeff Contr. Expan.
111.25 120.39 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	114	197.8	F
118	179.8	198.1	F

Left Levee Station= 59.93 Elevation= 201.025
Blocked Obstructions num= 1

Sta L	Sta R	Elev
143.39	178.45	204

Downstream Deck/Roadway Coordinates
num= 68

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.814		8.43	201.594		9.83	201.579	
23.38	201.318		38.06	201.013		38.92	201.052	
39.19	201.044		39.55	201.046		40.67	201.053	
44.98	201.024		45.55	201		48.21	201	
51.41	201		53.82	201		57.05	201.013	
59.14	201.02		61.55	201.011		63.08	201.006	
64.24	201		66.61	200.06		66.78	200	
66.95	199.933		69.25	199		73.56	198.862	

78.46	198.707	78.57	198.703	91.01	198.328
92.38	198.309	94.38	198.276	94.4	198.275
94.48	198.274	104.2	198.082	107.92	198.006
108.02	198.006	108.27	198.006	108.69	198.005
109.45	198.005	110.23	198.004	110.59	198.004
111.09	198.004	112.19	198.004	112.58	198.004
113.44	198.003	114.64	198.003	115.23	198.003
115.68	198.003	116.18	198.002	116.54	198.038
119.63	198.468	121.93	198.762	122.56	198.775
123.93	198.92	125.6	198.914	126.73	198.921
128.12	198.95	128.92	198.942	130.41	198.978
130.95	199	130.96	199	131.04	199
131.13	199	131.47	199.005	131.56	199.007
133.71	199.023	134.52	199.03	136.57	199.051
136.8	199.053	177.16	199.555		

Downstream Bridge Cross Section Data
Station Elevation Data num= 63

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.672	10.15	201.391	16.44	201.227	19.11	201.198	28.76	201.012
29.08	201.003	29.75	201.003	30.18	201.003	33.16	201.006	34.09	201.007
34.71	201.007	38.11	201.008	40.91	201.007	42.47	201.009	46.32	201.01
49.08	201.01	50.09	201.01	52.79	201.011	53.95	201.011	55.33	201.01
55.52	201.01	57.16	201.007	59.2	201.008	61.08	201.003	61.53	201.002
62.11	201	63.74	200.449	63.89	200.402	64.96	200	67.14	199.213
67.66	199	85.51	198.472	98.03	198.095	102.22	198.037	104.14	198.005
104.83	198	107.05	197.336	108.45	197	109.6	196.471	110.03	196.349
110.3	196.132	110.55	195.7	111.55	195.42	112.65	195.42	113.45	195.7
113.65	196.153	114.19	196.347	114.96	196.478	115.28	196.495	115.54	196.648
115.97	197	117.96	197.685	118.9	198	119.49	198.157	122.24	199
123.93	199.013	125.15	199.031	128.94	199.07	130.34	199.094	131.13	199.106
131.15	199.106	139.61	199.169	174.54	199.456				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	28.76	.025	62.11	.05	108.45	.035	115.97	.05

Bank Sta: Left Right Coeff Contr. Expan.
108.45 115.97 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	110	197.8	F
114	174.54	197.8	F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
139.13	174.54	204

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	Pipe Arch	2.1	3.23

FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef

Exit Loss Coef
5 20 .024 .024 0 .9
1
Upstream Elevation = 195.5
Centerline Station = 116
Downstream Elevation = 195.42
Centerline Station = 112

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	1.13	Culv Full Len (m)	20.00
# Barrels	1	Culv Vel US (m/s)	0.22
Q Barrel (m3/s)	1.13	Culv Vel DS (m/s)	0.22
E.G. US. (m)	199.81	Culv Inv El Up (m)	195.50
W.S. US. (m)	199.80	Culv Inv El Dn (m)	195.42
E.G. DS (m)	199.81	Culv Frctn Ls (m)	0.00
W.S. DS (m)	199.80	Culv Exit Loss (m)	0.00
Delta EG (m)	0.00	Culv Entr Loss (m)	0.00
Delta WS (m)	0.00	Q Weir (m3/s)	19.46
E.G. IC (m)	199.19	Weir Sta Lft (m)	69.13
E.G. OC (m)	199.81	Weir Sta Rgt (m)	179.80
Culvert Control	Outlet	Weir Submerg	1.00
Culv WS Inlet (m)	197.60	Weir Max Depth (m)	1.81
Culv WS Outlet (m)	197.52	Weir Avg Depth (m)	1.18
Culv Nml Depth (m)		Weir Flow Area (m2)	89.52
Culv Crt Depth (m)	0.31	Min El Weir Flow (m)	198.01

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	3.10	Culv Full Len (m)	20.00
# Barrels	1	Culv Vel US (m/s)	0.59
Q Barrel (m3/s)	3.10	Culv Vel DS (m/s)	0.59
E.G. US. (m)	201.14	Culv Inv El Up (m)	195.50
W.S. US. (m)	201.11	Culv Inv El Dn (m)	195.42
E.G. DS (m)	201.11	Culv Frctn Ls (m)	0.01
W.S. DS (m)	201.09	Culv Exit Loss (m)	0.00
Delta EG (m)	0.02	Culv Entr Loss (m)	0.02
Delta WS (m)	0.03	Q Weir (m3/s)	119.46
E.G. IC (m)	201.12	Weir Sta Lft (m)	39.13
E.G. OC (m)	201.14	Weir Sta Rgt (m)	179.80
Culvert Control	Outlet	Weir Submerg	0.99
Culv WS Inlet (m)	197.60	Weir Max Depth (m)	3.12
Culv WS Outlet (m)	197.52	Weir Avg Depth (m)	1.84
Culv Nml Depth (m)		Weir Flow Area (m2)	194.21
Culv Crt Depth (m)	0.55	Min El Weir Flow (m)	198.01

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.181

```
INPUT
Description: Section 46.181 - Private Driveway - D/S Bounding Section - J.D.
             Barnes 2003 topo mapping
Station Elevation Data    num=      63
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 201.672   10.15 201.391   16.44 201.227   19.11 201.198   28.76 201.012
   29.08 201.003   29.75 201.003   30.18 201.003   33.16 201.006   34.09 201.007
   34.71 201.007   38.11 201.008   40.91 201.007   42.47 201.009   46.32  201.01
   49.08  201.01   50.09  201.01   52.79 201.011   53.95 201.011   55.33  201.01
   55.52  201.01   57.16 201.007    59.2 201.008   61.08 201.003   61.53 201.002
   62.11     201   63.74 200.449   63.89 200.402   64.96     200   67.14 199.213
   67.66     199   85.51 198.472   98.03 198.095  102.22 198.037  104.14 198.005
  104.83     198  107.05 197.336  108.45     197   109.6 196.471  110.03 196.349
   110.3 196.132  110.55   195.7  111.55  195.42  112.65  195.42  113.45   195.7
  113.65 196.153  114.19 196.347  114.96 196.478  115.28 196.495  115.54 196.648
  115.97     197  117.96 197.685   118.9     198  119.49 198.157  122.24     199
  123.93 199.013  125.15 199.031  128.94  199.07  130.34 199.094  131.13 199.106
  131.15 199.106  139.61 199.169  174.54 199.456

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   28.76    .025   62.11     .05  108.45    .035  115.97     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        108.45  115.97               10      10      10             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     110   197.8       F
     114  174.54   197.8       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
  139.13  174.54     204

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           199.81    Element                Left OB    Channel
Right OB
  Vel Head (m)              0.00    Wt. n-Val.              0.050      0.035
0.050
  W.S. Elev (m)           199.80    Reach Len. (m)          10.00      10.00
10.00
  Crit W.S. (m)           197.07    Flow Area (m2)          59.22      27.86
23.15
  E.G. Slope (m/m)      0.000032    Area (m2)               59.22      27.86
23.15
  Q Total (m3/s)            20.59   Flow (m3/s)              8.22       9.83
2.54
  Top Width (m)             73.62   Top Width (m)           42.94       7.52
23.16
  Vel Total (m/s)           0.19    Avg. Vel. (m/s)          0.14       0.35
0.11
  Max Chl Dpth (m)          4.38    Hydr. Depth (m)          1.38       3.70
1.00
  Conv. Total (m3/s)      3657.4    Conv. (m3/s)            1460.9     1746.0
450.5
  Length Wtd. (m)           10.00   Wetted Per. (m)          43.24       8.57
24.11
  Min Ch El (m)           195.42    Shear (N/m2)             0.43       1.01
0.30
  Alpha                     1.97    Stream Power (N/m s)     0.06       0.36
0.03
```

Frctn Loss (m)	0.00	Cum Volume (1000 m3)	42.92	72.51	35.89
C & E Loss (m)	0.00	Cum SA (1000 m2)	45.97	23.54	49.66

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.11	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.09	Reach Len. (m)	10.00	10.00	10.00
Crit W.S. (m)	199.00	Flow Area (m2)	119.37	37.51	52.88
E.G. Slope (m/m)	0.000190	Area (m2)	119.37	37.51	52.88
Q Total (m3/s)	122.56	Flow (m3/s)	59.30	39.50	23.76
Top Width (m)	114.19	Top Width (m)	83.51	7.52	23.16
Vel Total (m/s)	0.58	Avg. Vel. (m/s)	0.50	1.05	0.45
Max Chl Dpth (m)	5.67	Hydr. Depth (m)	1.43	4.99	2.28
Conv. Total (m3/s)	8896.6	Conv. (m3/s)	4304.8	2867.1	1724.7
Length Wtd. (m)	10.00	Wetted Per. (m)	84.01	8.57	25.39
Min Ch El (m)	195.42	Shear (N/m2)	2.64	8.14	3.88
Alpha	1.51	Stream Power (N/m s)	1.31	8.58	1.74
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	171.74	174.48	199.59
C & E Loss (m)	0.00	Cum SA (1000 m2)	101.90	23.54	126.75

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.18

INPUT
Description: Section 46.18 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 36

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.977	11.8	201.517	19.72	201.217	24.63	201.027	25.49	201
25.73	200.891	27.72	200	72.09	200	72.38	200.049	72.68	200
73.08	199.878	75.33	199	90.41	198.582	110.99	198	113.81	197.148
114.16	197	114.84	196.777	115.23	196.607	117.24	196	118.92	195.419
119.01	195.418	119.32	195.43	120.38	195.971	120.82	196	123.44	196.968
123.53	197	123.87	197.147	125.89	198	126.38	198.193	128.56	199
130.21	199.025	143.32	199.109	146.37	199.102	152.23	199.148	160.44	199.206

181.15 199.373

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	117.24	.035	120.82	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
117.24	120.82	25	25	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
146.08	181.15	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.80	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)		Flow Area (m2)	64.59	14.65	30.67
E.G. Slope (m/m)	0.000038	Area (m2)	64.59	14.65	30.67
Q Total (m3/s)	20.59	Flow (m3/s)	10.15	6.30	4.14
Top Width (m)	72.80	Top Width (m)	43.96	3.58	25.26
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.16	0.43	0.14
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.47	4.09	1.21
Conv. Total (m3/s)	3360.8	Conv. (m3/s)	1657.3	1027.6	676.0
Length Wtd. (m)	25.00	Wetted Per. (m)	44.44	3.81	26.52
Min Ch El (m)	195.42	Shear (N/m2)	0.53	1.42	0.43
Alpha	2.06	Stream Power (N/m s)	0.08	0.61	0.06
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	42.30	72.30	35.62
C & E Loss (m)	0.00	Cum SA (1000 m2)	45.53	23.49	49.42

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.11	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.09	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)		Flow Area (m2)	172.08	19.25	63.15
E.G. Slope (m/m)	0.000189	Area (m2)	172.08	19.25	63.15
Q Total (m3/s)	122.56	Flow (m3/s)	70.32	22.26	29.98

Top Width (m)	122.99	Top Width (m)	94.15	3.58	25.26
Vel Total (m/s)	0.48	Avg. Vel. (m/s)	0.41	1.16	0.47
Max Chl Dpth (m)	5.67	Hydr. Depth (m)	1.83	5.38	2.50
Conv. Total (m3/s)	8920.1	Conv. (m3/s)	5117.8	1620.2	2182.2
Length Wtd. (m)	25.00	Wetted Per. (m)	94.89	3.81	27.81
Min Ch El (m)	195.42	Shear (N/m2)	3.36	9.36	4.20
Alpha	1.70	Stream Power (N/m s)	1.37	10.82	2.00
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	170.28	174.20	199.01
C & E Loss (m)	0.00	Cum SA (1000 m2)	101.01	23.49	126.51

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: RIVER-1
REACH: Reach-1 RS: 46.172

INPUT
Description: Section 46.172 - Doughton Road - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 112

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.734	12.56	201.239	18.71	201	19.16	200.796	20.83	200
22.76	199.053	22.87	199	62.25	199	63.17	199.011	64.63	199.022
66.94	199.001	66.98	199	67.01	199	68.2	198.967	103.48	198
104.09	197.739	105.82	197	106.27	196.833	107.29	196.474	107.64	196.354
108.58	196	109	195.6	109.6	195.423	111	195.423	111.7	195.6
112.13	196	114.2	196.671	115.34	197	118.55	197.877	118.99	198
121.05	198.574	123.33	199	123.42	199.001	123.5	199.001	123.54	199.001
123.9	199.003	124.23	199.004	124.61	199.005	126.14	199.011	127.45	199.01
127.51	199.01	130.18	199.02	131.13	199.023	131.75	199.022	131.93	199.022
136.67	199.034	138.19	199.034	142.37	199.028	144.48	199.031	146.18	199.033
147.98	199.03	151.4	199.025	152.23	199.024	153.19	199.023	162.26	199.102
168.85	199.106	176.2	199.054	176.37	199.053	179.61	199.282	179.92	199.303
181.07	199.326	182.68	199.444	185.09	199.554	185.23	199.561	190.14	200
190.33	200.08	192.14	200.106	194.32	200.348	197.51	200.575	198.87	200.608
201.34	200.55	205.59	200.325	205.97	200.323	207.47	200.186	208.18	200.159
208.63	200.138	208.84	200.128	209.03	200.12	209.29	200.117	209.54	200.119
210.38	200.139	210.98	200.174	211.81	200.246	213.46	200.375	218.29	200.752
218.48	200.763	218.67	200.765	219.17	200.789	219.59	200.805	220.25	200.786
223.9	200.72	227.49	200.773	227.81	200.78	230.24	200.911	230.52	200.931
231.19	201	231.74	201.005	232.08	201.007	242.92	201.282	250.3	201.41
251.76	201.387	251.9	201.386	253.2	201.371	255.13	201.441	255.57	201.457
256.04	201.474	256.2	201.479	256.73	201.495	258.39	201.529	263.36	201.693
264.27	201.707	264.32	201.707						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	108.58	.035	112.13	.05

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Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        108.58  112.13                40      40      40             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0  108.23  197.78       F
  112.38  264.32  197.78       F
Right Levee     Station=  198.87      Elevation= 200.608

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           199.80    Element                 Left OB    Channel
Right OB
  Vel Head (m)              0.00    Wt. n-Val.               0.050      0.035
0.050
  W.S. Elev (m)           199.80    Reach Len. (m)           40.00      40.00
40.00
  Crit W.S. (m)           197.01    Flow Area (m2)           97.96      15.11
68.87
  E.G. Slope (m/m)      0.000021    Area (m2)                97.96      15.11
68.87
  Q Total (m3/s)           20.59    Flow (m3/s)               9.73       4.91
5.95
  Top Width (m)           166.69    Top Width (m)            87.35       3.55
75.79
  Vel Total (m/s)           0.11    Avg. Vel. (m/s)           0.10       0.32
0.09
  Max Chl Dpth (m)          4.38    Hydr. Depth (m)           1.12       4.26
0.91
  Conv. Total (m3/s)      4455.0    Conv. (m3/s)           2105.7     1062.1
1287.3
  Length Wtd. (m)          40.00    Wetted Per. (m)          87.93       3.92
76.22
  Min Ch El (m)           195.42    Shear (N/m2)              0.23       0.81
0.19
  Alpha                     2.50    Stream Power (N/m s)      0.02       0.26
0.02
  Frctn Loss (m)                    Cum Volume (1000 m3)     40.27      71.92
34.37
  C & E Loss (m)                    Cum SA (1000 m2)         43.89      23.40
48.16


Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #Regional w red'n


  E.G. Elev (m)           201.10    Element                 Left OB    Channel
Right OB
  Vel Head (m)              0.01    Wt. n-Val.               0.050      0.035
0.050
  W.S. Elev (m)           201.09    Reach Len. (m)           40.00      40.00
40.00
  Crit W.S. (m)           199.38    Flow Area (m2)          212.63      19.69
193.70
  E.G. Slope (m/m)      0.000074    Area (m2)               212.63      19.69
193.70
  Q Total (m3/s)          122.56    Flow (m3/s)              63.45      14.21
44.90
```

Top Width (m)	219.18	Top Width (m)	92.27	3.55	123.35
Vel Total (m/s)	0.29	Avg. Vel. (m/s)	0.30	0.72	0.23
Max Chl Dpth (m)	5.67	Hydr. Depth (m)	2.30	5.55	1.57
Conv. Total (m3/s)	14244.4	Conv. (m3/s)	7373.8	1652.0	5218.7
Length Wtd. (m)	40.00	Wetted Per. (m)	93.13	3.92	123.88
Min Ch El (m)	195.42	Shear (N/m2)	1.66	3.65	1.14
Alpha	1.52	Stream Power (N/m s)	0.49	2.64	0.26
Frctn Loss (m)		Cum Volume (1000 m3)	165.48	173.71	195.80
C & E Loss (m)		Cum SA (1000 m2)	98.68	23.40	124.65

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1715

INPUT
Description: Hum 13-4R. Doughton Road Culvert - 3.54 m W x 2.27 m H x 30 m L Corrugated Metal Pipe Arch Culvert. Drawing by Paul Theil (Dwg No. 8036P-A-17, February 1998) used to code culvert in HEC-RAS format..

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 30
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 146

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.659		17.1	201		18.56	200.215	
19.04	200		20.71	199.079		20.88	199	
58.5	199		58.75	199.001		59.61	199.002	
59.67	199.002		60.49	199.079		61.88	199.001	
62.77	199		62.78	198.999		62.87	198.999	
64.51	198.988		77.88	198.499		79.03	198.456	
80.45	198.394		80.53	198.393		80.55	198.393	
82.71	198.354		101.77	198.004		101.87	198.004	
102.35	198.004		102.49	198.003		103.08	198.003	
103.88	198.003		104.94	198.002		105.2	198.001	
105.36	198.001		105.37	198.001		105.48	198.001	
105.59	198.001		106.17	198		111.07	197.984	
112.06	197.981		112.22	197.981		112.33	197.981	
112.33	197.981		114.49	197.978		114.57	197.978	
114.65	197.978		115.8	197.978		118.45	197.973	
118.88	197.972		119.32	197.973		119.67	197.973	

120.76	197.97	121.29	197.971	125.31	197.974
128.81	197.969	129.56	197.969	129.66	197.969
131.93	197.969	135.28	197.977	135.33	197.977
135.42	197.977	135.86	197.977	136.49	197.98
136.85	197.98	138.97	197.983	140.58	197.983
142.91	197.985	143.34	197.986	144	197.987
148.3	197.988	148.81	197.988	150.8	197.989
151.39	197.989	151.44	197.989	151.49	197.989
152.06	197.99	152.7	197.99	156.88	197.993
158.94	197.995	160.16	197.995	160.52	197.995
163.7	197.998	163.89	197.998	166.05	198
171.66	198.147	174	198.212	174.94	198.277
175.14	198.281	175.27	198.285	175.43	198.29
175.45	198.29	175.57	198.292	181.56	199
181.89	199	188.35	199	188.45	199
189.17	199	189.18	199	189.3	199
189.37	199	189.43	199	190.46	199
190.69	199	196.39	199	199.89	199
200.58	199	201.89	199	202.2	199
202.34	199	205.71	199	205.77	199
206.03	199	207.51	199	207.73	199
208.17	199	209.97	199	211.96	199.213
212.01	199.214	213.13	199.214	220.85	199.754
223.57	199.952	224.34	199.955	224.39	199.955
224.45	199.955	225.21	199.96	227.97	199.964
228.07	199.964	229.26	199.965	230.05	199.967
232.33	199.971	235.53	199.979	235.78	199.979
238.51	199.989	241.24	199.999	241.32	199.999
241.46	199.999	241.56	200	242.02	200.028
242.12	200.031	255.22	200.891	257.31	200.902
257.33	200.902	259.53	200.742	259.59	200.74
260.02	200.761	260.61	200.75	262.62	200.866
263.38	200.931	263.45	200.931		

Upstream Bridge Cross Section Data

Station Elevation Data num= 112

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.734	12.56	201.239	18.71	201	19.16	200.796	20.83	200
22.76	199.053	22.87	199	62.25	199	63.17	199.011	64.63	199.022
66.94	199.001	66.98	199	67.01	199	68.2	198.967	103.48	198
104.09	197.739	105.82	197	106.27	196.833	107.29	196.474	107.64	196.354
108.58	196	109	195.6	109.6	195.423	111	195.423	111.7	195.6
112.13	196	114.2	196.671	115.34	197	118.55	197.877	118.99	198
121.05	198.574	123.33	199	123.42	199.001	123.5	199.001	123.54	199.001
123.9	199.003	124.23	199.004	124.61	199.005	126.14	199.011	127.45	199.01
127.51	199.01	130.18	199.02	131.13	199.023	131.75	199.022	131.93	199.022
136.67	199.034	138.19	199.034	142.37	199.028	144.48	199.031	146.18	199.033
147.98	199.03	151.4	199.025	152.23	199.024	153.19	199.023	162.26	199.102
168.85	199.106	176.2	199.054	176.37	199.053	179.61	199.282	179.92	199.303
181.07	199.326	182.68	199.444	185.09	199.554	185.23	199.561	190.14	200
190.33	200.08	192.14	200.106	194.32	200.348	197.51	200.575	198.87	200.608
201.34	200.55	205.59	200.325	205.97	200.323	207.47	200.186	208.18	200.159
208.63	200.138	208.84	200.128	209.03	200.12	209.29	200.117	209.54	200.119
210.38	200.139	210.98	200.174	211.81	200.246	213.46	200.375	218.29	200.752
218.48	200.763	218.67	200.765	219.17	200.789	219.59	200.805	220.25	200.786
223.9	200.72	227.49	200.773	227.81	200.78	230.24	200.911	230.52	200.931
231.19	201	231.74	201.005	232.08	201.007	242.92	201.282	250.3	201.41
251.76	201.387	251.9	201.386	253.2	201.371	255.13	201.441	255.57	201.457
256.04	201.474	256.2	201.479	256.73	201.495	258.39	201.529	263.36	201.693
264.27	201.707	264.32	201.707						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val

```
       0     .05  108.58    .035  112.13     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
        108.58  112.13           .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0  108.23  197.78       F
  112.38  264.32  197.78       F
Right Levee     Station=  198.87      Elevation= 200.608

Downstream  Deck/Roadway Coordinates
    num=     146
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0 201.659            17.1     201           18.56 200.215
   19.04     200           20.71 199.079           20.88     199
    58.5     199           58.75 199.001           59.61 199.002
   59.67 199.002           60.49 199.079           61.88 199.001
   62.77     199           62.78 198.999           62.87 198.999
   64.51 198.988           77.88 198.499           79.03 198.456
   80.45 198.394           80.53 198.393           80.55 198.393
   82.71 198.354          101.77 198.004          101.87 198.004
  102.35 198.004          102.49 198.003          103.08 198.003
  103.88 198.003          104.94 198.002           105.2 198.001
  105.36 198.001          105.37 198.001          105.48 198.001
  105.59 198.001          106.17     198          111.07 197.984
  112.06 197.981          112.22 197.981          112.33 197.981
  112.33 197.981          114.49 197.978          114.57 197.978
  114.65 197.978           115.8 197.978          118.45 197.973
  118.88 197.972          119.32 197.973          119.67 197.973
  120.76  197.97          121.29 197.971          125.31 197.974
  128.81 197.969          129.56 197.969          129.66 197.969
  131.93 197.969          135.28 197.977          135.33 197.977
  135.42 197.977          135.86 197.977          136.49  197.98
  136.85  197.98          138.97 197.983          140.58 197.983
  142.91 197.985          143.34 197.986             144 197.987
   148.3 197.988          148.81 197.988           150.8 197.989
  151.39 197.989          151.44 197.989          151.49 197.989
  152.06  197.99           152.7  197.99          156.88 197.993
  158.94 197.995          160.16 197.995          160.52 197.995
   163.7 197.998          163.89 197.998          166.05     198
  171.66 198.147             174 198.212          174.94 198.277
  175.14 198.281          175.27 198.285          175.43  198.29
  175.45  198.29          175.57 198.292          181.56     199
  181.89     199          188.35     199          188.45     199
  189.17     199          189.18     199           189.3     199
  189.37     199          189.43     199          190.46     199
  190.69     199          196.39     199          199.89     199
  200.58     199          201.89     199           202.2     199
  202.34     199          205.71     199          205.77     199
  206.03     199          207.51     199          207.73     199
  208.17     199          209.97     199          211.96 199.213
  212.01 199.214          213.13 199.214          220.85 199.754
  223.57 199.952          224.34 199.955          224.39 199.955
  224.45 199.955          225.21  199.96          227.97 199.964
  228.07 199.964          229.26 199.965          230.05 199.967
  232.33 199.971          235.53 199.979          235.78 199.979
  238.51 199.989          241.24 199.999          241.32 199.999
  241.46 199.999          241.56     200          242.02 200.028
  242.12 200.031          255.22 200.891          257.31 200.902
  257.33 200.902          259.53 200.742          259.59  200.74
  260.02 200.761          260.61  200.75          262.62 200.866
  263.38 200.931          263.45 200.931
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Downstream Bridge Cross Section Data
Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.96	4.98	201.796	12.44	201.256	13.15	201.237	13.25	201.233
14.75	201.164	14.84	201.161	15.12	201.157	15.39	201.155	15.62	201.154
15.69	201.151	15.99	201	16.36	200.819	17.96	200	56.42	200
56.75	200.006	57.02	200.008	57.33	200.003	57.62	200	58.14	199.138
58.25	199.189	58.47	199	60.02	198.995	63.55	198.984	63.81	198.985
64	198.985	65.42	198.99	68.25	198.998	68.82	199	72	199.002
72.03	199.002	72.61	199.001	73.78	199.001	75.32	199	75.36	199
80.19	198.767	92.67	198.166	96.3	198	97.51	197.516	98.72	197
99.68	196.606	99.91	196.501	100.61	196.23	100.78	196	101.09	195.65
102	195.4	103	195.4	103.89	195.65	104.2	196	105.92	196.441
106.96	196.581	107.6	196.655	107.9	196.67	111.41	197	111.54	197.014
111.55	197.013	112.49	197.087	113.31	197.14	116.28	197.185	119.01	197.211
119.24	197.207	121.22	197.229	124.15	197.307	124.51	197.35	124.99	197.41
125.11	197.425	127.76	197.44	128.22	197.417	130.42	198	132.06	198.488
133.88	199	134.14	199.003	134.41	199.003	134.45	199.003	137.25	199.032
137.75	199.031	141.77	199.052	141.83	199.052	141.86	199.053	148.67	199.216
150.74	199.224	152.75	199.228	159.58	199.291	160.35	199.297	162.8	199.347
166.55	199.342	166.7	199.342	167.68	199.362	170.27	199.374	170.75	199.383
172.18	199.397	173.54	199.408	175.72	199.407	176.75	199.414	180.91	199.49
186.98	199.604	187.2	199.611	193.04	199.639	200	200	200.45	200.012
202.09	200.042	206.82	200.085	218.03	200.5	221.19	200.617	221.21	200.618
221.33	200.618	221.54	200.615	221.57	200.615	229.4	200.491	229.74	200.48
236.66	200.579	244.75	200.914	250.98	200.952	251.55	200.969	251.75	200.978
251.93	200.979	253.5	201	255.98	201.045	256.93	201.053	257.81	201.067
258.72	201.075	258.93	201.079						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100.78	.035	104.2	.05	133.88	.025

Bank Sta: Left Right Coeff Contr. Expan.
100.78 104.2 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	100.49	197.5	F
104.45	258.93	197.5	F

Right Levee Station= 221.19 Elevation= 200.62

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 Pipe Arch 2.27 3.54
FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG

Culvert Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
5	30	.024	.024	0	.9	1

Upstream Elevation = 195.423
Centerline Station = 110.35
Downstream Elevation = 195.4

Centerline Station = 102.49

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	0.95	Culv Full Len (m)	30.00
# Barrels	1	Culv Vel US (m/s)	0.15
Q Barrel (m3/s)	0.95	Culv Vel DS (m/s)	0.15
E.G. US. (m)	199.80	Culv Inv El Up (m)	195.42
W.S. US. (m)	199.80	Culv Inv El Dn (m)	195.40
E.G. DS (m)	199.80	Culv Frctn Ls (m)	0.00
W.S. DS (m)	199.80	Culv Exit Loss (m)	0.00
Delta EG (m)	0.00	Culv Entr Loss (m)	0.00
Delta WS (m)	0.00	Q Weir (m3/s)	19.64
E.G. IC (m)	198.51	Weir Sta Lft (m)	21.23
E.G. OC (m)	199.80	Weir Sta Rgt (m)	187.93
Culvert Control	Outlet	Weir Submerg	1.00
Culv WS Inlet (m)	197.69	Weir Max Depth (m)	1.83
Culv WS Outlet (m)	197.67	Weir Avg Depth (m)	0.97
Culv Nml Depth (m)		Weir Flow Area (m2)	161.62
Culv Crt Depth (m)	0.28	Min El Weir Flow (m)	197.97

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	2.17	Culv Full Len (m)	30.00
# Barrels	1	Culv Vel US (m/s)	0.35
Q Barrel (m3/s)	2.17	Culv Vel DS (m/s)	0.35
E.G. US. (m)	201.10	Culv Inv El Up (m)	195.42
W.S. US. (m)	201.09	Culv Inv El Dn (m)	195.40
E.G. DS (m)	201.09	Culv Frctn Ls (m)	0.00
W.S. DS (m)	201.08	Culv Exit Loss (m)	0.00
Delta EG (m)	0.01	Culv Entr Loss (m)	0.01
Delta WS (m)	0.01	Q Weir (m3/s)	120.40
E.G. IC (m)	201.09	Weir Sta Lft (m)	16.33
E.G. OC (m)	201.10	Weir Sta Rgt (m)	235.46
Culvert Control	Outlet	Weir Submerg	1.00
Culv WS Inlet (m)	197.69	Weir Max Depth (m)	3.12
Culv WS Outlet (m)	197.67	Weir Avg Depth (m)	1.85
Culv Nml Depth (m)		Weir Flow Area (m2)	405.36
Culv Crt Depth (m)	0.43	Min El Weir Flow (m)	197.97

Warning: The weir over culvert is submerged.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.171

INPUT
Description: Section 46.171 - Doughton Road - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.96	4.98	201.796	12.44	201.256	13.15	201.237	13.25	201.233
14.75	201.164	14.84	201.161	15.12	201.157	15.39	201.155	15.62	201.154
15.69	201.151	15.99	201	16.36	200.819	17.96	200	56.42	200

56.75	200.006	57.02	200.008	57.33	200.003	57.62	200	58.14	199.138
58.25	199.189	58.47	199	60.02	198.995	63.55	198.984	63.81	198.985
64	198.985	65.42	198.99	68.25	198.998	68.82	199	72	199.002
72.03	199.002	72.61	199.001	73.78	199.001	75.32	199	75.36	199
80.19	198.767	92.67	198.166	96.3	198	97.51	197.516	98.72	197
99.68	196.606	99.91	196.501	100.61	196.23	100.78	196	101.09	195.65
102	195.4	103	195.4	103.89	195.65	104.2	196	105.92	196.441
106.96	196.581	107.6	196.655	107.9	196.67	111.41	197	111.54	197.014
111.55	197.013	112.49	197.087	113.31	197.14	116.28	197.185	119.01	197.211
119.24	197.207	121.22	197.229	124.15	197.307	124.51	197.35	124.99	197.41
125.11	197.425	127.76	197.44	128.22	197.417	130.42	198	132.06	198.488
133.88	199	134.14	199.003	134.41	199.003	134.45	199.003	137.25	199.032
137.75	199.031	141.77	199.052	141.83	199.052	141.86	199.053	148.67	199.216
150.74	199.224	152.75	199.228	159.58	199.291	160.35	199.297	162.8	199.347
166.55	199.342	166.7	199.342	167.68	199.362	170.27	199.374	170.75	199.383
172.18	199.397	173.54	199.408	175.72	199.407	176.75	199.414	180.91	199.49
186.98	199.604	187.2	199.611	193.04	199.639	200	200	200.45	200.012
202.09	200.042	206.82	200.085	218.03	200.5	221.19	200.617	221.21	200.618
221.33	200.618	221.54	200.615	221.57	200.615	229.4	200.491	229.74	200.48
236.66	200.579	244.75	200.914	250.98	200.952	251.55	200.969	251.75	200.978
251.93	200.979	253.5	201	255.98	201.045	256.93	201.053	257.81	201.067
258.72	201.075	258.93	201.079						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100.78	.035	104.2	.05	133.88	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
100.78	104.2	20	20	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	100.49	197.5	F
104.45	258.93	197.5	F

Right Levee Station= 221.19 Elevation= 200.62

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.045
W.S. Elev (m)	199.80	Reach Len. (m)	20.00	20.00	20.00
Crit W.S. (m)	197.05	Flow Area (m2)	53.47	14.56	103.52
E.G. Slope (m/m)	0.000013	Area (m2)	53.47	14.56	103.52
Q Total (m3/s)	20.59	Flow (m3/s)	4.42	3.69	12.48
Top Width (m)	138.41	Top Width (m)	43.04	3.42	91.95
Vel Total (m/s)	0.12	Avg. Vel. (m/s)	0.08	0.25	0.12
Max Chl Dpth (m)	4.40	Hydr. Depth (m)	1.24	4.26	1.13
Conv. Total (m3/s)	5677.0	Conv. (m3/s)	1218.0	1018.1	3441.0
Length Wtd. (m)	20.00	Wetted Per. (m)	43.98	3.80	92.28
Min Ch El (m)	195.40	Shear (N/m2)	0.16	0.49	0.14
Alpha	1.51	Stream Power (N/m s)	0.01	0.13	

0.02					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	40.27	65.14	34.37
C & E Loss (m)	0.00	Cum SA (1000 m2)	41.29	23.26	44.80

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.09	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.037
W.S. Elev (m)	201.08	Reach Len. (m)	20.00	20.00	20.00
Crit W.S. (m)	198.40	Flow Area (m2)	152.90	18.95	256.04
E.G. Slope (m/m)	0.000047	Area (m2)	152.90	18.95	256.04
Q Total (m3/s)	122.56	Flow (m3/s)	30.86	10.88	80.82
Top Width (m)	243.10	Top Width (m)	84.95	3.42	154.73
Vel Total (m/s)	0.29	Avg. Vel. (m/s)	0.20	0.57	0.32
Max Chl Dpth (m)	5.68	Hydr. Depth (m)	1.80	5.54	1.65
Conv. Total (m3/s)	17786.0	Conv. (m3/s)	4478.4	1578.9	11728.6
Length Wtd. (m)	20.00	Wetted Per. (m)	86.27	3.80	155.09
Min Ch El (m)	195.40	Shear (N/m2)	0.83	2.32	0.77
Alpha	1.28	Stream Power (N/m s)	0.17	1.33	0.24
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	165.48	157.18	195.80
C & E Loss (m)	0.00	Cum SA (1000 m2)	95.14	23.26	119.09

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.17

INPUT
Description: Section 46.17 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 116

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.688	1.92	202.495	4.4	202.266	4.48	202.251	4.75	202.184
4.79	202.176	6.6	202	12.45	201.979	17.91	201.166	18.18	201.154
19.37	201.103	21.4	201	23.54	200.628	24.48	200.486	25.02	200.437

```
   25.18  200.42   27.13 200.345   28.69 200.283   51.47 200.233   52.85 200.015
    52.9 200.016   53.01 200.016   53.18 200.017    53.5 200.019   53.65 200.018
   55.08     200   55.93 199.504   57.96     199   58.81 198.999   60.02 198.998
   60.13 198.998   60.21 198.998   60.95     199   66.84 199.005   72.96 199.008
   73.69 199.009    73.9 199.009    74.3 199.009   84.33 199.001   84.69     199
   87.85 198.724    88.8  198.65   91.93 198.411   92.06 198.399   92.24 198.395
    94.4 198.329   97.14 198.228  101.19     198   104.3 197.667  105.19 197.601
  106.64 197.457  107.07 197.401  107.61  197.33  109.57 197.016  109.72     197
   111.4 196.518  112.75 196.275  112.89 196.246     114     196  115.21 195.596
  116.81 195.074  118.88 195.516  119.22  195.58     121  195.98  121.83     196
  122.59 196.161  122.66 196.178  126.09     197  126.52 197.207  127.48 197.726
  128.12     198  128.84 198.316  128.95 198.391  130.41     199  131.35 199.029
  131.66 199.042  131.84 199.047  145.77 199.679  145.82  199.68  148.15 199.686
  148.22 199.687  150.32 199.708  150.42 199.708  155.89 199.771  163.77 199.844
   166.6  199.87  172.77 199.998  172.98     200  173.86     200  177.76 200.001
  180.71 200.001  182.41 200.001  187.06     200  189.66     200  190.48     200
  191.66 199.999  192.68     200  193.35     200  195.14 200.052  210.59 200.774
  213.61 200.883  216.46 200.997  216.77 200.998   216.8     201  218.28  201.01
  220.35 201.021  223.37 201.004  223.38 201.003  223.46 201.003  223.87 201.001
     224 201.001   224.1 201.001  224.26 201.001  247.41 201.031  254.26 201.314
  261.99 201.319

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05     114    .035  121.83     .05  130.41    .025

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           114  121.83               25      25      25             .1       .3
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
     224  254.26     204

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           199.80    Element                 Left OB    Channel
Right OB
  Vel Head (m)              0.00    Wt. n-Val.               0.050      0.035
0.046
  W.S. Elev (m)           199.80    Reach Len. (m)           25.00      25.00
25.00
  Crit W.S. (m)                     Flow Area (m2)           78.43      33.06
29.72
  E.G. Slope (m/m)      0.000016    Area (m2)                78.43      33.06
29.72
  Q Total (m3/s)            20.59   Flow (m3/s)               7.48       9.53
3.58
  Top Width (m)           103.45    Top Width (m)            58.57       7.83
37.04
  Vel Total (m/s)           0.15    Avg. Vel. (m/s)           0.10       0.29
0.12
  Max Chl Dpth (m)          4.72    Hydr. Depth (m)           1.34       4.22
0.80
  Conv. Total (m3/s)      5225.2    Conv. (m3/s)             1897.9     2417.7
909.5
  Length Wtd. (m)           25.00   Wetted Per. (m)          58.93       8.08
37.62
  Min Ch El (m)           195.07    Shear (N/m2)              0.20       0.62
0.12
  Alpha                     2.08    Stream Power (N/m s)      0.02       0.18
0.01
  Frctn Loss (m)            0.00    Cum Volume (1000 m3)     38.95      64.66
33.04
```

C & E Loss (m)	0.00	Cum SA (1000 m2)	40.27	23.15 43.51

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.09	Element	Left OB	Channel Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035 0.032
W.S. Elev (m)	201.08	Reach Len. (m)	25.00	25.00 25.00
Crit W.S. (m)		Flow Area (m2)	179.99	43.06 129.50
E.G. Slope (m/m)	0.000069	Area (m2)	179.99	43.06 129.50
Q Total (m3/s)	122.56	Flow (m3/s)	45.88	31.16 45.52
Top Width (m)	204.08	Top Width (m)	94.08	7.83 102.17
Vel Total (m/s)	0.35	Avg. Vel. (m/s)	0.25	0.72 0.35
Max Chl Dpth (m)	6.00	Hydr. Depth (m)	1.91	5.50 1.27
Conv. Total (m3/s)	14769.6	Conv. (m3/s)	5529.1	3754.9 5485.6
Length Wtd. (m)	25.00	Wetted Per. (m)	94.56	8.08 102.85
Min Ch El (m)	195.07	Shear (N/m2)	1.29	3.60 0.85
Alpha	1.68	Stream Power (N/m s)	0.33	2.61 0.30
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	162.15	156.56 191.95
C & E Loss (m)	0.00	Cum SA (1000 m2)	93.35	23.15 116.52

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: RIVER-1
REACH: Reach-1 RS: 46.162

INPUT
Description: Section 46.162 - Private Roadway - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 109

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.192	1.24	201.169	3.79	201.018	4.16	201	4.19	201
4.59	201	4.76	201	7.68	200.999	11.04	200.998	13.8	200.998
16.96	200.999	17.05	200.985	18.41	200.657	20.17	200.244	20.23	200.243

23.96	200	24.33	200	24.56	200	24.59	200	24.88	200
26.07	200.001	26.81	200.001	26.89	200.001	27.42	200.001	28.48	200.001
30.58	200.002	32.04	200.002	32.36	200.002	32.54	200.002	32.61	200.002
32.89	200.003	34.51	199.895	34.73	199.893	44.5	199.802	46.83	199.776
54.07	199.447	58.78	199.43	64.92	199.322	69.2	199.246	76.37	199.103
81.58	199.008	81.84	199	87.1	198.433	90.24	198	91.32	197.577
93.35	197	93.64	196.919	94.7	196.457	95.67	196.041	95.77	196
95.88	195.96	97	195.074	98.92	195.074	100.12	195.765	100.4	196
101.1	196.258	101.63	196.43	103.42	197	104.06	197.319	105.45	198
106.48	198.488	107.42	199	110.59	199.341	122.09	199.985	122.25	199.995
122.4	200	122.41	200	122.46	200	122.47	200	122.58	200
123.04	200	129.01	200	130.19	200	140.85	200	144.86	200
145.37	200	145.55	200	145.59	200	148.08	200	150.4	200
151.72	200.029	154.44	200.045	164.08	200.101	179.01	200.467	180.22	200.507
181.74	200.559	183.87	200.633	184.02	200.638	184.28	200.645	187.85	200.734
192.91	200.868	197.74	201	200.12	201.06	203.17	201.141	203.19	201.141
203.79	201.145	209.64	201.071	209.78	201.07	219.82	201.072	226.92	201.085
234.49	201.039	242.9	201.219	248.47	201.125	248.56	201.126	248.94	201.13
253.08	201.56	254.15	201.702	256.45	201.992	256.6	202		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	95.77	.035	100.4	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
95.77	100.4	30	30	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	96	198.8	F
100	256.6	198.8	F

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
154.44	183.87	204	209.64	248.47	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.80	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (m)	199.79	Reach Len. (m)	30.00	30.00
30.00				
Crit W.S. (m)	196.65	Flow Area (m2)	41.88	20.60
20.89				
E.G. Slope (m/m)	0.000060	Area (m2)	41.88	20.60
20.89				
Q Total (m3/s)	20.59	Flow (m3/s)	5.72	11.40
3.46				
Top Width (m)	73.08	Top Width (m)	50.24	4.63
18.21				
Vel Total (m/s)	0.25	Avg. Vel. (m/s)	0.14	0.55
0.17				
Max Chl Dpth (m)	4.72	Hydr. Depth (m)	0.83	4.45
1.15				
Conv. Total (m3/s)	2655.0	Conv. (m3/s)	737.6	1470.6
446.8				
Length Wtd. (m)	30.00	Wetted Per. (m)	50.67	5.22
18.88				
Min Ch El (m)	195.07	Shear (N/m2)	0.49	2.33
0.65				
Alpha	2.94	Stream Power (N/m s)	0.07	1.29
0.11				

Frctn Loss (m)		Cum Volume (1000 m3)	37.44	63.99
32.41				
C & E Loss (m)		Cum SA (1000 m2)	38.91	22.99
42.82				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.08	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (m)	201.05	Reach Len. (m)	30.00	30.00
30.00				
Crit W.S. (m)	198.81	Flow Area (m2)	135.12	26.43
85.01				
E.G. Slope (m/m)	0.000245	Area (m2)	135.12	26.43
85.01				
Q Total (m3/s)	122.56	Flow (m3/s)	54.28	34.89
33.39				
Top Width (m)	167.01	Top Width (m)	92.51	4.63
69.87				
Vel Total (m/s)	0.50	Avg. Vel. (m/s)	0.40	1.32
0.39				
Max Chl Dpth (m)	5.98	Hydr. Depth (m)	1.46	5.71
1.22				
Conv. Total (m3/s)	7825.2	Conv. (m3/s)	3465.7	2227.8
2131.7				
Length Wtd. (m)	30.00	Wetted Per. (m)	93.05	5.22
71.97				
Min Ch El (m)	195.07	Shear (N/m2)	3.49	12.19
2.84				
Alpha	2.47	Stream Power (N/m s)	1.40	16.10
1.12				
Frctn Loss (m)		Cum Volume (1000 m3)	158.21	155.69
189.26				
C & E Loss (m)		Cum SA (1000 m2)	91.01	22.99
114.37				

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1615

INPUT
Description: Hum 13-KK. Paradise Convention Centre Culvert - 3.23 m W x 2.1 m H x 20 m L Corrugated Metal Pipe Arch Culvert. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5

Deck/Roadway Width = 20
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 126

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.017		9.94	201		10.9	201	
11.2	200.998		11.24	200.998		11.49	200.997	
11.55	200.996		11.63	200.996		11.72	200.995	
11.81	200.995		12.69	200.991		13.63	200.995	
13.69	200.995		13.79	200.995		13.91	200.995	
14.12	200.995		14.43	200.995		15.32	200.994	
16.77	200.993		17.25	200.993		17.58	200.992	
17.88	200.988		18.13	200.991		18.74	201	
19.67	201		20.75	201		22.23	201	
22.68	201		23	201		25.78	200.523	
29.88	200		30.35	200		30.39	200	
30.42	200		30.46	200		30.91	200	
31.74	200		31.8	200		31.81	200	
32.21	199.978		32.38	199.976		37.76	199.901	
45.3	199.796		45.48	199.793		46.6	199.774	
47.47	199.76		48.2	199.747		48.73	199.737	
52.37	199.712		62.24	199.953		80.06	199.792	
80.14	199.784		82.52	199.86		83.52	199.767	
86.47	199.141		86.75	199.129		86.83	199.126	
86.88	199.126		87.13	199.124		87.38	199.123	
92.32	199.013		93.07	199.015		93.82	199.013	
94.29	199.014		95.15	199.016		97.02	199.018	
99.48	199.024		101.85	199.025		101.94	199.025	
102.27	199.026		102.57	199.026		108.65	199.546	
109.85	199.579		110.34	199.599		111.74	199.692	
113.68	199.827		113.8	199.834		114.21	199.865	
114.64	199.898		115.6	200		115.65	200	
115.87	200		115.88	200		116.22	200	
133.27	200.001		141.62	200.001		151.28	200	
152.5	200		152.57	200		152.67	200	
153.56	200.001		154.38	200		157.21	200.062	
161.12	200.085		198.43	201		198.44	201	
198.44	201		198.46	201		198.85	201.004	
198.89	201.004		199.24	201.005		201.34	201.009	
203.5	201.021		204.2	201.024		204.77	201.027	
206.84	201.024		207.23	201.023		207.31	201.023	
207.75	201.023		208.37	201.022		211.58	201.02	
227.39	201.113		228.72	201.124		234.54	201.088	
245.86	201		245.92	201		245.93	201	
245.97	201		247.18	201		247.71	201	
247.87	201		248.82	201.063		250.46	201.201	
257.76	202		258.46	202.763		258.74	203	

Upstream Bridge Cross Section Data
Station Elevation Data num= 109

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.192	1.24	201.169	3.79	201.018	4.16	201	4.19	201
4.59	201	4.76	201	7.68	200.999	11.04	200.998	13.8	200.998
16.96	200.999	17.05	200.985	18.41	200.657	20.17	200.244	20.23	200.243
23.96	200	24.33	200	24.56	200	24.59	200	24.88	200
26.07	200.001	26.81	200.001	26.89	200.001	27.42	200.001	28.48	200.001
30.58	200.002	32.04	200.002	32.36	200.002	32.54	200.002	32.61	200.002
32.89	200.003	34.51	199.895	34.73	199.893	44.5	199.802	46.83	199.776
54.07	199.447	58.78	199.43	64.92	199.322	69.2	199.246	76.37	199.103
81.58	199.008	81.84	199	87.1	198.433	90.24	198	91.32	197.577
93.35	197	93.64	196.919	94.7	196.457	95.67	196.041	95.77	196
95.88	195.96	97	195.074	98.92	195.074	100.12	195.765	100.4	196
101.1	196.258	101.63	196.43	103.42	197	104.06	197.319	105.45	198

106.48	198.488	107.42	199	110.59	199.341	122.09	199.985	122.25	199.995
122.4	200	122.41	200	122.46	200	122.47	200	122.58	200
123.04	200	129.01	200	130.19	200	140.85	200	144.86	200
145.37	200	145.55	200	145.59	200	148.08	200	150.4	200
151.72	200.029	154.44	200.045	164.08	200.101	179.01	200.467	180.22	200.507
181.74	200.559	183.87	200.633	184.02	200.638	184.28	200.645	187.85	200.734
192.91	200.868	197.74	201	200.12	201.06	203.17	201.141	203.19	201.141
203.79	201.145	209.64	201.071	209.78	201.07	219.82	201.072	226.92	201.085
234.49	201.039	242.9	201.219	248.47	201.125	248.56	201.126	248.94	201.13
253.08	201.56	254.15	201.702	256.45	201.992	256.6	202		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	95.77	.035	100.4	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
95.77	100.4	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	96	198.8	F
100	256.6	198.8	F

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
154.44	183.87	204	209.64	248.47	204

Downstream Deck/Roadway Coordinates num= 126

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.017		9.94	201		10.9	201	
11.2	200.998		11.24	200.998		11.49	200.997	
11.55	200.996		11.63	200.996		11.72	200.995	
11.81	200.995		12.69	200.991		13.63	200.995	
13.69	200.995		13.79	200.995		13.91	200.995	
14.12	200.995		14.43	200.995		15.32	200.994	
16.77	200.993		17.25	200.993		17.58	200.992	
17.88	200.988		18.13	200.991		18.74	201	
19.67	201		20.75	201		22.23	201	
22.68	201		23	201		25.78	200.523	
29.88	200		30.35	200		30.39	200	
30.42	200		30.46	200		30.91	200	
31.74	200		31.8	200		31.81	200	
32.21	199.978		32.38	199.976		37.76	199.901	
45.3	199.796		45.48	199.793		46.6	199.774	
47.47	199.76		48.2	199.747		48.73	199.737	
52.37	199.712		62.24	199.953		80.06	199.792	
80.14	199.784		82.52	199.86		83.52	199.767	
86.47	199.141		86.75	199.129		86.83	199.126	
86.88	199.126		87.13	199.124		87.38	199.123	
92.32	199.013		93.07	199.015		93.82	199.013	
94.29	199.014		95.15	199.016		97.02	199.018	
99.48	199.024		101.85	199.025		101.94	199.025	
102.27	199.026		102.57	199.026		108.65	199.546	
109.85	199.579		110.34	199.599		111.74	199.692	
113.68	199.827		113.8	199.834		114.21	199.865	
114.64	199.898		115.6	200		115.65	200	
115.87	200		115.88	200		116.22	200	
133.27	200.001		141.62	200.001		151.28	200	
152.5	200		152.57	200		152.67	200	
153.56	200.001		154.38	200		157.21	200.062	
161.12	200.085		198.43	201		198.44	201	
198.44	201		198.46	201		198.85	201.004	
198.89	201.004		199.24	201.005		201.34	201.009	
203.5	201.021		204.2	201.024		204.77	201.027	

206.84	201.024	207.23	201.023	207.31	201.023
207.75	201.023	208.37	201.022	211.58	201.02
227.39	201.113	228.72	201.124	234.54	201.088
245.86	201	245.92	201	245.93	201
245.97	201	247.18	201	247.71	201
247.87	201	248.82	201.063	250.46	201.201
257.76	202	258.46	202.763	258.74	203

Downstream Bridge Cross Section Data
Station Elevation Data num= 97

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.234	6.98	201.333	9.75	201.336	9.77	201.336	17.8	201.001
17.86	201.001	18.1	201.001	19.36	201.001	20.8	201.001	25.37	201
25.69	201	26.12	201	29.2	201	35.72	200.103	36.41	200
36.94	199.99	50.43	199.898	66.47	200.295	73.43	200.347	83.13	199.309
84.14	199	88.09	198.41	90.41	198	91.93	197.362	92.38	197.153
92.68	197	92.7	196.996	92.92	196.907	94.09	196.435	94.82	196.155
94.98	196.097	95.34	196	95.45	195.993	95.5	195.993	95.57	195.99
95.6	195.99	95.68	195.987	95.95	195.983	96.08	195.977	96.09	195.977
96.4	195.5	97.3	195.055	98.25	195.055	98.61	195.055	99.49	195.4
100.35	196	100.36	196.016	100.39	196.018	100.4	196.019	101.12	196.161
101.26	196.181	101.4	196.224	101.65	196.305	102.38	196.618	102.6	196.702
103.35	197	103.53	197.076	104.33	197.5	105.15	198	105.7	198.366
106.74	199	112.96	199.847	113.59	200.124	114.14	200	115.59	200
121.06	200	128.26	200.001	134.61	200.001	134.71	200.001	134.82	200.001
140.07	200.001	142.39	200.001	148.34	200.001	158.18	200.001	158.9	200.001
160.19	200	160.29	200	163.09	200.057	163.77	200.072	188.65	200.623
188.78	200.626	191.1	200.678	193.84	200.742	203.22	200.935	204.53	200.978
204.69	200.98	205.35	201	205.36	201	205.87	201	205.94	201
205.95	201	210.51	200.999	213.45	201	228.33	201.138	239.76	201.423
255.77	201.644	259.74	202						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	95.34	.035	100.35	.05

Bank Sta: Left Right Coeff Contr. Expan.
95.34 100.35 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	96	198.8	F
100	259.74	198.8	F

Left Levee Station= 73.43 Elevation= 200.35
Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
112.96	193.84	204	213.45	255.77	204

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 = 199
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 Pipe Arch 2.1 3.23
FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef

```
Exit Loss Coef
                5      20     .024     .024        0                    .9
      1
Upstream   Elevation =  195.074
           Centerline Station =  98
Downstream Elevation =  195.055
           Centerline Station =  98
```

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	3.51	Culv Full Len (m)	20.00
# Barrels	1	Culv Vel US (m/s)	0.67
Q Barrel (m3/s)	3.51	Culv Vel DS (m/s)	0.67
E.G. US. (m)	199.80	Culv Inv El Up (m)	195.07
W.S. US. (m)	199.79	Culv Inv El Dn (m)	195.05
E.G. DS (m)	199.76	Culv Frctn Ls (m)	0.01
W.S. DS (m)	199.75	Culv Exit Loss (m)	0.01
Delta EG (m)	0.04	Culv Entr Loss (m)	0.02
Delta WS (m)	0.04	Q Weir (m3/s)	17.08
E.G. IC (m)	198.77	Weir Sta Lft (m)	45.02
E.G. OC (m)	199.80	Weir Sta Rgt (m)	113.29
Culvert Control	Outlet	Weir Submerg	0.91
Culv WS Inlet (m)	197.17	Weir Max Depth (m)	0.79
Culv WS Outlet (m)	197.16	Weir Avg Depth (m)	0.41
Culv Nml Depth (m)		Weir Flow Area (m2)	17.62
Culv Crt Depth (m)	0.59	Min El Weir Flow (m)	199.02

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	1.98	Culv Full Len (m)	20.00
# Barrels	1	Culv Vel US (m/s)	0.38
Q Barrel (m3/s)	1.98	Culv Vel DS (m/s)	0.38
E.G. US. (m)	201.08	Culv Inv El Up (m)	195.07
W.S. US. (m)	201.05	Culv Inv El Dn (m)	195.05
E.G. DS (m)	201.07	Culv Frctn Ls (m)	0.00
W.S. DS (m)	200.99	Culv Exit Loss (m)	0.00
Delta EG (m)	0.01	Culv Entr Loss (m)	0.01
Delta WS (m)	0.06	Q Weir (m3/s)	118.27
E.G. IC (m)	201.07	Weir Sta Lft (m)	2.73
E.G. OC (m)	201.08	Weir Sta Rgt (m)	209.64
Culvert Control	Outlet	Weir Submerg	0.98
Culv WS Inlet (m)	197.17	Weir Max Depth (m)	2.07
Culv WS Outlet (m)	197.16	Weir Avg Depth (m)	1.03
Culv Nml Depth (m)		Weir Flow Area (m2)	175.13
Culv Crt Depth (m)	0.43	Min El Weir Flow (m)	199.02

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.161

INPUT
Description: Section 46.161 - Private Roadway - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 97

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.234	6.98	201.333	9.75	201.336	9.77	201.336	17.8	201.001
17.86	201.001	18.1	201.001	19.36	201.001	20.8	201.001	25.37	201
25.69	201	26.12	201	29.2	201	35.72	200.103	36.41	200
36.94	199.99	50.43	199.898	66.47	200.295	73.43	200.347	83.13	199.309
84.14	199	88.09	198.41	90.41	198	91.93	197.362	92.38	197.153
92.68	197	92.7	196.996	92.92	196.907	94.09	196.435	94.82	196.155
94.98	196.097	95.34	196	95.45	195.993	95.5	195.993	95.57	195.99
95.6	195.99	95.68	195.987	95.95	195.983	96.08	195.977	96.09	195.977
96.4	195.5	97.3	195.055	98.25	195.055	98.61	195.055	99.49	195.4
100.35	196	100.36	196.016	100.39	196.018	100.4	196.019	101.12	196.161
101.26	196.181	101.4	196.224	101.65	196.305	102.38	196.618	102.6	196.702
103.35	197	103.53	197.076	104.33	197.5	105.15	198	105.7	198.366
106.74	199	112.96	199.847	113.59	200.124	114.14	200	115.59	200
121.06	200	128.26	200.001	134.61	200.001	134.71	200.001	134.82	200.001
140.07	200.001	142.39	200.001	148.34	200.001	158.18	200.001	158.9	200.001
160.19	200	160.29	200	163.09	200.057	163.77	200.072	188.65	200.623
188.78	200.626	191.1	200.678	193.84	200.742	203.22	200.935	204.53	200.978
204.69	200.98	205.35	201	205.36	201	205.87	201	205.94	201
205.95	201	210.51	200.999	213.45	201	228.33	201.138	239.76	201.423
255.77	201.644	259.74	202						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	95.34	.035	100.35	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
95.34	100.35	115	115	110	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	96	198.8	F
100	259.74	198.8	F

Left Levee Station= 73.43 Elevation= 200.35
Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
112.96	193.84	204	213.45	255.77	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.76	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.75	Reach Len. (m)	115.00	115.00	110.00
Crit W.S. (m)	196.68	Flow Area (m2)	22.94	21.69	18.04
E.G. Slope (m/m)	0.000066	Area (m2)	22.94	21.69	18.04
Q Total (m3/s)	20.59	Flow (m3/s)	4.56	12.33	3.70
Top Width (m)	33.18	Top Width (m)	16.30	5.01	11.87
Vel Total (m/s)	0.33	Avg. Vel. (m/s)	0.20	0.57	0.21
Max Chl Dpth (m)	4.69	Hydr. Depth (m)	1.41	4.33	1.52
Conv. Total (m3/s)	2543.9	Conv. (m3/s)	563.8	1523.0	

457.0					
Length Wtd. (m)	114.24	Wetted Per. (m)	16.84	5.63	12.65
Min Ch El (m)	195.05	Shear (N/m2)	0.87	2.48	0.92
Alpha	1.94	Stream Power (N/m s)	0.17	1.41	0.19
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	37.44	63.00	32.41
C & E Loss (m)	0.00	Cum SA (1000 m2)	37.91	22.85	42.37

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.07	Element	Left OB	Channel	Right OB
Vel Head (m)	0.08	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	200.99	Reach Len. (m)	115.00	115.00	110.00
Crit W.S. (m)	198.80	Flow Area (m2)	85.42	27.90	35.07
E.G. Slope (m/m)	0.000494	Area (m2)	85.42	27.90	35.07
Q Total (m3/s)	122.56	Flow (m3/s)	44.76	51.49	26.31
Top Width (m)	94.74	Top Width (m)	66.04	5.01	23.68
Vel Total (m/s)	0.83	Avg. Vel. (m/s)	0.52	1.85	0.75
Max Chl Dpth (m)	5.93	Hydr. Depth (m)	1.29	5.57	1.48
Conv. Total (m3/s)	5517.0	Conv. (m3/s)	2014.8	2317.8	1184.4
Length Wtd. (m)	113.39	Wetted Per. (m)	66.70	5.63	25.86
Min Ch El (m)	195.05	Shear (N/m2)	6.20	24.00	6.56
Alpha	2.42	Stream Power (N/m s)	3.25	44.28	4.92
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	158.21	149.95	189.26
C & E Loss (m)	0.03	Cum SA (1000 m2)	88.64	22.85	112.97

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.15

INPUT
Description: Section 46.15 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 127

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.186	1.5	202.211	3.88	202.172	12.6	202	18.62	201.651
19.7	201.593	24.97	201.562	31.47	201.499	34.76	201.41	37.06	201.349
38.71	201.307	40.01	201.275	46.43	201.234	53.66	201.182	63.04	201.024
64.83	201	71.77	201	81.8	201.001	98.39	201	98.42	201
98.43	201	98.62	201	99	201	99.33	201	102.54	201
105.72	201	107.82	201	116.56	201	116.8	201	116.89	201
117.43	201	120.19	201	129	201.384	129.41	201.366	129.47	201.361
130.32	201.338	132.46	201.25	145.66	201.39	149.94	201.365	150.29	201.371
150.32	201.371	150.34	201.37	165.5	201.241	174.71	201.093	174.73	201.093
178.62	201.002	178.71	201	179.11	200.997	180.09	200.997	180.29	200.997
182.91	200.994	183.59	200.992	187.46	200.99	189.73	200.989	193.41	200.986
196.61	200.981	201.38	200.993	202.28	200.998	202.8	201	202.82	201.001
204.7	201.012	204.87	201.012	207.02	201	215.88	200.597	217.98	200.503
229.1	200	239.57	200	240.14	200	240.35	200	240.69	200
241.46	200.001	244.02	200.003	244.52	200.003	247.88	200	252.68	199.697
253.79	199.631	254.22	199.606	254.25	199.604	254.45	199.589	254.57	199.581
254.58	199.58	257.09	199.519	293.77	199	311.44	198.052	312.46	198
313.91	197.526	315.84	197	316.71	196.647	317.76	196	318.28	195.859
320.41	195.022	323.03	195.56	324.63	196	325.3	196.405	326.37	197
327.54	197.629	328.2	198	330.14	198.631	330.95	199	332.88	199.124
334.89	199.177	336.12	199.217	343.97	199.5	348.81	199.629	349.11	199.635
350.43	199.664	351.55	199.685	352.86	199.711	358.34	199.849	358.57	199.852
363.52	199.98	371.23	199.957	379.73	199.99	380.54	199.992	381.05	199.993
381.68	199.994	381.77	199.994	381.97	199.994	381.98	199.994	382.55	199.994
383.23	199.994	383.28	199.994	383.63	199.994	388.93	199.98	393.62	199.989
395.11	199.992	396.07	199.992						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	293.77	.08	317.76	.035	324.63	.08	330.95	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
317.76	324.63	50	50	.1	.3

Left Levee Station= 145.66 Elevation= 201.39
Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
38.64	61.59	204	257.09	293.77	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.75	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.061
W.S. Elev (m)	199.74	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	196.48	Flow Area (m2)	37.70	29.14	20.59
E.G. Slope (m/m)	0.000044	Area (m2)	37.70	29.14	20.59
Q Total (m3/s)	20.59	Flow (m3/s)	3.98	14.03	2.58
Top Width (m)	65.42	Top Width (m)	29.11	6.87	29.44
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.11	0.48	0.13
Max Chl Dpth (m)	4.72	Hydr. Depth (m)	1.30	4.24	

0.70					
Conv. Total (m3/s)	3113.9	Conv. (m3/s)	602.0	2122.3	
389.5					
Length Wtd. (m)	50.00	Wetted Per. (m)	30.50	7.16	
30.16					
Min Ch El (m)	195.02	Shear (N/m2)	0.53	1.74	
0.29					
Alpha	2.92	Stream Power (N/m s)	0.06	0.84	
0.04					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	33.96	60.08	
30.28					
C & E Loss (m)	0.00	Cum SA (1000 m2)	35.30	22.16	
40.10					

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.01	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.03	Wt. n-Val.	0.071	0.035	
0.032					
W.S. Elev (m)	200.99	Reach Len. (m)	50.00	50.00	
50.00					
Crit W.S. (m)	198.74	Flow Area (m2)	107.71	37.69	
100.58					
E.G. Slope (m/m)	0.000161	Area (m2)	107.71	37.69	
100.58					
Q Total (m3/s)	122.56	Flow (m3/s)	28.62	41.35	
52.59					
Top Width (m)	156.70	Top Width (m)	78.39	6.87	
71.44					
Vel Total (m/s)	0.50	Avg. Vel. (m/s)	0.27	1.10	
0.52					
Max Chl Dpth (m)	5.96	Hydr. Depth (m)	1.37	5.49	
1.41					
Conv. Total (m3/s)	9655.4	Conv. (m3/s)	2254.7	3257.8	
4142.8					
Length Wtd. (m)	50.00	Wetted Per. (m)	82.30	7.16	
73.15					
Min Ch El (m)	195.02	Shear (N/m2)	2.07	8.32	
2.17					
Alpha	2.18	Stream Power (N/m s)	0.55	9.12	
1.14					
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	147.10	146.18	
181.80					
C & E Loss (m)	0.01	Cum SA (1000 m2)	80.33	22.16	
107.73					

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.
Note: Multiple critical depths were found at this location. The critical depth

with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.142

INPUT
Description: Section 46.142 - Private Roadway - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 54

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.236	12.59	201	21	200.671	22.43	200.623	37.81	200
39.38	200	40.23	200	42.31	200.027	44.55	200.047	44.93	200.051
45.27	200.048	49.43	200	56.95	199.696	56.96	199.695	56.98	199.695
85.47	199.453	94.46	199	96.11	198.897	108.79	198	110.82	197.095
111.08	197	111.27	196.916	113.02	196	115.02	195.28	116.06	195
116.72	194.83	117.13	194.83	117.19	194.83	117.27	194.83	118.2	195
120.05	195.7	120.42	195.827	121	196	123.66	196.903	123.94	197
124.59	197.177	124.93	197.245	126.67	198	128.21	198.693	128.78	199
131.04	199.231	132.73	199.5	140.22	199.865	142.99	200	146.99	200.195
153.53	200.5	153.55	200.5	156.96	200.577	157.48	200.588	173.76	200.995
173.97	201	179.85	201.266	181.95	201.351	185.83	201.5		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	94.46	.08	113.02	.035	121	.08	142.99	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
113.02	121	60	60	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	115.11	199.5	F
119.14	185.83	199.5	F

Left Levee Station= 44.93 Elevation= 200.051
Blocked Obstructions num= 1

Sta L	Sta R	Elev
56.98	96.11	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.75	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	199.74	Reach Len. (m)	60.00	60.00	60.00
Crit W.S. (m)	196.40	Flow Area (m2)	27.82	35.17	21.08
E.G. Slope (m/m)	0.000037	Area (m2)	27.82	35.17	21.08
Q Total (m3/s)	20.59	Flow (m3/s)	2.80	15.95	1.83
Top Width (m)	42.64	Top Width (m)	18.02	7.98	16.65
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.10	0.45	0.09
Max Chl Dpth (m)	4.91	Hydr. Depth (m)	1.54	4.41	1.27
Conv. Total (m3/s)	3380.5	Conv. (m3/s)	460.2	2619.3	301.0

Length Wtd. (m)	60.00	Wetted Per. (m)	19.39	8.35	17.26
Min Ch El (m)	194.83	Shear (N/m2)	0.52	1.53	0.44
Alpha	2.69	Stream Power (N/m s)	0.05	0.69	0.04
Frctn Loss (m)		Cum Volume (1000 m3)	32.32	58.47	29.24
C & E Loss (m)		Cum SA (1000 m2)	34.12	21.79	38.95

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

			Left OB	Channel	Right OB
E.G. Elev (m)	201.00	Element			
Vel Head (m)	0.08	Wt. n-Val.	0.071	0.035	0.069
W.S. Elev (m)	200.91	Reach Len. (m)	60.00	60.00	60.00
Crit W.S. (m)	199.50	Flow Area (m2)	76.41	44.53	56.71
E.G. Slope (m/m)	0.000350	Area (m2)	76.41	44.53	56.71
Q Total (m3/s)	122.56	Flow (m3/s)	28.44	72.59	21.53
Top Width (m)	116.53	Top Width (m)	59.07	7.98	49.48
Vel Total (m/s)	0.69	Avg. Vel. (m/s)	0.37	1.63	0.38
Max Chl Dpth (m)	6.08	Hydr. Depth (m)	1.29	5.58	1.15
Conv. Total (m3/s)	6554.2	Conv. (m3/s)	1521.0	3881.9	1151.2
Length Wtd. (m)	60.00	Wetted Per. (m)	62.81	8.35	50.12
Min Ch El (m)	194.83	Shear (N/m2)	4.17	18.28	3.88
Alpha	3.43	Stream Power (N/m s)	1.55	29.80	1.47
Frctn Loss (m)		Cum Volume (1000 m3)	142.50	144.12	177.87
C & E Loss (m)		Cum SA (1000 m2)	76.89	21.79	104.71

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1415

INPUT
Description: Hum 13-JJ. Private Driveway Culvert - 3.23 m W x 2.1 m H x 52 m L

Corrugated Metal Pipe Arch Culvert. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004
by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 52
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 76

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.501		9.03	201.276		10.69	201.235	
11.93	201.205		15.26	201.124		15.65	201.116	
17.33	201.085		18.3	201.067		21.82	201	
22.59	200.991		22.61	200.991		24.72	200.975	
26.52	200.961		27.55	200.966		33.24	200.845	
34.76	200.824		37.08	200.776		39.72	200.726	
44.95	200.557		45.1	200.554		54.53	200.18	
61.95	200		72.68	199.814		72.97	199.813	
73.26	199.813		73.34	199.813		76.99	199.789	
82.12	199.738		84.44	199.737		86.82	199.742	
87.45	199.733		88.14	199.722		88.29	199.72	
94.48	199.736		95.23	199.732		95.99	199.728	
96.52	199.728		97.04	199.728		97.15	199.728	
97.87	199.727		98.58	199.727		100.35	199.739	
106	199.685		107.51	199.675		109.42	199.671	
109.55	199.67		110.18	199.672		116.42	199.732	
116.58	199.736		116.81	199.741		117.04	199.746	
117.21	199.75		120.07	199.82		125.43	199.969	
126.11	199.987		126.2	199.988		126.71	200	
126.77	200.001		127.26	200.002		127.65	200.002	
133.77	200.118		138.89	200.206		139.11	200.209	
140.01	200.216		140.99	200.224		148.28	200.355	
148.4	200.357		153.83	200.495		154.42	200.496	
154.61	200.497		155.83	200.5		162.15	200.643	
176.54	201		177.09	201.017		191.23	201.5	
191.27	201.5							

Upstream Bridge Cross Section Data
Station Elevation Data num= 54

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.236	12.59	201	21	200.671	22.43	200.623	37.81	200
39.38	200	40.23	200	42.31	200.027	44.55	200.047	44.93	200.051
45.27	200.048	49.43	200	56.95	199.696	56.96	199.695	56.98	199.695
85.47	199.453	94.46	199	96.11	198.897	108.79	198	110.82	197.095
111.08	197	111.27	196.916	113.02	196	115.02	195.28	116.06	195
116.72	194.83	117.13	194.83	117.19	194.83	117.27	194.83	118.2	195
120.05	195.7	120.42	195.827	121	196	123.66	196.903	123.94	197
124.59	197.177	124.93	197.245	126.67	198	128.21	198.693	128.78	199
131.04	199.231	132.73	199.5	140.22	199.865	142.99	200	146.99	200.195
153.53	200.5	153.55	200.5	156.96	200.577	157.48	200.588	173.76	200.995
173.97	201	179.85	201.266	181.95	201.351	185.83	201.5		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	94.46	.08	113.02	.035	121	.08	142.99	.025

Bank Sta: Left	Right	Coeff Contr.	Expan.
113.02	121	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	115.11	199.5	F

119.14 185.83 199.5 F
Left Levee Station= 44.93 Elevation= 200.051
Blocked Obstructions num= 1

Sta L	Sta R	Elev
56.98	96.11	204

Downstream Deck/Roadway Coordinates
num= 76

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.501		9.03	201.276		10.69	201.235	
11.93	201.205		15.26	201.124		15.65	201.116	
17.33	201.085		18.3	201.067		21.82	201	
22.59	200.991		22.61	200.991		24.72	200.975	
26.52	200.961		27.55	200.966		33.24	200.845	
34.76	200.824		37.08	200.776		39.72	200.726	
44.95	200.557		45.1	200.554		54.53	200.18	
61.95	200		72.68	199.814		72.97	199.813	
73.26	199.813		73.34	199.813		76.99	199.789	
82.12	199.738		84.44	199.737		86.82	199.742	
87.45	199.733		88.14	199.722		88.29	199.72	
94.48	199.736		95.23	199.732		95.99	199.728	
96.52	199.728		97.04	199.728		97.15	199.728	
97.87	199.727		98.58	199.727		100.35	199.739	
106	199.685		107.51	199.675		109.42	199.671	
109.55	199.67		110.18	199.672		116.42	199.732	
116.58	199.736		116.81	199.741		117.04	199.746	
117.21	199.75		120.07	199.82		125.43	199.969	
126.11	199.987		126.2	199.988		126.71	200	
126.77	200.001		127.26	200.002		127.65	200.002	
133.77	200.118		138.89	200.206		139.11	200.209	
140.01	200.216		140.99	200.224		148.28	200.355	
148.4	200.357		153.83	200.495		154.42	200.496	
154.61	200.497		155.83	200.5		162.15	200.643	
176.54	201		177.09	201.017		191.23	201.5	
191.27	201.5							

Downstream Bridge Cross Section Data
Station Elevation Data num= 102

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.964	2.43	201.92	2.94	201.91	3.53	201.894	4.38	201.869
5.84	201.802	10.38	201.593	13.97	201.399	14.53	201.37	16.68	201.262
16.97	201.25	18.86	201.161	21.88	201.012	22.13	201.011	23.05	201.004
26.53	201	27.47	200.995	28.29	200.997	28.76	200.997	28.82	200.997
29.15	200.996	33.62	200.993	33.7	200.993	37.58	200.533	37.75	200.516
37.79	200.514	38.56	200.515	42.31	200.545	48.93	200.615	49.07	200.618
50.33	200.646	50.39	200.649	61.33	200.328	70.12	200.012	72.92	200.006
73.26	200.005	73.27	200.005	73.46	200.005	73.47	200.004	78.8	200.01
78.81	200.01	80.68	200	84.14	199.945	85.98	199.929	88.28	199.936
92.02	199.995	93.24	199.991	94.47	199.996	95.37	200	97.6	200.002
98.34	200.002	99.45	200.003	100.7	200.002	101.57	200.001	102.44	200
103.62	199.631	105.8	199	106.7	198.73	108.53	198.229	108.84	198.134
109.24	198	109.55	197.899	109.76	197.822	111.11	197	111.52	196.37
111.75	196	111.95	195.708	112.46	195	117.89	194.823	120.59	194.823
122.27	194.884	125.1	195	126.97	195.253	128.35	195.435	132.42	195.983
132.63	195.986	132.82	196	134.16	196.531	134.6	196.682	135.45	197
135.58	197.071	137.13	198	137.6	198.204	137.71	198.254	139.23	199
140.32	199.45	141.61	200	146.06	200.194	161.96	200.967	165.01	200.972
168.03	200.99	169.39	200.999	169.49	201	169.5	201.001	169.55	201.001
170.18	201.005	170.26	201.005	170.49	201.006	172.16	201.006	179.97	201.133
180.44	201.14	194	201.345						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val

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      0     .05   105.8     .08  112.46    .035   125.1     .08  139.23    .025

Bank Sta: Left   Right    Coeff Contr.   Expan.
        112.46   125.1            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0  116.68     197       F
   120.7     194     197       F
Left Levee      Station=   50.33      Elevation=  200.65

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     Pipe Arch     2.1    3.23
FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                 5      52     .024     .024        0                    .9
      1
Upstream   Elevation =  194.88
           Centerline Station =  117.13
Downstream Elevation =  194.82
           Centerline Station =  118.7

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      20.31    Culv Full Len (m)        52.00
  # Barrels                   1     Culv Vel US (m/s)         3.87
  Q Barrel (m3/s)          20.31    Culv Vel DS (m/s)         3.87
  E.G. US. (m)            199.75    Culv Inv El Up (m)      194.88
  W.S. US. (m)            199.74    Culv Inv El Dn (m)      194.82
  E.G. DS (m)             197.45    Culv Frctn Ls (m)         0.87
  W.S. DS (m)             197.43    Culv Exit Loss (m)        0.75
  Delta EG (m)              2.30    Culv Entr Loss (m)        0.69
  Delta WS (m)              2.31    Q Weir (m3/s)             0.28
  E.G. IC (m)             198.58    Weir Sta Lft (m)         96.11
  E.G. OC (m)             199.75    Weir Sta Rgt (m)        117.14
  Culvert Control         Outlet    Weir Submerg              0.00
  Culv WS Inlet (m)       196.98    Weir Max Depth (m)        0.08
  Culv WS Outlet (m)      196.92    Weir Avg Depth (m)        0.04
  Culv Nml Depth (m)                Weir Flow Area (m2)       0.88
  Culv Crt Depth (m)        1.65    Min El Weir Flow (m)    199.67


Warning: During the culvert inlet control computations, the program could not
balance the culvert/weir flow.  The reported
         inlet energy grade answer may not be valid.

CULVERT OUTPUT  Profile #Regional w red'n  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      19.10    Culv Full Len (m)        52.00
  # Barrels                   1     Culv Vel US (m/s)         3.64
  Q Barrel (m3/s)          19.10    Culv Vel DS (m/s)         3.64
```

E.G. US. (m)	200.99	Culv Inv El Up (m)	194.88
W.S. US. (m)	200.91	Culv Inv El Dn (m)	194.82
E.G. DS (m)	199.10	Culv Frctn Ls (m)	0.77
W.S. DS (m)	198.95	Culv Exit Loss (m)	0.52
Delta EG (m)	1.89	Culv Entr Loss (m)	0.61
Delta WS (m)	1.97	Q Weir (m3/s)	103.46
E.G. IC (m)	200.94	Weir Sta Lft (m)	22.23
E.G. OC (m)	200.99	Weir Sta Rgt (m)	173.77
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	196.98	Weir Max Depth (m)	1.33
Culv WS Outlet (m)	196.92	Weir Avg Depth (m)	0.67
Culv Nml Depth (m)		Weir Flow Area (m2)	75.53
Culv Crt Depth (m)	1.57	Min El Weir Flow (m)	199.67

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.141

INPUT
Description: Section 46.141 - Private Roadway - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 102

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.964	2.43	201.92	2.94	201.91	3.53	201.894	4.38	201.869
5.84	201.802	10.38	201.593	13.97	201.399	14.53	201.37	16.68	201.262
16.97	201.25	18.86	201.161	21.88	201.012	22.13	201.011	23.05	201.004
26.53	201	27.47	200.995	28.29	200.997	28.76	200.997	28.82	200.997
29.15	200.996	33.62	200.993	33.7	200.993	37.58	200.533	37.75	200.516
37.79	200.514	38.56	200.515	42.31	200.545	48.93	200.615	49.07	200.618
50.33	200.646	50.39	200.649	61.33	200.328	70.12	200.012	72.92	200.006
73.26	200.005	73.27	200.005	73.46	200.005	73.47	200.004	78.8	200.01
78.81	200.01	80.68	200	84.14	199.945	85.98	199.929	88.28	199.936
92.02	199.995	93.24	199.991	94.47	199.996	95.37	200	97.6	200.002
98.34	200.002	99.45	200.003	100.7	200.002	101.57	200.001	102.44	200
103.62	199.631	105.8	199	106.7	198.73	108.53	198.229	108.84	198.134
109.24	198	109.55	197.899	109.76	197.822	111.11	197	111.52	196.37
111.75	196	111.95	195.708	112.46	195	117.89	194.823	120.59	194.823
122.27	194.884	125.1	195	126.97	195.253	128.35	195.435	132.42	195.983
132.63	195.986	132.82	196	134.16	196.531	134.6	196.682	135.45	197
135.58	197.071	137.13	198	137.6	198.204	137.71	198.254	139.23	199
140.32	199.45	141.61	200	146.06	200.194	161.96	200.967	165.01	200.972
168.03	200.99	169.39	200.999	169.49	201	169.5	201.001	169.55	201.001
170.18	201.005	170.26	201.005	170.49	201.006	172.16	201.006	179.97	201.133
180.44	201.14	194	201.345						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	105.8	.08	112.46	.035	125.1	.08	139.23	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
112.46	125.1	30	25	20	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116.68	197	F
120.7	194	197	F

Left Levee Station= 50.33 Elevation= 200.65

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	197.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	197.43	Reach Len. (m)	30.00	25.00	20.00
Crit W.S. (m)	196.22	Flow Area (m2)	2.13	32.14	17.40
E.G. Slope (m/m)	0.000104	Area (m2)	2.13	32.14	17.40
Q Total (m3/s)	20.59	Flow (m3/s)	0.20	17.45	2.93
Top Width (m)	25.79	Top Width (m)	2.06	12.64	11.09
Vel Total (m/s)	0.40	Avg. Vel. (m/s)	0.10	0.54	0.17
Max Chl Dpth (m)	2.61	Hydr. Depth (m)	1.03	2.54	1.57
Conv. Total (m3/s)	2017.4	Conv. (m3/s)	20.0	1710.0	287.3
Length Wtd. (m)	24.73	Wetted Per. (m)	3.25	12.65	11.46
Min Ch El (m)	194.82	Shear (N/m2)	0.67	2.60	1.55
Alpha	1.60	Stream Power (N/m s)	0.06	1.41	0.26
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	32.32	57.70	29.24
C & E Loss (m)	0.00	Cum SA (1000 m2)	33.52	21.17	38.11

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	199.10	Element	Left OB	Channel	Right OB
Vel Head (m)	0.15	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	198.95	Reach Len. (m)	30.00	25.00	20.00
Crit W.S. (m)	197.00	Flow Area (m2)	8.15	51.27	36.30
E.G. Slope (m/m)	0.000693	Area (m2)	8.15	51.27	36.30
Q Total (m3/s)	122.56	Flow (m3/s)	2.73	98.06	21.77
Top Width (m)	33.15	Top Width (m)	6.49	12.64	14.02
Vel Total (m/s)	1.28	Avg. Vel. (m/s)	0.33	1.91	0.60
Max Chl Dpth (m)	4.12	Hydr. Depth (m)	1.26	4.06	2.59
Conv. Total (m3/s)	4654.5	Conv. (m3/s)	103.7	3724.1	826.7
Length Wtd. (m)	24.71	Wetted Per. (m)	7.94	12.65	

14.76					
Min Ch El (m)	194.82	Shear (N/m2)	6.98	27.57	
16.72					
Alpha	1.83	Stream Power (N/m s)	2.34	52.73	
10.03					
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	142.50	138.63	
177.87					
C & E Loss (m)	0.03	Cum SA (1000 m2)	74.93	21.17	
102.81					

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.14

INPUT
Description: Section 46.14 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 77

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.098	2.06	202	3.77	201.783	3.8	201.785	6.14	201.803
8.42	201.79	12.49	201.689	12.69	201.684	17.83	201.529	20.79	201.459
33.23	201.049	35.11	201.034	39.84	201.001	39.85	201.001	39.89	201.001
39.92	201.001	39.96	201.001	40.1	201	53.76	200.745	58.1	200.647
58.57	200.638	64.09	200.501	64.12	200.501	64.22	200.5	71.26	200.142
74.41	200	75.87	199.864	77.75	199.81	88.67	199.239	90.92	199.19
94.02	199.106	98.67	199.004	98.73	199.004	98.82	199.004	98.97	199.004
104.41	199	106.38	198.532	109.25	198	111.6	197.01	111.62	197
111.64	196.992	113.27	196.326	114.07	196	114.61	195.85	116.18	195.444
117.28	195	120.38	194.954	124.47	194.898	126.14	194.877	129.68	194.823
133.94	194.919	135.82	194.961	137.74	195	138.12	195.172	139.11	196
139.82	196.864	139.93	197	140.61	197.763	140.81	197.95	140.88	198
141	198.098	142.31	199	145.61	199.973	145.72	200	159.64	200.564
168.75	200.894	180.93	200.961	188.25	200.988	188.75	200.981	190	200.965
190.01	200.965	192.12	200.994	192.14	200.994	192.16	200.994	192.55	201
208.35	201.2341	216.71	201.358						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	104.41	.08	117.28	.035	137.74	.08	142.31	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
117.28	137.74	37.5	37.5	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
145.61	208.35	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	197.44	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	197.44	Reach Len. (m)	37.50	37.50	37.50
Crit W.S. (m)		Flow Area (m2)	8.58	51.63	3.58
E.G. Slope (m/m)	0.000050	Area (m2)	8.58	51.63	3.58
Q Total (m3/s)	20.59	Flow (m3/s)	0.86	19.41	

0.32				
Top Width (m)	29.73	Top Width (m)	6.69	20.46
2.58				
Vel Total (m/s)	0.32	Avg. Vel. (m/s)	0.10	0.38
0.09				
Max Chl Dpth (m)	2.61	Hydr. Depth (m)	1.28	2.52
1.39				
Conv. Total (m3/s)	2899.4	Conv. (m3/s)	121.2	2733.6
44.6				
Length Wtd. (m)	37.50	Wetted Per. (m)	7.13	20.46
3.58				
Min Ch El (m)	194.82	Shear (N/m2)	0.59	1.25
0.49				
Alpha	1.28	Stream Power (N/m s)	0.06	0.47
0.04				
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	32.16	56.66
29.03				
C & E Loss (m)	0.05	Cum SA (1000 m2)	33.39	20.76
37.98				

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	199.06	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.09	Wt. n-Val.	0.080	0.035
0.080				
W.S. Elev (m)	198.97	Reach Len. (m)	37.50	37.50
37.50				
Crit W.S. (m)		Flow Area (m2)	22.93	83.00
8.88				
E.G. Slope (m/m)	0.000346	Area (m2)	22.93	83.00
8.88				
Q Total (m3/s)	122.56	Flow (m3/s)	7.63	112.26
2.66				
Top Width (m)	37.73	Top Width (m)	12.74	20.46
4.53				
Vel Total (m/s)	1.07	Avg. Vel. (m/s)	0.33	1.35
0.30				
Max Chl Dpth (m)	4.15	Hydr. Depth (m)	1.80	4.06
1.96				
Conv. Total (m3/s)	6585.2	Conv. (m3/s)	410.2	6031.9
143.1				
Length Wtd. (m)	37.50	Wetted Per. (m)	13.40	20.46
6.07				
Min Ch El (m)	194.82	Shear (N/m2)	5.81	13.78
4.97				
Alpha	1.48	Stream Power (N/m s)	1.94	18.64
1.49				
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	142.03	136.95
177.42				
C & E Loss (m)	0.05	Cum SA (1000 m2)	74.64	20.76
102.62				

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: RIVER-1
REACH: Reach-1 RS: 46.132

INPUT
Description: Section 46.132 - Private Driveway - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 158

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203.031	4.21	203	6.29	202.04	6.39	202	6.47	201.973
9.02	201	11.19	200.218	11.79	200	11.95	199.995	12.11	199.991
13.73	199.942	14.44	199.957	15.58	200	22.02	200.459	23.3	200.5
23.73	200.501	23.84	200.501	23.88	200.501	24.1	200.505	27.21	200.56
39.78	200.546	43.86	200.559	45.36	200.616	45.59	200.618	46.09	200.615
60.3	200.512	60.52	200.5	67.58	200.314	71.78	200.282	75.54	200.281
75.73	200.287	78.77	200	79.96	199.843	80.54	199.765	86.79	199
91.14	198.248	92.76	198	92.82	197.999	92.88	197.999	93.81	197.998
94.59	197.998	95.38	197.998	96.45	197.998	97.49	197.997	103.13	197.995
104.78	197.997	105.78	197.996	106.85	197.997	107.61	198	112.33	198.851
112.89	199	113.63	199	115.71	199.001	116.33	199.001	118.64	199
119.62	198.642	121.42	198	123.03	197.538	125.2	197.319	125.59	197.265
126.04	197.198	126.29	197.179	126.45	197.149	126.85	197.083	127.29	197.085
127.33	197.08	127.37	197.076	127.89	197.013	129.85	197.011	129.95	197.01
130.35	197.01	132.11	197.014	132.3	197.012	133.91	197.011	134.07	197.009
134.24	197.009	134.44	197.009	134.47	197.009	135.58	197.018	136.75	197.007
136.96	197.005	136.98	197.005	137.16	197.005	137.18	197.005	138.6	197.011
138.83	197.009	139.36	197.005	139.64	197.003	139.73	197	140.03	196.913
140.21	196.887	140.28	196.867	140.33	196.854	140.58	196.76	141.61	196.467
141.72	196.455	143.1	196	143.4	195.948	145.84	195	146.14	194.87
146.23	194.823	146.44	194.865	147.11	195	147.76	195.231	149.57	196
150.75	196.979	150.78	197	150.81	197.022	151.68	198	152.7	198.573
153.48	199	153.61	199.01	158.04	199.446	163.24	199.854	164.21	199.935
164.49	199.957	164.51	199.958	165.41	199.996	165.46	199.999	165.53	200
165.55	200.004	165.69	200.013	165.92	200.013	166.1	200.023	167.24	200.039
167.72	200.033	168.11	200.078	168.16	200.077	168.21	200.076	168.33	200.077
170.66	200.113	172.93	200.103	175.92	200.024	175.95	200.023	177.95	200.045
177.96	200.044	177.97	200.043	177.97	200.042	188.98	200.112	192.6	200.049
195.25	200	195.28	200	196.41	200	197.16	200	197.45	200
197.5	200	200.28	200	201.07	200	201.93	200	202.05	200
213.45	200.076	216.09	200.093	218.17	200.105	219.59	200.114	220.81	200.121
221.65	200.128	222.07	200.132	227.76	200.187				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	139.73	.08	145.84	.035	147.11	.08	151.68	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
145.84	147.11	27.5	27.5	.3	.5

Left Levee Station= 118.64 Elevation= 199

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	197.38	Element	Left OB	Channel	Right OB
Vel Head (m)	0.54	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	196.84	Reach Len. (m)	27.50	27.50	27.50
Crit W.S. (m)	196.84	Flow Area (m2)	4.72	2.45	3.76
E.G. Slope (m/m)	0.010373	Area (m2)	4.72	2.45	3.76
Q Total (m3/s)	20.59	Flow (m3/s)	5.25	10.72	4.62
Top Width (m)	10.22	Top Width (m)	5.47	1.27	3.47
Vel Total (m/s)	1.88	Avg. Vel. (m/s)	1.11	4.38	1.23
Max Chl Dpth (m)	2.02	Hydr. Depth (m)	0.86	1.93	1.08
Conv. Total (m3/s)	202.2	Conv. (m3/s)	51.6	105.2	45.4
Length Wtd. (m)	27.50	Wetted Per. (m)	5.78	1.33	3.97
Min Ch El (m)	194.82	Shear (N/m2)	83.04	187.78	96.36
Alpha	3.00	Stream Power (N/m s)	92.33	822.29	118.32
Frctn Loss (m)	0.06	Cum Volume (1000 m3)	31.91	55.64	28.89
C & E Loss (m)	0.24	Cum SA (1000 m2)	33.16	20.35	37.86

Warning: The energy equation could not be 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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.97	Element	Left OB	Channel	Right OB
Vel Head (m)	0.61	Wt. n-Val.	0.061	0.035	0.080
W.S. Elev (m)	198.35	Reach Len. (m)	27.50	27.50	27.50

Crit W.S. (m)	198.35	Flow Area (m2)	36.11	4.37	10.17
E.G. Slope (m/m)	0.009790	Area (m2)	36.11	4.37	10.17
Q Total (m3/s)	122.56	Flow (m3/s)	76.73	27.32	18.52
Top Width (m)	31.87	Top Width (m)	25.40	1.27	5.19
Vel Total (m/s)	2.42	Avg. Vel. (m/s)	2.12	6.26	1.82
Max Chl Dpth (m)	3.53	Hydr. Depth (m)	1.42	3.44	1.96
Conv. Total (m3/s)	1238.7	Conv. (m3/s)	775.5	276.1	187.1
Length Wtd. (m)	27.50	Wetted Per. (m)	25.90	1.33	6.29
Min Ch El (m)	194.82	Shear (N/m2)	133.89	316.13	155.28
Alpha	2.06	Stream Power (N/m s)	284.46	1978.05	282.66
Frctn Loss (m)	0.07	Cum Volume (1000 m3)	140.93	135.31	177.06
C & E Loss (m)	0.25	Cum SA (1000 m2)	73.92	20.35	102.44

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 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: RIVER-1
REACH: Reach-1 RS: 46.13

INPUT
Description: Section 46.13 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 127

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203.03	.53	203	.96	202.775	2.6	202	4.3	201.009
4.31	201	4.46	200.95	7.15	200	9.26	199.922	13.37	199.838
14.21	199.82	16.49	199.886	21.16	199.987	21.18	200	21.39	200.001
21.4	200.001	21.83	200.002	29.6	200.151	34.56	200.228	35.93	200.238
37.21	200.246	37.34	200.247	39.62	200.26	42.15	200.288	44.35	200.296
46.4	200.303	51.59	200.321	52.9	200.324	54.35	200.328	55.76	200.33

57.13	200.323	58.65	200.312	59.48	200.303	60.41	200.293	60.51	200.291
60.64	200.291	60.78	200.29	60.92	200.29	61.05	200.289	62.88	200.27
65.13	200.241	68.92	200.17	71.75	200.101	75.66	200	75.68	200
76.81	199.771	77.55	199.623	80.95	199	83.24	198.448	85.09	198
86.6	197.995	87.61	197.991	98.22	197.954	101.88	197.965	111.06	198
112.99	198.592	115.45	198.783	118.53	198.292	118.71	198.22	118.81	198.215
119.38	198	122.2	197.044	122.33	197	122.49	196.957	126.05	196
126.98	195.7	127.15	195.657	128.79	195.261	129.74	195.021	129.84	195.018
129.93	195.011	129.96	195.01	130.02	195	131.97	194.859	144.15	194
145.77	193.62	148.15	193	148.36	192.929	148.69	192.82	149.6	192.963
149.87	193	150.14	193.206	150.99	194	151.39	194.702	151.52	195
151.69	195.371	152.08	196	152.24	196.027	152.47	196.039	152.56	196.043
152.62	196.045	152.67	196.044	152.68	196.044	152.79	196.042	152.82	196.041
152.98	196.035	154.35	196.467	155.01	196.685	155.45	196.85	155.58	196.893
155.62	196.908	155.76	196.973	155.82	197	155.89	197.042	157.56	198
161.85	198.688	163.59	199	164.11	199.021	168.85	199.177	171.26	199.182
173.88	199.243	176.15	199.295	177.78	199.33	179.26	199.361	183.65	199.389
188.79	199.423	194.86	199.511	194.9	199.511	201.21	199.575	206.07	199.623
222.21	200	223.15	200.01	223.53	200.01	223.62	200.01	223.66	200.01
224.17	200.01	236.77	200.272						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	119.38	.08	148.15	.035	149.87	.08	157.56	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
148.15	149.87	25	25	.1	.3

Left Levee Station= 115.45 Elevation= 198.783

Blocked Obstructions num= 1

Sta L	Sta R	Elev
171	229	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	195.74	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.06	Wt. n-Val.	0.080	0.035
0.080				
W.S. Elev (m)	195.67	Reach Len. (m)	25.00	25.00
25.00				
Crit W.S. (m)	194.77	Flow Area (m2)	26.30	4.75
3.20				
E.G. Slope (m/m)	0.000918	Area (m2)	26.30	4.75
3.20				
Q Total (m3/s)	20.59	Flow (m3/s)	11.46	7.97
1.17				
Top Width (m)	24.79	Top Width (m)	21.07	1.72
2.01				
Vel Total (m/s)	0.60	Avg. Vel. (m/s)	0.44	1.68
0.36				
Max Chl Dpth (m)	2.85	Hydr. Depth (m)	1.25	2.76
1.59				
Conv. Total (m3/s)	679.6	Conv. (m3/s)	378.2	262.9
38.5				
Length Wtd. (m)	25.00	Wetted Per. (m)	21.31	1.76
3.40				
Min Ch El (m)	192.82	Shear (N/m2)	11.11	24.26
8.48				
Alpha	3.32	Stream Power (N/m s)	4.84	40.67
3.08				
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	31.48	55.54
28.80				

C & E Loss (m)	0.01	Cum SA (1000 m2)	32.80	20.31 37.79

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.50	Element	Left OB	Channel Right OB
Vel Head (m)	0.12	Wt. n-Val.	0.080	0.035 0.080
W.S. Elev (m)	198.38	Reach Len. (m)	25.00	25.00 25.00
Crit W.S. (m)	196.37	Flow Area (m2)	95.68	9.40 18.58
E.G. Slope (m/m)	0.001047	Area (m2)	95.68	9.40 18.58
Q Total (m3/s)	122.56	Flow (m3/s)	84.80	26.54 11.23
Top Width (m)	41.93	Top Width (m)	30.16	1.72 10.05
Vel Total (m/s)	0.99	Avg. Vel. (m/s)	0.89	2.82 0.60
Max Chl Dpth (m)	5.56	Hydr. Depth (m)	3.17	5.47 1.85
Conv. Total (m3/s)	3787.8	Conv. (m3/s)	2620.7	820.1 347.0
Length Wtd. (m)	25.00	Wetted Per. (m)	30.81	1.76 12.08
Min Ch El (m)	192.82	Shear (N/m2)	31.89	54.76 15.79
Alpha	2.34	Stream Power (N/m s)	28.26	154.56 9.54
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	139.11	135.12 176.67
C & E Loss (m)	0.00	Cum SA (1000 m2)	73.16	20.31 102.23

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.122

INPUT
Description: Section 46.122 - Peelar Road - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 153

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203.853	.23	203.855	.93	203.865	1.01	203.866	2.78	203.939
3.03	203.939	3.37	203.951	3.73	203.964	5.01	203.946	5.31	203.936
5.61	203.945	6.98	204	8.21	203.442	9.46	203	9.88	202.784
11.44	202	13.15	201.154	13.44	201	14.01	200.722	15.52	200
17.01	199.481	18.02	199	20.35	198.365	21.48	198.229	22.2	198.229

22.48	198.242	22.55	198.253	23.36	198.361	25.19	198.587
26.16	198.662	26.31	198.67	26.95	198.656	27.03	198.655
28	198.645	29.49	198.666	32.66	198.758	32.85	198.766
33.38	198.788	36.68	199	43.6	199.165	43.64	199.166
44.06	199.173	44.1	199.174	45.22	199.23	45.29	199.233
49.48	199.327	54.88	199.38	58.89	199.448	59.82	199.441
62.67	199.521	66.36	199.453	67.01	199.441	68.92	199.378
69.47	199.357	72.61	199.214	73.37	199.196	73.56	199.181
74.94	199	75.77	198.822	76.04	198.77	77.37	198.575
78.16	198.426	78.34	198.376	78.46	198.351	79.57	198
79.94	197.998	80.59	197.996	83.89	197.984	85.16	197.985
85.23	197.984	85.29	197.984	86.24	197.981	86.6	197.98
86.93	197.981	86.99	197.981	92.12	197.978	92.67	197.975
93.8	197.973	96.51	197.968	109.87	197.327	112.55	197.295
123.04	197.978	123.43	197.979	124.91	197.982	126.71	197.996
126.79	197.996	127.47	198	130.8	198	132.4	198
133.05	198	133.1	198	133.26	198	134.36	198
135.44	198	135.67	198	136.01	198	136.06	198
136.92	198	136.94	198	138.2	197.725	141.43	197
143.11	196.356	143.45	196.246	143.63	196.196	144.35	196
145.45	195.701	148.42	195	151.6	194.377	153.04	194
154.48	193.345	154.54	193.311	155.34	193	155.73	192.919
157.65	192.63	159.49	192.987	159.52	193	159.55	193.013
161.56	194	162.02	194.215	163.58	195	164.59	195.492
165.53	196	165.88	196.23	167.15	197	169.04	197.525
170.01	198	170.48	198.005	171.29	198.01	171.61	198.012
176.33	198.211	181.2	198.381	185.45	198.603	188.51	198.84
190.44	198.995	190.51	199	192.15	199.001	192.24	199.001
192.28	199.001	192.41	199.001	192.81	199.001	194.2	199.001
195.83	199.001	195.94	199.001	196.05	199.001	200.13	199.042
211.06	199.149	222.84	199.423	229.22	199.464	230.38	199.482
231.47	199.497	235.25	199.523	240.57	199.568	242.89	199.629

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	155.34	.035	159.52	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
155.34	159.52	38	38	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	155.42	196.7	F
159.34	242.89	196.7	F

Left Levee Station= 136.92 Elevation= 198

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	195.70	Element	Left OB	Channel	Right OB
Vel Head (m)	0.19	Wt. n-Val.		0.035	
W.S. Elev (m)	195.50	Reach Len. (m)	38.00	38.00	38.00
Crit W.S. (m)	194.21	Flow Area (m2)		10.61	
E.G. Slope (m/m)	0.001248	Area (m2)	9.67	11.27	6.39
Q Total (m3/s)	20.59	Flow (m3/s)		20.59	
Top Width (m)	18.32	Top Width (m)	9.05	4.18	5.09
Vel Total (m/s)	1.94	Avg. Vel. (m/s)		1.94	
Max Chl Dpth (m)	2.87	Hydr. Depth (m)		2.71	
Conv. Total (m3/s)	582.8	Conv. (m3/s)		582.8	
Length Wtd. (m)	38.00	Wetted Per. (m)		3.98	

Min Ch El (m)	192.63	Shear (N/m2)		32.62
Alpha	1.00	Stream Power (N/m s)		63.31
Frctn Loss (m)		Cum Volume (1000 m3)	31.03	55.34
28.68				
C & E Loss (m)		Cum SA (1000 m2)	32.42	20.24
37.70				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.47	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.16	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (m)	198.31	Reach Len. (m)	38.00	38.00
38.00				
Crit W.S. (m)	196.70	Flow Area (m2)	78.09	23.01
30.08				
E.G. Slope (m/m)	0.000790	Area (m2)	78.09	23.01
30.08				
Q Total (m3/s)	122.56	Flow (m3/s)	44.00	57.01
21.55				
Top Width (m)	102.88	Top Width (m)	78.97	4.18
19.73				
Vel Total (m/s)	0.93	Avg. Vel. (m/s)	0.56	2.48
0.72				
Max Chl Dpth (m)	5.68	Hydr. Depth (m)	0.99	5.50
1.52				
Conv. Total (m3/s)	4359.4	Conv. (m3/s)	1564.9	2027.9
766.6				
Length Wtd. (m)	38.00	Wetted Per. (m)	79.79	4.25
20.90				
Min Ch El (m)	192.63	Shear (N/m2)	7.59	42.00
11.15				
Alpha	3.51	Stream Power (N/m s)	4.27	104.06
7.99				
Frctn Loss (m)		Cum Volume (1000 m3)	136.94	134.72
176.06				
C & E Loss (m)		Cum SA (1000 m2)	71.80	20.24
101.86				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1215

INPUT
Description: Hum 13-3R. Peelar Road Culvert - 3.72 m W x 2.35 m H x 30 m L Corrugated Metal Pipe Arch Culvert. No drawings available. Size

estimated from HEC-2 coding.

HEC-2 to HEC-RAS conversion
January 2004 by Acres included recoding of culvert to HEC-RAS format, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 3
Deck/Roadway Width = 30
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 157

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	198.649		1.52	198.401		2.47	198	
2.8	198		2.85	198		3.5	198	
3.74	198		4.59	198		13.86	198	
15.45	198		15.74	198		17.17	198	
18.02	197.999		19.18	197.875		22.99	197.861	
24.53	197.999		28.09	197.999		28.15	197.999	
28.28	197.999		28.43	197.999		28.64	197.999	
29.19	197.999		31.03	197.999		31.34	197.999	
32.15	197.999		32.89	197.999		34.84	197.999	
34.92	197.999		37.18	197.998		37.71	197.998	
38.66	197.998		41.94	197.997		43.56	197.997	
44.75	197.997		45.96	197.997		46.74	197.997	
49.78	197.996		50.07	197.995		52.53	197.995	
54.64	197.995		55.11	197.995		55.42	197.995	
55.76	197.995		57.94	197.995		59.43	197.994	
60.73	197.994		61.45	197.993		62	197.993	
64.12	197.992		64.22	197.992		64.28	197.992	
65.61	197.989		67.27	197.991		68.33	197.991	
71.97	197.999		72.26	198		73.27	198.017	
76.65	198.059		77.23	198.092		78.18	198.119	
80.03	198.063		81.1	198		81.68	197.998	
81.8	197.997		82.79	197.994		83.16	197.992	
83.96	197.989		86.33	197.985		91.22	197.968	
99.31	197.849		99.61	197.847		100.72	197.846	
105.6	197.845		107.24	197.851		115.83	197.928	
117.78	197.909		118.71	197.903		119.04	197.903	
119.4	197.899		121.59	197.885		122.03	197.885	
124.28	197.863		124.74	197.388		125.47	197.26	
125.59	197.264		125.6	197.264		127.02	197.214	
127.16	197.211		127.78	197.201		139.62	197	
140.18	196.992		140.89	196.988		141.46	196.989	
142	196.987		142.75	196.987		143.84	196.986	
143.94	196.986		150.74	196.962		158.29	196.957	
158.39	196.957		160.98	196.955		164.67	196.924	
165.88	196.912		167.31	196.935		168.65	196.948	
168.79	196.948		168.84	196.949		169.49	196.951	
170.16	196.951		171.53	196.952		172.2	196.956	
172.58	196.955		172.76	196.956		172.87	196.955	
172.93	196.955		174	196.962		174.57	196.956	
175.1	196.959		175.75	196.962		178.58	196.956	
180.14	196.971		182.32	196.983		182.65	196.984	
182.82	196.987		183.42	196.997		183.61	197	
186.18	197.165		192.25	197.667		192.7	197.681	
193.37	197.689		193.89	197.919		194.46	197.92	
195.12	197.925		196.24	197.935		198.9	197.945	
202.32	197.938		208.58	197.985		210.37	197.994	
210.52	198		211.83	198.115		211.87	198.116	
222.47	198.877		223.67	198.88		226.51	198.911	
228.79	198.924		230.7	198.93		232.45	198.935	
237.16	198.966		237.24	198.966		237.7	198.968	

238.12	198.971	239.89	198.978	239.96	198.978
240.04	198.979	240.24	198.978	240.47	198.98
240.87	199				

Upstream Bridge Cross Section Data
Station Elevation Data num= 153

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203.853	.23	203.855	.93	203.865	1.01	203.866	2.78	203.939
3.03	203.939	3.37	203.951	3.73	203.964	5.01	203.946	5.31	203.936
5.61	203.945	6.98	204	8.21	203.442	9.46	203	9.88	202.784
11.44	202	13.15	201.154	13.44	201	14.01	200.722	15.52	200
17.01	199.481	18.02	199	20.35	198.365	21.48	198.229	22.2	198.229
22.48	198.242	22.55	198.253	23.36	198.361	25.19	198.587	26.16	198.662
26.31	198.67	26.95	198.656	27.03	198.655	28	198.645	29.49	198.666
32.66	198.758	32.85	198.766	33.38	198.788	36.68	199	43.6	199.165
43.64	199.166	44.06	199.173	44.1	199.174	45.22	199.23	45.29	199.233
49.48	199.327	54.88	199.38	58.89	199.448	59.82	199.441	62.67	199.521
66.36	199.453	67.01	199.441	68.92	199.378	69.47	199.357	72.61	199.214
73.37	199.196	73.56	199.181	74.94	199	75.77	198.822	76.04	198.77
77.37	198.575	78.16	198.426	78.34	198.376	78.46	198.351	79.57	198
79.94	197.998	80.59	197.996	83.89	197.984	85.16	197.985	85.23	197.984
85.29	197.984	86.24	197.981	86.6	197.98	86.93	197.981	86.99	197.981
92.12	197.978	92.67	197.975	93.8	197.973	96.51	197.968	109.87	197.327
112.55	197.295	123.04	197.978	123.43	197.979	124.91	197.982	126.71	197.996
126.79	197.996	127.47	198	130.8	198	132.4	198	133.05	198
133.1	198	133.26	198	134.36	198	135.44	198	135.67	198
136.01	198	136.06	198	136.92	198	136.94	198	138.2	197.725
141.43	197	143.11	196.356	143.45	196.246	143.63	196.196	144.35	196
145.45	195.701	148.42	195	151.6	194.377	153.04	194	154.48	193.345
154.54	193.311	155.34	193	155.73	192.919	157.65	192.63	159.49	192.987
159.52	193	159.55	193.013	161.56	194	162.02	194.215	163.58	195
164.59	195.492	165.53	196	165.88	196.23	167.15	197	169.04	197.525
170.01	198	170.48	198.005	171.29	198.01	171.61	198.012	176.33	198.211
181.2	198.381	185.45	198.603	188.51	198.84	190.44	198.995	190.51	199
192.15	199.001	192.24	199.001	192.28	199.001	192.41	199.001	192.81	199.001
194.2	199.001	195.83	199.001	195.94	199.001	196.05	199.001	200.13	199.042
211.06	199.149	222.84	199.423	229.22	199.464	230.38	199.482	231.47	199.497
235.25	199.523	240.57	199.568	242.89	199.629				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	155.34	.035	159.52	.05

Bank Sta: Left Right Coeff Contr. Expan.
155.34 159.52 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	155.42	196.7	F
159.34	242.89	196.7	F

Left Levee Station= 136.92 Elevation= 198

Downstream Deck/Roadway Coordinates
num= 157

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	198.649		1.52	198.401		2.47	198	
2.8	198		2.85	198		3.5	198	
3.74	198		4.59	198		13.86	198	
15.45	198		15.74	198		17.17	198	
18.02	197.999		19.18	197.875		22.99	197.861	
24.53	197.999		28.09	197.999		28.15	197.999	
28.28	197.999		28.43	197.999		28.64	197.999	
29.19	197.999		31.03	197.999		31.34	197.999	
32.15	197.999		32.89	197.999		34.84	197.999	

34.92	197.999	37.18	197.998	37.71	197.998
38.66	197.998	41.94	197.997	43.56	197.997
44.75	197.997	45.96	197.997	46.74	197.997
49.78	197.996	50.07	197.995	52.53	197.995
54.64	197.995	55.11	197.995	55.42	197.995
55.76	197.995	57.94	197.995	59.43	197.994
60.73	197.994	61.45	197.993	62	197.993
64.12	197.992	64.22	197.992	64.28	197.992
65.61	197.989	67.27	197.991	68.33	197.991
71.97	197.999	72.26	198	73.27	198.017
76.65	198.059	77.23	198.092	78.18	198.119
80.03	198.063	81.1	198	81.68	197.998
81.8	197.997	82.79	197.994	83.16	197.992
83.96	197.989	86.33	197.985	91.22	197.968
99.31	197.849	99.61	197.847	100.72	197.846
105.6	197.845	107.24	197.851	115.83	197.928
117.78	197.909	118.71	197.903	119.04	197.903
119.4	197.899	121.59	197.885	122.03	197.885
124.28	197.863	124.74	197.388	125.47	197.26
125.59	197.264	125.6	197.264	127.02	197.214
127.16	197.211	127.78	197.201	139.62	197
140.18	196.992	140.89	196.988	141.46	196.989
142	196.987	142.75	196.987	143.84	196.986
143.94	196.986	150.74	196.962	158.29	196.957
158.39	196.957	160.98	196.955	164.67	196.924
165.88	196.912	167.31	196.935	168.65	196.948
168.79	196.948	168.84	196.949	169.49	196.951
170.16	196.951	171.53	196.952	172.2	196.956
172.58	196.955	172.76	196.956	172.87	196.955
172.93	196.955	174	196.962	174.57	196.956
175.1	196.959	175.75	196.962	178.58	196.956
180.14	196.971	182.32	196.983	182.65	196.984
182.82	196.987	183.42	196.997	183.61	197
186.18	197.165	192.25	197.667	192.7	197.681
193.37	197.689	193.89	197.919	194.46	197.92
195.12	197.925	196.24	197.935	198.9	197.945
202.32	197.938	208.58	197.985	210.37	197.994
210.52	198	211.83	198.115	211.87	198.116
222.47	198.877	223.67	198.88	226.51	198.911
228.79	198.924	230.7	198.93	232.45	198.935
237.16	198.966	237.24	198.966	237.7	198.968
238.12	198.971	239.89	198.978	239.96	198.978
240.04	198.979	240.24	198.978	240.47	198.98
240.87	199				

Downstream Bridge Cross Section Data
Station Elevation Data num= 193

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.116	.09	201.103	.16	201.086	2.46	201.134	2.97	201
4.37	200.471	4.61	200.366	5.6	200.081	5.84	200	5.96	199.911
5.99	199.908	6.02	199.896	6.07	199.878	6.15	199.835	7.19	199.231
7.68	199	8.13	198.755	8.5	198.631	8.62	198.603	9.26	198.509
9.72	198.47	10.14	198.456	10.23	198.452	10.32	198.448	11.96	198.458
17.93	198.627	18.79	198.683	20.17	198.853	21.45	198.905	21.67	198.908
22.9	198.868	23.49	198.882	23.72	198.871	24.78	198.788	24.93	198.787
28.22	198.487	32.27	198.564	32.41	198.559	32.55	198.553	32.7	198.554
34.55	198.443	36.02	198.405	47.41	198.657	48.15	198.664	48.64	198.668
48.8	198.663	49	198.655	56.83	198.515	56.94	198.515	57.21	198.506
57.47	198.5	59.64	198.564	60.7	198.535	64.04	198.604	69.34	198.85
70.1	198.861	70.3	198.882	70.32	198.882	71.57	199	74.15	199
75.35	199	76.07	199	76.75	199	77.12	199	78.35	199
79.35	199	79.82	199	81.11	199	81.15	199	81.23	199
81.33	199	81.52	199	84.17	199	85.18	199	86.83	199

86.9	199	86.98	199	91.42	199	92.96	199	96.93	199		
97.22	199	97.61	199	98.45	199	98.47	199	98.92	199		
99.22	199	101.39	199	102.08	199	102.12	199	102.14	199		
103.01	199	103.02	199	106.1	198.877	110.03	198.634	110.07	198.631		
110.12	198.629	110.16	198.627	112.11	198.13	112.47	198.125	114.53	198.075		
115.89	198.061	116.61	198.058	116.85	198.054	117.55	198.032	119.12	198		
121.6	197.696	125.61	197.384	130.31	197	130.42	196.977	131.19	196.835		
134.73	196.198	135.06	196.126	135.92	196	136.57	195.912	137.53	195.823		
137.73	195.805	139.61	195.582	141.72	195.474	142.72	195.431	142.83	195.423		
146.3	195	146.85	194.937	146.93	194.922	147.7	194.851	147.91	194.818		
150.84	194.094	151.01	194.05	151.08	194.036	151.14	194.027	151.23	194		
151.49	193.87	152.54	193.041	152.6	193	152.61	192.999	152.94	192.956		
153.08	192.961	153.39	192.841	153.59	192.827	154.01	192	154.29	191.839		
154.31	191.823	154.36	191.841	154.5	191.889	154.85	192	155.27	192.599		
155.43	192.632	156.55	192.853	157.2	192.963	157.33	193	157.71	193.1		
157.92	193.149	158.07	193.188	158.44	193.273	159.2	193.41	159.73	193.495		
161.66	194	161.73	194.024	162.6	194.305	162.76	194.371	163.8	195		
164.8	195.636	165.37	196	166.09	196.414	167	197	168.71	197.76		
169.29	198	170.4	198.016	170.43	198.017	170.57	198.018	172.02	198.031		
174.94	198.052	176.13	198.07	176.47	198.141	179.95	198.291	191.32	198.853		
196.68	199	198.11	199.013	201.12	199.029	202.88	199.024	217.21	199.414		
218.54	199.448	219.63	199.477	219.66	199.478	219.79	199.484	219.93	199.488		
227.87	199.454	235.99	199.769	237.56	199.797	238.2	199.8	238.42	199.808		
238.61	199.813	239.21	199.826	239.73	199.834						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	152.6	.035	157.33	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
152.6	157.33	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	152.9	196.51	F
156.88	239.73	196.51	F

Left Levee Station= 103.02 Elevation= 199

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	Pipe Arch	2.35	3.72

FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	3	30	.024	.024	0	.9	1

Upstream Elevation = 192.63
Centerline Station = 157.4
Downstream Elevation = 192.37
Centerline Station = 154.9

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	20.59	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	3.64
Q Barrel (m3/s)	20.59	Culv Vel DS (m/s)	4.09
E.G. US. (m)	195.70	Culv Inv El Up (m)	192.63
W.S. US. (m)	195.50	Culv Inv El Dn (m)	192.37
E.G. DS (m)	194.62	Culv Frctn Ls (m)	0.01
W.S. DS (m)	193.92	Culv Exit Loss (m)	0.16
Delta EG (m)	1.08	Culv Entr Loss (m)	0.61
Delta WS (m)	1.58	Q Weir (m3/s)	
E.G. IC (m)	195.55	Weir Sta Lft (m)	
E.G. OC (m)	195.70	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	194.41	Weir Max Depth (m)	
Culv WS Outlet (m)	193.92	Weir Avg Depth (m)	
Culv Nml Depth (m)	1.90	Weir Flow Area (m2)	
Culv Crt Depth (m)	1.53	Min El Weir Flow (m)	196.92

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	10.85	Culv Full Len (m)	30.00
# Barrels	1	Culv Vel US (m/s)	1.62
Q Barrel (m3/s)	10.85	Culv Vel DS (m/s)	1.62
E.G. US. (m)	198.47	Culv Inv El Up (m)	192.63
W.S. US. (m)	198.31	Culv Inv El Dn (m)	192.37
E.G. DS (m)	198.23	Culv Frctn Ls (m)	0.07
W.S. DS (m)	198.14	Culv Exit Loss (m)	0.04
Delta EG (m)	0.24	Culv Entr Loss (m)	0.12
Delta WS (m)	0.17	Q Weir (m3/s)	111.71
E.G. IC (m)	198.34	Weir Sta Lft (m)	19.96
E.G. OC (m)	198.47	Weir Sta Rgt (m)	182.92
Culvert Control	Outlet	Weir Submerg	0.64
Culv WS Inlet (m)	194.98	Weir Max Depth (m)	1.56
Culv WS Outlet (m)	194.72	Weir Avg Depth (m)	0.74
Culv Nml Depth (m)		Weir Flow Area (m2)	80.97
Culv Crt Depth (m)	1.08	Min El Weir Flow (m)	196.92

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.121

INPUT
Description: Section 46.121 - Peelar Road - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 193

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.116	.09	201.103	.16	201.086	2.46	201.134	2.97	201
4.37	200.471	4.61	200.366	5.6	200.081	5.84	200	5.96	199.911
5.99	199.908	6.02	199.896	6.07	199.878	6.15	199.835	7.19	199.231
7.68	199	8.13	198.755	8.5	198.631	8.62	198.603	9.26	198.509
9.72	198.47	10.14	198.456	10.23	198.452	10.32	198.448	11.96	198.458
17.93	198.627	18.79	198.683	20.17	198.853	21.45	198.905	21.67	198.908
22.9	198.868	23.49	198.882	23.72	198.871	24.78	198.788	24.93	198.787
28.22	198.487	32.27	198.564	32.41	198.559	32.55	198.553	32.7	198.554
34.55	198.443	36.02	198.405	47.41	198.657	48.15	198.664	48.64	198.668
48.8	198.663	49	198.655	56.83	198.515	56.94	198.515	57.21	198.506
57.47	198.5	59.64	198.564	60.7	198.535	64.04	198.604	69.34	198.85
70.1	198.861	70.3	198.882	70.32	198.882	71.57	199	74.15	199
75.35	199	76.07	199	76.75	199	77.12	199	78.35	199
79.35	199	79.82	199	81.11	199	81.15	199	81.23	199

81.33	199	81.52	199	84.17	199	85.18	199	86.83	199		
86.9	199	86.98	199	91.42	199	92.96	199	96.93	199		
97.22	199	97.61	199	98.45	199	98.47	199	98.92	199		
99.22	199	101.39	199	102.08	199	102.12	199	102.14	199		
103.01	199	103.02	199	106.1	198.877	110.03	198.634	110.07	198.631		
110.12	198.629	110.16	198.627	112.11	198.13	112.47	198.125	114.53	198.075		
115.89	198.061	116.61	198.058	116.85	198.054	117.55	198.032	119.12	198		
121.6	197.696	125.61	197.384	130.31	197	130.42	196.977	131.19	196.835		
134.73	196.198	135.06	196.126	135.92	196	136.57	195.912	137.53	195.823		
137.73	195.805	139.61	195.582	141.72	195.474	142.72	195.431	142.83	195.423		
146.3	195	146.85	194.937	146.93	194.922	147.7	194.851	147.91	194.818		
150.84	194.094	151.01	194.05	151.08	194.036	151.14	194.027	151.23	194		
151.49	193.87	152.54	193.041	152.6	193	152.61	192.999	152.94	192.956		
153.08	192.961	153.39	192.841	153.59	192.827	154.01	192	154.29	191.839		
154.31	191.823	154.36	191.841	154.5	191.889	154.85	192	155.27	192.599		
155.43	192.632	156.55	192.853	157.2	192.963	157.33	193	157.71	193.1		
157.92	193.149	158.07	193.188	158.44	193.273	159.2	193.41	159.73	193.495		
161.66	194	161.73	194.024	162.6	194.305	162.76	194.371	163.8	195		
164.8	195.636	165.37	196	166.09	196.414	167	197	168.71	197.76		
169.29	198	170.4	198.016	170.43	198.017	170.57	198.018	172.02	198.031		
174.94	198.052	176.13	198.07	176.47	198.141	179.95	198.291	191.32	198.853		
196.68	199	198.11	199.013	201.12	199.029	202.88	199.024	217.21	199.414		
218.54	199.448	219.63	199.477	219.66	199.478	219.79	199.484	219.93	199.488		
227.87	199.454	235.99	199.769	237.56	199.797	238.2	199.8	238.42	199.808		
238.61	199.813	239.21	199.826	239.73	199.834						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	152.6	.035	157.33	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
152.6	157.33	20	20	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	152.9	196.51	F
156.88	239.73	196.51	F

Left Levee Station= 103.02 Elevation= 199

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	194.62	Element	Left OB	Channel	Right OB
Vel Head (m)	0.69	Wt. n-Val.		0.035	
W.S. Elev (m)	193.92	Reach Len. (m)	20.00	20.00	20.00
Crit W.S. (m)	193.92	Flow Area (m2)		5.58	
E.G. Slope (m/m)	0.014163	Area (m2)	0.54	6.30	1.90
Q Total (m3/s)	20.59	Flow (m3/s)		20.59	
Top Width (m)	9.97	Top Width (m)	1.21	4.73	4.03
Vel Total (m/s)	3.69	Avg. Vel. (m/s)		3.69	
Max Chl Dpth (m)	2.10	Hydr. Depth (m)		1.40	
Conv. Total (m3/s)	173.0	Conv. (m3/s)		173.0	
Length Wtd. (m)	20.00	Wetted Per. (m)		4.93	

Min Ch El (m)	191.82	Shear (N/m2)			157.14
Alpha	1.00	Stream Power (N/m s)			580.15
Frctn Loss (m)	0.24	Cum Volume (1000 m3)	31.03	55.08	28.68
C & E Loss (m)	0.15	Cum SA (1000 m2)	32.22	20.07	37.53

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 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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.23	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	198.14	Reach Len. (m)	20.00	20.00	20.00
Crit W.S. (m)	196.51	Flow Area (m2)	68.57	26.25	37.11
E.G. Slope (m/m)	0.000574	Area (m2)	68.57	26.25	37.11
Q Total (m3/s)	122.56	Flow (m3/s)	46.17	49.79	26.60
Top Width (m)	64.38	Top Width (m)	40.52	4.73	19.13
Vel Total (m/s)	0.93	Avg. Vel. (m/s)	0.67	1.90	0.72
Max Chl Dpth (m)	6.32	Hydr. Depth (m)	1.69	5.55	1.94
Conv. Total (m3/s)	5115.7	Conv. (m3/s)	1927.2	2078.2	1110.4
Length Wtd. (m)	20.00	Wetted Per. (m)	41.16	5.69	20.27
Min Ch El (m)	191.82	Shear (N/m2)	9.38	25.96	10.30
Alpha	2.02	Stream Power (N/m s)	6.31	49.24	7.39
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	136.94	131.43	176.06
C & E Loss (m)	0.03	Cum SA (1000 m2)	69.53	20.07	101.12

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: RIVER-1
REACH: Reach-1 RS: 46.12

INPUT
Description: Section 46.12 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 121

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204.017	.64	204	1.57	203.584	2.88	203	4.16	202.234
4.52	202	5.56	201.407	6.37	201	10.22	201	14.03	201
15.11	201.341	17.03	201.774	17.39	201.08	19.08	201.047	20.72	201
24.05	200.087	24.34	200	25.06	199.958	40.15	199.007	40.26	199.007
42.43	199.003	42.76	199.003	45.21	199.27	45.36	199.272	47	199.255
47.99	199.251	57.78	199.012	58.42	199.012	60	199.011	66.24	199
66.68	199	66.83	199	67.45	199	68.32	199	70.6	199
78.32	199	82.38	198.38	85.31	198	86.68	197.459	88	197
88.9	197	89.01	197	89.06	197	89.47	197	90.05	197
90.13	197	90.19	197	92.58	197	93.92	197	95.28	197
98.06	197	98.16	197	98.96	197	104.19	196.364	106.24	196.391
109.27	196	109.29	195.994	109.82	195.992	109.83	195.992	110.07	195.99
110.19	195.988	111.79	195.978	112.9	195.816	112.97	195.809	116.66	195.626
117.36	195.562	117.5	195.552	118.97	195.46	120.07	195.413	121.94	195.336
125.09	195	127.14	194.798	128.66	194.593	128.86	194.565	129.9	194.436
130.12	194.409	133.39	194	134.46	193.993	134.62	193.992	134.65	193.992
134.67	193.992	136.01	193.914	142.87	193.531	143.04	193.525	143.27	193.512
144.35	193.401	148.02	193	149.07	192.548	150.54	192	150.66	191.955
150.99	191.823	151.13	191.883	151.39	192	153.89	192.96	154.01	193
154.32	193.077	156.61	193.626	157.62	193.852	158.11	194	159.55	194.326
162.27	195	164.16	195.858	164.18	195.863	164.2	195.868	164.23	195.877
164.52	196	165.52	196.466	165.69	196.535	166.77	196.945	166.9	197
167	197.043	168.84	198	179.75	198.43	194.54	199	199.89	199.172
218.12	199.701	222.85	199.836	227.56	199.963	228.52	200	228.56	200
228.84	200								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	148.02	.035	154.01	.05

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
148.02 154.01 35 38 40 .1 .3
Left Levee Station= 45.21 Elevation= 199.27

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	193.92	Element	Left OB	Channel	Right OB
Vel Head (m)	0.40	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	193.51	Reach Len. (m)	35.00	38.00	40.00
Crit W.S. (m)	193.51	Flow Area (m2)	1.22	6.62	0.55
E.G. Slope (m/m)	0.009935	Area (m2)	1.22	6.62	

0.55				
Q Total (m3/s)	20.59	Flow (m3/s)	0.97	19.19
0.43				
Top Width (m)	12.93	Top Width (m)	4.80	5.99
2.14				
Vel Total (m/s)	2.46	Avg. Vel. (m/s)	0.80	2.90
0.79				
Max Chl Dpth (m)	1.69	Hydr. Depth (m)	0.25	1.10
0.26				
Conv. Total (m3/s)	206.6	Conv. (m3/s)	9.7	192.5
4.3				
Length Wtd. (m)	37.95	Wetted Per. (m)	4.83	6.44
2.20				
Min Ch El (m)	191.82	Shear (N/m2)	24.55	100.14
24.27				
Alpha	1.31	Stream Power (N/m s)	19.52	290.43
19.16				
Frctn Loss (m)	0.15	Cum Volume (1000 m3)	31.02	54.95
28.65				
C & E Loss (m)	0.07	Cum SA (1000 m2)	32.16	19.96
37.46				

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 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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.19	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (m)	198.17	Reach Len. (m)	35.00	38.00
40.00				
Crit W.S. (m)	194.95	Flow Area (m2)	170.19	34.50
46.06				
E.G. Slope (m/m)	0.000121	Area (m2)	170.19	34.50
46.06				
Q Total (m3/s)	122.56	Flow (m3/s)	71.65	33.24
17.68				
Top Width (m)	89.13	Top Width (m)	64.02	5.99
19.13				
Vel Total (m/s)	0.49	Avg. Vel. (m/s)	0.42	0.96
0.38				
Max Chl Dpth (m)	6.35	Hydr. Depth (m)	2.66	5.76
2.41				
Conv. Total (m3/s)	11128.4	Conv. (m3/s)	6505.3	3018.1

1605.0					
Length Wtd. (m)	37.26	Wetted Per. (m)	64.42	6.44	20.03
Min Ch El (m)	191.82	Shear (N/m2)	3.14	6.37	2.74
Alpha	1.58	Stream Power (N/m s)	1.32	6.14	1.05
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	134.55	130.82	175.23
C & E Loss (m)	0.05	Cum SA (1000 m2)	68.48	19.96	100.74

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.11

INPUT
Description: Station 46.11 - Highway 407 - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 157

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204.194	7.42	204	8.35	203.615	9.72	203	10.51	202.654
11.9	202	13.52	201.278	13.79	201.12	14.04	201	14.65	200.732
16.39	200	19.18	199.003	19.19	199	19.21	199	19.73	199
20.17	199	20.27	199	21.54	199.137	21.57	199.136	22.93	199.296
27.45	199.348	31.63	199.351	31.74	199.347	35.8	199.168	40.37	199.056
40.58	199.048	41.65	199	41.8	199	43.05	199	44.74	199
45.85	199	51.4	198.797	51.94	198.785	52.27	198.776	52.69	198.777
53.03	198.784	53.16	198.787	53.2	198.788	53.37	198.79	53.4	198.791
61.25	199	65.25	199	67.89	199	69.57	199	71.3	199
72.99	198.774	81.96	199	82.48	199	82.91	199	87.13	199
87.27	199	89.8	199.348	92.33	199.42	92.43	199.422	92.63	199.428
92.82	199.435	93.33	199.424	96.19	199	96.38	199	96.8	199
96.94	199	97.06	198.997	97.07	198.997	97.08	198.997	97.09	198.997
97.3	198.997	98.11	198.973	108.25	198.335	110.22	198.302	111.36	198.277
114.19	198.195	116.72	198.145	119.02	198.024	119.8	198.022	120.85	198.023
124.59	198.036	124.96	198.033	126.47	198.02	128.17	198.004	128.71	198.001
128.74	198	129.24	197.91	129.28	197.902	129.33	197.895	131.38	197.515
132.26	197.384	132.42	197.378	134.55	197.078	134.78	197.085	136.08	197.005
136.09	197.005	136.2	197	137.94	196.567	140.2	196	140.31	195.965
140.65	195.808	142.27	195.002	142.28	195	142.86	194.747	143.59	194.559
143.95	194.432	145.52	194	147.05	193.476	147.49	193.353	148.41	193
149.22	192.702	149.63	192.585	149.8	192	150	191.725	153.14	191.725
153.57	191.725	156	191.725	156.2	192	156.84	193	157.12	193.11
157.35	193.215	158.69	194	160.15	194.705	160.84	195	161.92	195.417
163.52	196	165.53	196.656	166.54	197	169.15	197.405	171.98	197.769
172.73	197.841	173.74	198	174.74	198.01	174.77	198.01	175.33	198.016
176.17	198.026	176.63	198.028	178.63	198.05	178.89	198.05	193.15	198.522
195.72	198.556	198.31	198.69	202.36	198.883	204.46	199	222.27	199.574
235.58	200	245.55	200.352	249	200.514	250.09	200.573	255.18	200.87

```
  257.13 200.961  257.34 200.963   257.9 200.992  261.45 200.989  261.74  200.99
  264.23 200.975  264.53 200.978  266.78 200.994  266.87     201  268.79 201.048
  272.01 201.138  283.95 201.338

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   149.8    .035   156.2     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         149.8   156.2              235     235     235             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   149.5  200.65       F
   156.5  283.95   200.5       F
Left Levee      Station=   92.82      Elevation= 199.435

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           193.64    Element                Left OB    Channel
Right OB
  Vel Head (m)              0.16    Wt. n-Val.              0.050      0.035
0.050
  W.S. Elev (m)           193.48    Reach Len. (m)         235.00     235.00
235.00
  Crit W.S. (m)           192.75    Flow Area (m2)           0.32      11.17
0.37
  E.G. Slope (m/m)      0.002016    Area (m2)                1.36      11.17
0.88
  Q Total (m3/s)            20.59   Flow (m3/s)              0.16      20.17
0.26
  Top Width (m)             10.76   Top Width (m)            2.76       6.40
1.60
  Vel Total (m/s)            1.74   Avg. Vel. (m/s)          0.51       1.81
0.69
  Max Chl Dpth (m)           1.75   Hydr. Depth (m)          1.05       1.74
1.24
  Conv. Total (m3/s)        458.6   Conv. (m3/s)             3.6       449.3
5.7
  Length Wtd. (m)         235.00    Wetted Per. (m)          0.74       6.68
0.56
  Min Ch El (m)           191.73    Shear (N/m2)             8.37      33.04
13.26
  Alpha                     1.06    Stream Power (N/m s)     4.24      59.70
9.12
  Frctn Loss (m)                    Cum Volume (1000 m3)    30.97      54.61
28.63
  C & E Loss (m)                    Cum SA (1000 m2)        32.03      19.73
37.39



Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #Regional w red'n


  E.G. Elev (m)           198.13    Element                Left OB    Channel
Right OB
  Vel Head (m)              0.49    Wt. n-Val.              0.050      0.035
0.050
  W.S. Elev (m)           197.64    Reach Len. (m)         235.00     235.00
```

235.00					
Crit W.S. (m)	195.01	Flow Area (m2)	1.56	37.83	1.62
E.G. Slope (m/m)	0.001191	Area (m2)	40.24	37.83	28.33
Q Total (m3/s)	122.56	Flow (m3/s)	1.77	118.50	2.29
Top Width (m)	40.33	Top Width (m)	19.12	6.40	14.81
Vel Total (m/s)	2.99	Avg. Vel. (m/s)	1.13	3.13	1.41
Max Chl Dpth (m)	5.92	Hydr. Depth (m)	5.22	5.91	5.41
Conv. Total (m3/s)	3551.8	Conv. (m3/s)	51.4	3434.2	66.3
Length Wtd. (m)	235.00	Wetted Per. (m)	0.74	6.68	0.56
Min Ch El (m)	191.73	Shear (N/m2)	24.55	66.13	34.06
Alpha	1.07	Stream Power (N/m s)	27.80	207.16	47.99
Frctn Loss (m)		Cum Volume (1000 m3)	130.87	129.45	173.74
C & E Loss (m)		Cum SA (1000 m2)	67.03	19.73	100.06

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1015

INPUT
Description: Hum 13-2R. Highway 407 Culvert - 6.0 m W x 4.3 m H x 215 m L Concrete Box Culvert. Drawings by MTO (WP 140-87-08, Sheet 76, 1993) used to code in new culvert not previously coded in HEC-2.

HEC-2 to HEC-RAS conversion January 2004 by Acres
included coding of culvert to HEC-RAS format, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 12
Deck/Roadway Width = 215
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 146

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	204.208		4.75	204.007		4.97	204.007	
5.27	204.006		5.82	204.006		6.46	204.006	
7.86	204.005		8.62	204.005		8.71	204.005	
8.78	204.005		15.85	204.005		16.29	204.005	
17.76	204.004		17.9	204.004		18.19	204.004	
18.94	204.004		19.1	204.004		19.28	204.004	
20.12	204.004		21.34	204.004		21.76	204.004	
23.12	204.003		23.2	204.003		23.24	204.003	
23.33	204.003		23.38	204.003		23.44	204.003	
23.71	204.003		26.02	204.003		26.83	204.003	
28.53	204.003		34.85	204.001		37.83	204	

37.89	204	37.96	204	37.98	204				
38.02	204	43.02	203.56	47.14	203.538				
50.92	203.25	56.58	203.216	56.61	203.216				
56.64	203.216	56.83	203.213	57.93	203.201				
60.55	203.159	62.45	203.15	64.39	203.13				
64.6	203.129	64.76	203.127	69.02	203.102				
72.02	203.093	74.17	203.074	74.23	203.074				
75.29	203.068	75.83	203.062	76.16	203.061				
76.51	203.057	76.78	203.053	83.95	203				
84.95	202.936	85.88	202.932	86.17	202.919				
91.34	202.663	92.19	202.66	93.67	202.607				
93.81	202.601	95.31	202.52	102.69	202.429				
106.82	202.107	109.74	202.092	114.1	202.071				
117.19	202.043	117.24	202.043	117.39	202.042				
117.45	202.041	118.91	202.033	121.76	202				
126.9	201.626	135.34	201.601	138.96	201.498				
146.46	201.017	146.74	201.017	147.02	201.017				
147.32	201.017	148.59	201.016	150.04	201.016				
150.78	201.016	152	201.015	152.08	201.014				
152.54	201.014	153.09	201.014	153.16	201.014				
157.65	201.014	158.63	201.014	159.79	201.014				
159.86	201.014	159.95	201.014	163.62	201.013				
167.46	201.011	171.93	201.294	176.54	201.237				
179.73	201.007	180.03	201.007	180.13	201.007				
182.08	201.007	183.45	201.007	196.02	201.006				
199.93	201.005	200.98	201.005	201.21	201.005				
203.84	201.005	219.13	201.005	223.98	201.005				
224.97	201.005	225.02	201.005	225.67	201.005				
226.17	201.005	226.62	201.005	226.68	201.005				
228.24	201.005	228.93	201.005	238.94	201.006				
244.81	201.005	246.52	201.005	249.44	201.005				
251.75	201.154	255.03	201.173	256.62	201.006				
259.78	201.005	260.65	201.005	262.23	201.005				
262.29	201.005	262.38	201.005	265.7	201.004				
265.92	201.004	266.14	201.004	266.66	201.004				
268.21	201.004	270.47	201.004	270.83	201.004				
271.72	201.005	271.99	201.005	272.99	201.005				
279.13	201.004	279.54	201.004						

Upstream Bridge Cross Section Data
Station Elevation Data num= 157

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204.194	7.42	204	8.35	203.615	9.72	203	10.51	202.654
11.9	202	13.52	201.278	13.79	201.12	14.04	201	14.65	200.732
16.39	200	19.18	199.003	19.19	199	19.21	199	19.73	199
20.17	199	20.27	199	21.54	199.137	21.57	199.136	22.93	199.296
27.45	199.348	31.63	199.351	31.74	199.347	35.8	199.168	40.37	199.056
40.58	199.048	41.65	199	41.8	199	43.05	199	44.74	199
45.85	199	51.4	198.797	51.94	198.785	52.27	198.776	52.69	198.777
53.03	198.784	53.16	198.787	53.2	198.788	53.37	198.79	53.4	198.791
61.25	199	65.25	199	67.89	199	69.57	199	71.3	199
72.99	198.774	81.96	199	82.48	199	82.91	199	87.13	199
87.27	199	89.8	199.348	92.33	199.42	92.43	199.422	92.63	199.428
92.82	199.435	93.33	199.424	96.19	199	96.38	199	96.8	199
96.94	199	97.06	198.997	97.07	198.997	97.08	198.997	97.09	198.997
97.3	198.997	98.11	198.973	108.25	198.335	110.22	198.302	111.36	198.277
114.19	198.195	116.72	198.145	119.02	198.024	119.8	198.022	120.85	198.023
124.59	198.036	124.96	198.033	126.47	198.02	128.17	198.004	128.71	198.001
128.74	198	129.24	197.91	129.28	197.902	129.33	197.895	131.38	197.515
132.26	197.384	132.42	197.378	134.55	197.078	134.78	197.085	136.08	197.005
136.09	197.005	136.2	197	137.94	196.567	140.2	196	140.31	195.965
140.65	195.808	142.27	195.002	142.28	195	142.86	194.747	143.59	194.559
143.95	194.432	145.52	194	147.05	193.476	147.49	193.353	148.41	193

149.22	192.702	149.63	192.585	149.8	192	150	191.725	153.14	191.725
153.57	191.725	156	191.725	156.2	192	156.84	193	157.12	193.11
157.35	193.215	158.69	194	160.15	194.705	160.84	195	161.92	195.417
163.52	196	165.53	196.656	166.54	197	169.15	197.405	171.98	197.769
172.73	197.841	173.74	198	174.74	198.01	174.77	198.01	175.33	198.016
176.17	198.026	176.63	198.028	178.63	198.05	178.89	198.05	193.15	198.522
195.72	198.556	198.31	198.69	202.36	198.883	204.46	199	222.27	199.574
235.58	200	245.55	200.352	249	200.514	250.09	200.573	255.18	200.87
257.13	200.961	257.34	200.963	257.9	200.992	261.45	200.989	261.74	200.99
264.23	200.975	264.53	200.978	266.78	200.994	266.87	201	268.79	201.048
272.01	201.138	283.95	201.338						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	149.8	.035	156.2	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
149.8	156.2	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	149.5	200.65	F
156.5	283.95	200.5	F

Left Levee Station= 92.82 Elevation= 199.435

Downstream Deck/Roadway Coordinates
num= 146

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	204.208		4.75	204.007		4.97	204.007	
5.27	204.006		5.82	204.006		6.46	204.006	
7.86	204.005		8.62	204.005		8.71	204.005	
8.78	204.005		15.85	204.005		16.29	204.005	
17.76	204.004		17.9	204.004		18.19	204.004	
18.94	204.004		19.1	204.004		19.28	204.004	
20.12	204.004		21.34	204.004		21.76	204.004	
23.12	204.003		23.2	204.003		23.24	204.003	
23.33	204.003		23.38	204.003		23.44	204.003	
23.71	204.003		26.02	204.003		26.83	204.003	
28.53	204.003		34.85	204.001		37.83	204	
37.89	204		37.96	204		37.98	204	
38.02	204		43.02	203.56		47.14	203.538	
50.92	203.25		56.58	203.216		56.61	203.216	
56.64	203.216		56.83	203.213		57.93	203.201	
60.55	203.159		62.45	203.15		64.39	203.13	
64.6	203.129		64.76	203.127		69.02	203.102	
72.02	203.093		74.17	203.074		74.23	203.074	
75.29	203.068		75.83	203.062		76.16	203.061	
76.51	203.057		76.78	203.053		83.95	203	
84.95	202.936		85.88	202.932		86.17	202.919	
91.34	202.663		92.19	202.66		93.67	202.607	
93.81	202.601		95.31	202.52		102.69	202.429	
106.82	202.107		109.74	202.092		114.1	202.071	
117.19	202.043		117.24	202.043		117.39	202.042	
117.45	202.041		118.91	202.033		121.76	202	
126.9	201.626		135.34	201.601		138.96	201.498	
146.46	201.017		146.74	201.017		147.02	201.017	
147.32	201.017		148.59	201.016		150.04	201.016	
150.78	201.016		152	201.015		152.08	201.014	
152.54	201.014		153.09	201.014		153.16	201.014	
157.65	201.014		158.63	201.014		159.79	201.014	
159.86	201.014		159.95	201.014		163.62	201.013	
167.46	201.011		171.93	201.294		176.54	201.237	
179.73	201.007		180.03	201.007		180.13	201.007	
182.08	201.007		183.45	201.007		196.02	201.006	

199.93 201.005	200.98 201.005	201.21 201.005
203.84 201.005	219.13 201.005	223.98 201.005
224.97 201.005	225.02 201.005	225.67 201.005
226.17 201.005	226.62 201.005	226.68 201.005
228.24 201.005	228.93 201.005	238.94 201.006
244.81 201.005	246.52 201.005	249.44 201.005
251.75 201.154	255.03 201.173	256.62 201.006
259.78 201.005	260.65 201.005	262.23 201.005
262.29 201.005	262.38 201.005	265.7 201.004
265.92 201.004	266.14 201.004	266.66 201.004
268.21 201.004	270.47 201.004	270.83 201.004
271.72 201.005	271.99 201.005	272.99 201.005
279.13 201.004	279.54 201.004	

Downstream Bridge Cross Section Data

Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.016	1.7	202.008	3.31	202	6.36	201.056	6.55	201
9.56	200.072	9.81	200	10.8	199.702	11.4	199.711	13.91	199.257
20.78	199.071	21.41	199.041	21.73	199.035	22.13	199.012	28.32	199.055
30.43	199.043	30.53	199.043	30.61	199	34.33	198.39	36.83	198
38.26	197.761	38.91	197.735	42.59	197.626	45.28	197.715	49.27	197.928
49.51	197.912	49.64	197.913	50.24	198	54.26	198.904	54.69	199
55.54	199.006	55.6	199.007	56.47	199.015	56.56	199.016	58.01	199.028
58.36	199.031	64.08	199.075	66.11	199.058	71.53	199.016	73.74	199
78.09	198.205	79.43	198	80.3	197.717	82.64	197	84.16	196.504
85.78	196	87.38	195.494	88.82	195	90.55	194.411	91.82	194
93.73	193.361	95.06	193	96.61	192.832	96.99	192.821	97.75	192.766
99.02	192.647	104.34	192.001	104.36	192.001	104.39	192	107.5	192
108	191.6	114	191.6	114.5	192	116.67	192	119.53	192.809
120.23	193	120.93	193.226	123.26	194	125.52	194.789	126.17	195
129.05	195.811	130	196	130.82	196.156	134.81	197	136.27	197.006
139.91	197.009	140.26	197.01	149.58	197.28	159.19	197.543	159.78	197.568
160.61	197.581	161.67	197.609	161.81	197.612	162.94	197.638	163.7	197.652
169.85	197.681	172.35	197.776	174.11	197.816	175.39	197.838	176.32	197.837
176.8	197.835	177.83	197.831	178.38	197.827	178.95	197.822	180.79	197.795
184.91	197.765	186.04	197.738	186.65	197.724	187.33	197.708	192.06	197.647
192.56	197.637	195.08	197.575	199.98	197.49	201.37	197.459	203.14	197.409
207.72	197.255	214.28	197.01	214.52	197	219.09	196.443	220.61	196.279
221.92	196.225	229.69	196.45	231.97	196.372	232.71	196.357	233.41	196.345
235.42	196.321	237.27	196.318	238.24	196.334	239.43	196.362	242.98	196.554
248.74	196.965	250.8	197						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	107.5	.035	114.5	.05

Bank Sta: Left Right Coeff Contr. Expan.
107.5 114.5 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	107.5	200	F
114.5	250.8	200	F

Left Levee Station= 64.08 Elevation= 199.075
Right Levee Station= 175.39 Elevation= 197.838

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	4.3	6

FHWA Chart # 58- Rectangular concrete
FHWA Scale # 2 - Side tapered; More favorable edges
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	12	215	.015	.015	0	.5	1

Upstream Elevation = 191.725
Centerline Station = 153
Downstream Elevation = 191.6
Centerline Station = 111

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	20.59	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	2.24
Q Barrel (m3/s)	20.59	Culv Vel DS (m/s)	3.23
E.G. US. (m)	193.64	Culv Inv El Up (m)	191.73
W.S. US. (m)	193.48	Culv Inv El Dn (m)	191.60
E.G. DS (m)	193.07	Culv Frctn Ls (m)	0.01
W.S. DS (m)	192.59	Culv Exit Loss (m)	0.13
Delta EG (m)	0.57	Culv Entr Loss (m)	0.13
Delta WS (m)	0.89	Q Weir (m3/s)	
E.G. IC (m)	193.62	Weir Sta Lft (m)	
E.G. OC (m)	193.64	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	193.26	Weir Max Depth (m)	
Culv WS Outlet (m)	192.66	Weir Avg Depth (m)	
Culv Nml Depth (m)	1.92	Weir Flow Area (m2)	
Culv Crt Depth (m)	1.06	Min El Weir Flow (m)	201.01

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	122.56	Culv Full Len (m)	119.53
# Barrels	1	Culv Vel US (m/s)	4.75
Q Barrel (m3/s)	122.56	Culv Vel DS (m/s)	5.85
E.G. US. (m)	198.13	Culv Inv El Up (m)	191.73
W.S. US. (m)	197.64	Culv Inv El Dn (m)	191.60
E.G. DS (m)	196.35	Culv Frctn Ls (m)	0.45
W.S. DS (m)	194.78	Culv Exit Loss (m)	0.48
Delta EG (m)	1.78	Culv Entr Loss (m)	0.58
Delta WS (m)	2.86	Q Weir (m3/s)	
E.G. IC (m)	198.26	Weir Sta Lft (m)	
E.G. OC (m)	198.13	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	196.03	Weir Max Depth (m)	
Culv WS Outlet (m)	195.09	Weir Avg Depth (m)	
Culv Nml Depth (m)	4.30	Weir Flow Area (m2)	
Culv Crt Depth (m)	3.49	Min El Weir Flow (m)	201.01

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.
Note: During supercritical analysis, the culvert direct step method went to critical depth. The program then assumed critical depth at the outlet.

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: 46.10

INPUT
Description: Station 46.10 - Highway 407 - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.016	1.7	202.008	3.31	202	6.36	201.056	6.55	201
9.56	200.072	9.81	200	10.8	199.702	11.4	199.711	13.91	199.257
20.78	199.071	21.41	199.041	21.73	199.035	22.13	199.012	28.32	199.055
30.43	199.043	30.53	199.043	30.61	199	34.33	198.39	36.83	198
38.26	197.761	38.91	197.735	42.59	197.626	45.28	197.715	49.27	197.928
49.51	197.912	49.64	197.913	50.24	198	54.26	198.904	54.69	199
55.54	199.006	55.6	199.007	56.47	199.015	56.56	199.016	58.01	199.028
58.36	199.031	64.08	199.075	66.11	199.058	71.53	199.016	73.74	199
78.09	198.205	79.43	198	80.3	197.717	82.64	197	84.16	196.504
85.78	196	87.38	195.494	88.82	195	90.55	194.411	91.82	194
93.73	193.361	95.06	193	96.61	192.832	96.99	192.821	97.75	192.766
99.02	192.647	104.34	192.001	104.36	192.001	104.39	192	107.5	192
108	191.6	114	191.6	114.5	192	116.67	192	119.53	192.809
120.23	193	120.93	193.226	123.26	194	125.52	194.789	126.17	195
129.05	195.811	130	196	130.82	196.156	134.81	197	136.27	197.006
139.91	197.009	140.26	197.01	149.58	197.28	159.19	197.543	159.78	197.568
160.61	197.581	161.67	197.609	161.81	197.612	162.94	197.638	163.7	197.652
169.85	197.681	172.35	197.776	174.11	197.816	175.39	197.838	176.32	197.837
176.8	197.835	177.83	197.831	178.38	197.827	178.95	197.822	180.79	197.795
184.91	197.765	186.04	197.738	186.65	197.724	187.33	197.708	192.06	197.647
192.56	197.637	195.08	197.575	199.98	197.49	201.37	197.459	203.14	197.409
207.72	197.255	214.28	197.01	214.52	197	219.09	196.443	220.61	196.279
221.92	196.225	229.69	196.45	231.97	196.372	232.71	196.357	233.41	196.345
235.42	196.321	237.27	196.318	238.24	196.334	239.43	196.362	242.98	196.554
248.74	196.965	250.8	197						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	107.5	.035	114.5	.05

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
107.5 114.5 130 200 160 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	107.5	200	F
114.5	250.8	200	F

Left Levee Station= 64.08 Elevation= 199.075
Right Levee Station= 175.39 Elevation= 197.838

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	193.07	Element	Left OB	Channel	Right OB
Vel Head (m)	0.48	Wt. n-Val.		0.035	

W.S. Elev (m)	192.59	Reach Len. (m)	130.00	200.00	160.00
Crit W.S. (m)	192.59	Flow Area (m2)		6.72	
E.G. Slope (m/m)	0.012821	Area (m2)	3.28	6.72	1.89
Q Total (m3/s)	20.59	Flow (m3/s)		20.59	
Top Width (m)	19.24	Top Width (m)	7.99	7.00	4.25
Vel Total (m/s)	3.07	Avg. Vel. (m/s)		3.07	
Max Chl Dpth (m)	0.99	Hydr. Depth (m)		0.96	
Conv. Total (m3/s)	181.8	Conv. (m3/s)		181.8	
Length Wtd. (m)	199.34	Wetted Per. (m)		7.28	
Min Ch El (m)	191.60	Shear (N/m2)		115.98	
Alpha	1.00	Stream Power (N/m s)		355.55	
Frctn Loss (m)	1.06	Cum Volume (1000 m3)	30.97	52.54	28.63
C & E Loss (m)	0.13	Cum SA (1000 m2)	30.77	18.15	36.70

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 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, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	196.35	Element	Left OB	Channel	Right OB
Vel Head (m)	1.57	Wt. n-Val.		0.035	
W.S. Elev (m)	194.78	Reach Len. (m)	130.00	200.00	160.00
Crit W.S. (m)	194.78	Flow Area (m2)		22.09	
E.G. Slope (m/m)	0.008591	Area (m2)	34.85	22.09	18.94

Q Total (m3/s)	122.56	Flow (m3/s)			122.56
Top Width (m)	36.05	Top Width (m)	18.04	7.00	11.00
Vel Total (m/s)	5.55	Avg. Vel. (m/s)			5.55
Max Chl Dpth (m)	3.18	Hydr. Depth (m)			3.16
Conv. Total (m3/s)	1322.3	Conv. (m3/s)			1322.3
Length Wtd. (m)	184.22	Wetted Per. (m)			7.28
Min Ch El (m)	191.60	Shear (N/m2)			255.57
Alpha	1.00	Stream Power (N/m s)			1418.26
Frctn Loss (m)	0.11	Cum Volume (1000 m3)	130.87	122.47	173.74
C & E Loss (m)	0.77	Cum SA (1000 m2)	62.66	18.15	97.02

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, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.09

INPUT
Description: Section 46.09 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	199.5	20	198	60	198	92	191	93	190
95	189	99	189	100	190	102	191	146	192
173	194	210	196	255	197				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	93	.035	100	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
93	100	80	95	125	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	191.07	Element	Left OB	Channel	Right OB
Vel Head (m)	0.22	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	190.85	Reach Len. (m)	80.00	95.00	125.00
Crit W.S. (m)		Flow Area (m2)	0.36	11.45	0.72
E.G. Slope (m/m)	0.003188	Area (m2)	0.36	11.45	0.72
Q Total (m3/s)	24.80	Flow (m3/s)	0.18	24.18	0.43
Top Width (m)	9.55	Top Width (m)	0.85	7.00	1.70
Vel Total (m/s)	1.98	Avg. Vel. (m/s)	0.51	2.11	0.59
Max Chl Dpth (m)	1.85	Hydr. Depth (m)	0.43	1.64	0.43
Conv. Total (m3/s)	439.2	Conv. (m3/s)	3.2	428.3	7.6
Length Wtd. (m)	95.20	Wetted Per. (m)	1.20	7.65	1.90
Min Ch El (m)	189.00	Shear (N/m2)	9.40	46.80	11.89
Alpha	1.11	Stream Power (N/m s)	4.77	98.81	7.05
Frctn Loss (m)	0.21	Cum Volume (1000 m3)	30.73	50.72	28.42
C & E Loss (m)	0.02	Cum SA (1000 m2)	30.19	16.75	36.23

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	194.31	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	194.28	Reach Len. (m)	80.00	95.00	125.00
Crit W.S. (m)		Flow Area (m2)	28.44	35.49	165.48
E.G. Slope (m/m)	0.000218	Area (m2)	28.44	35.49	165.48
Q Total (m3/s)	133.76	Flow (m3/s)	11.93	41.61	80.23
Top Width (m)	101.27	Top Width (m)	16.01	7.00	78.25
Vel Total (m/s)	0.58	Avg. Vel. (m/s)	0.42	1.17	0.48
Max Chl Dpth (m)	5.28	Hydr. Depth (m)	1.78	5.07	2.11
Conv. Total (m3/s)	9065.7	Conv. (m3/s)	808.3	2820.1	5437.3
Length Wtd. (m)	115.54	Wetted Per. (m)	16.78	7.65	78.58
Min Ch El (m)	189.00	Shear (N/m2)	3.62	9.90	

4.50					
Alpha	1.72	Stream Power (N/m s)	1.52	11.61	2.18
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	126.76	116.71	158.99
C & E Loss (m)	0.01	Cum SA (1000 m2)	60.44	16.75	89.88

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: RIVER-1
REACH: Reach-1 RS: 46.082

INPUT
Description: Section 46.082 - Jane Steet - U/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	196	50	195	94	194	116	192	122	189
123	188.7	129	188.7	129.5	189	132	189.5	175	190
192	191	220	192	225	193	267	194	300	195

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	122	.035	129.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
122	129.5	75	75	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	122.5	196.5	F
129.5	300	193.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	190.84	Element	Left OB	Channel	Right OB
Vel Head (m)	0.17	Wt. n-Val.		0.035	
W.S. Elev (m)	190.68	Reach Len. (m)	75.00	75.00	75.00
Crit W.S. (m)	189.80	Flow Area (m2)		13.72	
E.G. Slope (m/m)	0.001663	Area (m2)	2.81	14.60	47.27
Q Total (m3/s)	24.80	Flow (m3/s)		24.80	
Top Width (m)	67.85	Top Width (m)	3.35	7.50	56.99
Vel Total (m/s)	1.81	Avg. Vel. (m/s)		1.81	
Max Chl Dpth (m)	1.98	Hydr. Depth (m)		1.96	
Conv. Total (m3/s)	607.9	Conv. (m3/s)		607.9	

Length Wtd. (m)	75.00	Wetted Per. (m)			7.11
Min Ch El (m)	188.70	Shear (N/m2)			31.50
Alpha	1.00	Stream Power (N/m s)			56.93
Frctn Loss (m)		Cum Volume (1000 m3)	30.61	49.48	25.42
C & E Loss (m)		Cum SA (1000 m2)	30.03	16.06	32.56

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	194.30	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.035	0.050
W.S. Elev (m)	194.29	Reach Len. (m)	75.00	75.00	75.00
Crit W.S. (m)	192.06	Flow Area (m2)		39.01	393.75
E.G. Slope (m/m)	0.000051	Area (m2)	52.93	41.70	393.75
Q Total (m3/s)	133.76	Flow (m3/s)		24.89	108.87
Top Width (m)	195.26	Top Width (m)	40.72	7.50	147.04
Vel Total (m/s)	0.31	Avg. Vel. (m/s)		0.64	0.28
Max Chl Dpth (m)	5.59	Hydr. Depth (m)		5.57	2.68
Conv. Total (m3/s)	18640.6	Conv. (m3/s)		3469.1	15171.5
Length Wtd. (m)	75.00	Wetted Per. (m)		7.11	147.25
Min Ch El (m)	188.70	Shear (N/m2)		2.77	1.35
Alpha	1.44	Stream Power (N/m s)		1.77	0.37
Frctn Loss (m)		Cum Volume (1000 m3)	123.50	113.05	124.03
C & E Loss (m)		Cum SA (1000 m2)	58.18	16.06	75.80

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.0815

INPUT
Description: Hum 13-1R. Jane Street. 6.0 m W x 4.3 m H x 65 m L Concrete Box

Culvert. Previous drawings by Ducan Hopper (1964) are out of date. Culvert modified as part of Highway 407, but no drawings available. Field observations used to update previous HEC-2 coding.

HEC-2 to HEC-RAS conversion January 2004 by Acres
included recoding of culvert to HEC-RAS format, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 65
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 5

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	200		126	196.5		235	193.5	
267	194		300	195				

Upstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	196	50	195	94	194	116	192	122	189
123	188.7	129	188.7	129.5	189	132	189.5	175	190
192	191	220	192	225	193	267	194	300	195

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	122	.035	129.5	.05

Bank Sta: Left Right Coeff Contr. Expan.
122 129.5 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	122.5	196.5	F
129.5	300	193.5	F

Downstream Deck/Roadway Coordinates
num= 5

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	200		126	196.5		235	193.5	
267	194		300	195				

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	196	50	195	94	194	116	192	122	189
123	188.7	129	188.7	129.5	189	132	189.5	175	190
192	191	220	192	225	193	267	194	300	195

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	122	.035	129.5	.08	225	.05

Bank Sta: Left Right Coeff Contr. Expan.
122 129.5 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	122.5	196.5	F
129.5	300	191.8	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 = 193.5

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	4.3	6

FHWA Chart # 58- Rectangular concrete
FHWA Scale # 2 - Side tapered; More favorable edges
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	5	65	.015	.015	0	.5	1

Upstream Elevation = 188.7
Centerline Station = 126
Downstream Elevation = 188.7
Centerline Station = 126

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	24.80	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	2.57
Q Barrel (m3/s)	24.80	Culv Vel DS (m/s)	3.02
E.G. US. (m)	190.84	Culv Inv El Up (m)	188.70
W.S. US. (m)	190.68	Culv Inv El Dn (m)	188.70
E.G. DS (m)	190.42	Culv Frctn Ls (m)	0.01
W.S. DS (m)	190.07	Culv Exit Loss (m)	0.12
Delta EG (m)	0.43	Culv Entr Loss (m)	0.20
Delta WS (m)	0.61	Q Weir (m3/s)	
E.G. IC (m)	190.84	Weir Sta Lft (m)	
E.G. OC (m)	190.81	Weir Sta Rgt (m)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (m)	190.31	Weir Max Depth (m)	
Culv WS Outlet (m)	190.07	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	1.20	Min El Weir Flow (m)	193.50

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	104.27	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	4.54
Q Barrel (m3/s)	104.27	Culv Vel DS (m/s)	5.54
E.G. US. (m)	194.30	Culv Inv El Up (m)	188.70
W.S. US. (m)	194.29	Culv Inv El Dn (m)	188.70
E.G. DS (m)	191.93	Culv Frctn Ls (m)	0.06
W.S. DS (m)	191.80	Culv Exit Loss (m)	1.47
Delta EG (m)	2.37	Culv Entr Loss (m)	0.72
Delta WS (m)	2.49	Q Weir (m3/s)	29.50
E.G. IC (m)	194.30	Weir Sta Lft (m)	205.90
E.G. OC (m)	194.25	Weir Sta Rgt (m)	276.93
Culvert Control	Inlet	Weir Submerg	0.00
Culv WS Inlet (m)	192.53	Weir Max Depth (m)	0.80
Culv WS Outlet (m)	191.83	Weir Avg Depth (m)	0.43
Culv Nml Depth (m)		Weir Flow Area (m2)	30.77
Culv Crt Depth (m)	3.13	Min El Weir Flow (m)	193.50

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.081

INPUT
Description: Section 46.081 - Jane Steet - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	196	50	195	94	194	116	192	122	189
123	188.7	129	188.7	129.5	189	132	189.5	175	190
192	191	220	192	225	193	267	194	300	195

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	122	.035	129.5	.08	225	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
122	129.5	185	175	145	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	122.5	196.5	F
129.5	300	191.8	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	190.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.		0.035	
W.S. Elev (m)	190.07	Reach Len. (m)	185.00	175.00	145.00
Crit W.S. (m)	189.80	Flow Area (m2)		9.46	
E.G. Slope (m/m)	0.005752	Area (m2)	1.14	10.03	15.71
Q Total (m3/s)	24.80	Flow (m3/s)		24.80	
Top Width (m)	56.27	Top Width (m)	2.13	7.50	46.64
Vel Total (m/s)	2.62	Avg. Vel. (m/s)		2.62	
Max Chl Dpth (m)	1.37	Hydr. Depth (m)		1.35	
Conv. Total (m3/s)	326.9	Conv. (m3/s)		326.9	
Length Wtd. (m)	166.20	Wetted Per. (m)		7.11	
Min Ch El (m)	188.70	Shear (N/m2)		75.07	
Alpha	1.00	Stream Power (N/m s)		196.84	
Frctn Loss (m)	1.19	Cum Volume (1000 m3)	30.61	48.52	25.42
C & E Loss (m)	0.11	Cum SA (1000 m2)	29.82	15.50	28.67

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.93	Element	Left OB	Channel	Right OB
Vel Head (m)	0.13	Wt. n-Val.		0.035	0.080
W.S. Elev (m)	191.80	Reach Len. (m)	185.00	175.00	145.00
Crit W.S. (m)	191.80	Flow Area (m2)		21.59	125.59
E.G. Slope (m/m)	0.001613	Area (m2)	7.84	23.03	125.59
Q Total (m3/s)	133.76	Flow (m3/s)		51.97	81.79
Top Width (m)	98.00	Top Width (m)	5.60	7.50	84.90
Vel Total (m/s)	0.91	Avg. Vel. (m/s)		2.41	0.65
Max Chl Dpth (m)	3.10	Hydr. Depth (m)		3.08	1.48
Conv. Total (m3/s)	3330.5	Conv. (m3/s)		1294.0	2036.5
Length Wtd. (m)	155.29	Wetted Per. (m)		7.11	85.00
Min Ch El (m)	188.70	Shear (N/m2)		48.07	23.37
Alpha	3.04	Stream Power (N/m s)		115.71	15.22
Frctn Loss (m)	0.24	Cum Volume (1000 m3)	123.50	106.93	124.03
C & E Loss (m)	0.04	Cum SA (1000 m2)	56.44	15.50	67.10

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1   RS: 46.07

INPUT
Description: Section 46.07 - J.D. Barnes 2003 topo mapping

Section 46.06
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	193	15	190	20	189	24	188	25	188
25	187.7	27	187.7	27	188	30	188	64	189
70	190	102	193	146	193	157	194		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	25	.035	27	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
25	27	95	165	125	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	189.12	Element	Left OB	Channel	Right OB
Vel Head (m)	0.13	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	188.99	Reach Len. (m)	95.00	165.00	125.00
Crit W.S. (m)		Flow Area (m2)	2.93	2.57	19.49
E.G. Slope (m/m)	0.009195	Area (m2)	2.93	2.57	19.49
Q Total (m3/s)	24.80	Flow (m3/s)	2.44	7.00	15.36
Top Width (m)	43.47	Top Width (m)	4.94	2.00	36.52
Vel Total (m/s)	0.99	Avg. Vel. (m/s)	0.83	2.72	0.79
Max Chl Dpth (m)	1.29	Hydr. Depth (m)	0.59	1.29	0.53
Conv. Total (m3/s)	258.6	Conv. (m3/s)	25.4	73.0	160.2
Length Wtd. (m)	133.79	Wetted Per. (m)	5.07	2.60	36.54
Min Ch El (m)	187.70	Shear (N/m2)	52.17	89.20	48.09
Alpha	2.58	Stream Power (N/m s)	43.42	242.64	37.91
Frctn Loss (m)	1.22	Cum Volume (1000 m3)	30.23	47.42	22.87
C & E Loss (m)	0.01	Cum SA (1000 m2)	29.16	14.67	22.64

Warning: The energy loss was 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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.31	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	191.26	Reach Len. (m)	95.00	165.00	125.00

Crit W.S. (m)		Flow Area (m2)	27.00	7.11	122.40
E.G. Slope (m/m)	0.001526	Area (m2)	27.00	7.11	122.40
Q Total (m3/s)	133.76	Flow (m3/s)	18.22	15.53	100.02
Top Width (m)	74.67	Top Width (m)	16.28	2.00	56.39
Vel Total (m/s)	0.85	Avg. Vel. (m/s)	0.67	2.18	0.82
Max Chl Dpth (m)	3.56	Hydr. Depth (m)	1.66	3.56	2.17
Conv. Total (m3/s)	3423.9	Conv. (m3/s)	466.3	397.4	2560.2
Length Wtd. (m)	117.48	Wetted Per. (m)	16.62	2.60	56.55
Min Ch El (m)	187.70	Shear (N/m2)	24.31	40.94	32.40
Alpha	1.53	Stream Power (N/m s)	16.40	89.38	26.47
Frctn Loss (m)	0.05	Cum Volume (1000 m3)	120.28	104.29	106.05
C & E Loss (m)	0.01	Cum SA (1000 m2)	54.41	14.67	56.86

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: RIVER-1
REACH: Reach-1 RS: 46.06

INPUT
Description: Section 46.06 - J.D. Barnes 2003 topo mapping
Section 46.06
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	192	25	191	47	190	55	188	114	187
118	186.9	119	186.4	121	186.4	122	186.9	125	187
142	192	187	192	217	192	222	191	255	191
257	192	275	193						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	118	.035	122	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
118	122	130	165	145	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
142	275	192.1	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	187.89	Element	Left OB	Channel	Right OB
Vel Head (m)	0.23	Wt. n-Val.	0.080	0.035	

0.080					
W.S. Elev (m)	187.66	Reach Len. (m)	130.00	165.00	145.00
Crit W.S. (m)	187.66	Flow Area (m2)	15.80	4.55	2.88
E.G. Slope (m/m)	0.008997	Area (m2)	15.80	4.55	2.88
Q Total (m3/s)	24.80	Flow (m3/s)	9.60	12.93	2.27
Top Width (m)	52.35	Top Width (m)	43.09	4.00	5.25
Vel Total (m/s)	1.07	Avg. Vel. (m/s)	0.61	2.84	0.79
Max Chl Dpth (m)	1.26	Hydr. Depth (m)	0.37	1.14	0.55
Conv. Total (m3/s)	261.4	Conv. (m3/s)	101.2	136.3	23.9
Length Wtd. (m)	156.17	Wetted Per. (m)	43.10	4.24	5.35
Min Ch El (m)	186.40	Shear (N/m2)	32.35	94.77	47.56
Alpha	3.88	Stream Power (N/m s)	19.65	269.37	37.36
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	29.34	46.83	21.47
C & E Loss (m)	0.07	Cum SA (1000 m2)	26.88	14.17	20.03

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 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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.25	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	191.23	Reach Len. (m)	130.00	165.00	145.00
Crit W.S. (m)		Flow Area (m2)	271.80	18.82	43.27
E.G. Slope (m/m)	0.000217	Area (m2)	271.80	18.82	51.07
Q Total (m3/s)	133.76	Flow (m3/s)	98.07	21.40	14.29

Top Width (m)	154.77	Top Width (m)	98.77	4.00	52.00
Vel Total (m/s)	0.40	Avg. Vel. (m/s)	0.36	1.14	0.33
Max Chl Dpth (m)	4.83	Hydr. Depth (m)	2.75	4.71	2.49
Conv. Total (m3/s)	9083.5	Conv. (m3/s)	6659.4	1453.4	970.7
Length Wtd. (m)	148.83	Wetted Per. (m)	99.05	4.24	18.00
Min Ch El (m)	186.40	Shear (N/m2)	5.84	9.45	5.11
Alpha	1.96	Stream Power (N/m s)	2.11	10.75	1.69
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	106.09	102.15	95.21
C & E Loss (m)	0.00	Cum SA (1000 m2)	48.95	14.17	50.09

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.05

INPUT
Description: Section 46.05 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	193	30	192	72	191	90	186	93	185
95	184.8	100	184.5	123	184.5	128	184.8	150	189
170	190	190	191	210	192	217	191	260	190
280	190	292	193						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	95	.035	128	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
95	128	70	70	65 .1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
210	292	192.1	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	187.52	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	187.52	Reach Len. (m)	70.00	70.00	65.00
Crit W.S. (m)	184.93	Flow Area (m2)	15.47	98.20	19.40
E.G. Slope (m/m)	0.000015	Area (m2)	15.47	98.20	

19.40					
Q Total (m3/s)	24.80	Flow (m3/s)	0.96	22.69	
1.15					
Top Width (m)	57.73	Top Width (m)	10.48	33.00	
14.25					
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.06	0.23	
0.06					
Max Chl Dpth (m)	3.02	Hydr. Depth (m)	1.48	2.98	
1.36					
Conv. Total (m3/s)	6342.1	Conv. (m3/s)	245.0	5802.9	
294.2					
Length Wtd. (m)	69.23	Wetted Per. (m)	10.86	33.02	
14.51					
Min Ch El (m)	184.50	Shear (N/m2)	0.21	0.45	
0.20					
Alpha	1.42	Stream Power (N/m s)	0.01	0.10	
0.01					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	27.31	38.36	
19.85					
C & E Loss (m)	0.00	Cum SA (1000 m2)	23.40	11.12	
18.62					

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.24	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	
0.080					
W.S. Elev (m)	191.23	Reach Len. (m)	70.00	70.00	
65.00					
Crit W.S. (m)	185.72	Flow Area (m2)	79.98	220.47	
144.74					
E.G. Slope (m/m)	0.000024	Area (m2)	79.98	220.47	
203.68					
Q Total (m3/s)	133.76	Flow (m3/s)	8.82	110.04	
14.90					
Top Width (m)	201.52	Top Width (m)	32.51	33.00	
136.02					
Vel Total (m/s)	0.30	Avg. Vel. (m/s)	0.11	0.50	
0.10					
Max Chl Dpth (m)	6.73	Hydr. Depth (m)	2.46	6.68	
2.18					
Conv. Total (m3/s)	27150.8	Conv. (m3/s)	1790.8	22336.0	
3024.0					
Length Wtd. (m)	68.38	Wetted Per. (m)	33.36	33.02	
66.98					
Min Ch El (m)	184.50	Shear (N/m2)	0.57	1.59	
0.51					
Alpha	2.29	Stream Power (N/m s)	0.06	0.79	
0.05					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	83.22	82.41	
76.74					
C & E Loss (m)	0.00	Cum SA (1000 m2)	40.42	11.12	
36.45					

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.04

INPUT
Description: Section 46.04 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	192	38	192	65	191	107	190	120	189
126	185	127	184	130	184	131	184.5	135	185
148	189	190	189.5	205	189	220	189	232	192

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	126	.035	131	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
126	131	115	100	70	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
190	232	190	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	187.52	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	187.48	Reach Len. (m)	115.00	100.00	70.00
Crit W.S. (m)	185.46	Flow Area (m2)	4.60	16.64	20.88
E.G. Slope (m/m)	0.000306	Area (m2)	4.60	16.64	20.88
Q Total (m3/s)	24.80	Flow (m3/s)	1.03	17.32	6.44
Top Width (m)	20.77	Top Width (m)	3.72	5.00	12.05
Vel Total (m/s)	0.59	Avg. Vel. (m/s)	0.22	1.04	0.31
Max Chl Dpth (m)	3.48	Hydr. Depth (m)	1.24	3.33	1.73
Conv. Total (m3/s)	1417.3	Conv. (m3/s)	58.7	990.2	368.4
Length Wtd. (m)	98.06	Wetted Per. (m)	4.47	5.53	12.45
Min Ch El (m)	184.00	Shear (N/m2)	3.09	9.03	5.03
Alpha	2.26	Stream Power (N/m s)	0.69	9.40	1.55

Frctn Loss (m)	0.03	Cum Volume (1000 m3)	26.61	34.34	18.54
C & E Loss (m)	0.00	Cum SA (1000 m2)	22.90	9.79	17.76

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.23	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	191.19	Reach Len. (m)	115.00	100.00	70.00
Crit W.S. (m)	187.49	Flow Area (m2)	76.88	35.22	233.69
E.G. Slope (m/m)	0.000190	Area (m2)	76.88	35.22	233.69
Q Total (m3/s)	133.76	Flow (m3/s)	14.46	47.70	71.61
Top Width (m)	169.03	Top Width (m)	66.26	5.00	97.78
Vel Total (m/s)	0.39	Avg. Vel. (m/s)	0.19	1.35	0.31
Max Chl Dpth (m)	7.19	Hydr. Depth (m)	1.16	7.04	2.39
Conv. Total (m3/s)	9694.4	Conv. (m3/s)	1047.8	3457.0	5189.6
Length Wtd. (m)	95.43	Wetted Per. (m)	67.52	5.53	98.69
Min Ch El (m)	184.00	Shear (N/m2)	2.13	11.89	4.42
Alpha	4.73	Stream Power (N/m s)	0.40	16.10	1.35
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	77.73	73.46	62.53
C & E Loss (m)	0.01	Cum SA (1000 m2)	36.96	9.79	28.86

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: RIVER-1
REACH: Reach-1 RS: 46.032

INPUT
Description: Section 46.032 - CNR - U/S Bounding Section - J.D. Barnes 2003

topo mapping
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	191.25	6	191	9.7	190	13.7	189.8	58	189
88.3	188	109.3	185	121.7	184.2	125	184	181.4	182.6
195.4	182.6	209	184	287.6	185	289.7	187	297.1	188
316	189	328	189	334	185.4	350	192		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	125	.035	209	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
125	209	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	182.9	189.8	F
193.9	350	191.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	187.49	Element	Left OB	Channel	Right OB
Vel Head (m)	0.08	Wt. n-Val.		0.035	
W.S. Elev (m)	187.41	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	184.15	Flow Area (m2)		52.87	
E.G. Slope (m/m)	0.000242	Area (m2)	65.97	354.71	240.20
Q Total (m3/s)	66.97	Flow (m3/s)		66.97	
Top Width (m)	208.45	Top Width (m)	32.54	84.00	91.91
Vel Total (m/s)	1.27	Avg. Vel. (m/s)		1.27	
Max Chl Dpth (m)	4.81	Hydr. Depth (m)		4.81	
Conv. Total (m3/s)	4301.8	Conv. (m3/s)		4301.8	
Length Wtd. (m)	50.00	Wetted Per. (m)		11.00	
Min Ch El (m)	182.60	Shear (N/m2)		11.42	
Alpha	1.00	Stream Power (N/m s)		14.47	
Frctn Loss (m)		Cum Volume (1000 m3)	22.55	15.77	9.41
C & E Loss (m)		Cum SA (1000 m2)	20.82	5.34	14.12

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.22	Element	Left OB	Channel	Right OB

Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035
W.S. Elev (m)	191.22	Reach Len. (m)	50.00	50.00
50.00				
Crit W.S. (m)	185.84	Flow Area (m2)	375.67	554.11
E.G. Slope (m/m)	0.000007	Area (m2)	375.67	674.68
709.24				
Q Total (m3/s)	200.64	Flow (m3/s)	26.82	173.83
Top Width (m)	347.26	Top Width (m)	124.16	84.00
139.10				
Vel Total (m/s)	0.22	Avg. Vel. (m/s)	0.07	0.31
Max Chl Dpth (m)	8.62	Hydr. Depth (m)	3.03	8.04
Conv. Total (m3/s)	73340.5	Conv. (m3/s)	9801.9	63538.5
Length Wtd. (m)	50.00	Wetted Per. (m)	124.57	68.92
Min Ch El (m)	182.60	Shear (N/m2)	0.22	0.59
Alpha	1.85	Stream Power (N/m s)	0.02	0.19
Frctn Loss (m)		Cum Volume (1000 m3)	51.71	37.97
29.53				
C & E Loss (m)		Cum SA (1000 m2)	26.01	5.34
20.57				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.0315

INPUT
Description: Hum 13-1RR. CNR Culvert. Twin 3.0 m W x 3.5 m H x 32 m L
Structural Steel Plate Arch Culverts. No drawings available.
Size estimated from HEC-2 coding.

HEC-2 to HEC-RAS conversion
January 2004 by Acres included recoding of culvert to HEC-RAS format, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 13
Deck/Roadway Width = 32
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 10

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	191.2		5	191		8.7	190	
12.7	189.8		16.6	190		25	190.3	
115.5	191		274.1	192		335	192.5	
350	192.65							

Upstream Bridge Cross Section Data
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

```
      0  191.25       6     191     9.7     190    13.7   189.8      58     189
   88.3     188   109.3     185   121.7   184.2     125     184   181.4   182.6
  195.4   182.6     209     184   287.6     185   289.7     187   297.1     188
    316     189     328     189     334   185.4     350     192

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .08     125    .035     209     .08

Bank Sta: Left   Right    Coeff Contr.   Expan.
          125     209             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   182.9   189.8       F
   193.9     350   191.5       F

Downstream  Deck/Roadway Coordinates
    num=      10
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0   191.2               5     191             8.7     190
    12.7   189.8            16.6     190              25   190.3
   115.5     191           274.1     192             335   192.5
     350  192.65

Downstream Bridge Cross Section Data
Station Elevation Data    num=      15
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   191.2       6     191     9.7     190    13.7   189.8      58     189
    88.3     188   109.3     185   121.7   184.2     125     184     170   183.2
     171   182.6     180   182.6     181   183.2     195     184     310     190

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .08     170    .035     181     .08

Bank Sta: Left   Right    Coeff Contr.   Expan.
          170     181             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     170     187       F
     181     310     187       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         =   190.5
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       Ellipse     3.5       3
FHWA Chart # 30- Vertical Ellipse; Concrete
FHWA Scale # 1 - Square edge with headwall
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                13      32     .024     .024        0                   .7
      1
Number of Barrels =  2
Upstream   Elevation =  182.6
```

Centerline Stations
Sta. Sta.
185.4 191.4
Downstream Elevation = 182.6
Centerline Stations
Sta. Sta.
172 178

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	66.97	Culv Full Len (m)	
# Barrels	2	Culv Vel US (m/s)	4.07
Q Barrel (m3/s)	33.49	Culv Vel DS (m/s)	5.02
E.G. US. (m)	187.49	Culv Inv El Up (m)	182.60
W.S. US. (m)	187.41	Culv Inv El Dn (m)	182.60
E.G. DS (m)	184.99	Culv Frctn Ls (m)	0.01
W.S. DS (m)	184.22	Culv Exit Loss (m)	1.53
Delta EG (m)	2.50	Culv Entr Loss (m)	0.59
Delta WS (m)	3.19	Q Weir (m3/s)	
E.G. IC (m)	187.09	Weir Sta Lft (m)	
E.G. OC (m)	187.49	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	186.05	Weir Max Depth (m)	
Culv WS Outlet (m)	185.24	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	2.64	Min El Weir Flow (m)	190.50

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	112.90	Culv Full Len (m)	29.43
# Barrels	2	Culv Vel US (m/s)	6.84
Q Barrel (m3/s)	56.45	Culv Vel DS (m/s)	7.01
E.G. US. (m)	191.22	Culv Inv El Up (m)	182.60
W.S. US. (m)	191.22	Culv Inv El Dn (m)	182.60
E.G. DS (m)	187.51	Culv Frctn Ls (m)	1.06
W.S. DS (m)	185.89	Culv Exit Loss (m)	0.89
Delta EG (m)	3.71	Culv Entr Loss (m)	1.67
Delta WS (m)	5.32	Q Weir (m3/s)	87.74
E.G. IC (m)	191.21	Weir Sta Lft (m)	0.68
E.G. OC (m)	191.22	Weir Sta Rgt (m)	150.71
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	186.10	Weir Max Depth (m)	1.40
Culv WS Outlet (m)	185.89	Weir Avg Depth (m)	0.51
Culv Nml Depth (m)		Weir Flow Area (m2)	76.97
Culv Crt Depth (m)	3.25	Min El Weir Flow (m)	190.50

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.031

INPUT
Description: Section 46.031 - CNR - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	191.2	6	191	9.7	190	13.7	189.8	58	189
88.3	188	109.3	185	121.7	184.2	125	184	170	183.2
171	182.6	180	182.6	181	183.2	195	184	310	190

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	170	.035	181	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
170	181	90	110	75	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	170	187	F
181	310	187	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	184.99	Element	Left OB	Channel	Right OB
Vel Head (m)	0.77	Wt. n-Val.		0.035	
W.S. Elev (m)	184.22	Reach Len. (m)	90.00	110.00	75.00
Crit W.S. (m)	184.22	Flow Area (m2)		17.18	
E.G. Slope (m/m)	0.010691	Area (m2)	28.11	17.18	9.07
Q Total (m3/s)	66.97	Flow (m3/s)		66.97	
Top Width (m)	77.69	Top Width (m)	48.55	11.00	18.14
Vel Total (m/s)	3.90	Avg. Vel. (m/s)		3.90	
Max Chl Dpth (m)	1.62	Hydr. Depth (m)		1.56	
Conv. Total (m3/s)	647.7	Conv. (m3/s)		647.7	
Length Wtd. (m)	102.88	Wetted Per. (m)		11.33	
Min Ch El (m)	182.60	Shear (N/m2)		158.94	
Alpha	1.00	Stream Power (N/m s)		619.61	
Frctn Loss (m)	0.24	Cum Volume (1000 m3)	22.55	6.82	9.41
C & E Loss (m)	0.37	Cum SA (1000 m2)	18.79	2.97	11.37

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 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, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	187.51	Element	Left OB	Channel	Right OB
Vel Head (m)	1.62	Wt. n-Val.		0.035	
W.S. Elev (m)	185.89	Reach Len. (m)	90.00	110.00	75.00
Crit W.S. (m)	185.89	Flow Area (m2)		35.64	
E.G. Slope (m/m)	0.008428	Area (m2)	128.00	35.64	66.50
Q Total (m3/s)	200.64	Flow (m3/s)		200.64	
Top Width (m)	128.26	Top Width (m)	66.96	11.00	50.30
Vel Total (m/s)	5.63	Avg. Vel. (m/s)		5.63	
Max Chl Dpth (m)	3.29	Hydr. Depth (m)		3.24	
Conv. Total (m3/s)	2185.5	Conv. (m3/s)		2185.5	
Length Wtd. (m)	101.96	Wetted Per. (m)		11.33	
Min Ch El (m)	182.60	Shear (N/m2)		259.91	
Alpha	1.00	Stream Power (N/m s)		1463.36	
Frctn Loss (m)	0.23	Cum Volume (1000 m3)	51.71	11.26	29.53
C & E Loss (m)	0.78	Cum SA (1000 m2)	21.23	2.97	15.83

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 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, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.03

INPUT
Description: Section 46.03 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	189	17	183	34	182.3	35	182	39	182
40	182.3	43	183	88	182.5	89	181.5	93	181.5
94	182.5	96	183	100	184	103	185	138	187
187	188								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	88	.035	94	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
88	94	185	205	150	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	43	183.1	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	184.04	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	184.00	Reach Len. (m)	185.00	205.00	150.00
Crit W.S. (m)	183.28	Flow Area (m2)	96.30	14.00	4.49
E.G. Slope (m/m)	0.000995	Area (m2)	96.30	14.00	4.49
Q Total (m3/s)	66.97	Flow (m3/s)	45.19	20.35	1.43
Top Width (m)	85.83	Top Width (m)	73.83	6.00	6.00
Vel Total (m/s)	0.58	Avg. Vel. (m/s)	0.47	1.45	0.32
Max Chl Dpth (m)	2.50	Hydr. Depth (m)	1.30	2.33	0.75
Conv. Total (m3/s)	2122.9	Conv. (m3/s)	1432.3	645.2	45.4
Length Wtd. (m)	184.84	Wetted Per. (m)	74.19	6.83	6.18
Min Ch El (m)	181.50	Shear (N/m2)	12.67	20.00	7.10
Alpha	2.33	Stream Power (N/m s)	5.94	29.09	2.26
Frctn Loss (m)	0.32	Cum Volume (1000 m3)	16.95	5.11	8.90
C & E Loss (m)	0.01	Cum SA (1000 m2)	13.29	2.03	10.47

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	185.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	185.39	Reach Len. (m)	185.00	205.00	150.00
Crit W.S. (m)	183.85	Flow Area (m2)	201.48	22.32	16.79
E.G. Slope (m/m)	0.000999	Area (m2)	201.48	22.32	16.79
Q Total (m3/s)	200.64	Flow (m3/s)	149.42	44.40	6.81
Top Width (m)	99.53	Top Width (m)	77.76	6.00	15.77
Vel Total (m/s)	0.83	Avg. Vel. (m/s)	0.74	1.99	0.41
Max Chl Dpth (m)	3.89	Hydr. Depth (m)	2.59	3.72	1.06
Conv. Total (m3/s)	6347.1	Conv. (m3/s)	4726.9	1404.7	215.6
Length Wtd. (m)	181.78	Wetted Per. (m)	78.36	6.83	16.13
Min Ch El (m)	181.50	Shear (N/m2)	25.20	32.03	10.20
Alpha	1.86	Stream Power (N/m s)	18.69	63.72	4.14
Frctn Loss (m)	0.29	Cum Volume (1000 m3)	36.88	8.07	26.40
C & E Loss (m)	0.01	Cum SA (1000 m2)	14.72	2.03	13.35

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: RIVER-1
REACH: Reach-1 RS: 46.02

INPUT
Description: Section 46.02 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	189	18	183	41	182	44	181.7	44	181
46	181	47	181.7	50	182	70	183	78	185
90	186	120	187	150	188				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	44	.035	47	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
44	47	110	120	110	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	183.71	Element	Left OB	Channel	Right OB
Vel Head (m)	0.13	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	183.57	Reach Len. (m)	110.00	120.00	110.00
Crit W.S. (m)		Flow Area (m2)	30.30	7.36	27.25
E.G. Slope (m/m)	0.003860	Area (m2)	30.30	7.36	27.25
Q Total (m3/s)	66.97	Flow (m3/s)	24.89	19.90	22.18
Top Width (m)	56.00	Top Width (m)	27.71	3.00	25.29
Vel Total (m/s)	1.03	Avg. Vel. (m/s)	0.82	2.70	0.81
Max Chl Dpth (m)	2.57	Hydr. Depth (m)	1.09	2.45	1.08
Conv. Total (m3/s)	1077.9	Conv. (m3/s)	400.7	320.3	356.9
Length Wtd. (m)	113.76	Wetted Per. (m)	27.84	3.92	25.40
Min Ch El (m)	181.00	Shear (N/m2)	41.19	71.11	40.62
Alpha	2.48	Stream Power (N/m s)	33.85	192.16	33.06
Frctn Loss (m)	0.34	Cum Volume (1000 m3)	5.24	2.92	6.52
C & E Loss (m)	0.00	Cum SA (1000 m2)	3.89	1.11	8.12

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	185.15	Element	Left OB	Channel	Right OB
Vel Head (m)	0.16	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	184.99	Reach Len. (m)	110.00	120.00	110.00
Crit W.S. (m)		Flow Area (m2)	72.73	11.63	67.24
E.G. Slope (m/m)	0.003026	Area (m2)	72.73	11.63	67.24
Q Total (m3/s)	200.64	Flow (m3/s)	85.86	37.73	77.05
Top Width (m)	65.95	Top Width (m)	31.98	3.00	30.97
Vel Total (m/s)	1.32	Avg. Vel. (m/s)	1.18	3.24	1.15
Max Chl Dpth (m)	3.99	Hydr. Depth (m)	2.27	3.88	2.17
Conv. Total (m3/s)	3647.3	Conv. (m3/s)	1560.7	685.9	1400.7

Length Wtd. (m)	112.32	Wetted Per. (m)	32.34	3.92	31.26
Min Ch El (m)	181.00	Shear (N/m2)	66.75	88.03	63.84
Alpha	1.76	Stream Power (N/m s)	78.79	285.62	73.15
Frctn Loss (m)	0.25	Cum Volume (1000 m3)	11.52	4.59	20.10
C & E Loss (m)	0.01	Cum SA (1000 m2)	4.57	1.11	9.85

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.01

INPUT
Description: Section 46.01 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	189	14	188	20	182	33	181	34	180.4
37	180.4	38	182	87	183	98	185	106	186
126	187	180	188						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	33	.035	38	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
33	38	95	105	95	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	183.36	Element	Left OB	Channel	Right OB
Vel Head (m)	0.14	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	183.22	Reach Len. (m)	95.00	105.00	95.00
Crit W.S. (m)		Flow Area (m2)	23.16	13.02	35.59
E.G. Slope (m/m)	0.002412	Area (m2)	23.16	13.02	35.59
Q Total (m3/s)	66.97	Flow (m3/s)	19.18	30.43	17.36
Top Width (m)	69.45	Top Width (m)	14.22	5.00	50.23
Vel Total (m/s)	0.93	Avg. Vel. (m/s)	0.83	2.34	0.49
Max Chl Dpth (m)	2.82	Hydr. Depth (m)	1.63	2.60	0.71
Conv. Total (m3/s)	1363.7	Conv. (m3/s)	390.6	619.7	353.4
Length Wtd. (m)	100.25	Wetted Per. (m)	14.77	6.05	50.26
Min Ch El (m)	180.40	Shear (N/m2)	37.08	50.86	16.75
Alpha	3.15	Stream Power (N/m s)	30.72	118.91	8.17

Frctn Loss (m)	0.19	Cum Volume (1000 m3)	2.30	1.70	3.06
C & E Loss (m)	0.00	Cum SA (1000 m2)	1.59	0.63	3.97

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	184.89	Element	Left OB	Channel	Right OB
Vel Head (m)	0.13	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	184.76	Reach Len. (m)	95.00	105.00	95.00
Crit W.S. (m)		Flow Area (m2)	46.23	20.71	119.40
E.G. Slope (m/m)	0.001702	Area (m2)	46.23	20.71	119.40
Q Total (m3/s)	200.64	Flow (m3/s)	46.54	55.43	98.67
Top Width (m)	79.46	Top Width (m)	15.76	5.00	58.69
Vel Total (m/s)	1.08	Avg. Vel. (m/s)	1.01	2.68	0.83
Max Chl Dpth (m)	4.36	Hydr. Depth (m)	2.93	4.14	2.03
Conv. Total (m3/s)	4863.7	Conv. (m3/s)	1128.2	1343.8	2391.7
Length Wtd. (m)	98.47	Wetted Per. (m)	16.95	6.05	58.86
Min Ch El (m)	180.40	Shear (N/m2)	45.53	57.11	33.85
Alpha	2.20	Stream Power (N/m s)	45.84	152.85	27.97
Frctn Loss (m)	0.16	Cum Volume (1000 m3)	4.97	2.65	9.84
C & E Loss (m)	0.01	Cum SA (1000 m2)	1.94	0.63	4.92

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.00

INPUT
Description: Section 46.00 - J.D. Barnes 2003 topo mapping (This section location corresponds to D/S HEC-RAS model section 475.53)

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	188	20	187	40	182	55	181	57	180
60	180	62	181	73	182	95	183	103	184
110	185	123	187	180	187				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	55	.035	62	.08

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

55 62 0 0 0 .1 .3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	183.18	Element	Left OB	Channel	Right OB
Vel Head (m)	0.14	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	183.04	Reach Len. (m)			
Crit W.S. (m)	182.26	Flow Area (m2)	25.26	19.28	28.83
E.G. Slope (m/m)	0.001480	Area (m2)	25.26	19.28	28.83
Q Total (m3/s)	66.97	Flow (m3/s)	14.53	39.87	12.57
Top Width (m)	59.48	Top Width (m)	19.16	7.00	33.32
Vel Total (m/s)	0.91	Avg. Vel. (m/s)	0.58	2.07	0.44
Max Chl Dpth (m)	3.04	Hydr. Depth (m)	1.32	2.75	0.87
Conv. Total (m3/s)	1740.6	Conv. (m3/s)	377.6	1036.3	326.7
Length Wtd. (m)		Wetted Per. (m)	19.32	7.47	33.39
Min Ch El (m)	180.00	Shear (N/m2)	18.98	37.46	12.53
Alpha	3.19	Stream Power (N/m s)	10.92	77.47	5.47
Frctn Loss (m)		Cum Volume (1000 m3)			
C & E Loss (m)		Cum SA (1000 m2)			

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	184.73	Element	Left OB	Channel	Right OB
Vel Head (m)	0.19	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	184.54	Reach Len. (m)			
Crit W.S. (m)	183.38	Flow Area (m2)	58.50	29.78	87.66
E.G. Slope (m/m)	0.001535	Area (m2)	58.50	29.78	87.66
Q Total (m3/s)	200.64	Flow (m3/s)	49.83	83.80	67.01
Top Width (m)	76.94	Top Width (m)	25.16	7.00	44.78
Vel Total (m/s)	1.14	Avg. Vel. (m/s)	0.85	2.81	0.76
Max Chl Dpth (m)	4.54	Hydr. Depth (m)	2.33	4.25	1.96
Conv. Total (m3/s)	5120.9	Conv. (m3/s)	1271.8	2138.8	1710.3
Length Wtd. (m)		Wetted Per. (m)	25.51	7.47	44.95

Min Ch El (m)	180.00	Shear (N/m2)	34.53	60.00	29.36
Alpha	2.83	Stream Power (N/m s)	29.41	168.84	22.44
Frctn Loss (m)		Cum Volume (1000 m3)			
C & E Loss (m)		Cum SA (1000 m2)			

SUMMARY OF MANNING'S N VALUES

River:RIVER-1

Reach	River Sta.	n1	n2	n3	n4	n5	n6	n7
Reach-1	46.45	.05	.035	.08				
Reach-1	46.44	.05	.035	.05				
Reach-1	46.43	.05	.08	.035	.08	.05		
Reach-1	46.42	.05	.08	.035	.08	.05		
Reach-1	46.413	.05	.08	.035	.08	.05		
Reach-1	46.4125	Inl Struct						
Reach-1	46.412	.05	.08	.035	.08	.05		
Reach-1	46.4115	Culvert						
Reach-1	46.411	.05	.08	.035	.08	.05		
Reach-1	46.41	.05	.08	.035	.08	.035	.08	.05
Reach-1	46.402	.05	.08	.035	.08	.05		
Reach-1	46.4015	Culvert						
Reach-1	46.401	.05	.08	.035	.08	.05		
Reach-1	46.392	.05	.025	.05	.08	.035	.08	.05
Reach-1	46.3915	Mult Open						
Reach-1	46.391	.05	.025	.05	.08	.05		
Reach-1	46.39	.05	.025	.05	.08	.035	.08	.05
Reach-1	46.382	.025	.08	.035	.08	.05		
Reach-1	46.3815	Culvert						
Reach-1	46.381	.025	.05	.08	.035	.08	.05	
Reach-1	46.36	.025	.05	.08	.035	.08		

.05
Reach-1 46.35 .025 .05 .08 .035 .08
.05
Reach-1 46.34 .025 .05 .08 .035 .08
.05
Reach-1 46.33 .05 .08 .035 .08 .05

Reach-1 46.322 .05 .08 .035 .08 .05

Reach-1 46.3215 Culvert

Reach-1 46.321 .05 .08 .035 .08 .05

Reach-1 46.32 .05 .08 .035 .08 .05

Reach-1 46.312 .05 .08 .035 .08 .05

Reach-1 46.3115 Culvert

Reach-1 46.311 .05 .08 .035 .08 .05

Reach-1 46.31 .05 .08 .035 .08 .05

Reach-1 46.30 .05 .08 .035 .08 .025
.05
Reach-1 46.292 .05 .08 .035 .08 .05

Reach-1 46.2915 Culvert

Reach-1 46.291 .05 .08 .035 .08 .05

Reach-1 46.29 .05 .08 .035 .08 .05

Reach-1 46.282 .05 .08 .035 .08 .05
.025 .05
Reach-1 46.2815 Culvert

Reach-1 46.281 .05 .08 .035 .08 .05
.025 .05
Reach-1 46.28 .05 .08 .035 .08 .05
.025 .05
Reach-1 46.274 .05 .08 .035 .08 .05

Reach-1 46.2735 Bridge

Reach-1 46.273 .05 .08 .035 .08 .05

Reach-1 46.272 .05 .08 .035 .08 .05

Reach-1 46.2715 Culvert

Reach-1 46.271 .05 .05 .08 .035 .08
.05
Reach-1 46.27 .08 .035 .08

Reach-1 46.26 .05 .08 .035 .08 .05

Reach-1 46.25 .05 .08 .035 .08 .05

Reach-1 46.24 .05 .08 .035 .08 .05

Reach-1 46.2375 .05 .08 .035 .08 .05

Reach-1	46.235	Culvert				
Reach-1	46.2325	.05	.08	.035	.08	.05
Reach-1	46.23	.05	.08	.035	.08	.05
Reach-1	46.22	.08	.035	.08	.035	.05
Reach-1	46.214	.05	.035	.08		
Reach-1	46.2135	Inl Struct				
Reach-1	46.213	.05	.035	.08		
Reach-1	46.212	.05	.035	.08		
Reach-1	46.2115	Culvert				
Reach-1	46.211	.05	.035	.08		
Reach-1	46.21	.05	.035	.05		
Reach-1	46.202	.05	.035	.05		
Reach-1	46.2015	Culvert				
Reach-1	46.201	.05	.035	.05		
Reach-1	46.192	.05	.035	.05		
Reach-1	46.1915	Culvert				
Reach-1	46.191	.05	.035	.05		
Reach-1	46.19	.05	.025	.05	.035	.05
Reach-1	46.182	.05	.025	.05	.035	.05
Reach-1	46.1815	Culvert				
Reach-1	46.181	.05	.025	.05	.035	.05
Reach-1	46.18	.05	.035	.05		
Reach-1	46.172	.05	.035	.05		
Reach-1	46.1715	Culvert				
Reach-1	46.171	.05	.035	.05	.025	
Reach-1	46.17	.05	.035	.05	.025	
Reach-1	46.162	.05	.035	.05		
Reach-1	46.1615	Culvert				
Reach-1	46.161	.05	.035	.05		
Reach-1	46.15	.05	.08	.035	.08	.025
Reach-1	46.142	.05	.08	.035	.08	.025
Reach-1	46.1415	Culvert				

Reach-1	46.141		.05	.08	.035	.08	.025
Reach-1	46.14		.05	.08	.035	.08	.025
Reach-1	46.132		.05	.08	.035	.08	.05
Reach-1	46.13		.05	.08	.035	.08	.05
Reach-1	46.122		.05	.035	.05		
Reach-1	46.1215	Culvert					
Reach-1	46.121		.05	.035	.05		
Reach-1	46.12		.05	.035	.05		
Reach-1	46.11		.05	.035	.05		
Reach-1	46.1015	Culvert					
Reach-1	46.10		.05	.035	.05		
Reach-1	46.09		.05	.035	.05		
Reach-1	46.082		.05	.035	.05		
Reach-1	46.0815	Culvert					
Reach-1	46.081		.08	.035	.08	.05	
Reach-1	46.07		.08	.035	.08		
Reach-1	46.06		.08	.035	.08		
Reach-1	46.05		.08	.035	.08		
Reach-1	46.04		.08	.035	.08		
Reach-1	46.032		.08	.035	.08		
Reach-1	46.0315	Culvert					
Reach-1	46.031		.08	.035	.08		
Reach-1	46.03		.08	.035	.08		
Reach-1	46.02		.08	.035	.08		
Reach-1	46.01		.08	.035	.08		
Reach-1	46.00		.08	.035	.08		

SUMMARY OF REACH LENGTHS

River: RIVER-1

Reach	River Sta.	Left	Channel	Right

Reach-1	46.45		180	180	170
Reach-1	46.44		130	130	125
Reach-1	46.43		100	100	95
Reach-1	46.42		295	240	190
Reach-1	46.413		5	5	5
Reach-1	46.4125	Inl Struct			
Reach-1	46.412		45	45	45
Reach-1	46.4115	Culvert			
Reach-1	46.411		80	80	90
Reach-1	46.41		140	140	120
Reach-1	46.402		100	100	100
Reach-1	46.4015	Culvert			
Reach-1	46.401		80	95	100
Reach-1	46.392		70	70	70
Reach-1	46.3915	Mult Open			
Reach-1	46.391		45	35	25
Reach-1	46.39		50	35	25
Reach-1	46.382		45	45	45
Reach-1	46.3815	Culvert			
Reach-1	46.381		260	275	290
Reach-1	46.36		150	150	150
Reach-1	46.35		120	120	120
Reach-1	46.34		225	205	190
Reach-1	46.33		130	130	130
Reach-1	46.322		50	50	50
Reach-1	46.3215	Culvert			
Reach-1	46.321		50	50	50
Reach-1	46.32		110	110	110
Reach-1	46.312		60	60	60
Reach-1	46.3115	Culvert			
Reach-1	46.311		150	150	150
Reach-1	46.31		150	150	150
Reach-1	46.30		110	110	110
Reach-1	46.292		55	55	55
Reach-1	46.2915	Culvert			
Reach-1	46.291		145	150	155
Reach-1	46.29		135	145	150
Reach-1	46.282		50	50	50
Reach-1	46.2815	Culvert			
Reach-1	46.281		40	40	40
Reach-1	46.28		50	50	50
Reach-1	46.274		1	1	1
Reach-1	46.2735	Bridge			
Reach-1	46.273		4	4	4
Reach-1	46.272		100	80	60
Reach-1	46.2715	Culvert			
Reach-1	46.271		55	60	70
Reach-1	46.27		100	110	120
Reach-1	46.26		115	120	120
Reach-1	46.25		140	130	125
Reach-1	46.24		54	51	45
Reach-1	46.2375		30	30	30
Reach-1	46.235	Culvert			
Reach-1	46.2325		94	94	94
Reach-1	46.23		101	95	89
Reach-1	46.22		125	140	115
Reach-1	46.214		1	1	1
Reach-1	46.2135	Inl Struct			
Reach-1	46.213		15	15	15
Reach-1	46.212		55	45	10
Reach-1	46.2115	Culvert			
Reach-1	46.211		10	10	10

Reach-1	46.21		30	30	30
Reach-1	46.202		70	70	70
Reach-1	46.2015	Culvert			
Reach-1	46.201		20	25	30
Reach-1	46.192		25	25	25
Reach-1	46.1915	Culvert			
Reach-1	46.191		50	50	50
Reach-1	46.19		45	45	45
Reach-1	46.182		30	30	30
Reach-1	46.1815	Culvert			
Reach-1	46.181		10	10	10
Reach-1	46.18		25	25	25
Reach-1	46.172		40	40	40
Reach-1	46.1715	Culvert			
Reach-1	46.171		20	20	20
Reach-1	46.17		25	25	25
Reach-1	46.162		30	30	30
Reach-1	46.1615	Culvert			
Reach-1	46.161		115	115	110
Reach-1	46.15		50	50	50
Reach-1	46.142		60	60	60
Reach-1	46.1415	Culvert			
Reach-1	46.141		30	25	20
Reach-1	46.14		37.5	37.5	37.5
Reach-1	46.132		27.5	27.5	27.5
Reach-1	46.13		25	25	25
Reach-1	46.122		38	38	38
Reach-1	46.1215	Culvert			
Reach-1	46.121		20	20	20
Reach-1	46.12		35	38	40
Reach-1	46.11		235	235	235
Reach-1	46.1015	Culvert			
Reach-1	46.10		130	200	160
Reach-1	46.09		80	95	125
Reach-1	46.082		75	75	75
Reach-1	46.0815	Culvert			
Reach-1	46.081		185	175	145
Reach-1	46.07		95	165	125
Reach-1	46.06		130	165	145
Reach-1	46.05		70	70	65
Reach-1	46.04		115	100	70
Reach-1	46.032		50	50	50
Reach-1	46.0315	Culvert			
Reach-1	46.031		90	110	75
Reach-1	46.03		185	205	150
Reach-1	46.02		110	120	110
Reach-1	46.01		95	105	95
Reach-1	46.00		0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: RIVER-1

Reach	River Sta.	Contr.	Expan.
Reach-1	46.45	.1	.3
Reach-1	46.44	.1	.3
Reach-1	46.43	.1	.3
Reach-1	46.42	.1	.3
Reach-1	46.413	.3	.5

Reach-1	46.4125	Inl Struct		
Reach-1	46.412		.3	.5
Reach-1	46.4115	Culvert		
Reach-1	46.411		.3	.5
Reach-1	46.41		.1	.3
Reach-1	46.402		.3	.5
Reach-1	46.4015	Culvert		
Reach-1	46.401		.3	.5
Reach-1	46.392		.3	.5
Reach-1	46.3915	Mult Open		
Reach-1	46.391		.3	.5
Reach-1	46.39		.1	.3
Reach-1	46.382		.3	.5
Reach-1	46.3815	Culvert		
Reach-1	46.381		.3	.5
Reach-1	46.36		.1	.3
Reach-1	46.35		.1	.3
Reach-1	46.34		.1	.3
Reach-1	46.33		.1	.3
Reach-1	46.322		.3	.5
Reach-1	46.3215	Culvert		
Reach-1	46.321		.3	.5
Reach-1	46.32		.1	.3
Reach-1	46.312		.3	.5
Reach-1	46.3115	Culvert		
Reach-1	46.311		.3	.5
Reach-1	46.31		.1	.3
Reach-1	46.30		.1	.3
Reach-1	46.292		.3	.5
Reach-1	46.2915	Culvert		
Reach-1	46.291		.3	.5
Reach-1	46.29		.1	.3
Reach-1	46.282		.3	.5
Reach-1	46.2815	Culvert		
Reach-1	46.281		.3	.5
Reach-1	46.28		.1	.3
Reach-1	46.274		.3	.5
Reach-1	46.2735	Bridge		
Reach-1	46.273		.3	.5
Reach-1	46.272		.3	.5
Reach-1	46.2715	Culvert		
Reach-1	46.271		.3	.5
Reach-1	46.27		.1	.3
Reach-1	46.26		.1	.3
Reach-1	46.25		.1	.3
Reach-1	46.24		.1	.3
Reach-1	46.2375		.1	.3
Reach-1	46.235	Culvert		
Reach-1	46.2325		.1	.3
Reach-1	46.23		.1	.3
Reach-1	46.22		.1	.3
Reach-1	46.214		.3	.5
Reach-1	46.2135	Inl Struct		
Reach-1	46.213		.3	.5
Reach-1	46.212		.3	.5
Reach-1	46.2115	Culvert		
Reach-1	46.211		.3	.5
Reach-1	46.21		.1	.3
Reach-1	46.202		.3	.5
Reach-1	46.2015	Culvert		
Reach-1	46.201		.3	.5
Reach-1	46.192		.3	.5
Reach-1	46.1915	Culvert		

Reach-1	46.191	.3	.5
Reach-1	46.19	.1	.3
Reach-1	46.182	.3	.5
Reach-1	46.1815	Culvert	
Reach-1	46.181	.3	.5
Reach-1	46.18	.1	.3
Reach-1	46.172	.3	.5
Reach-1	46.1715	Culvert	
Reach-1	46.171	.3	.5
Reach-1	46.17	.1	.3
Reach-1	46.162	.3	.5
Reach-1	46.1615	Culvert	
Reach-1	46.161	.3	.5
Reach-1	46.15	.1	.3
Reach-1	46.142	.3	.5
Reach-1	46.1415	Culvert	
Reach-1	46.141	.3	.5
Reach-1	46.14	.1	.3
Reach-1	46.132	.3	.5
Reach-1	46.13	.1	.3
Reach-1	46.122	.3	.5
Reach-1	46.1215	Culvert	
Reach-1	46.121	.3	.5
Reach-1	46.12	.1	.3
Reach-1	46.11	.3	.5
Reach-1	46.1015	Culvert	
Reach-1	46.10	.3	.5
Reach-1	46.09	.1	.3
Reach-1	46.082	.3	.5
Reach-1	46.0815	Culvert	
Reach-1	46.081	.3	.5
Reach-1	46.07	.1	.3
Reach-1	46.06	.1	.3
Reach-1	46.05	.1	.3
Reach-1	46.04	.1	.3
Reach-1	46.032	.3	.5
Reach-1	46.0315	Culvert	
Reach-1	46.031	.3	.5
Reach-1	46.03	.1	.3
Reach-1	46.02	.1	.3
Reach-1	46.01	.1	.3
Reach-1	46.00	.1	.3

HEC-RAS HEC-RAS 5.0.0 February 2016
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

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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: Black Creek Update (2016-02-26)
Project File : BlackCreekUpdate.prj
Run Date and Time: 6/30/2016 3:29:29 PM

Project in SI units

Project Description:
Main Humber River and Tributaries Digital Flood Plain Mapping
Hec-Ras File:
Black Creek Geometry.gxx covers Sheets HUM 13 (Converted Hec-2 file 46f1tbc.dat using new mapping), HUM 13A, HUM 13B & HUM 13C (New HEC-RAS based on new mapping)

PLAN DATA

Plan Title: Portage Parkway (Feb 2016 Alternative#2)
Plan File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.p06

Geometry Title: BlackCreek-PortageAlternative#2-Feb2016
Geometry File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.g04

Flow Title : Black Creek EXISTING Flows - April '10
Flow File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.f04

Plan Summary Information:

Number of: Cross Sections	=	86	Multiple Openings	=	1
Culverts	=	19	Inline Structures	=	2
Bridges	=	2	Lateral Structures	=	0

Computational Information
Water surface calculation tolerance = 0.003
Critical depth calculation tolerance = 0.003
Maximum number of iterations = 20

Maximum difference tolerance = 0.1
Flow tolerance factor = 0.001

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

FLOW DATA

Flow Title: Black Creek EXISTING Flows - April '10
Flow File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.f04

Flow Data (m3/s)

River	Reach	RS	2-year	5-year	10-year	25-year	50-year	100-year	Aug. 19th	Regional	w red'n
RIVER-1	Reach-1	46.45	3.729	4.826	5.609	6.57	7.342	7.79	16.701	42.698	
RIVER-1	Reach-1	46.413	1.611	2.011	2.244	2.66	3.591	4.753	10.797	42.698	
RIVER-1	Reach-1	46.41	3.066	4.074	4.85	5.926	6.831	7.624	17.745	47.801	
RIVER-1	Reach-1	46.36	6.209	8.542	10.169	12.321	14.297	16.307	41.071	66.485	
RIVER-1	Reach-1	46.33	8.661	12.09	14.453	17.546	20.243	22.971	57.024	74.783	
RIVER-1	Reach-1	46.30	10.769	15.139	18.134	22.036	25.353	28.697	70.731	81.913	
RIVER-1	Reach-1	46.274	8.055	11.399	13.737	17.024	19.57	22.105	52.858	81.913	
RIVER-1	Reach-1	46.25	15.029	21.487	25.936	31.807	36.287	40.806	96.524	108.096	
RIVER-1	Reach-1	46.214	3.775	6.823	9.185	12.675	15.796	19.055	49.3	108.096	
RIVER-1	Reach-1	46.21	7.789	11.08	13.186	15.823	17.823	20.589	50.389	122.563	
RIVER-1	Reach-1	46.09	8.997	12.899	15.58	19.072	21.783	24.795	62.776	133.764	
RIVER-1	Reach-1	46.032	19.481	29.214	36.46	51.57	58.851	66.972	191.204	200.643	

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
RIVER-1	Reach-1	2-year		
Known WS = 181.99				
RIVER-1	Reach-1	5-year		
Known WS = 182.42				
RIVER-1	Reach-1	10-year		
Known WS = 182.66				
RIVER-1	Reach-1	25-year		
Known WS = 182.73				
RIVER-1	Reach-1	50-year		
Known WS = 182.89				
RIVER-1	Reach-1	100-year		
Known WS = 183.04				
RIVER-1	Reach-1	Aug. 19th		
Known WS = 184.54				
RIVER-1	Reach-1	Regional w red'n		
Known WS = 184.54				

GEOMETRY DATA

Geometry Title: BlackCreek-PortageAlternative#2-Feb2016
Geometry File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.g04

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.45

INPUT
Description: Section 46.45 - J.D. Barnes 2003 topo mapping - U/S Study Limit
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	209	30	208	75	207.5	84	206.5	85	206.5
90	207.5	130	208	136	209				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	75	.035	90	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
75	90	180	180	170	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	207.38	Element	Left OB	Channel	Right OB
Vel Head (m)	0.19	Wt. n-Val.		0.035	

W.S. Elev (m)	207.19	Reach Len. (m)	180.00	180.00
170.00				
Crit W.S. (m)	207.19	Flow Area (m2)		4.02
E.G. Slope (m/m)	0.017095	Area (m2)		4.02
Q Total (m3/s)	7.79	Flow (m3/s)		7.79
Top Width (m)	10.66	Top Width (m)		10.66
Vel Total (m/s)	1.94	Avg. Vel. (m/s)		1.94
Max Chl Dpth (m)	0.69	Hydr. Depth (m)		0.38
Conv. Total (m3/s)	59.6	Conv. (m3/s)		59.6
Length Wtd. (m)	179.49	Wetted Per. (m)		10.76
Min Ch El (m)	206.50	Shear (N/m2)		62.62
Alpha	1.00	Stream Power (N/m s)		121.33
Frctn Loss (m)	0.16	Cum Volume (1000 m3)	120.07	215.25
77.72				
C & E Loss (m)	0.05	Cum SA (1000 m2)	121.54	84.02
93.46				

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 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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	208.17	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.22	Wt. n-Val.	0.050	0.035	
0.080					
W.S. Elev (m)	207.95	Reach Len. (m)	180.00	180.00	
170.00					
Crit W.S. (m)	207.95	Flow Area (m2)	8.94	14.69	
7.94					
E.G. Slope (m/m)	0.006925	Area (m2)	8.94	14.69	
7.94					
Q Total (m3/s)	42.70	Flow (m3/s)	5.47	34.19	
3.04					
Top Width (m)	90.74	Top Width (m)	40.10	15.00	

35.64					
Vel Total (m/s)	1.35	Avg. Vel. (m/s)	0.61	2.33	
0.38					
Max Chl Dpth (m)	1.45	Hydr. Depth (m)	0.22	0.98	
0.22					
Conv. Total (m3/s)	513.1	Conv. (m3/s)	65.7	410.9	
36.5					
Length Wtd. (m)	177.73	Wetted Per. (m)	40.10	15.15	
35.65					
Min Ch El (m)	206.50	Shear (N/m2)	15.13	65.81	
15.13					
Alpha	2.40	Stream Power (N/m s)	9.26	153.23	
5.79					
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	450.69	442.05	
387.46					
C & E Loss (m)	0.07	Cum SA (1000 m2)	335.09	84.42	
330.69					

Warning: The energy equation could not be 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: RIVER-1
REACH: Reach-1 RS: 46.44

INPUT
Description: Section 46.44 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	209	84	208	118	205	126	204	129	203.7
131	203.7	132	204	136	205	139	206	216	207
224	208	300	209						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	126	.035	132	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
126	132	130	130	125	.1 .3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	205.29	Element	Left OB	Channel

Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	205.28	Reach Len. (m)	130.00	130.00	125.00
Crit W.S. (m)		Flow Area (m2)	6.69	8.88	3.24
E.G. Slope (m/m)	0.000274	Area (m2)	6.69	8.88	3.24
Q Total (m3/s)	7.79	Flow (m3/s)	1.57	5.42	0.80
Top Width (m)	22.02	Top Width (m)	11.18	6.00	4.84
Vel Total (m/s)	0.41	Avg. Vel. (m/s)	0.23	0.61	0.25
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.60	1.48	0.67
Conv. Total (m3/s)	470.5	Conv. (m3/s)	94.6	327.5	48.4
Length Wtd. (m)	129.13	Wetted Per. (m)	11.25	6.06	5.01
Min Ch El (m)	203.70	Shear (N/m2)	1.60	3.94	1.74
Alpha	1.61	Stream Power (N/m s)	0.37	2.41	0.43
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	119.46	214.09	77.45
C & E Loss (m)	0.00	Cum SA (1000 m2)	120.53	82.52	93.05

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.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.46	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	207.46	Reach Len. (m)	130.00	130.00	125.00
Crit W.S. (m)		Flow Area (m2)	57.86	21.94	92.22
E.G. Slope (m/m)	0.000074	Area (m2)	57.86	21.94	92.22
Q Total (m3/s)	42.70	Flow (m3/s)	13.64	12.70	16.35
Top Width (m)	129.50	Top Width (m)	35.84	6.00	87.66
Vel Total (m/s)	0.25	Avg. Vel. (m/s)	0.24	0.58	0.18
Max Chl Dpth (m)	3.76	Hydr. Depth (m)	1.61	3.66	1.05
Conv. Total (m3/s)	4969.1	Conv. (m3/s)	1587.5	1478.4	1903.2
Length Wtd. (m)	128.13	Wetted Per. (m)	36.02	6.06	87.98
Min Ch El (m)	203.70	Shear (N/m2)	1.16	2.62	0.76

Alpha	2.10	Stream Power (N/m s)	0.27	1.52
0.13				
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	444.68	438.75
378.95				
C & E Loss (m)	0.00	Cum SA (1000 m2)	328.26	82.53
320.21				

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.43

INPUT
Description: Section 46.43 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	95	210	95	208.3	105	208	116	205
143	204	145	203.5	149	203.5	150	204	177	205
180	206	187	207	231	208	310	208.6		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	105	.08	143	.035	150	.08	177	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
143	150	100	100	95	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	205.27	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035
0.080				
W.S. Elev (m)	205.27	Reach Len. (m)	100.00	100.00
95.00				
Crit W.S. (m)		Flow Area (m2)	20.95	11.65
20.93				
E.G. Slope (m/m)	0.000076	Area (m2)	20.95	11.65
20.93				
Q Total (m3/s)	7.79	Flow (m3/s)	1.88	4.00
1.91				
Top Width (m)	62.81	Top Width (m)	27.99	7.00
27.81				
Vel Total (m/s)	0.15	Avg. Vel. (m/s)	0.09	0.34
0.09				
Max Chl Dpth (m)	1.77	Hydr. Depth (m)	0.75	1.66
0.75				
Conv. Total (m3/s)	894.4	Conv. (m3/s)	215.7	459.5
219.3				
Length Wtd. (m)	99.26	Wetted Per. (m)	28.05	7.18
27.88				
Min Ch El (m)	203.50	Shear (N/m2)	0.56	1.21
0.56				
Alpha	3.05	Stream Power (N/m s)	0.05	0.41
0.05				
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	117.67	212.75
75.93				
C & E Loss (m)	0.00	Cum SA (1000 m2)	117.98	81.68
91.01				

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.46	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035	0.077
W.S. Elev (m)	207.45	Reach Len. (m)	100.00	100.00	95.00
Crit W.S. (m)		Flow Area (m2)	90.70	26.91	96.67
E.G. Slope (m/m)	0.000047	Area (m2)	90.70	26.91	96.67
Q Total (m3/s)	42.70	Flow (m3/s)	14.32	12.73	15.65
Top Width (m)	99.83	Top Width (m)	35.99	7.00	56.85
Vel Total (m/s)	0.20	Avg. Vel. (m/s)	0.16	0.47	0.16
Max Chl Dpth (m)	3.95	Hydr. Depth (m)	2.52	3.84	1.70
Conv. Total (m3/s)	6221.5	Conv. (m3/s)	2086.2	1854.9	2280.4
Length Wtd. (m)	98.70	Wetted Per. (m)	36.33	7.18	57.10
Min Ch El (m)	203.50	Shear (N/m2)	1.15	1.73	0.78
Alpha	2.13	Stream Power (N/m s)	0.18	0.82	0.13
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	435.02	435.58	367.14
C & E Loss (m)	0.00	Cum SA (1000 m2)	323.59	81.69	311.18

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.42

INPUT
Description: Section 46.42 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208.5	13	208	29	207	31	206	52	205
64	204	66	203.3	70	203.3	74	204	80	205
84	206	105	207	215	208	231	208.3		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	29	.08	64	.035	74	.08	105	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
64	74	295	240	190	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	205.27	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	205.26	Reach Len. (m)	295.00	240.00	190.00
Crit W.S. (m)		Flow Area (m2)	9.83	17.50	4.69
E.G. Slope (m/m)	0.000085	Area (m2)	9.83	17.50	4.69
Q Total (m3/s)	7.79	Flow (m3/s)	0.77	6.61	0.41
Top Width (m)	34.50	Top Width (m)	17.46	10.00	7.04
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.08	0.38	0.09
Max Chl Dpth (m)	1.96	Hydr. Depth (m)	0.56	1.75	0.67
Conv. Total (m3/s)	845.3	Conv. (m3/s)	83.6	717.4	44.3
Length Wtd. (m)	241.75	Wetted Per. (m)	17.51	10.18	7.15
Min Ch El (m)	203.30	Shear (N/m2)	0.47	1.43	0.55
Alpha	2.06	Stream Power (N/m s)	0.04	0.54	0.05
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	116.13	211.30	74.72
C & E Loss (m)	0.00	Cum SA (1000 m2)	115.71	80.83	89.35

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.077
W.S. Elev (m)	207.44	Reach Len. (m)	295.00	240.00	190.00
Crit W.S. (m)		Flow Area (m2)	79.45	39.30	55.78
E.G. Slope (m/m)	0.000067	Area (m2)	79.45	39.30	55.78
Q Total (m3/s)	42.70	Flow (m3/s)	13.58	22.59	6.53
Top Width (m)	131.42	Top Width (m)	42.04	10.00	79.38
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.17	0.57	0.12
Max Chl Dpth (m)	4.14	Hydr. Depth (m)	1.89	3.93	0.70
Conv. Total (m3/s)	5223.7	Conv. (m3/s)	1661.7	2763.2	798.8
Length Wtd. (m)	248.69	Wetted Per. (m)	42.35	10.18	79.62
Min Ch El (m)	203.30	Shear (N/m2)	1.23	2.53	

0.46				
Alpha	3.11	Stream Power (N/m s)	0.21	1.45
0.05				
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	426.51	432.27
359.90				
C & E Loss (m)	0.00	Cum SA (1000 m2)	319.69	80.84
304.71				

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: RIVER-1
REACH: Reach-1 RS: 46.413

INPUT
Description: Section 46.413 - Creditview Road - Inline Weir Section
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	203.05	144.7	203.05	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
128	146	5	5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	129.7	207.11	F
144.7	352	207.4	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	205.26	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.00	Wt. n-Val.		0.035
W.S. Elev (m)	205.26	Reach Len. (m)	5.00	5.00
5.00				
Crit W.S. (m)	203.27	Flow Area (m2)		33.11
E.G. Slope (m/m)	0.000009	Area (m2)	29.76	39.05
14.63				
Q Total (m3/s)	4.75	Flow (m3/s)		4.75
Top Width (m)	52.28	Top Width (m)	22.19	18.00
12.09				
Vel Total (m/s)	0.14	Avg. Vel. (m/s)		0.14
Max Chl Dpth (m)	2.21	Hydr. Depth (m)		2.21
Conv. Total (m3/s)	1603.4	Conv. (m3/s)		1603.4
Length Wtd. (m)	5.00	Wetted Per. (m)		15.00

Min Ch El (m)	203.05	Shear (N/m2)			0.19
Alpha	1.00	Stream Power (N/m s)			0.03
Frctn Loss (m)		Cum Volume (1000 m3)	110.29	204.51	72.88
C & E Loss (m)		Cum SA (1000 m2)	109.86	77.47	87.53

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.44	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.079	0.035	0.080
W.S. Elev (m)	207.44	Reach Len. (m)	5.00	5.00	5.00
Crit W.S. (m)	203.99	Flow Area (m2)	93.26	78.25	48.66
E.G. Slope (m/m)	0.000021	Area (m2)	93.26	78.25	48.66
Q Total (m3/s)	42.70	Flow (m3/s)	10.48	27.13	5.09
Top Width (m)	99.98	Top Width (m)	62.82	18.00	19.16
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.11	0.35	0.10
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.48	4.35	2.54
Conv. Total (m3/s)	9326.4	Conv. (m3/s)	2288.6	5926.3	1111.4
Length Wtd. (m)	5.00	Wetted Per. (m)	63.27	18.13	19.70
Min Ch El (m)	203.05	Shear (N/m2)	0.30	0.89	0.51
Alpha	2.15	Stream Power (N/m s)	0.03	0.31	0.05
Frctn Loss (m)		Cum Volume (1000 m3)	401.04	418.16	349.98
C & E Loss (m)		Cum SA (1000 m2)	304.22	77.48	295.35

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

INLINE STRUCTURE

RIVER: RIVER-1
REACH: Reach-1 RS: 46.4125

INPUT
Description: Hum 13B-4R. Creditview Road - 4 Cell - 3.0 m W x 1.5 m H x 41 m L Concrete Box Culverts and 6.5 m W Weir with Drop Inlet Structure.

Drawings by Urban Ecosystems Ltd. (DT-2 & G-4), 1999.

New
HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 1
Deck/Roadway Width = .5
Weir Coefficient = 1.75
Weir Embankment Coordinates num = 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	129.75	207.11	129.75	207	133.95	207
133.95	204.7	137.2	204.7	140.45	204.7	140.45	207	144.65	207
144.65	207.4	205	207.79	305	208.3	352	208.6		

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 =
Weir crest shape = Broad Crested

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.412

INPUT
Description: Section 46.412 - Creditview Road - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	203.05	144.7	203.05	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
128	146	45	45	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	129.7	207.11	F
144.7	352	207.4	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.91	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.01	Wt. n-Val.		0.035
W.S. Elev (m)	203.91	Reach Len. (m)	45.00	45.00
45.00				
Crit W.S. (m)	203.27	Flow Area (m2)		12.85
E.G. Slope (m/m)	0.000206	Area (m2)	2.98	14.74
1.32				
Q Total (m3/s)	4.75	Flow (m3/s)		4.75

Top Width (m)	39.16	Top Width (m)	14.65	18.00	6.51
Vel Total (m/s)	0.37	Avg. Vel. (m/s)		0.37	
Max Chl Dpth (m)	0.86	Hydr. Depth (m)		0.86	
Conv. Total (m3/s)	331.1	Conv. (m3/s)		331.1	
Length Wtd. (m)	45.00	Wetted Per. (m)		15.00	
Min Ch El (m)	203.05	Shear (N/m2)		1.73	
Alpha	1.00	Stream Power (N/m s)		0.64	
Frctn Loss (m)		Cum Volume (1000 m3)	110.29	204.31	72.88
C & E Loss (m)		Cum SA (1000 m2)	109.77	77.38	87.49

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.37	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	
W.S. Elev (m)	207.37	Reach Len. (m)	45.00	45.00	45.00
Crit W.S. (m)	203.99	Flow Area (m2)	89.20	71.72	
E.G. Slope (m/m)	0.000032	Area (m2)	89.20	77.04	47.37
Q Total (m3/s)	42.70	Flow (m3/s)	12.31	30.39	
Top Width (m)	94.35	Top Width (m)	57.41	18.00	18.94
Vel Total (m/s)	0.27	Avg. Vel. (m/s)	0.14	0.42	
Max Chl Dpth (m)	4.32	Hydr. Depth (m)	1.55	4.29	
Conv. Total (m3/s)	7588.4	Conv. (m3/s)	2187.2	5401.2	
Length Wtd. (m)	45.00	Wetted Per. (m)	57.86	16.76	
Min Ch El (m)	203.05	Shear (N/m2)	0.48	1.33	
Alpha	1.89	Stream Power (N/m s)	0.07	0.56	
Frctn Loss (m)		Cum Volume (1000 m3)	401.04	417.58	349.98
C & E Loss (m)		Cum SA (1000 m2)	303.92	77.39	295.25

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.4115

INPUT
Description: Hum 13B-4R. Creditview Road - 4 Cell - 3.0 m W x 1.5 m H x 45 m L
Concrete Box Culverts and 6.5 m W Weir with Drop Inlet Structure.
Drawings by Urban Ecosystems Ltd. (DT-2 & G-4), 1999.

New
HEC-RAS coding January 2004 by Acres included coding of culvert
in HEC-RAS, including adjustments to roadway coding and hydraulic
loss coefficients.

Distance from Upstream XS = 10
Deck/Roadway Width = 25
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 11

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	208		60	207.5		129.7	207.11	
129.7	208.5		137.2	208.5		144.7	208.5	
144.7	207.4		205	207.79		265	208	
305	208.3		352	208.6				

Upstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	203.05	144.7	203.05	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
128	146	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	129.7	207.11	F
144.7	352	207.4	F

Downstream Deck/Roadway Coordinates
num= 11

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	208		60	207.5		129.7	207.11	
129.7	208.5		137.2	208.5		144.7	208.5	
144.7	207.4		205	207.79		265	208	
305	208.3		352	208.6				

Downstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	202.96	144.7	202.96	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

```
Bank Sta: Left   Right    Coeff Contr.   Expan.
          128     146            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   129.7   206.8       F
   144.7     352   206.8       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           Box     1.5       3
FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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      41     .015     .015        0                   .5
      1
Number of Barrels =  4
Upstream   Elevation =  203.05
Centerline Stations
    Sta.    Sta.    Sta.    Sta.
   132.1   135.5   138.9   142.3
Downstream Elevation =  202.96
Centerline Stations
    Sta.    Sta.    Sta.    Sta.
   132.1   135.5   138.9   142.3

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       4.75    Culv Full Len (m)
  # Barrels                    4    Culv Vel US (m/s)         0.47
  Q Barrel (m3/s)           1.19    Culv Vel DS (m/s)         0.42
  E.G. US. (m)            203.91    Culv Inv El Up (m)      203.05
  W.S. US. (m)            203.91    Culv Inv El Dn (m)      202.96
  E.G. DS (m)             203.90    Culv Frctn Ls (m)         0.01
  W.S. DS (m)             203.90    Culv Exit Loss (m)        0.00
  Delta EG (m)              0.01    Culv Entr Loss (m)        0.01
  Delta WS (m)              0.01    Q Weir (m3/s)
  E.G. IC (m)             203.46    Weir Sta Lft (m)
  E.G. OC (m)             203.91    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
  Culv WS Inlet (m)       203.90    Weir Max Depth (m)
  Culv WS Outlet (m)      203.90    Weir Avg Depth (m)
  Culv Nml Depth (m)        0.31    Weir Flow Area (m2)
  Culv Crt Depth (m)        0.25    Min El Weir Flow (m)    207.11


CULVERT OUTPUT  Profile #Regional w red'n  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      39.14    Culv Full Len (m)        41.00
  # Barrels                   4     Culv Vel US (m/s)         2.17
  Q Barrel (m3/s)           9.79    Culv Vel DS (m/s)         2.17
  E.G. US. (m)            207.37    Culv Inv El Up (m)      203.05
  W.S. US. (m)            207.37    Culv Inv El Dn (m)      202.96
```

E.G. DS (m)	206.91	Culv Frctn Ls (m)	0.11
W.S. DS (m)	206.90	Culv Exit Loss (m)	0.24
Delta EG (m)	0.47	Culv Entr Loss (m)	0.12
Delta WS (m)	0.46	Q Weir (m3/s)	3.55
E.G. IC (m)	204.84	Weir Sta Lft (m)	82.56
E.G. OC (m)	207.37	Weir Sta Rgt (m)	129.70
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	204.55	Weir Max Depth (m)	0.26
Culv WS Outlet (m)	204.46	Weir Avg Depth (m)	0.13
Culv Nml Depth (m)		Weir Flow Area (m2)	6.21
Culv Crt Depth (m)	1.03	Min El Weir Flow (m)	207.11

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.411

INPUT
Description: Section 46.411 - Creditview Road - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	202.96	144.7	202.96	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
128	146	80	80	90	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	129.7	206.8	F
144.7	352	206.8	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.90	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.035	
W.S. Elev (m)	203.90	Reach Len. (m)	80.00	80.00	90.00
Crit W.S. (m)	203.18	Flow Area (m2)		14.03	
E.G. Slope (m/m)	0.000154	Area (m2)	2.81	16.02	1.25
Q Total (m3/s)	4.75	Flow (m3/s)		4.75	
Top Width (m)	38.55	Top Width (m)	14.23	18.00	6.32
Vel Total (m/s)	0.34	Avg. Vel. (m/s)		0.34	
Max Chl Dpth (m)	0.94	Hydr. Depth (m)		0.94	

Conv. Total (m3/s)	383.3	Conv. (m3/s)			383.3
Length Wtd. (m)	80.76	Wetted Per. (m)			15.00
Min Ch El (m)	202.96	Shear (N/m2)			1.41
Alpha	1.00	Stream Power (N/m s)			0.48
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	110.29	204.14	72.88
C & E Loss (m)	0.00	Cum SA (1000 m2)	109.12	76.57	87.20

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.91	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	206.90	Reach Len. (m)	80.00	80.00	90.00
Crit W.S. (m)	203.90	Flow Area (m2)	70.79	70.16	38.91
E.G. Slope (m/m)	0.000033	Area (m2)	70.79	70.16	38.91
Q Total (m3/s)	42.70	Flow (m3/s)	9.47	28.50	4.72
Top Width (m)	63.11	Top Width (m)	27.68	18.00	17.43
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.13	0.41	0.12
Max Chl Dpth (m)	3.94	Hydr. Depth (m)	2.56	3.90	2.23
Conv. Total (m3/s)	7384.4	Conv. (m3/s)	1638.0	4929.7	816.7
Length Wtd. (m)	81.46	Wetted Per. (m)	28.11	18.19	17.89
Min Ch El (m)	202.96	Shear (N/m2)	0.83	1.26	0.71
Alpha	2.05	Stream Power (N/m s)	0.11	0.51	0.09
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	401.04	416.47	349.98
C & E Loss (m)	0.00	Cum SA (1000 m2)	302.01	76.58	294.44

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: RIVER-1
REACH: Reach-1 RS: 46.41

INPUT
Description: Section 46.41 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207.5	71	207	83	204	84	203.56	123	203.56
126	205	136	205	140	204	156	203.1	161	202.5
164	202.5	166	203	195	204	206	208	234	208.2

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	71	.08	83	.035	126	.08	156	.035
166	.08	195	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
156	166	140	140	120	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.89	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.043	0.035	0.080
W.S. Elev (m)	203.88	Reach Len. (m)	140.00	140.00	120.00
Crit W.S. (m)		Flow Area (m2)	18.36	11.85	11.35
E.G. Slope (m/m)	0.000131	Area (m2)	18.36	11.85	11.35
Q Total (m3/s)	7.62	Flow (m3/s)	2.38	4.30	0.94
Top Width (m)	90.03	Top Width (m)	54.37	10.00	25.66
Vel Total (m/s)	0.18	Avg. Vel. (m/s)	0.13	0.36	0.08
Max Chl Dpth (m)	1.38	Hydr. Depth (m)	0.34	1.18	0.44
Conv. Total (m3/s)	667.0	Conv. (m3/s)	208.1	376.5	82.4
Length Wtd. (m)	138.77	Wetted Per. (m)	54.53	10.10	25.67
Min Ch El (m)	202.50	Shear (N/m2)	0.43	1.50	0.57
Alpha	2.39	Stream Power (N/m s)	0.06	0.55	0.05
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	109.44	203.02	72.31
C & E Loss (m)	0.00	Cum SA (1000 m2)	106.38	75.45	85.76

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.91	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.044	0.035	0.077
W.S. Elev (m)	206.90	Reach Len. (m)	140.00	140.00	120.00
Crit W.S. (m)		Flow Area (m2)	240.60	42.04	110.32
E.G. Slope (m/m)	0.000008	Area (m2)	240.60	42.04	110.32
Q Total (m3/s)	47.80	Flow (m3/s)	30.75	8.57	8.48
Top Width (m)	131.60	Top Width (m)	84.62	10.00	36.99
Vel Total (m/s)	0.12	Avg. Vel. (m/s)	0.13	0.20	0.08
Max Chl Dpth (m)	4.40	Hydr. Depth (m)	2.84	4.20	2.98
Conv. Total (m3/s)	17337.4	Conv. (m3/s)	11152.2	3108.6	3076.7
Length Wtd. (m)	135.44	Wetted Per. (m)	85.54	10.10	37.51
Min Ch El (m)	202.50	Shear (N/m2)	0.21	0.31	0.22
Alpha	1.28	Stream Power (N/m s)	0.03	0.06	0.02
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	388.58	411.98	343.27
C & E Loss (m)	0.00	Cum SA (1000 m2)	297.52	75.46	291.99

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: RIVER-1
REACH: Reach-1 RS: 46.402

INPUT
Description: Section 46.402 - Highway 400 - U/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	212	21	206	97	205	104	203	105	202.4
115	202.4	116	203	125	205	136	206	187	206
250	206	270	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	97	.08	104	.035	116	.08	136	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
104	116	100	100	100	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	106	206.7	F
114.5	270	206.7	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.86	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.84	Reach Len. (m)	100.00	100.00	100.00
Crit W.S. (m)	202.83	Flow Area (m2)		12.25	
E.G. Slope (m/m)	0.000291	Area (m2)	1.24	16.70	1.59
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	18.73	Top Width (m)	2.95	12.00	3.79
Vel Total (m/s)	0.62	Avg. Vel. (m/s)		0.62	
Max Chl Dpth (m)	1.44	Hydr. Depth (m)		1.44	
Conv. Total (m3/s)	446.7	Conv. (m3/s)		446.7	
Length Wtd. (m)	100.00	Wetted Per. (m)		8.50	
Min Ch El (m)	202.40	Shear (N/m2)		4.12	
Alpha	1.00	Stream Power (N/m s)		2.56	
Frctn Loss (m)		Cum Volume (1000 m3)	108.07	201.03	71.54
C & E Loss (m)		Cum SA (1000 m2)	102.37	73.91	83.99

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.90	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.055	0.035	0.059
W.S. Elev (m)	206.90	Reach Len. (m)	100.00	100.00	100.00
Crit W.S. (m)	203.88	Flow Area (m2)	128.12	53.40	148.16
E.G. Slope (m/m)	0.000023	Area (m2)	128.12	53.40	148.16
Q Total (m3/s)	47.80	Flow (m3/s)	15.09	19.42	13.30
Top Width (m)	241.15	Top Width (m)	86.15	12.00	143.00
Vel Total (m/s)	0.14	Avg. Vel. (m/s)	0.12	0.36	0.09
Max Chl Dpth (m)	4.50	Hydr. Depth (m)	1.49	4.45	

1.04					
Conv. Total (m3/s)	9978.9	Conv. (m3/s)	3149.8	4053.4	2775.8
Length Wtd. (m)	100.00	Wetted Per. (m)	86.56	12.33	143.31
Min Ch El (m)	202.40	Shear (N/m2)	0.33	0.97	0.23
Alpha	2.87	Stream Power (N/m s)	0.04	0.35	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	362.77	405.30	327.76
C & E Loss (m)		Cum SA (1000 m2)	285.56	73.92	281.19

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.4015

INPUT
Description: Hum 13B-3R. Highway 400 - 3 Cell - 2.4 m W x 2.4 m H x 80 m L Concrete Box Culverts. Drawings by McCormick Rankin (Sheet 40 & 47, no date) used to code culvert in HEC-RAS format.

New
HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 14
Deck/Roadway Width = 80
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	206.5		189	207		270	207.8	

Upstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	212	21	206	97	205	104	203	105	202.4
115	202.4	116	203	125	205	136	206	187	206
250	206	270	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	97	.08	104	.035	116	.08	136	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
104	116	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	106	206.7	F
114.5	270	206.7	F

Downstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord

```
       0   206.5             189     207             270   207.8

Downstream Bridge Cross Section Data
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0     212      21     206      97     205     104     203     105   202.4
     115   202.4     116     203     125     205     136     206     187     206
     270   206.5

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05      21     .08     104    .035     116     .08     136     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
           104     116            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     106     206       F
   114.5     270     206       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           Box     2.4     2.4
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
                14      80     .015     .015        0                    .4
      1
Number of Barrels =  3
Upstream   Elevation =  202.4
Centerline Stations
    Sta.    Sta.    Sta.
   107.5   110.2   112.9
Downstream Elevation =  202.4
Centerline Stations
    Sta.    Sta.    Sta.
   107.5   110.2   112.9

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       7.62    Culv Full Len (m)
  # Barrels                    3    Culv Vel US (m/s)         0.74
  Q Barrel (m3/s)           2.54    Culv Vel DS (m/s)         0.75
  E.G. US. (m)            203.86    Culv Inv El Up (m)      202.40
  W.S. US. (m)            203.84    Culv Inv El Dn (m)      202.40
  E.G. DS (m)             203.82    Culv Frctn Ls (m)         0.01
  W.S. DS (m)             203.80    Culv Exit Loss (m)        0.01
  Delta EG (m)              0.04    Culv Entr Loss (m)        0.01
  Delta WS (m)              0.04    Q Weir (m3/s)
  E.G. IC (m)             203.16    Weir Sta Lft (m)
  E.G. OC (m)             203.86    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
```

Culv WS Inlet (m)	203.82	Weir Max Depth (m)	
Culv WS Outlet (m)	203.80	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.49	Min El Weir Flow (m)	206.70

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	31.75	Culv Full Len (m)	80.00
# Barrels	3	Culv Vel US (m/s)	1.84
Q Barrel (m3/s)	10.58	Culv Vel DS (m/s)	1.84
E.G. US. (m)	206.90	Culv Inv El Up (m)	202.40
W.S. US. (m)	206.90	Culv Inv El Dn (m)	202.40
E.G. DS (m)	206.55	Culv Frctn Ls (m)	0.12
W.S. DS (m)	206.54	Culv Exit Loss (m)	0.16
Delta EG (m)	0.35	Culv Entr Loss (m)	0.07
Delta WS (m)	0.36	Q Weir (m3/s)	16.05
E.G. IC (m)	205.08	Weir Sta Lft (m)	17.83
E.G. OC (m)	206.90	Weir Sta Rgt (m)	153.01
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	204.80	Weir Max Depth (m)	0.35
Culv WS Outlet (m)	204.80	Weir Avg Depth (m)	0.18
Culv Nml Depth (m)		Weir Flow Area (m2)	23.95
Culv Crt Depth (m)	1.26	Min El Weir Flow (m)	206.70

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.401

INPUT
Description: Section 46.401 - Highway 400 - D/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	212	21	206	97	205	104	203	105	202.4
115	202.4	116	203	125	205	136	206	187	206
270	206.5								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	21	.08	104	.035	116	.08	136	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
104	116	80	95	100	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	106	206	F
114.5	270	206	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.82	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	

W.S. Elev (m)	203.80	Reach Len. (m)	80.00	95.00	100.00
Crit W.S. (m)	202.83	Flow Area (m2)		11.93	
E.G. Slope (m/m)	0.000319	Area (m2)	1.13	16.24	1.45
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	18.42	Top Width (m)	2.81	12.00	3.61
Vel Total (m/s)	0.64	Avg. Vel. (m/s)		0.64	
Max Chl Dpth (m)	1.40	Hydr. Depth (m)		1.40	
Conv. Total (m3/s)	427.0	Conv. (m3/s)		427.0	
Length Wtd. (m)	95.00	Wetted Per. (m)		8.50	
Min Ch El (m)	202.40	Shear (N/m2)		4.39	
Alpha	1.00	Stream Power (N/m s)		2.80	
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	108.07	200.43	71.54
C & E Loss (m)	0.00	Cum SA (1000 m2)	102.08	72.71	83.62

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.55	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.066
W.S. Elev (m)	206.54	Reach Len. (m)	80.00	95.00	100.00
Crit W.S. (m)	203.88	Flow Area (m2)	97.50	49.10	86.22
E.G. Slope (m/m)	0.000063	Area (m2)	97.50	49.10	86.22
Q Total (m3/s)	47.80	Flow (m3/s)	10.67	27.93	9.20
Top Width (m)	250.90	Top Width (m)	84.90	12.00	154.00
Vel Total (m/s)	0.21	Avg. Vel. (m/s)	0.11	0.57	0.11
Max Chl Dpth (m)	4.14	Hydr. Depth (m)	1.15	4.09	0.56
Conv. Total (m3/s)	6031.7	Conv. (m3/s)	1346.0	3524.5	1161.2
Length Wtd. (m)	90.36	Wetted Per. (m)	85.26	12.33	154.31
Min Ch El (m)	202.40	Shear (N/m2)	0.70	2.45	0.34
Alpha	4.60	Stream Power (N/m s)	0.08	1.39	0.04
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	362.77	397.89	327.76

C & E Loss (m)	0.00	Cum SA (1000 m2)	277.01	72.72	266.34

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: RIVER-1
REACH: Reach-1 RS: 46.392

INPUT
Description: Section 46.392 - Langstaff Road - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	15	206	30	206	103	206	106	205
130	205	135	203	136	202.5	145	202.5	147	203
153	205	175	205	191	210	203	210		

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.025	103	.05	130	.08	135	.035
147	.08	153	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
135	147	70	70	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	136.4	206.2	F
145	203	212.9	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.79	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.035	
W.S. Elev (m)	203.76	Reach Len. (m)	70.00	70.00	70.00
Crit W.S. (m)	202.93	Flow Area (m2)		10.85	
E.G. Slope (m/m)	0.000443	Area (m2)	0.73	14.39	0.87
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	16.19	Top Width (m)	1.90	12.00	2.29
Vel Total (m/s)	0.70	Avg. Vel. (m/s)		0.70	
Max Chl Dpth (m)	1.26	Hydr. Depth (m)		1.26	
Conv. Total (m3/s)	362.1	Conv. (m3/s)		362.1	
Length Wtd. (m)	70.00	Wetted Per. (m)		8.60	
Min Ch El (m)	202.50	Shear (N/m2)		5.49	

Alpha	1.00	Stream Power (N/m s)		3.85
Frctn Loss (m)		Cum Volume (1000 m3)	108.00	198.98
71.42				
C & E Loss (m)		Cum SA (1000 m2)	101.89	71.57
83.33				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.54	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.01	Wt. n-Val.	0.043	0.035
W.S. Elev (m)	206.53	Reach Len. (m)	70.00	70.00
70.00				
Crit W.S. (m)	203.97	Flow Area (m2)	99.87	40.07
E.G. Slope (m/m)	0.000081	Area (m2)	99.87	47.63
52.65				
Q Total (m3/s)	47.80	Flow (m3/s)	21.97	25.84
Top Width (m)	166.90	Top Width (m)	121.99	12.00
32.90				
Vel Total (m/s)	0.34	Avg. Vel. (m/s)	0.22	0.64
Max Chl Dpth (m)	4.03	Hydr. Depth (m)	0.82	4.01
Conv. Total (m3/s)	5302.3	Conv. (m3/s)	2436.5	2865.8
Length Wtd. (m)	70.00	Wetted Per. (m)	122.61	10.12
Min Ch El (m)	202.50	Shear (N/m2)	0.65	3.16
Alpha	2.12	Stream Power (N/m s)	0.14	2.04
Frctn Loss (m)		Cum Volume (1000 m3)	354.88	393.29
320.81				
C & E Loss (m)		Cum SA (1000 m2)	268.73	71.58
256.99				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

MULTIPLE OPENING

RIVER: RIVER-1
REACH: Reach-1 RS: 46.3915

INPUT
Description: Hum 13B-2R. Langstaff Road - 3 Cell - 2.4 m W x 2.4 m H x 60 m L Concrete Box Culverts. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004 by Acres
included coding of culvert in HEC-RAS, including adjustments to
roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 60
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 9

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	212.8		8	213	212	28	213.2	212.3
73	213.82	212.82	103	213.4	212.4	103	213.4	206
142	213		182	212		203	211.5	

Upstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	15	206	30	206	103	206	106	205
130	205	135	203	136	202.5	145	202.5	147	203
153	205	175	205	191	210	203	210		

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.025	103	.05	130	.08	135	.035
147	.08	153	.05						

Bank Sta: Left	Right	Coeff Contr.	Expan.
135	147	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	136.4	206.2	F
145	203	212.9	F

Downstream Deck/Roadway Coordinates
num= 9

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	212.8		8	213	212	28	213.2	212.3
73	213.82	212.82	103	213.4	212.4	103	213.4	206
142	213		182	212		203	211.5	

Downstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	15	206	30	206	103	206	106	205
130	205	135	203	136	202.4	145	202.4	147	203
153	205	175	205	191	210	203	210		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.025	103	.05	130	.08	153	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
135	147	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	136.4	206	F
145	203	211	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 Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Box	2.4	2.4

FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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
	5	60	.015	.015	0	.5	1

Number of Barrels = 3
Upstream Elevation = 202.5
Centerline Stations

Sta.	Sta.	Sta.
138	140.7	143.4

Downstream Elevation = 202.4
Centerline Stations

Sta.	Sta.	Sta.
138	140.7	143.4

Multiple Opening Stagnation Limits

	Upstream		Downstream	
Opening Type	Sta. Left	Sta. Right	Sta. Left	Sta. Right
Bridge	0	120	0	120
Culvert Group	120	203	120	203

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.391

INPUT
Description: Section 46.391 - Langstaff Road - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	15	206	30	206	103	206	106	205
130	205	135	203	136	202.4	145	202.4	147	203
153	205	175	205	191	210	203	210		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.025	103	.05	130	.08	153	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
135	147	45	35	25	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	136.4	206	F
145	203	211	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.74	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.080	
W.S. Elev (m)	203.72	Reach Len. (m)	45.00	35.00	25.00
Crit W.S. (m)	202.83	Flow Area (m2)		11.33	
E.G. Slope (m/m)	0.002005	Area (m2)	0.64	14.91	0.77
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	15.95	Top Width (m)	1.79	12.00	2.15
Vel Total (m/s)	0.67	Avg. Vel. (m/s)		0.67	
Max Chl Dpth (m)	1.32	Hydr. Depth (m)		1.32	
Conv. Total (m3/s)	170.3	Conv. (m3/s)		170.3	
Length Wtd. (m)	35.03	Wetted Per. (m)		8.60	
Min Ch El (m)	202.40	Shear (N/m2)		25.91	
Alpha	1.00	Stream Power (N/m s)		17.43	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	108.00	198.98	71.42
C & E Loss (m)	0.01	Cum SA (1000 m2)	101.76	70.73	83.17

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.045	0.080	
W.S. Elev (m)	206.45	Reach Len. (m)	45.00	35.00	25.00

Crit W.S. (m)	203.87	Flow Area (m2)	89.27	40.15
E.G. Slope (m/m)	0.000212	Area (m2)	89.27	47.64
49.80				
Q Total (m3/s)	47.80	Flow (m3/s)	29.55	18.25
Top Width (m)	166.29	Top Width (m)	121.67	12.00
32.62				
Vel Total (m/s)	0.37	Avg. Vel. (m/s)	0.33	0.45
Max Chl Dpth (m)	4.04	Hydr. Depth (m)	0.73	4.01
Conv. Total (m3/s)	3284.9	Conv. (m3/s)	2030.9	1254.0
Length Wtd. (m)	38.91	Wetted Per. (m)	122.27	10.17
Min Ch El (m)	202.40	Shear (N/m2)	1.52	8.20
Alpha	1.07	Stream Power (N/m s)	0.50	3.73
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	354.88	393.29
320.81				
C & E Loss (m)	0.00	Cum SA (1000 m2)	260.21	70.74
254.70				

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: RIVER-1
REACH: Reach-1 RS: 46.39

INPUT
Description: Section 46.39 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	20	205	45	205	51	206.5	133	206.3
142	206	152	205	161	204	185	204	193	203
195	202.4	204	202.4	206	203	212	204	236	205
268	210								

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	51	.025	142	.05	185	.08	193	.035
206	.08	212	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
193	206	50	35	25	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	51	206.6	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.72	Element	Left OB	Channel

Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.71	Reach Len. (m)	50.00	35.00	25.00
Crit W.S. (m)	202.80	Flow Area (m2)	2.00	15.80	1.50
E.G. Slope (m/m)	0.000206	Area (m2)	2.00	15.80	1.50
Q Total (m3/s)	7.62	Flow (m3/s)	0.18	7.31	0.13
Top Width (m)	22.91	Top Width (m)	5.66	13.00	4.25
Vel Total (m/s)	0.39	Avg. Vel. (m/s)	0.09	0.46	0.09
Max Chl Dpth (m)	1.31	Hydr. Depth (m)	0.35	1.22	0.35
Conv. Total (m3/s)	531.2	Conv. (m3/s)	12.5	509.4	9.3
Length Wtd. (m)	35.09	Wetted Per. (m)	5.70	13.18	4.30
Min Ch El (m)	202.40	Shear (N/m2)	0.71	2.42	0.71
Alpha	1.32	Stream Power (N/m s)	0.06	1.12	0.06
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	107.94	198.44	71.39
C & E Loss (m)	0.00	Cum SA (1000 m2)	101.59	70.29	83.09

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.055	0.035	0.057
W.S. Elev (m)	206.44	Reach Len. (m)	50.00	35.00	25.00
Crit W.S. (m)	203.62	Flow Area (m2)	116.11	51.38	71.01
E.G. Slope (m/m)	0.000029	Area (m2)	166.83	51.38	71.01
Q Total (m3/s)	47.80	Flow (m3/s)	18.06	19.50	10.23
Top Width (m)	216.75	Top Width (m)	164.50	13.00	39.24
Vel Total (m/s)	0.20	Avg. Vel. (m/s)	0.16	0.38	0.14
Max Chl Dpth (m)	4.04	Hydr. Depth (m)	0.97	3.95	1.81
Conv. Total (m3/s)	8912.5	Conv. (m3/s)	3367.8	3636.7	1908.0
Length Wtd. (m)	40.73	Wetted Per. (m)	119.45	13.18	39.46

Min Ch El (m)	202.40	Shear (N/m2)	0.27	1.10	0.51
Alpha	1.80	Stream Power (N/m s)	0.04	0.42	0.07
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	349.12	391.56	319.30
C & E Loss (m)	0.00	Cum SA (1000 m2)	253.77	70.30	253.80

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: RIVER-1
REACH: Reach-1 RS: 46.382

INPUT
Description: Section 46.382 - Hwy 400 / Langstaff Rd Ramp - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	50	206.5	95	205	220	204	227	203
235	202.4	244	202.4	247	203	252	204	257	205
269	206	300	206	300	209.5				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	50	.08	227	.035	247	.08	257	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
227	247	45	45	45	.3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235.2	206.38	F
243.8	300	207.55	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.71	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.68	Reach Len. (m)	45.00	45.00	45.00
Crit W.S. (m)	202.83	Flow Area (m2)		11.03	
E.G. Slope (m/m)	0.000420	Area (m2)	1.63	22.35	1.16
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	28.19	Top Width (m)	4.78	20.00	3.41
Vel Total (m/s)	0.69	Avg. Vel. (m/s)		0.69	
Max Chl Dpth (m)	1.28	Hydr. Depth (m)		1.28	
Conv. Total (m3/s)	371.9	Conv. (m3/s)		371.9	

Length Wtd. (m)	45.00	Wetted Per. (m)		8.60
Min Ch El (m)	202.40	Shear (N/m2)		5.29
Alpha	1.00	Stream Power (N/m s)		3.65
Frctn Loss (m)		Cum Volume (1000 m3)	107.84	197.77
71.36				
C & E Loss (m)		Cum SA (1000 m2)	101.33	69.71
83.00				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.45	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035
W.S. Elev (m)	206.44	Reach Len. (m)	45.00	45.00
45.00				
Crit W.S. (m)	203.86	Flow Area (m2)	294.88	65.54
E.G. Slope (m/m)	0.000024	Area (m2)	294.88	77.58
49.53				
Q Total (m3/s)	47.80	Flow (m3/s)	25.30	22.51
Top Width (m)	248.32	Top Width (m)	175.32	20.00
53.00				
Vel Total (m/s)	0.13	Avg. Vel. (m/s)	0.09	0.34
Max Chl Dpth (m)	4.04	Hydr. Depth (m)	1.68	3.90
Conv. Total (m3/s)	9847.2	Conv. (m3/s)	5211.0	4636.1
Length Wtd. (m)	45.00	Wetted Per. (m)	175.42	16.82
Min Ch El (m)	202.40	Shear (N/m2)	0.39	0.90
Alpha	3.38	Stream Power (N/m s)	0.03	0.31
Frctn Loss (m)		Cum Volume (1000 m3)	337.58	389.30
317.80				
C & E Loss (m)		Cum SA (1000 m2)	245.27	69.72
252.65				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.3815

INPUT

Description: Hum 13B-1R. Hwy 400 / Langstaff Rd Ramp - 3 Cell - 2.4 m W x 2.4 m H x 38 m L Concrete Box Culverts. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004
by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 2
Deck/Roadway Width = 38
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	207		130	206.38		200	206	
230	207		260	208		285	209	
300	209.5							

Upstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	50	206.5	95	205	220	204	227	203
235	202.4	244	202.4	247	203	252	204	257	205
269	206	300	206	300	209.5				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	50	.08	227	.035	247	.08	257	.05

Bank Sta: Left Right Coeff Contr. Expan.
227 247 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235.2	206.38	F
243.8	300	207.55	F

Downstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	207		130	206.38		200	206	
230	207		260	208		285	209	
300	209.5							

Downstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	50	206.5	95	205	220	204	227	203
235	202.3	244	202.3	247	203	252	204	257	205
269	206	300	206	300	209.5				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	50	.05	220	.08	227	.035	247	.08
257	.05								

Bank Sta: Left Right Coeff Contr. Expan.
227 247 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235.2	205.5	F
243.8	300	205.5	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           Box     2.4     2.4
FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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
                 2      38     .015     .015        0                    .7
      1
Number of Barrels =  3
Upstream   Elevation =  202.4
Centerline Stations
    Sta.    Sta.    Sta.
   236.9   239.5   242.1
Downstream Elevation =  202.3
Centerline Stations
    Sta.    Sta.    Sta.
   236.9   239.5   242.1

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       7.62    Culv Full Len (m)
  # Barrels                    3    Culv Vel US (m/s)         0.85
  Q Barrel (m3/s)           2.54    Culv Vel DS (m/s)         0.79
  E.G. US. (m)            203.71    Culv Inv El Up (m)      202.40
  W.S. US. (m)            203.68    Culv Inv El Dn (m)      202.30
  E.G. DS (m)             203.66    Culv Frctn Ls (m)         0.01
  W.S. DS (m)             203.64    Culv Exit Loss (m)        0.01
  Delta EG (m)              0.05    Culv Entr Loss (m)        0.03
  Delta WS (m)              0.04    Q Weir (m3/s)
  E.G. IC (m)             203.19    Weir Sta Lft (m)
  E.G. OC (m)             203.71    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
  Culv WS Inlet (m)       203.64    Weir Max Depth (m)
  Culv WS Outlet (m)      203.64    Weir Avg Depth (m)
  Culv Nml Depth (m)        0.58    Weir Flow Area (m2)
  Culv Crt Depth (m)        0.49    Min El Weir Flow (m)    206.38


CULVERT OUTPUT  Profile #Regional w red'n  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      32.69    Culv Full Len (m)        38.00
  # Barrels                   3     Culv Vel US (m/s)         1.89
  Q Barrel (m3/s)          10.90    Culv Vel DS (m/s)         1.89
  E.G. US. (m)            206.45    Culv Inv El Up (m)      202.40
  W.S. US. (m)            206.44    Culv Inv El Dn (m)      202.30
  E.G. DS (m)             206.08    Culv Frctn Ls (m)         0.06
  W.S. DS (m)             206.08    Culv Exit Loss (m)        0.18
  Delta EG (m)              0.37    Culv Entr Loss (m)        0.13
  Delta WS (m)              0.37    Q Weir (m3/s)            15.11
  E.G. IC (m)             205.10    Weir Sta Lft (m)        116.40
  E.G. OC (m)             206.45    Weir Sta Rgt (m)        213.35
  Culvert Control         Outlet    Weir Submerg              0.00
  Culv WS Inlet (m)       204.80    Weir Max Depth (m)        0.44
  Culv WS Outlet (m)      204.70    Weir Avg Depth (m)        0.22
```

Culv Nml Depth (m)		Weir Flow Area (m2)	21.25
Culv Crt Depth (m)	1.28	Min El Weir Flow (m)	206.38

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.381

INPUT
Description: Section 46.381 - Hwy 400 / Langstaff Rd Ramp - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	50	206.5	95	205	220	204	227	203
235	202.3	244	202.3	247	203	252	204	257	205
269	206	300	206	300	209.5				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	50	.05	220	.08	227	.035	247	.08
257	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
227	247	260	275	290	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235.2	205.5	F
243.8	300	205.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.66	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.64	Reach Len. (m)	260.00	275.00	290.00
Crit W.S. (m)	202.73	Flow Area (m2)		11.51	
E.G. Slope (m/m)	0.000365	Area (m2)	1.43	22.91	1.02
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	27.66	Top Width (m)	4.47	20.00	3.19
Vel Total (m/s)	0.66	Avg. Vel. (m/s)		0.66	
Max Chl Dpth (m)	1.34	Hydr. Depth (m)		1.34	
Conv. Total (m3/s)	399.3	Conv. (m3/s)		399.3	
Length Wtd. (m)	275.05	Wetted Per. (m)		8.60	
Min Ch El (m)	202.30	Shear (N/m2)		4.78	
Alpha	1.00	Stream Power (N/m s)		3.17	

Frctn Loss (m)	0.11	Cum Volume (1000 m3)	107.84	197.60	71.36
C & E Loss (m)	0.00	Cum SA (1000 m2)	101.12	68.81	82.85

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.052	0.035	0.076
W.S. Elev (m)	206.08	Reach Len. (m)	260.00	275.00	290.00
Crit W.S. (m)	203.77	Flow Area (m2)	232.27	71.65	29.98
E.G. Slope (m/m)	0.000019	Area (m2)	232.27	71.65	29.98
Q Total (m3/s)	47.80	Flow (m3/s)	24.83	20.86	2.11
Top Width (m)	237.26	Top Width (m)	164.26	20.00	53.00
Vel Total (m/s)	0.14	Avg. Vel. (m/s)	0.11	0.29	0.07
Max Chl Dpth (m)	3.78	Hydr. Depth (m)	1.41	3.58	0.57
Conv. Total (m3/s)	10944.2	Conv. (m3/s)	5685.9	4775.6	482.6
Length Wtd. (m)	272.95	Wetted Per. (m)	164.35	20.11	53.31
Min Ch El (m)	202.30	Shear (N/m2)	0.26	0.67	0.11
Alpha	2.10	Stream Power (N/m s)	0.03	0.19	0.01
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	337.58	387.38	317.80
C & E Loss (m)	0.01	Cum SA (1000 m2)	237.63	68.82	250.26

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: RIVER-1
REACH: Reach-1 RS: 46.36

INPUT

Description: Section 46.36 - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207.4	29	207	39	205	50	202	52	201.6
57	201.6	59	202	71	205	130	205.8		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	29	.05	39	.08	50	.035	59	.08
71	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
50	59	150	150	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
110	130	208	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.54	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.51	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)		Flow Area (m2)	4.17	16.37	4.55
E.G. Slope (m/m)	0.000436	Area (m2)	4.17	16.37	4.55
Q Total (m3/s)	16.31	Flow (m3/s)	0.88	14.46	0.96
Top Width (m)	20.56	Top Width (m)	5.53	9.00	6.03
Vel Total (m/s)	0.65	Avg. Vel. (m/s)	0.21	0.88	0.21
Max Chl Dpth (m)	1.91	Hydr. Depth (m)	0.75	1.82	0.75
Conv. Total (m3/s)	781.3	Conv. (m3/s)	42.1	693.0	46.1
Length Wtd. (m)	150.00	Wetted Per. (m)	5.73	9.08	6.22
Min Ch El (m)	201.60	Shear (N/m2)	3.11	7.70	3.12
Alpha	1.65	Stream Power (N/m s)	0.66	6.81	0.66
Frctn Loss (m)	0.06	Cum Volume (1000 m3)	107.12	192.20	70.55
C & E Loss (m)	0.00	Cum SA (1000 m2)	99.82	64.83	81.51

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.05	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.079	0.035	0.068
W.S. Elev (m)	206.02	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)		Flow Area (m2)	30.26	38.95	

59.51					
E.G. Slope (m/m)	0.000195	Area (m2)	30.26	38.95	
66.55					
Q Total (m3/s)	66.49	Flow (m3/s)	9.17	41.00	
16.31					
Top Width (m)	96.08	Top Width (m)	16.08	9.00	
71.00					
Vel Total (m/s)	0.52	Avg. Vel. (m/s)	0.30	1.05	
0.27					
Max Chl Dpth (m)	4.42	Hydr. Depth (m)	1.88	4.33	
1.17					
Conv. Total (m3/s)	4764.1	Conv. (m3/s)	657.4	2937.7	
1169.1					
Length Wtd. (m)	150.00	Wetted Per. (m)	16.58	9.08	
51.37					
Min Ch El (m)	201.60	Shear (N/m2)	3.48	8.19	
2.21					
Alpha	2.68	Stream Power (N/m s)	1.06	8.62	
0.61					
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	303.45	372.17	
303.80					
C & E Loss (m)	0.00	Cum SA (1000 m2)	214.19	64.83	
232.28					

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.35

INPUT
Description: Section 46.35 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	206.8	29	206.5	35	206	49	202	52	201.4
56	201.4	59	202	79	205	100	205.5	100	208
139	208								

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	29	.05	35	.08	49	.035	59	.08
79	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
49	59	120	120	120	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.49	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	
0.080					
W.S. Elev (m)	203.46	Reach Len. (m)	120.00	120.00	
120.00					
Crit W.S. (m)		Flow Area (m2)	3.73	18.79	
7.10					
E.G. Slope (m/m)	0.000315	Area (m2)	3.73	18.79	

7.10					
Q Total (m3/s)	16.31	Flow (m3/s)	0.65	14.39	
1.27					
Top Width (m)	24.83	Top Width (m)	5.11	10.00	
9.73					
Vel Total (m/s)	0.55	Avg. Vel. (m/s)	0.18	0.77	
0.18					
Max Chl Dpth (m)	2.06	Hydr. Depth (m)	0.73	1.88	
0.73					
Conv. Total (m3/s)	919.3	Conv. (m3/s)	36.8	811.2	
71.3					
Length Wtd. (m)	120.00	Wetted Per. (m)	5.31	10.12	
9.84					
Min Ch El (m)	201.40	Shear (N/m2)	2.16	5.73	
2.23					
Alpha	1.72	Stream Power (N/m s)	0.38	4.39	
0.40					
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	106.53	189.56	
69.68					
C & E Loss (m)	0.00	Cum SA (1000 m2)	99.03	63.40	
80.33					

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.02	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	
0.075					
W.S. Elev (m)	205.99	Reach Len. (m)	120.00	120.00	
120.00					
Crit W.S. (m)		Flow Area (m2)	27.91	44.14	
65.49					
E.G. Slope (m/m)	0.000158	Area (m2)	27.91	44.14	
65.49					
Q Total (m3/s)	66.49	Flow (m3/s)	6.77	42.26	
17.45					
Top Width (m)	64.98	Top Width (m)	13.98	10.00	
41.00					
Vel Total (m/s)	0.48	Avg. Vel. (m/s)	0.24	0.96	
0.27					
Max Chl Dpth (m)	4.59	Hydr. Depth (m)	2.00	4.41	
1.60					
Conv. Total (m3/s)	5296.1	Conv. (m3/s)	539.0	3366.7	
1390.4					
Length Wtd. (m)	120.00	Wetted Per. (m)	14.54	10.12	
41.72					
Min Ch El (m)	201.40	Shear (N/m2)	2.97	6.74	
2.43					
Alpha	2.60	Stream Power (N/m s)	0.72	6.45	
0.65					
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	299.08	365.94	
293.90					
C & E Loss (m)	0.00	Cum SA (1000 m2)	211.93	63.41	
223.88					

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.34

INPUT
Description: Section 46.34 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	206.4	30	206.4	36	206	46	202	51	201.2
53	201.2	58	202	68	205	144	205.4		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	30	.05	36	.08	46	.035	58	.08
68	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
46	58	225	205	190	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
100	144	208	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.43	Reach Len. (m)	225.00	205.00	190.00
Crit W.S. (m)		Flow Area (m2)	2.55	22.75	3.40
E.G. Slope (m/m)	0.000243	Area (m2)	2.55	22.75	3.40
Q Total (m3/s)	16.31	Flow (m3/s)	0.38	15.41	0.52
Top Width (m)	20.34	Top Width (m)	3.57	12.00	4.76
Vel Total (m/s)	0.57	Avg. Vel. (m/s)	0.15	0.68	0.15
Max Chl Dpth (m)	2.23	Hydr. Depth (m)	0.71	1.90	0.71
Conv. Total (m3/s)	1045.9	Conv. (m3/s)	24.3	988.6	33.0
Length Wtd. (m)	204.98	Wetted Per. (m)	3.85	12.13	4.97
Min Ch El (m)	201.20	Shear (N/m2)	1.58	4.47	1.63
Alpha	1.35	Stream Power (N/m s)	0.23	3.03	0.25
Frctn Loss (m)	0.07	Cum Volume (1000 m3)	106.15	187.07	69.05
C & E Loss (m)	0.00	Cum SA (1000 m2)	98.50	62.08	79.46

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.01	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	

0.065					
W.S. Elev (m)	205.97	Reach Len. (m)	225.00	205.00	190.00
Crit W.S. (m)		Flow Area (m2)	19.74	53.28	53.20
E.G. Slope (m/m)	0.000144	Area (m2)	19.74	53.28	83.54
Q Total (m3/s)	66.49	Flow (m3/s)	4.46	49.09	12.94
Top Width (m)	107.93	Top Width (m)	9.93	12.00	86.00
Vel Total (m/s)	0.53	Avg. Vel. (m/s)	0.23	0.92	0.24
Max Chl Dpth (m)	4.77	Hydr. Depth (m)	1.99	4.44	1.27
Conv. Total (m3/s)	5531.4	Conv. (m3/s)	371.1	4084.1	1076.2
Length Wtd. (m)	205.80	Wetted Per. (m)	10.70	12.13	42.44
Min Ch El (m)	201.20	Shear (N/m2)	2.61	6.22	1.78
Alpha	2.31	Stream Power (N/m s)	0.59	5.73	0.43
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	296.22	360.10	284.96
C & E Loss (m)	0.00	Cum SA (1000 m2)	210.50	62.09	216.26

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.33

INPUT
Description: Section 46.33 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	67	205	75	202	78	201	83	201
86	202	97	205	115	205	115	208	180	208

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	67	.08	75	.035	86	.08	97	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
75	86	130	130	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.38	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.33	Reach Len. (m)	130.00	130.00	130.00
Crit W.S. (m)		Flow Area (m2)	2.37	22.67	

3.26				
E.G. Slope (m/m)	0.000452	Area (m2)	2.37	22.67
3.26				
Q Total (m3/s)	22.97	Flow (m3/s)	0.46	21.87
0.65				
Top Width (m)	19.45	Top Width (m)	3.56	11.00
4.89				
Vel Total (m/s)	0.81	Avg. Vel. (m/s)	0.19	0.96
0.20				
Max Chl Dpth (m)	2.33	Hydr. Depth (m)	0.67	2.06
0.67				
Conv. Total (m3/s)	1081.0	Conv. (m3/s)	21.7	1028.9
30.4				
Length Wtd. (m)	130.00	Wetted Per. (m)	3.80	11.32
5.07				
Min Ch El (m)	201.00	Shear (N/m2)	2.77	8.87
2.85				
Alpha	1.35	Stream Power (N/m s)	0.54	8.55
0.56				
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	105.59	182.41
68.42				
C & E Loss (m)	0.00	Cum SA (1000 m2)	97.70	59.72
78.54				

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.98	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.03	Wt. n-Val.	0.058	0.035
0.070				
W.S. Elev (m)	205.95	Reach Len. (m)	130.00	130.00
130.00				
Crit W.S. (m)		Flow Area (m2)	83.32	51.46
44.07				
E.G. Slope (m/m)	0.000128	Area (m2)	83.32	51.46
44.07				
Q Total (m3/s)	74.78	Flow (m3/s)	18.67	45.71
10.40				
Top Width (m)	115.00	Top Width (m)	75.00	11.00
29.00				
Vel Total (m/s)	0.42	Avg. Vel. (m/s)	0.22	0.89
0.24				
Max Chl Dpth (m)	4.95	Hydr. Depth (m)	1.11	4.68
1.52				
Conv. Total (m3/s)	6598.4	Conv. (m3/s)	1647.0	4033.4
917.9				
Length Wtd. (m)	130.00	Wetted Per. (m)	76.49	11.32
30.35				
Min Ch El (m)	201.00	Shear (N/m2)	1.37	5.72
1.83				
Alpha	2.88	Stream Power (N/m s)	0.31	5.08
0.43				
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	284.63	349.36
272.83				
C & E Loss (m)	0.00	Cum SA (1000 m2)	200.94	59.73
205.34				

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

water surface.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.322

INPUT
Description: Section 46.322 - Applewod Crescent - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	58	208	58	205.5	66	205.5	78.5	201.8
79.15	201	91	201	91.5	201.8	100.5	205.7	115	205.7
115	208	175	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	66	.08	78.5	.035	91.5	.08	100.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
78.5	91.5	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	78.5	205.6	F
91.5	175	205.6	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.035	
W.S. Elev (m)	203.30	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	201.71	Flow Area (m2)		29.43	
E.G. Slope (m/m)	0.000273	Area (m2)	3.80	29.43	2.59
Q Total (m3/s)	22.97	Flow (m3/s)		22.97	
Top Width (m)	21.52	Top Width (m)	5.06	13.00	3.46
Vel Total (m/s)	0.78	Avg. Vel. (m/s)		0.78	
Max Chl Dpth (m)	2.30	Hydr. Depth (m)		2.26	
Conv. Total (m3/s)	1391.2	Conv. (m3/s)		1391.2	
Length Wtd. (m)	50.00	Wetted Per. (m)		13.82	
Min Ch El (m)	201.00	Shear (N/m2)		5.69	
Alpha	1.00	Stream Power (N/m s)		4.44	
Frctn Loss (m)		Cum Volume (1000 m3)	105.19	179.03	68.04
C & E Loss (m)		Cum SA (1000 m2)	97.14	58.16	78.00

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.96	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.078	0.035	0.078
W.S. Elev (m)	205.92	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	202.54	Flow Area (m2)	31.65	63.45	22.63
E.G. Slope (m/m)	0.000153	Area (m2)	31.65	63.45	22.63
Q Total (m3/s)	74.78	Flow (m3/s)	7.79	61.95	5.04
Top Width (m)	57.00	Top Width (m)	20.50	13.00	23.50
Vel Total (m/s)	0.64	Avg. Vel. (m/s)	0.25	0.98	0.22
Max Chl Dpth (m)	4.92	Hydr. Depth (m)	1.54	4.88	0.96
Conv. Total (m3/s)	6043.9	Conv. (m3/s)	629.8	5006.6	407.5
Length Wtd. (m)	50.00	Wetted Per. (m)	21.45	13.82	24.52
Min Ch El (m)	201.00	Shear (N/m2)	2.22	6.89	1.39
Alpha	1.98	Stream Power (N/m s)	0.55	6.73	0.31
Frctn Loss (m)		Cum Volume (1000 m3)	277.16	341.89	268.50
C & E Loss (m)		Cum SA (1000 m2)	194.74	58.17	201.93

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.3215

INPUT
Description: Hum 13A-4R. Applewood Crescent - Twin Cell - 4.3 m W x 2.4 m H x 30 m L Concrete Box Culverts. Based on Drawings - July 2010

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.
Distance from Upstream XS = 10
Deck/Roadway Width = 30
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 2
Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord

58	205.6	115	205.6

Upstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	58	208	58	205.5	66	205.5	78.5	201.8
79.15	201	91	201	91.5	201.8	100.5	205.7	115	205.7
115	208	175	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	66	.08	78.5	.035	91.5	.08	100.5	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
78.5	91.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	78.5	205.6	F
91.5	175	205.6	F

Downstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
58	205.6	115	205.6

Downstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	58	208	58	205.5	66	205.5	78.5	201.8
79.15	200.6	91	200.6	91.5	201.8	100.5	205.7	115	205.7
115	208	175	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	66	.08	78.5	.035	91.5	.08	100.5	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
78.5	91.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	78.5	205	F
91.5	175	205	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	Box	2.44	4.27

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
10	30	.015	.015	0	.4	1

Number of Barrels = 2

Upstream Elevation = 201
Centerline Stations
Sta. Sta.
82.5 87.5
Downstream Elevation = 200.6
Centerline Stations
Sta. Sta.
82.5 87.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	22.97	Culv Full Len (m)	14.59
# Barrels	2	Culv Vel US (m/s)	1.21
Q Barrel (m3/s)	11.49	Culv Vel DS (m/s)	1.10
E.G. US. (m)	203.33	Culv Inv El Up (m)	201.00
W.S. US. (m)	203.30	Culv Inv El Dn (m)	200.60
E.G. DS (m)	203.25	Culv Frctn Ls (m)	0.01
W.S. DS (m)	203.23	Culv Exit Loss (m)	0.04
Delta EG (m)	0.08	Culv Entr Loss (m)	0.03
Delta WS (m)	0.07	Q Weir (m3/s)	
E.G. IC (m)	202.42	Weir Sta Lft (m)	
E.G. OC (m)	203.33	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	203.23	Weir Max Depth (m)	
Culv WS Outlet (m)	203.04	Weir Avg Depth (m)	
Culv Nml Depth (m)	0.59	Weir Flow Area (m2)	
Culv Crt Depth (m)	0.90	Min El Weir Flow (m)	205.60

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	58.92	Culv Full Len (m)	30.00
# Barrels	2	Culv Vel US (m/s)	2.83
Q Barrel (m3/s)	29.46	Culv Vel DS (m/s)	2.83
E.G. US. (m)	205.96	Culv Inv El Up (m)	201.00
W.S. US. (m)	205.92	Culv Inv El Dn (m)	200.60
E.G. DS (m)	205.36	Culv Frctn Ls (m)	0.08
W.S. DS (m)	205.31	Culv Exit Loss (m)	0.35
Delta EG (m)	0.59	Culv Entr Loss (m)	0.16
Delta WS (m)	0.61	Q Weir (m3/s)	15.87
E.G. IC (m)	204.55	Weir Sta Lft (m)	58.00
E.G. OC (m)	205.96	Weir Sta Rgt (m)	115.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	203.44	Weir Max Depth (m)	0.36
Culv WS Outlet (m)	203.04	Weir Avg Depth (m)	0.33
Culv Nml Depth (m)		Weir Flow Area (m2)	18.97
Culv Crt Depth (m)	1.69	Min El Weir Flow (m)	205.60

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.321

INPUT
Description: Section 46.322 - Applewod Crescent - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	58	208	58	205.5	66	205.5	78.5	201.8
79.15	200.6	91	200.6	91.5	201.8	100.5	205.7	115	205.7
115	208	175	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	66	.08	78.5	.035	91.5	.08	100.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
78.5	91.5	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	78.5	205	F
91.5	175	205	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.25	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.23	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	201.32	Flow Area (m2)		33.49	
E.G. Slope (m/m)	0.000189	Area (m2)	3.45	33.49	2.36
Q Total (m3/s)	22.97	Flow (m3/s)		22.97	
Top Width (m)	21.12	Top Width (m)	4.83	13.00	3.30
Vel Total (m/s)	0.69	Avg. Vel. (m/s)		0.69	
Max Chl Dpth (m)	2.63	Hydr. Depth (m)		2.58	
Conv. Total (m3/s)	1670.4	Conv. (m3/s)		1670.4	
Length Wtd. (m)	50.00	Wetted Per. (m)		14.51	
Min Ch El (m)	200.60	Shear (N/m2)		4.28	
Alpha	1.00	Stream Power (N/m s)		2.93	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	105.19	178.27	68.04
C & E Loss (m)	0.02	Cum SA (1000 m2)	96.89	57.51	77.83

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.36	Element	Left OB	Channel	Right OB

Vel Head (m)	0.05	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	205.31	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	202.15	Flow Area (m2)	20.82	60.55	14.22
E.G. Slope (m/m)	0.000215	Area (m2)	20.82	60.55	14.22
Q Total (m3/s)	74.78	Flow (m3/s)	5.40	65.79	3.58
Top Width (m)	32.96	Top Width (m)	11.86	13.00	8.10
Vel Total (m/s)	0.78	Avg. Vel. (m/s)	0.26	1.09	0.25
Max Chl Dpth (m)	4.71	Hydr. Depth (m)	1.76	4.66	1.76
Conv. Total (m3/s)	5095.7	Conv. (m3/s)	368.2	4483.2	244.3
Length Wtd. (m)	50.00	Wetted Per. (m)	12.37	14.51	8.83
Min Ch El (m)	200.60	Shear (N/m2)	3.56	8.81	3.40
Alpha	1.71	Stream Power (N/m s)	0.92	9.57	0.86
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	277.16	339.54	268.50
C & E Loss (m)	0.02	Cum SA (1000 m2)	193.93	57.52	201.14

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.32

INPUT
Description: Section 46.32 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	45	208	45	205.5	52	205	66	201
68	200.6	69	200.6	71	201	84	205	102	206
102	208	152	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	52	.08	66	.035	71	.08	84	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
66	71	110	110	110	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.22	Element	Left OB	Channel	Right OB

Vel Head (m)	0.08	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.13	Reach Len. (m)	110.00	110.00	110.00
Crit W.S. (m)		Flow Area (m2)	7.97	11.87	7.40
E.G. Slope (m/m)	0.000840	Area (m2)	7.97	11.87	7.40
Q Total (m3/s)	22.97	Flow (m3/s)	2.94	17.32	2.72
Top Width (m)	19.41	Top Width (m)	7.47	5.00	6.94
Vel Total (m/s)	0.84	Avg. Vel. (m/s)	0.37	1.46	0.37
Max Chl Dpth (m)	2.53	Hydr. Depth (m)	1.07	2.37	1.07
Conv. Total (m3/s)	792.4	Conv. (m3/s)	101.3	597.3	93.7
Length Wtd. (m)	110.00	Wetted Per. (m)	7.77	5.08	7.26
Min Ch El (m)	200.60	Shear (N/m2)	8.46	19.26	8.40
Alpha	2.30	Stream Power (N/m s)	3.12	28.10	3.09
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	104.91	177.13	67.79
C & E Loss (m)	0.02	Cum SA (1000 m2)	96.59	57.06	77.57

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.12	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	205.21	Reach Len. (m)	110.00	110.00	110.00
Crit W.S. (m)		Flow Area (m2)	31.23	22.25	29.11
E.G. Slope (m/m)	0.000650	Area (m2)	31.23	22.25	29.11
Q Total (m3/s)	74.78	Flow (m3/s)	16.32	43.37	15.10
Top Width (m)	38.69	Top Width (m)	16.93	5.00	16.76
Vel Total (m/s)	0.91	Avg. Vel. (m/s)	0.52	1.95	0.52
Max Chl Dpth (m)	4.61	Hydr. Depth (m)	1.85	4.45	1.74
Conv. Total (m3/s)	2934.2	Conv. (m3/s)	640.2	1701.5	592.6
Length Wtd. (m)	110.00	Wetted Per. (m)	17.49	5.08	17.37
Min Ch El (m)	200.60	Shear (N/m2)	11.37	27.90	10.67
Alpha	2.83	Stream Power (N/m s)	5.94	54.38	

5.54					
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	275.86	337.47	
267.41					
C & E Loss (m)	0.02	Cum SA (1000 m2)	193.21	57.07	
200.51					

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: RIVER-1
REACH: Reach-1 RS: 46.312

INPUT
Description: Section 46.312 - Edgeley Blvd - U/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	43	207	43	204.6	49	204.6	52	204.1
60.5	201.1	61.15	200.6	72.85	200.6	73.5	201.1	82	204.1
84	204.7	90	204.7	90	207	150	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	49	.08	60.5	.035	73.5	.08	84	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
60.5	73.5	60	60	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	60.5	204.7	F
73.5	150	204.7	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.16	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.03	Wt. n-Val.		0.035	
W.S. Elev (m)	203.14	Reach Len. (m)	60.00	60.00	
60.00					
Crit W.S. (m)	201.31	Flow Area (m2)		32.66	
E.G. Slope (m/m)	0.000184	Area (m2)	5.88	32.66	
5.88					
Q Total (m3/s)	22.97	Flow (m3/s)		22.97	
Top Width (m)	24.55	Top Width (m)	5.77	13.00	
5.77					
Vel Total (m/s)	0.70	Avg. Vel. (m/s)		0.70	
Max Chl Dpth (m)	2.54	Hydr. Depth (m)		2.51	
Conv. Total (m3/s)	1695.2	Conv. (m3/s)		1695.2	
Length Wtd. (m)	60.00	Wetted Per. (m)		13.34	

Min Ch El (m)	200.60	Shear (N/m2)		4.41
Alpha	1.00	Stream Power (N/m s)		3.10
Frctn Loss (m)		Cum Volume (1000 m3)	104.15	174.68
67.06				
C & E Loss (m)		Cum SA (1000 m2)	95.86	56.07
76.88				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.27	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.04	Wt. n-Val.	0.077	0.035
0.078				
W.S. Elev (m)	205.23	Reach Len. (m)	60.00	60.00
60.00				
Crit W.S. (m)	202.13	Flow Area (m2)	28.76	59.86
27.18				
E.G. Slope (m/m)	0.000169	Area (m2)	28.76	59.86
27.18				
Q Total (m3/s)	74.78	Flow (m3/s)	7.27	60.47
7.03				
Top Width (m)	47.00	Top Width (m)	17.50	13.00
16.50				
Vel Total (m/s)	0.65	Avg. Vel. (m/s)	0.25	1.01
0.26				
Max Chl Dpth (m)	4.63	Hydr. Depth (m)	1.64	4.60
1.65				
Conv. Total (m3/s)	5753.3	Conv. (m3/s)	559.6	4652.5
541.1				
Length Wtd. (m)	60.00	Wetted Per. (m)	18.68	13.34
17.63				
Min Ch El (m)	200.60	Shear (N/m2)	2.55	7.43
2.55				
Alpha	2.01	Stream Power (N/m s)	0.65	7.51
0.66				
Frctn Loss (m)		Cum Volume (1000 m3)	272.56	332.95
264.32				
C & E Loss (m)		Cum SA (1000 m2)	191.31	56.08
198.68				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.3115

INPUT
Description: Hum 13A-3R. Edgeley Blvd - Twin Cell - 4.3 m W x 2.4 m H x 35 m L Concrete Box Culverts. July 2010

Drawing by Ander Engineering Ltd. (Dwg No. 88-150-7, October 1989) used to recode culvert in HEC-RAS format.

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 10
Deck/Roadway Width = 35
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 2

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
43	204.7		90	204.7	

Upstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	43	207	43	204.6	49	204.6	52	204.1
60.5	201.1	61.15	200.6	72.85	200.6	73.5	201.1	82	204.1
84	204.7	90	204.7	90	207	150	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	49	.08	60.5	.035	73.5	.08	84	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
60.5	73.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	60.5	204.7	F
73.5	150	204.7	F

Downstream Deck/Roadway Coordinates
num= 2

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
43	204.7		90	204.7	

Downstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	43	207	43	204.6	49	204.6	52	204.1
60.5	201.1	61.15	200.5	72.85	200.5	73.5	201.1	82	204.1
84	204.7	90	204.7	90	207	150	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	49	.08	60.5	.035	73.5	.08	84	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
60.5	73.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	60.5	203.5	F
73.5	150	203.5	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	Box	2.44	4.27

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
	10	35	.015	.015	0	.4	1

Number of Barrels = 2
Upstream Elevation = 200.6
Centerline Stations

Sta.	Sta.
64.5	69.5

Downstream Elevation = 200.5
Centerline Stations

Sta.	Sta.
64.5	69.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	22.97	Culv Full Len (m)	35.00
# Barrels	2	Culv Vel US (m/s)	1.10
Q Barrel (m3/s)	11.49	Culv Vel DS (m/s)	1.10
E.G. US. (m)	203.16	Culv Inv El Up (m)	200.60
W.S. US. (m)	203.14	Culv Inv El Dn (m)	200.50
E.G. DS (m)	203.09	Culv Frctn Ls (m)	0.01
W.S. DS (m)	203.06	Culv Exit Loss (m)	0.04
Delta EG (m)	0.08	Culv Entr Loss (m)	0.02
Delta WS (m)	0.07	Q Weir (m3/s)	
E.G. IC (m)	202.03	Weir Sta Lft (m)	
E.G. OC (m)	203.16	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	203.04	Weir Max Depth (m)	
Culv WS Outlet (m)	202.94	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.90	Min El Weir Flow (m)	204.70

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	45.55	Culv Full Len (m)	35.00
# Barrels	2	Culv Vel US (m/s)	2.19
Q Barrel (m3/s)	22.77	Culv Vel DS (m/s)	2.19
E.G. US. (m)	205.27	Culv Inv El Up (m)	200.60
W.S. US. (m)	205.23	Culv Inv El Dn (m)	200.50
E.G. DS (m)	204.93	Culv Frctn Ls (m)	0.05
W.S. DS (m)	204.88	Culv Exit Loss (m)	0.19
Delta EG (m)	0.34	Culv Entr Loss (m)	0.10
Delta WS (m)	0.35	Q Weir (m3/s)	29.24
E.G. IC (m)	204.16	Weir Sta Lft (m)	43.00
E.G. OC (m)	205.27	Weir Sta Rgt (m)	90.00
Culvert Control	Outlet	Weir Submerg	0.31
Culv WS Inlet (m)	203.04	Weir Max Depth (m)	0.57
Culv WS Outlet (m)	202.94	Weir Avg Depth (m)	0.57
Culv Nml Depth (m)		Weir Flow Area (m2)	26.85
Culv Crt Depth (m)	1.43	Min El Weir Flow (m)	204.70

Warning: During the culvert inlet control computations, the program could not

balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.311

INPUT
Description: Section 46.311 - Edgeley Blvd - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	43	207	43	204.6	49	204.6	52	204.1
60.5	201.1	61.15	200.5	72.85	200.5	73.5	201.1	82	204.1
84	204.7	90	204.7	90	207	150	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	49	.08	60.5	.035	73.5	.08	84	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
60.5	73.5	150	150	150	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	60.5	203.5	F
73.5	150	203.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.09	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.06	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)	201.21	Flow Area (m2)		32.92	
E.G. Slope (m/m)	0.000181	Area (m2)	5.46	32.92	5.46
Q Total (m3/s)	22.97	Flow (m3/s)		22.97	
Top Width (m)	24.12	Top Width (m)	5.56	13.00	5.56
Vel Total (m/s)	0.70	Avg. Vel. (m/s)		0.70	
Max Chl Dpth (m)	2.56	Hydr. Depth (m)		2.53	
Conv. Total (m3/s)	1706.9	Conv. (m3/s)		1706.9	
Length Wtd. (m)	150.00	Wetted Per. (m)		13.47	
Min Ch El (m)	200.50	Shear (N/m2)		4.34	
Alpha	1.00	Stream Power (N/m s)		3.03	
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	104.15	173.77	67.06
C & E Loss (m)	0.00	Cum SA (1000 m2)	95.52	55.29	76.54

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.93	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.079	0.035	0.079
W.S. Elev (m)	204.88	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)	202.03	Flow Area (m2)	22.62	56.53	21.40
E.G. Slope (m/m)	0.000225	Area (m2)	22.62	56.53	21.40
Q Total (m3/s)	74.78	Flow (m3/s)	5.89	63.08	5.81
Top Width (m)	47.00	Top Width (m)	17.50	13.00	16.50
Vel Total (m/s)	0.74	Avg. Vel. (m/s)	0.26	1.12	0.27
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.29	4.35	1.30
Conv. Total (m3/s)	4982.0	Conv. (m3/s)	392.5	4202.7	386.9
Length Wtd. (m)	150.00	Wetted Per. (m)	18.33	13.47	17.28
Min Ch El (m)	200.50	Shear (N/m2)	2.73	9.27	2.74
Alpha	1.92	Stream Power (N/m s)	0.71	10.35	0.74
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	272.56	330.12	264.32
C & E Loss (m)	0.00	Cum SA (1000 m2)	190.26	55.30	197.69

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.31

INPUT
Description: Section 46.31 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	40	207	40	204.5	46	204.5	49	204
58	201	61	200.4	67	200.4	70	201	81	204
85	204.6	107	204.6	107	207	148	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	46	.08	58	.035	70	.08	85	.05

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

58 70 150 150 150 .1 .3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.06	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.04	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)		Flow Area (m2)	6.22	29.84	7.61
E.G. Slope (m/m)	0.000177	Area (m2)	6.22	29.84	7.61
Q Total (m3/s)	22.97	Flow (m3/s)	1.01	20.71	1.25
Top Width (m)	25.58	Top Width (m)	6.11	12.00	7.47
Vel Total (m/s)	0.53	Avg. Vel. (m/s)	0.16	0.69	0.16
Max Chl Dpth (m)	2.64	Hydr. Depth (m)	1.02	2.49	1.02
Conv. Total (m3/s)	1724.8	Conv. (m3/s)	76.0	1554.8	94.0
Length Wtd. (m)	150.00	Wetted Per. (m)	6.44	12.12	7.74
Min Ch El (m)	200.40	Shear (N/m2)	1.68	4.28	1.71
Alpha	1.58	Stream Power (N/m s)	0.27	2.97	0.28
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	103.27	169.06	66.08
C & E Loss (m)	0.00	Cum SA (1000 m2)	94.64	53.42	75.56

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.90	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.079	0.035	0.078
W.S. Elev (m)	204.84	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)		Flow Area (m2)	24.94	51.52	33.31
E.G. Slope (m/m)	0.000236	Area (m2)	24.94	51.52	33.31
Q Total (m3/s)	74.78	Flow (m3/s)	6.86	59.32	8.61
Top Width (m)	67.00	Top Width (m)	18.00	12.00	37.00
Vel Total (m/s)	0.68	Avg. Vel. (m/s)	0.28	1.15	0.26
Max Chl Dpth (m)	4.44	Hydr. Depth (m)	1.39	4.29	0.90
Conv. Total (m3/s)	4870.5	Conv. (m3/s)	446.6	3863.5	560.4
Length Wtd. (m)	150.00	Wetted Per. (m)	18.87	12.12	37.69

Min Ch El (m)	200.40	Shear (N/m2)	3.05	9.83	2.04
Alpha	2.30	Stream Power (N/m s)	0.84	11.32	0.53
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	268.99	322.01	260.21
C & E Loss (m)	0.00	Cum SA (1000 m2)	187.60	53.43	193.68

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.30

INPUT
Description: Section 46.30 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	20	207	20	205	46	205	56	201
59	200.3	65	200.3	68	201	80	204	83	204.7
119	205	119	207	146	207				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	46	.08	56	.035	68	.08	83	.025
119	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
56	68	110	110	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.02	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.99	Reach Len. (m)	110.00	110.00	110.00
Crit W.S. (m)		Flow Area (m2)	4.95	30.17	7.92
E.G. Slope (m/m)	0.000274	Area (m2)	4.95	30.17	7.92
Q Total (m3/s)	28.70	Flow (m3/s)	0.97	26.13	1.60
Top Width (m)	24.93	Top Width (m)	4.97	12.00	7.96
Vel Total (m/s)	0.67	Avg. Vel. (m/s)	0.20	0.87	0.20
Max Chl Dpth (m)	2.69	Hydr. Depth (m)	0.99	2.51	0.99
Conv. Total (m3/s)	1735.2	Conv. (m3/s)	58.6	1580.0	96.6
Length Wtd. (m)	110.00	Wetted Per. (m)	5.36	12.16	8.20
Min Ch El (m)	200.30	Shear (N/m2)	2.48	6.65	2.59
Alpha	1.54	Stream Power (N/m s)	0.49	5.76	0.52
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	102.43	164.56	

64.92					
C & E Loss (m)	0.00	Cum SA (1000 m2)	93.81	51.62	
74.40					

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.86	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	204.79	Reach Len. (m)	110.00	110.00	110.00
Crit W.S. (m)		Flow Area (m2)	17.92	51.73	29.19
E.G. Slope (m/m)	0.000297	Area (m2)	17.92	51.73	29.19
Q Total (m3/s)	81.91	Flow (m3/s)	5.62	66.89	9.40
Top Width (m)	46.79	Top Width (m)	9.47	12.00	25.33
Vel Total (m/s)	0.83	Avg. Vel. (m/s)	0.31	1.29	0.32
Max Chl Dpth (m)	4.49	Hydr. Depth (m)	1.89	4.31	1.15
Conv. Total (m3/s)	4752.3	Conv. (m3/s)	326.2	3880.6	545.6
Length Wtd. (m)	110.00	Wetted Per. (m)	10.19	12.16	25.78
Min Ch El (m)	200.30	Shear (N/m2)	5.12	12.39	3.30
Alpha	2.01	Stream Power (N/m s)	1.61	16.02	1.06
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	265.78	314.27	255.53
C & E Loss (m)	0.01	Cum SA (1000 m2)	185.54	51.63	189.01

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.292

INPUT
Description: Section 46.292 - Millway Avenue - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	25	207	25	204	40	204	50	201
50.5	200.3	63	200.3	64	201	72	204	75	204.5
85	204.7	85	207	142	207				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	40	.08	50	.035	64	.08	72	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
50	64	55	55	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	50.5	204.1	F
63	142	204.1	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.00	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.		0.035	
W.S. Elev (m)	202.96	Reach Len. (m)	55.00	55.00	55.00
Crit W.S. (m)	201.11	Flow Area (m2)		33.22	
E.G. Slope (m/m)	0.000248	Area (m2)	6.39	36.68	5.11
Q Total (m3/s)	28.70	Flow (m3/s)		28.70	
Top Width (m)	25.74	Top Width (m)	6.52	14.00	5.22
Vel Total (m/s)	0.86	Avg. Vel. (m/s)		0.86	
Max Chl Dpth (m)	2.66	Hydr. Depth (m)		2.66	
Conv. Total (m3/s)	1820.9	Conv. (m3/s)		1820.9	
Length Wtd. (m)	55.00	Wetted Per. (m)		12.50	
Min Ch El (m)	200.30	Shear (N/m2)		6.47	
Alpha	1.00	Stream Power (N/m s)		5.59	
Frctn Loss (m)		Cum Volume (1000 m3)	101.81	160.89	64.20
C & E Loss (m)		Cum SA (1000 m2)	93.18	50.19	73.68

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.82	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.071	0.035	0.078
W.S. Elev (m)	204.77	Reach Len. (m)	55.00	55.00	55.00
Crit W.S. (m)	201.94	Flow Area (m2)	34.37	62.12	21.52
E.G. Slope (m/m)	0.000204	Area (m2)	34.37	62.12	21.52
Q Total (m3/s)	81.91	Flow (m3/s)	9.53	66.62	5.76
Top Width (m)	60.00	Top Width (m)	25.00	14.00	21.00
Vel Total (m/s)	0.69	Avg. Vel. (m/s)	0.28	1.07	0.27

Max Chl Dpth (m)	4.47	Hydr. Depth (m)	1.37	4.44	1.02
Conv. Total (m3/s)	5735.2	Conv. (m3/s)	667.5	4664.6	403.1
Length Wtd. (m)	55.00	Wetted Per. (m)	26.22	14.58	21.66
Min Ch El (m)	200.30	Shear (N/m2)	2.62	8.52	1.99
Alpha	1.97	Stream Power (N/m s)	0.73	9.14	0.53
Frctn Loss (m)		Cum Volume (1000 m3)	262.90	308.01	252.74
C & E Loss (m)		Cum SA (1000 m2)	183.65	50.20	186.46

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2915

INPUT
Description: Hum 13A-2RR. Millway Avenue Culvert - Twin Cell - 4.3 m W x 2.4 m H x 30 m L Concrete Box Culverts. Based on drawings - July 2010

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 15
Deck/Roadway Width = 30
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
25	204.1		75	204.1		85	204.7	

Upstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	25	207	25	204	40	204	50	201
50.5	200.3	63	200.3	64	201	72	204	75	204.5
85	204.7	85	207	142	207				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	40	.08	50	.035	64	.08	72	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
50	64	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	50.5	204.1	F
63	142	204.1	F

Downstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord

25	204.1	75	204.1	85	204.7

Downstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	25	207	25	204	40	204	50	201
50.5	200.2	63	200.2	64	201	72	204	75	204.5
85	204.7	85	207	142	207				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	40	.08	50	.035	64	.08	72	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
50	64	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	50.5	203.4	F
63	142	203.4	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	Box	2.44	4.27

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
	15	30	.015	.015	0	.4	1

Number of Barrels = 2
Upstream Elevation = 200.3
Centerline Stations

Sta.	Sta.
54.3	59.3

Downstream Elevation = 200.2
Centerline Stations

Sta.	Sta.
54.3	59.3

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	28.70	Culv Full Len (m)	30.00
# Barrels	2	Culv Vel US (m/s)	1.38
Q Barrel (m3/s)	14.35	Culv Vel DS (m/s)	1.38
E.G. US. (m)	203.00	Culv Inv El Up (m)	200.30
W.S. US. (m)	202.96	Culv Inv El Dn (m)	200.20
E.G. DS (m)	202.88	Culv Frctn Ls (m)	0.02
W.S. DS (m)	202.84	Culv Exit Loss (m)	0.06
Delta EG (m)	0.11	Culv Entr Loss (m)	0.04
Delta WS (m)	0.12	Q Weir (m3/s)	
E.G. IC (m)	201.97	Weir Sta Lft (m)	
E.G. OC (m)	203.00	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	

Culv WS Inlet (m)	202.74	Weir Max Depth (m)	
Culv WS Outlet (m)	202.64	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	1.05	Min El Weir Flow (m)	204.10

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	36.85	Culv Full Len (m)	30.00
# Barrels	2	Culv Vel US (m/s)	1.77
Q Barrel (m3/s)	18.42	Culv Vel DS (m/s)	1.77
E.G. US. (m)	204.82	Culv Inv El Up (m)	200.30
W.S. US. (m)	204.77	Culv Inv El Dn (m)	200.20
E.G. DS (m)	204.63	Culv Frctn Ls (m)	0.03
W.S. DS (m)	204.57	Culv Exit Loss (m)	0.10
Delta EG (m)	0.20	Culv Entr Loss (m)	0.06
Delta WS (m)	0.20	Q Weir (m3/s)	45.07
E.G. IC (m)	204.15	Weir Sta Lft (m)	25.00
E.G. OC (m)	204.82	Weir Sta Rgt (m)	85.00
Culvert Control	Outlet	Weir Submerg	0.62
Culv WS Inlet (m)	202.74	Weir Max Depth (m)	0.72
Culv WS Outlet (m)	202.64	Weir Avg Depth (m)	0.63
Culv Nml Depth (m)		Weir Flow Area (m2)	37.94
Culv Crt Depth (m)	1.24	Min El Weir Flow (m)	204.10

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.291

INPUT
Description: Section 46.291 - Millway Avenue - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	25	207	25	204	40	204	50	201
50.5	200.2	63	200.2	64	201	72	204	75	204.5
85	204.7	85	207	142	207				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	40	.08	50	.035	64	.08	72	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
50	64	145	150	155	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	50.5	203.4	F
63	142	203.4	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.88	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.		0.035	

W.S. Elev (m)	202.84	Reach Len. (m)	145.00	150.00	155.00
Crit W.S. (m)	201.01	Flow Area (m2)		33.03	
E.G. Slope (m/m)	0.000253	Area (m2)	5.66	36.39	4.53
Q Total (m3/s)	28.70	Flow (m3/s)		28.70	
Top Width (m)	25.05	Top Width (m)	6.14	14.00	4.91
Vel Total (m/s)	0.87	Avg. Vel. (m/s)		0.87	
Max Chl Dpth (m)	2.64	Hydr. Depth (m)		2.64	
Conv. Total (m3/s)	1803.7	Conv. (m3/s)		1803.7	
Length Wtd. (m)	149.98	Wetted Per. (m)		12.50	
Min Ch El (m)	200.20	Shear (N/m2)		6.56	
Alpha	1.00	Stream Power (N/m s)		5.70	
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	101.81	159.69	64.20
C & E Loss (m)	0.00	Cum SA (1000 m2)	92.83	49.42	73.40

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.63	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.073	0.035	0.079
W.S. Elev (m)	204.57	Reach Len. (m)	145.00	150.00	155.00
Crit W.S. (m)	201.84	Flow Area (m2)	29.27	60.59	17.65
E.G. Slope (m/m)	0.000239	Area (m2)	29.27	60.59	17.65
Q Total (m3/s)	81.91	Flow (m3/s)	8.10	68.74	5.08
Top Width (m)	53.54	Top Width (m)	25.00	14.00	14.54
Vel Total (m/s)	0.76	Avg. Vel. (m/s)	0.28	1.13	0.29
Max Chl Dpth (m)	4.37	Hydr. Depth (m)	1.17	4.33	1.21
Conv. Total (m3/s)	5298.0	Conv. (m3/s)	523.7	4445.8	328.6
Length Wtd. (m)	149.85	Wetted Per. (m)	26.01	14.72	15.13
Min Ch El (m)	200.20	Shear (N/m2)	2.64	9.65	2.74
Alpha	1.88	Stream Power (N/m s)	0.73	10.94	0.79
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	262.90	304.06	252.74

C & E Loss (m)	0.00	Cum SA (1000 m2)	182.27	49.43	185.48

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.29

INPUT
Description: Section 46.29 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	30	207	30	204.5	54	204	64	201
71	200.2	78	201	86	204	110	205	156	205

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	54	.08	64	.035	78	.08	86	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
64	78	135	145	150	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.84	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.80	Reach Len. (m)	135.00	145.00	150.00
Crit W.S. (m)		Flow Area (m2)	5.40	30.81	4.32
E.G. Slope (m/m)	0.000325	Area (m2)	5.40	30.81	4.32
Q Total (m3/s)	28.70	Flow (m3/s)	1.10	26.72	0.87
Top Width (m)	24.80	Top Width (m)	6.00	14.00	4.80
Vel Total (m/s)	0.71	Avg. Vel. (m/s)	0.20	0.87	0.20
Max Chl Dpth (m)	2.60	Hydr. Depth (m)	0.90	2.20	0.90
Conv. Total (m3/s)	1592.4	Conv. (m3/s)	61.2	1483.0	48.2
Length Wtd. (m)	144.88	Wetted Per. (m)	6.27	14.09	5.13
Min Ch El (m)	200.20	Shear (N/m2)	2.75	6.96	2.68
Alpha	1.40	Stream Power (N/m s)	0.56	6.04	0.54
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	101.01	154.65	63.52
C & E Loss (m)	0.00	Cum SA (1000 m2)	91.95	47.32	72.65

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.58	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.076	0.035	0.078
W.S. Elev (m)	204.52	Reach Len. (m)	135.00	145.00	150.00
Crit W.S. (m)		Flow Area (m2)	26.55	54.83	19.33
E.G. Slope (m/m)	0.000310	Area (m2)	26.55	54.83	19.33
Q Total (m3/s)	81.91	Flow (m3/s)	7.81	68.22	5.88
Top Width (m)	68.39	Top Width (m)	34.00	14.00	20.39
Vel Total (m/s)	0.81	Avg. Vel. (m/s)	0.29	1.24	0.30
Max Chl Dpth (m)	4.32	Hydr. Depth (m)	0.78	3.92	0.95
Conv. Total (m3/s)	4652.8	Conv. (m3/s)	443.7	3875.2	333.9
Length Wtd. (m)	144.53	Wetted Per. (m)	34.46	14.09	20.95
Min Ch El (m)	200.20	Shear (N/m2)	2.34	11.83	2.80
Alpha	1.97	Stream Power (N/m s)	0.69	14.72	0.85
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	258.85	295.40	249.87
C & E Loss (m)	0.01	Cum SA (1000 m2)	177.99	47.33	182.78

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.282

INPUT
Description: Section 46.282 - Pennsylvania Avenue - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	60	207	60	204	73	204	81	201
83	200.4	84	199.9	96	199.9	97	200.4	99	202
101	203	103	204	118	204	145	204	180	204.64
225	204.64								

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	83	.035	97	.08	103	.05
118	.025	145	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
83	97	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	83.5	204.1	F

96.5 225 204.05 F
Right Levee Station= 180 Elevation= 207

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.035	
W.S. Elev (m)	202.77	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	200.70	Flow Area (m2)		37.19	
E.G. Slope (m/m)	0.000182	Area (m2)	8.32	39.68	3.73
Q Total (m3/s)	28.70	Flow (m3/s)		28.70	
Top Width (m)	24.26	Top Width (m)	6.72	14.00	3.54
Vel Total (m/s)	0.77	Avg. Vel. (m/s)		0.77	
Max Chl Dpth (m)	2.87	Hydr. Depth (m)		2.86	
Conv. Total (m3/s)	2128.1	Conv. (m3/s)		2128.1	
Length Wtd. (m)	50.00	Wetted Per. (m)		13.12	
Min Ch El (m)	199.90	Shear (N/m2)		5.06	
Alpha	1.00	Stream Power (N/m s)		3.90	
Frctn Loss (m)		Cum Volume (1000 m3)	100.08	149.54	62.91
C & E Loss (m)		Cum SA (1000 m2)	91.09	45.29	72.02

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.54	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.076	0.035	0.048
W.S. Elev (m)	204.50	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	201.50	Flow Area (m2)	30.12	63.91	40.50
E.G. Slope (m/m)	0.000170	Area (m2)	30.12	63.91	40.50
Q Total (m3/s)	81.91	Flow (m3/s)	7.60	64.87	9.44
Top Width (m)	112.38	Top Width (m)	23.00	14.00	75.38
Vel Total (m/s)	0.61	Avg. Vel. (m/s)	0.25	1.02	0.23
Max Chl Dpth (m)	4.60	Hydr. Depth (m)	1.31	4.56	0.54

Conv. Total (m3/s)	6274.2	Conv. (m3/s)	582.3	4969.1	722.8
Length Wtd. (m)	50.00	Wetted Per. (m)	24.13	14.24	76.42
Min Ch El (m)	199.90	Shear (N/m2)	2.09	7.50	0.89
Alpha	2.23	Stream Power (N/m s)	0.53	7.62	0.21
Frctn Loss (m)		Cum Volume (1000 m3)	255.03	286.80	245.38
C & E Loss (m)		Cum SA (1000 m2)	174.15	45.30	175.59

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2815

INPUT
Description: Hum 13A-2R. Pennsylvania Avenue Culvert - Twin Cell - 5.7 m W x 2.4 m H x 40 m L Concrete Box Culverts. Drawing by Ander Engineering Ltd. (Dwg No. 85-102-9, December 1989) shows 4 Cell Culvert, but only two cells observed in field.

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 40
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 6

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	205	103	204	133	203.53
145	204	180	204	225	204

Upstream Bridge Cross Section Data
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	60	207	60	204	73	204	81	201
83	200.4	84	199.9	96	199.9	97	200.4	99	202
101	203	103	204	118	204	145	204	180	204.64
225	204.64								

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	83	.035	97	.08	103	.05
118	.025	145	.05						

Bank Sta: Left	Right	Coeff Contr.	Expan.
83	97	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	83.5	204.1	F
96.5	225	204.05	F

Right Levee Station= 180 Elevation= 207

Downstream Deck/Roadway Coordinates
num= 5

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	205	103	204	133	203.53
160	204	200	204		

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	73	204	81	201	83	200.4	84	199.8
96	199.8	97	200.4	99	202	101	203	103	204
118	204	145	204	160	204	200	204	200	206

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	83	.035	97	.08	103	.05
118	.025	145	.05						

Bank Sta: Left	Right	Coeff Contr.	Expan.
83	97	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	83.5	203.4	F
96.5	200	203.4	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	Box	3.05	4.57

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	40	.015	.015	0	.4	1

Number of Barrels = 2
Upstream Elevation = 199.3
Centerline Stations

Sta.	Sta.
87.5	92.5

Downstream Elevation = 199.2
Centerline Stations

Sta.	Sta.
87.5	92.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	28.70	Culv Full Len (m)	40.00
# Barrels	2	Culv Vel US (m/s)	1.03
Q Barrel (m3/s)	14.35	Culv Vel DS (m/s)	1.03
E.G. US. (m)	202.80	Culv Inv El Up (m)	199.30
W.S. US. (m)	202.77	Culv Inv El Dn (m)	199.20
E.G. DS (m)	202.74	Culv Frctn Ls (m)	0.01

W.S. DS (m)	202.71	Culv Exit Loss (m)	0.02
Delta EG (m)	0.06	Culv Entr Loss (m)	0.02
Delta WS (m)	0.06	Q Weir (m3/s)	
E.G. IC (m)	200.88	Weir Sta Lft (m)	
E.G. OC (m)	202.80	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	202.35	Weir Max Depth (m)	
Culv WS Outlet (m)	202.25	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	1.00	Min El Weir Flow (m)	204.05

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	39.53	Culv Full Len (m)	40.00
# Barrels	2	Culv Vel US (m/s)	1.42
Q Barrel (m3/s)	19.76	Culv Vel DS (m/s)	1.42
E.G. US. (m)	204.54	Culv Inv El Up (m)	199.30
W.S. US. (m)	204.50	Culv Inv El Dn (m)	199.20
E.G. DS (m)	204.42	Culv Frctn Ls (m)	0.02
W.S. DS (m)	204.38	Culv Exit Loss (m)	0.06
Delta EG (m)	0.12	Culv Entr Loss (m)	0.04
Delta WS (m)	0.12	Q Weir (m3/s)	42.39
E.G. IC (m)	202.56	Weir Sta Lft (m)	60.00
E.G. OC (m)	204.54	Weir Sta Rgt (m)	174.60
Culvert Control	Outlet	Weir Submerg	0.61
Culv WS Inlet (m)	202.35	Weir Max Depth (m)	0.54
Culv WS Outlet (m)	202.25	Weir Avg Depth (m)	0.39
Culv Nml Depth (m)		Weir Flow Area (m2)	45.05
Culv Crt Depth (m)	1.24	Min El Weir Flow (m)	204.05

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.281

INPUT
Description: Section 46.281 - Pennsylvania Avenue - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	73	204	81	201	83	200.4	84	199.8
96	199.8	97	200.4	99	202	101	203	103	204
118	204	145	204	160	204	200	204	200	206

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	83	.035	97	.08	103	.05
118	.025	145	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
83	97	40	40	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	83.5	203.4	F
96.5	200	203.4	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.74	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.035	
W.S. Elev (m)	202.71	Reach Len. (m)	40.00	40.00	40.00
Crit W.S. (m)	200.60	Flow Area (m2)		37.73	
E.G. Slope (m/m)	0.000174	Area (m2)	7.95	40.20	3.54
Q Total (m3/s)	28.70	Flow (m3/s)		28.70	
Top Width (m)	24.00	Top Width (m)	6.57	14.00	3.43
Vel Total (m/s)	0.76	Avg. Vel. (m/s)		0.76	
Max Chl Dpth (m)	2.91	Hydr. Depth (m)		2.90	
Conv. Total (m3/s)	2175.3	Conv. (m3/s)		2175.3	
Length Wtd. (m)	40.00	Wetted Per. (m)		13.17	
Min Ch El (m)	199.80	Shear (N/m2)		4.89	
Alpha	1.00	Stream Power (N/m s)		3.72	
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	100.08	148.66	62.91
C & E Loss (m)	0.01	Cum SA (1000 m2)	90.76	44.59	71.85

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.078	0.035	0.051
W.S. Elev (m)	204.38	Reach Len. (m)	40.00	40.00	40.00
Crit W.S. (m)	201.40	Flow Area (m2)	27.57	63.48	48.45
E.G. Slope (m/m)	0.000181	Area (m2)	27.57	63.48	48.45
Q Total (m3/s)	81.91	Flow (m3/s)	6.64	65.87	9.39
Top Width (m)	154.54	Top Width (m)	37.54	14.00	103.00
Vel Total (m/s)	0.59	Avg. Vel. (m/s)	0.24	1.04	0.19
Max Chl Dpth (m)	4.58	Hydr. Depth (m)	0.73	4.53	0.47

Conv. Total (m3/s)	6082.3	Conv. (m3/s)	493.4	4891.4	697.6
Length Wtd. (m)	40.00	Wetted Per. (m)	38.17	14.33	104.41
Min Ch El (m)	199.80	Shear (N/m2)	1.28	7.88	0.83
Alpha	2.54	Stream Power (N/m s)	0.31	8.18	0.16
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	255.03	283.47	245.38
C & E Loss (m)	0.02	Cum SA (1000 m2)	172.63	44.60	171.13

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: RIVER-1
REACH: Reach-1 RS: 46.28

INPUT
Description: Section 46.28 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	73	204	83	201	87	200	89	199.8
91	199.8	93	200	95	201	98	202	101	203
103	204	117	204	142	204	173	204	173	206

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	87	.035	93	.08	103	.05
117	.025	142	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
87	93	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.72	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.66	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)		Flow Area (m2)	13.21	16.74	8.43
E.G. Slope (m/m)	0.000518	Area (m2)	13.21	16.74	8.43
Q Total (m3/s)	28.70	Flow (m3/s)	4.56	21.54	2.60
Top Width (m)	22.50	Top Width (m)	9.52	6.00	6.97
Vel Total (m/s)	0.75	Avg. Vel. (m/s)	0.35	1.29	0.31
Max Chl Dpth (m)	2.86	Hydr. Depth (m)	1.39	2.79	

1.21					
Conv. Total (m3/s)	1260.5	Conv. (m3/s)	200.2	946.1	114.2
Length Wtd. (m)	50.00	Wetted Per. (m)	9.89	6.02	7.48
Min Ch El (m)	199.80	Shear (N/m2)	6.79	14.14	5.73
Alpha	2.27	Stream Power (N/m s)	2.34	18.19	1.77
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	99.66	147.52	62.67
C & E Loss (m)	0.02	Cum SA (1000 m2)	90.44	44.19	71.64

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.39	Element	Left OB	Channel	Right OB
Vel Head (m)	0.10	Wt. n-Val.	0.079	0.035	0.065
W.S. Elev (m)	204.29	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)		Flow Area (m2)	36.21	26.55	43.38
E.G. Slope (m/m)	0.000551	Area (m2)	36.21	26.55	43.38
Q Total (m3/s)	81.91	Flow (m3/s)	17.19	47.89	16.84
Top Width (m)	121.33	Top Width (m)	35.33	6.00	80.00
Vel Total (m/s)	0.77	Avg. Vel. (m/s)	0.47	1.80	0.39
Max Chl Dpth (m)	4.49	Hydr. Depth (m)	1.02	4.43	0.54
Conv. Total (m3/s)	3489.9	Conv. (m3/s)	732.2	2040.4	717.3
Length Wtd. (m)	50.00	Wetted Per. (m)	35.90	6.02	81.09
Min Ch El (m)	199.80	Shear (N/m2)	5.45	23.83	2.89
Alpha	3.32	Stream Power (N/m s)	2.59	42.98	1.12
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	253.75	281.67	243.55
C & E Loss (m)	0.02	Cum SA (1000 m2)	171.17	44.20	167.47

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: RIVER-1
REACH: Reach-1 RS: 46.274

INPUT
Description: Section 46.274 - Jane Street - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	76	204	83	201	90	200
94	199.34	98	199.34	102	200	106	201	116	204
130	204	205	204	205	206				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	76	.08	90	.035	106	.08	116	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	102	1	1	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	89	203.21	F
103	205	203.21	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.70	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.035
W.S. Elev (m)	202.68	Reach Len. (m)	0.50	0.50	0.50
Crit W.S. (m)	200.27	Flow Area (m2)	2.61	37.48	2.56
E.G. Slope (m/m)	0.000080	Area (m2)	18.59	37.48	13.45
Q Total (m3/s)	22.11	Flow (m3/s)	0.55	20.36	1.20
Top Width (m)	32.54	Top Width (m)	10.93	12.00	9.61
Vel Total (m/s)	0.52	Avg. Vel. (m/s)	0.21	0.54	0.47
Max Chl Dpth (m)	3.34	Hydr. Depth (m)	2.61	3.12	2.56
Conv. Total (m3/s)	2469.5	Conv. (m3/s)	61.5	2274.0	134.0
Length Wtd. (m)	0.50	Wetted Per. (m)	1.01	12.11	1.03
Min Ch El (m)	199.34	Shear (N/m2)	2.03	2.43	1.95
Alpha	1.06	Stream Power (N/m s)	0.43	1.32	0.91
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	98.86	146.16	62.13
C & E Loss (m)	0.04	Cum SA (1000 m2)	89.93	43.74	71.22

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.36	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.076	0.035	0.047
W.S. Elev (m)	204.33	Reach Len. (m)	0.50	0.50	0.50
Crit W.S. (m)	201.18	Flow Area (m2)	55.24	57.27	63.27
E.G. Slope (m/m)	0.000123	Area (m2)	55.24	57.27	63.27
Q Total (m3/s)	81.91	Flow (m3/s)	12.21	51.18	18.52
Top Width (m)	181.65	Top Width (m)	66.65	12.00	103.00
Vel Total (m/s)	0.47	Avg. Vel. (m/s)	0.22	0.89	0.29
Max Chl Dpth (m)	4.99	Hydr. Depth (m)	0.83	4.77	0.61
Conv. Total (m3/s)	7378.8	Conv. (m3/s)	1099.6	4610.8	1668.4
Length Wtd. (m)	0.50	Wetted Per. (m)	67.34	12.11	103.90
Min Ch El (m)	199.34	Shear (N/m2)	0.99	5.72	0.74
Alpha	2.42	Stream Power (N/m s)	0.22	5.11	0.22
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	251.47	279.57	240.88
C & E Loss (m)	0.03	Cum SA (1000 m2)	168.63	43.75	162.90

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.

BRIDGE

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2735

INPUT
Description: Hum 13A-1R. Jane Street Culverts - Upstream In-Line Weir Coded as Bridge. Weir is 25 m L. Drawings by Ander Engineering Ltd. (85-101-7 & 85-101-1) 1985.

New HEC-RAS coding January 2004 by
Acres included coding of in-line weir (as a bridge) and culverts in HEC-RAS.
Distance from Upstream XS = .5
Deck/Roadway Width = .25
Weir Coefficient = 1.72
Upstream Deck/Roadway Coordinates
num= 8

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
76	204	204	83.5	204		83.5	203.21	
90	203.21	200.7	102	203.21	200.7	108.5	203.21	
108.5	204		116	204				

Upstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	76	204	83	201	90	200
94	199.34	98	199.34	102	200	106	201	116	204
130	204	205	204	205	206				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	76	.08	90	.035	106	.08	116	.05

Bank Sta: Left Right Coeff Contr. Expan.
90 102 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	89	203.21	F
103	205	203.21	F

Downstream Deck/Roadway Coordinates
num= 8

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
76	204	204	83.5	204		83.5	203.21	
90	203.21	200.7	102	203.21	200.7	108.5	203.21	
108.5	204		116	204				

Downstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	76	204	83	201	90	200
94	199.34	98	199.34	102	200	106	201	116	204
130	204	205	204	205	206				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	76	.08	90	.035	106	.08	116	.05

Bank Sta: Left Right Coeff Contr. Expan.
90 102 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	89	203.2	F
103	205	203.2	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 Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method

Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT Profile #100-year

E.G. US. (m)	202.70	Element	Inside BR US	Inside BR DS
W.S. US. (m)	202.68	E.G. Elev (m)	202.66	202.66
Q Total (m3/s)	22.11	W.S. Elev (m)	202.53	202.53
Q Bridge (m3/s)	22.11	Crit W.S. (m)	200.26	200.26
Q Weir (m3/s)		Max Chl Dpth (m)	3.19	3.19
Weir Sta Lft (m)		Vel Total (m/s)	1.62	1.62
Weir Sta Rgt (m)		Flow Area (m2)	13.69	13.69
Weir Submerg		Froude # Chl	0.29	0.29
Weir Max Depth (m)		Specif Force (m3)	36.76	36.74
Min El Weir Flow (m)	203.21	Hydr Depth (m)		
Min El Prs (m)	200.70	W.P. Total (m)	25.52	25.52
Delta EG (m)	0.10	Conv. Total (m3/s)	267.9	267.9
Delta WS (m)	0.10	Top Width (m)		
BR Open Area (m2)	13.69	Frctn Loss (m)	0.00	0.00
BR Open Vel (m/s)	1.62	C & E Loss (m)	0.00	0.06
BR Sluice Coef		Shear Total (N/m2)	35.80	35.80
BR Sel Method	Energy only	Power Total (N/m s)	57.81	57.81

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
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.

BRIDGE OUTPUT Profile #Regional w red'n

E.G. US. (m)	204.36	Element	Inside BR US	Inside BR DS
W.S. US. (m)	204.33	E.G. Elev (m)	204.33	

Q Total (m3/s)	81.91	W.S. Elev (m)	204.22
Q Bridge (m3/s)	21.27	Crit W.S. (m)	203.76
Q Weir (m3/s)		Max Chl Dpth (m)	4.88
Weir Sta Lft (m)		Vel Total (m/s)	1.15
Weir Sta Rgt (m)		Flow Area (m2)	71.12
Weir Submerg		Froude # Chl	0.22
Weir Max Depth (m)		Specif Force (m3)	84.10
Min El Weir Flow (m)	203.21	Hydr Depth (m)	0.40
Min El Prs (m)	200.70	W.P. Total (m)	204.91
Delta EG (m)	0.07	Conv. Total (m3/s)	1004.5
Delta WS (m)	0.07	Top Width (m)	177.59
BR Open Area (m2)	13.69	Frctn Loss (m)	0.00
BR Open Vel (m/s)	1.55	C & E Loss (m)	0.00
BR Sluice Coef		Shear Total (N/m2)	22.63
BR Sel Method	Energy only	Power Total (N/m s)	26.07

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
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: RIVER-1
REACH: Reach-1 RS: 46.273

INPUT
Description: Section 46.273 - Jane Street - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	76	204	83	201	90	200
94	199.34	98	199.34	102	200	106	201	116	204
130	204	205	204	205	206				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	76	.08	90	.035	106	.08	116	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	102	4	4	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	89	203.2	F
103	205	203.2	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.60	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.035
W.S. Elev (m)	202.59	Reach Len. (m)	4.00	4.00	4.00
Crit W.S. (m)	200.27	Flow Area (m2)	2.51	36.31	2.46
E.G. Slope (m/m)	0.000089	Area (m2)	17.53	36.31	12.53
Q Total (m3/s)	22.11	Flow (m3/s)	0.55	20.37	1.19
Top Width (m)	31.99	Top Width (m)	10.70	12.00	9.29
Vel Total (m/s)	0.54	Avg. Vel. (m/s)	0.22	0.56	0.48
Max Chl Dpth (m)	3.25	Hydr. Depth (m)	2.51	3.03	2.46
Conv. Total (m3/s)	2340.5	Conv. (m3/s)	57.7	2157.2	125.6
Length Wtd. (m)	4.00	Wetted Per. (m)	1.01	12.11	1.03
Min Ch El (m)	199.34	Shear (N/m2)	2.18	2.62	2.09
Alpha	1.06	Stream Power (N/m s)	0.47	1.47	1.01
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	98.86	146.14	62.12
C & E Loss (m)	0.01	Cum SA (1000 m2)	89.92	43.73	71.22

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.29	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.077	0.035	0.046
W.S. Elev (m)	204.26	Reach Len. (m)	4.00	4.00	4.00
Crit W.S. (m)	201.19	Flow Area (m2)	50.38	56.38	55.61
E.G. Slope (m/m)	0.000136	Area (m2)	50.38	56.38	55.61
Q Total (m3/s)	81.91	Flow (m3/s)	11.78	52.44	17.69
Top Width (m)	179.04	Top Width (m)	64.04	12.00	

103.00					
Vel Total (m/s)	0.50	Avg. Vel. (m/s)	0.23	0.93	0.32
Max Chl Dpth (m)	4.92	Hydr. Depth (m)	0.79	4.70	0.54
Conv. Total (m3/s)	7015.4	Conv. (m3/s)	1009.1	4491.5	1514.7
Length Wtd. (m)	4.00	Wetted Per. (m)	64.73	12.11	103.82
Min Ch El (m)	199.34	Shear (N/m2)	1.04	6.23	0.72
Alpha	2.29	Stream Power (N/m s)	0.24	5.79	0.23
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	251.43	279.53	240.84
C & E Loss (m)	0.01	Cum SA (1000 m2)	168.56	43.73	162.79

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.272

INPUT
Description: Section 46.272 - Jane Street - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	80	204	90	201	91	200
92	199.34	100	199.34	101	200	102	201	105	202
115	203	120	204	130	204	205	204	205	206

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	80	.08	91	.035	102	.08	120	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
91	101	100	80	60	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	92	204	F
100	205	204	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.59	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.		0.035	
W.S. Elev (m)	202.56	Reach Len. (m)	100.00	80.00	60.00
Crit W.S. (m)	200.26	Flow Area (m2)		25.73	
E.G. Slope (m/m)	0.000190	Area (m2)	6.09	31.50	6.77
Q Total (m3/s)	22.11	Flow (m3/s)		22.11	

Top Width (m)	25.75	Top Width (m)	6.19	10.00	9.57
Vel Total (m/s)	0.86	Avg. Vel. (m/s)		0.86	
Max Chl Dpth (m)	3.22	Hydr. Depth (m)		3.22	
Conv. Total (m3/s)	1601.9	Conv. (m3/s)		1601.9	
Length Wtd. (m)	80.00	Wetted Per. (m)		8.00	
Min Ch El (m)	199.34	Shear (N/m2)		6.01	
Alpha	1.00	Stream Power (N/m s)		5.16	
Frctn Loss (m)		Cum Volume (1000 m3)	98.81	146.00	62.08
C & E Loss (m)		Cum SA (1000 m2)	89.89	43.69	71.18

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.28	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.075	0.035	0.064
W.S. Elev (m)	204.21	Reach Len. (m)	100.00	80.00	60.00
Crit W.S. (m)	201.54	Flow Area (m2)	31.29	48.08	50.77
E.G. Slope (m/m)	0.000260	Area (m2)	31.29	48.08	50.77
Q Total (m3/s)	81.91	Flow (m3/s)	7.27	61.43	13.22
Top Width (m)	177.49	Top Width (m)	63.49	10.00	104.00
Vel Total (m/s)	0.63	Avg. Vel. (m/s)	0.23	1.28	0.26
Max Chl Dpth (m)	4.87	Hydr. Depth (m)	0.49	4.81	0.49
Conv. Total (m3/s)	5084.6	Conv. (m3/s)	451.0	3813.2	820.4
Length Wtd. (m)	80.00	Wetted Per. (m)	64.35	10.40	104.94
Min Ch El (m)	199.34	Shear (N/m2)	1.24	11.77	1.23
Alpha	3.13	Stream Power (N/m s)	0.29	15.04	0.32
Frctn Loss (m)		Cum Volume (1000 m3)	251.27	279.33	240.63
C & E Loss (m)		Cum SA (1000 m2)	168.31	43.69	162.38

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2715

INPUT
Description: Hum 13A-1R. Jane Street Culverts - Twin Cell - 2.44 m W x 2.135 m H x 59 m L Concrete Box Culverts and Single Cel 2.44 W x 1.22 m H x 59 m L. Drawings by Ander Engineering Ltd. (85-101-7 & 85-101-1) 1985.

New HEC-RAS coding January 2004 by Acres
included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.
Distance from Upstream XS = 5
Deck/Roadway Width = 59
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	204	173	204

Upstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	80	204	90	201	91	200
92	199.34	100	199.34	101	200	102	201	105	202
115	203	120	204	130	204	205	204	205	206

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	80	.08	91	.035	102	.08	120	.05

Bank Sta: Left Right Coeff Contr. Expan.
91 101 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	92	204	F
100	205	204	F

Downstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	204	173	204

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	3	204	30	204	67	204	71	203
74	201	77	200	79	198.983	91	198.983	93	200
97	201	105	202	106	203	107	203.6	165	203.8

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.05	71	.08	77	.035	93	.08
106	.05								

Bank Sta: Left Right Coeff Contr. Expan.
77 93 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent

```
       0      81   202.5       F
      89     165   202.5       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 =  2

Culvert Name     Shape      Rise    Span
Culvert #1           Box   2.135    2.44
FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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
                 5      59     .015     .015        0                   .5
      1
Number of Barrels =  2
Upstream   Elevation =  200.78
Centerline Stations
    Sta.    Sta.
    93.6    98.4
Downstream Elevation =  200.403
Centerline Stations
    Sta.    Sta.
    82.6    87.4

Culvert Name     Shape      Rise    Span
Culvert #2           Box    1.22    2.44
FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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
                 5      59     .015     .015        0                   .5
      1
Upstream   Elevation =  199.34
           Centerline Station =  96
Downstream Elevation =  198.983
           Centerline Station =  85

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      16.32    Culv Full Len (m)
  # Barrels                   2     Culv Vel US (m/s)        2.51
  Q Barrel (m3/s)           8.16    Culv Vel DS (m/s)        1.93
  E.G. US. (m)            202.59    Culv Inv El Up (m)     200.78
  W.S. US. (m)            202.56    Culv Inv El Dn (m)     200.40
  E.G. DS (m)             202.18    Culv Frctn Ls (m)        0.03
  W.S. DS (m)             202.14    Culv Exit Loss (m)       0.15
  Delta EG (m)              0.42    Culv Entr Loss (m)       0.16
  Delta WS (m)              0.42    Q Weir (m3/s)
  E.G. IC (m)             202.49    Weir Sta Lft (m)
  E.G. OC (m)             202.59    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
  Culv WS Inlet (m)       202.11    Weir Max Depth (m)
  Culv WS Outlet (m)      202.14    Weir Avg Depth (m)
  Culv Nml Depth (m)        0.95    Weir Flow Area (m2)
```

Culv Crt Depth (m)	1.04	Min El Weir Flow (m)	204.00

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	35.25	Culv Full Len (m)	59.00
# Barrels	2	Culv Vel US (m/s)	3.38
Q Barrel (m3/s)	17.62	Culv Vel DS (m/s)	3.38
E.G. US. (m)	204.28	Culv Inv El Up (m)	200.78
W.S. US. (m)	204.21	Culv Inv El Dn (m)	200.40
E.G. DS (m)	203.14	Culv Frctn Ls (m)	0.32
W.S. DS (m)	203.08	Culv Exit Loss (m)	0.53
Delta EG (m)	1.14	Culv Entr Loss (m)	0.29
Delta WS (m)	1.13	Q Weir (m3/s)	37.29
E.G. IC (m)	203.87	Weir Sta Lft (m)	25.16
E.G. OC (m)	204.28	Weir Sta Rgt (m)	205.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	202.92	Weir Max Depth (m)	0.28
Culv WS Outlet (m)	202.54	Weir Avg Depth (m)	0.27
Culv Nml Depth (m)		Weir Flow Area (m2)	49.20
Culv Crt Depth (m)	1.75	Min El Weir Flow (m)	204.00

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #2

Q Culv Group (m3/s)	5.79	Culv Full Len (m)	59.00
# Barrels	1	Culv Vel US (m/s)	1.94
Q Barrel (m3/s)	5.79	Culv Vel DS (m/s)	1.94
E.G. US. (m)	202.59	Culv Inv El Up (m)	199.34
W.S. US. (m)	202.56	Culv Inv El Dn (m)	198.98
E.G. DS (m)	202.18	Culv Frctn Ls (m)	0.17
W.S. DS (m)	202.14	Culv Exit Loss (m)	0.15
Delta EG (m)	0.42	Culv Entr Loss (m)	0.10
Delta WS (m)	0.42	Q Weir (m3/s)	
E.G. IC (m)	200.70	Weir Sta Lft (m)	
E.G. OC (m)	202.59	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	200.56	Weir Max Depth (m)	
Culv WS Outlet (m)	200.20	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.83	Min El Weir Flow (m)	204.00

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #2

Q Culv Group (m3/s)	9.37	Culv Full Len (m)	59.00
# Barrels	1	Culv Vel US (m/s)	3.15
Q Barrel (m3/s)	9.37	Culv Vel DS (m/s)	3.15
E.G. US. (m)	204.28	Culv Inv El Up (m)	199.34
W.S. US. (m)	204.21	Culv Inv El Dn (m)	198.98
E.G. DS (m)	203.14	Culv Frctn Ls (m)	0.44
W.S. DS (m)	203.08	Culv Exit Loss (m)	0.45
Delta EG (m)	1.14	Culv Entr Loss (m)	0.25
Delta WS (m)	1.13	Q Weir (m3/s)	37.29
E.G. IC (m)	201.52	Weir Sta Lft (m)	25.16
E.G. OC (m)	204.28	Weir Sta Rgt (m)	205.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	200.56	Weir Max Depth (m)	0.28
Culv WS Outlet (m)	200.20	Weir Avg Depth (m)	0.27
Culv Nml Depth (m)		Weir Flow Area (m2)	49.20
Culv Crt Depth (m)	1.15	Min El Weir Flow (m)	204.00

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.271

INPUT
Description: Section 46.271 - Jane Street - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	3	204	30	204	67	204	71	203
74	201	77	200	79	198.983	91	198.983	93	200
97	201	105	202	106	203	107	203.6	165	203.8

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.05	71	.08	77	.035	93	.08
106	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
77	93	55	60	70	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	81	202.5	F
89	165	202.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.18	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.		0.035	
W.S. Elev (m)	202.14	Reach Len. (m)	55.00	60.00	70.00
Crit W.S. (m)	199.90	Flow Area (m2)		25.24	
E.G. Slope (m/m)	0.000203	Area (m2)	5.88	48.44	11.66
Q Total (m3/s)	22.11	Flow (m3/s)		22.11	
Top Width (m)	32.84	Top Width (m)	4.71	16.00	12.14
Vel Total (m/s)	0.88	Avg. Vel. (m/s)		0.88	
Max Chl Dpth (m)	3.15	Hydr. Depth (m)		3.15	
Conv. Total (m3/s)	1550.9	Conv. (m3/s)		1550.9	
Length Wtd. (m)	61.12	Wetted Per. (m)		8.00	
Min Ch El (m)	198.98	Shear (N/m2)		6.28	
Alpha	1.00	Stream Power (N/m s)		5.50	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	98.81	145.35	62.08
C & E Loss (m)	0.00	Cum SA (1000 m2)	89.34	42.65	70.53

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	203.14	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.08	Reach Len. (m)	55.00	60.00	70.00
Crit W.S. (m)	201.18	Flow Area (m2)	11.01	63.56	23.58
E.G. Slope (m/m)	0.000260	Area (m2)	11.01	63.56	23.58
Q Total (m3/s)	81.91	Flow (m3/s)	3.06	71.99	6.86
Top Width (m)	35.47	Top Width (m)	6.33	16.00	13.14
Vel Total (m/s)	0.83	Avg. Vel. (m/s)	0.28	1.13	0.29
Max Chl Dpth (m)	4.10	Hydr. Depth (m)	1.74	3.97	1.79
Conv. Total (m3/s)	5080.7	Conv. (m3/s)	190.0	4465.4	425.3
Length Wtd. (m)	61.45	Wetted Per. (m)	7.11	16.49	13.76
Min Ch El (m)	198.98	Shear (N/m2)	3.95	9.83	4.37
Alpha	1.63	Stream Power (N/m s)	1.10	11.13	1.27
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	251.27	275.00	240.63
C & E Loss (m)	0.05	Cum SA (1000 m2)	164.82	42.65	158.87

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.27

INPUT
Description: Section 46.27 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	10	204	40	204	63	206	73	206
78	204	90	203	100	200	103	199	104	198.9
105	198.9	106	199	112	200	120	203	147	203.5

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	103	.035	106	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
103	106	100	110	120	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.16	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.13	Reach Len. (m)	100.00	110.00	120.00
Crit W.S. (m)		Flow Area (m2)	15.41	9.58	21.78
E.G. Slope (m/m)	0.000317	Area (m2)	15.41	9.58	21.78
Q Total (m3/s)	22.11	Flow (m3/s)	4.41	10.54	7.16
Top Width (m)	24.75	Top Width (m)	10.09	3.00	11.67
Vel Total (m/s)	0.47	Avg. Vel. (m/s)	0.29	1.10	0.33
Max Chl Dpth (m)	3.23	Hydr. Depth (m)	1.53	3.19	1.87
Conv. Total (m3/s)	1241.6	Conv. (m3/s)	247.8	591.9	402.0
Length Wtd. (m)	110.32	Wetted Per. (m)	10.56	3.01	12.14
Min Ch El (m)	198.90	Shear (N/m2)	4.54	9.89	5.58
Alpha	2.81	Stream Power (N/m s)	1.30	10.88	1.83
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	98.22	143.61	60.91
C & E Loss (m)	0.00	Cum SA (1000 m2)	88.94	42.08	69.70

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	203.06	Element	Left OB	Channel	Right OB
Vel Head (m)	0.23	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.83	Reach Len. (m)	100.00	110.00	120.00
Crit W.S. (m)		Flow Area (m2)	23.32	11.69	30.64
E.G. Slope (m/m)	0.001866	Area (m2)	23.32	11.69	30.64
Q Total (m3/s)	81.91	Flow (m3/s)	18.59	35.62	27.70
Top Width (m)	28.97	Top Width (m)	12.43	3.00	13.54

Vel Total (m/s)	1.25	Avg. Vel. (m/s)	0.80	3.05	0.90
Max Chl Dpth (m)	3.93	Hydr. Depth (m)	1.88	3.90	2.26
Conv. Total (m3/s)	1896.3	Conv. (m3/s)	430.3	824.7	641.4
Length Wtd. (m)	110.37	Wetted Per. (m)	13.01	3.01	14.14
Min Ch El (m)	198.90	Shear (N/m2)	32.81	71.04	39.65
Alpha	2.87	Stream Power (N/m s)	26.15	216.56	35.85
Frctn Loss (m)	0.14	Cum Volume (1000 m3)	250.33	272.74	238.73
C & E Loss (m)	0.02	Cum SA (1000 m2)	164.30	42.08	157.93

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: RIVER-1
REACH: Reach-1 RS: 46.26

INPUT
Description: Section 46.26 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	15	204	24	200	30	199	32	198.8
34	198.8	36	199	47	202	54	202.5	64	202.5
64	205	109	205						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	15	.08	30	.035	36	.08	54	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
30	36	115	120	120	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.13	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.11	Reach Len. (m)	115.00	120.00	120.00
Crit W.S. (m)		Flow Area (m2)	20.70	19.48	17.83
E.G. Slope (m/m)	0.000138	Area (m2)	20.70	19.48	17.83
Q Total (m3/s)	22.11	Flow (m3/s)	4.56	14.31	3.24
Top Width (m)	29.33	Top Width (m)	10.75	6.00	12.58
Vel Total (m/s)	0.38	Avg. Vel. (m/s)	0.22	0.73	0.18

Max Chl Dpth (m)	3.31	Hydr. Depth (m)	1.92	3.25	1.42
Conv. Total (m3/s)	1880.4	Conv. (m3/s)	387.7	1217.4	275.3
Length Wtd. (m)	119.31	Wetted Per. (m)	11.29	6.02	12.99
Min Ch El (m)	198.80	Shear (N/m2)	2.49	4.38	1.86
Alpha	2.51	Stream Power (N/m s)	0.55	3.22	0.34
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	96.42	142.02	58.54
C & E Loss (m)	0.00	Cum SA (1000 m2)	87.90	41.58	68.24

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.89	Element	Left OB	Channel	Right OB
Vel Head (m)	0.15	Wt. n-Val.	0.080	0.035	0.079
W.S. Elev (m)	202.75	Reach Len. (m)	115.00	120.00	120.00
Crit W.S. (m)		Flow Area (m2)	27.96	23.28	30.65
E.G. Slope (m/m)	0.000912	Area (m2)	27.96	23.28	30.65
Q Total (m3/s)	81.91	Flow (m3/s)	17.73	49.48	14.70
Top Width (m)	46.18	Top Width (m)	12.18	6.00	28.00
Vel Total (m/s)	1.00	Avg. Vel. (m/s)	0.63	2.13	0.48
Max Chl Dpth (m)	3.95	Hydr. Depth (m)	2.30	3.88	1.09
Conv. Total (m3/s)	2712.6	Conv. (m3/s)	587.2	1638.6	486.9
Length Wtd. (m)	119.21	Wetted Per. (m)	12.85	6.02	28.67
Min Ch El (m)	198.80	Shear (N/m2)	19.47	34.58	9.56
Alpha	2.86	Stream Power (N/m s)	12.34	73.50	4.59
Frctn Loss (m)	0.09	Cum Volume (1000 m3)	247.76	270.82	235.05
C & E Loss (m)	0.01	Cum SA (1000 m2)	163.07	41.58	155.44

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: RIVER-1
REACH: Reach-1 RS: 46.25

INPUT
Description: Section 46.25 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	26	203	36	200	40	199	44	198.6
46	198.6	50	199	68	202	84	203	154	204

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	26	.08	40	.035	50	.08	68	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
40	50	140	130	125	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.11	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.08	Reach Len. (m)	140.00	130.00	125.00
Crit W.S. (m)		Flow Area (m2)	17.51	33.18	28.46
E.G. Slope (m/m)	0.000202	Area (m2)	17.51	33.18	28.46
Q Total (m3/s)	40.81	Flow (m3/s)	4.15	29.88	6.78
Top Width (m)	40.18	Top Width (m)	10.93	10.00	19.25
Vel Total (m/s)	0.52	Avg. Vel. (m/s)	0.24	0.90	0.24
Max Chl Dpth (m)	3.48	Hydr. Depth (m)	1.60	3.32	1.48
Conv. Total (m3/s)	2872.9	Conv. (m3/s)	292.2	2103.6	477.1
Length Wtd. (m)	130.55	Wetted Per. (m)	11.36	10.04	19.50
Min Ch El (m)	198.60	Shear (N/m2)	3.05	6.54	2.89
Alpha	2.29	Stream Power (N/m s)	0.72	5.89	0.69
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	94.22	138.86	55.76
C & E Loss (m)	0.00	Cum SA (1000 m2)	86.65	40.62	66.33

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.79	Element	Left OB	Channel	Right OB
Vel Head (m)	0.13	Wt. n-Val.	0.080	0.035	0.079
W.S. Elev (m)	202.67	Reach Len. (m)	140.00	130.00	125.00

Crit W.S. (m)		Flow Area (m2)	24.51	39.06	42.53
E.G. Slope (m/m)	0.000709	Area (m2)	24.51	39.06	42.53
Q Total (m3/s)	108.10	Flow (m3/s)	12.20	73.48	22.42
Top Width (m)	51.54	Top Width (m)	12.89	10.00	28.65
Vel Total (m/s)	1.02	Avg. Vel. (m/s)	0.50	1.88	0.53
Max Chl Dpth (m)	4.07	Hydr. Depth (m)	1.90	3.91	1.48
Conv. Total (m3/s)	4060.4	Conv. (m3/s)	458.1	2760.1	842.2
Length Wtd. (m)	130.59	Wetted Per. (m)	13.40	10.04	28.92
Min Ch El (m)	198.60	Shear (N/m2)	12.71	27.04	10.22
Alpha	2.40	Stream Power (N/m s)	6.33	50.87	5.39
Frctn Loss (m)	0.12	Cum Volume (1000 m3)	244.75	267.08	230.66
C & E Loss (m)	0.01	Cum SA (1000 m2)	161.63	40.62	152.04

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.24

INPUT
Description: Section 46.24 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	13	203	30	200	34	199	36	198.4
38	198.4	43	199	52	202	60	203	80	204

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	13	.08	34	.035	43	.08	60	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
34	43	54	51	45	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.03	Reach Len. (m)	54.00	51.00	45.00
Crit W.S. (m)		Flow Area (m2)	21.87	30.61	13.82
E.G. Slope (m/m)	0.000263	Area (m2)	21.87	30.61	13.82
Q Total (m3/s)	40.81	Flow (m3/s)	5.50	31.78	3.53
Top Width (m)	33.81	Top Width (m)	15.53	9.00	

9.28					
Vel Total (m/s)	0.62	Avg. Vel. (m/s)	0.25	1.04	
0.26					
Max Chl Dpth (m)	3.63	Hydr. Depth (m)	1.41	3.40	
1.49					
Conv. Total (m3/s)	2516.8	Conv. (m3/s)	339.1	1960.1	
217.7					
Length Wtd. (m)	50.57	Wetted Per. (m)	15.83	9.12	
9.77					
Min Ch El (m)	198.40	Shear (N/m2)	3.56	8.65	
3.65					
Alpha	2.25	Stream Power (N/m s)	0.90	8.98	
0.93					
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	91.46	134.71	
53.12					
C & E Loss (m)	0.00	Cum SA (1000 m2)	84.80	39.39	
64.55					

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.67	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.22	Wt. n-Val.	0.080	0.035	
0.080					
W.S. Elev (m)	202.44	Reach Len. (m)	54.00	51.00	
45.00					
Crit W.S. (m)		Flow Area (m2)	28.71	34.30	
18.29					
E.G. Slope (m/m)	0.001184	Area (m2)	28.71	34.30	
18.29					
Q Total (m3/s)	108.10	Flow (m3/s)	16.74	81.52	
9.84					
Top Width (m)	39.41	Top Width (m)	17.85	9.00	
12.56					
Vel Total (m/s)	1.33	Avg. Vel. (m/s)	0.58	2.38	
0.54					
Max Chl Dpth (m)	4.04	Hydr. Depth (m)	1.61	3.81	
1.46					
Conv. Total (m3/s)	3141.7	Conv. (m3/s)	486.4	2369.2	
286.0					
Length Wtd. (m)	50.48	Wetted Per. (m)	18.19	9.12	
13.07					
Min Ch El (m)	198.40	Shear (N/m2)	18.32	43.64	
16.25					
Alpha	2.45	Stream Power (N/m s)	10.68	103.73	
8.74					
Frctn Loss (m)	0.06	Cum Volume (1000 m3)	241.02	262.31	
226.86					
C & E Loss (m)	0.02	Cum SA (1000 m2)	159.48	39.39	
149.47					

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2375

INPUT

Description: Based on Bridge Section US

Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-1380	205.2	-1375	205.1	-1370	204.5	-1360	204.5	-1340	204.4
-1330	204.2	-1320	204.4	-1318	204	-1310	203	-1305	202
-1300	201	-1295	200	-1290	199.3	-1288	199.2	-1287	198.8
-1285	198.6	-1284	198.6	-1282	199.2	-1280	199.4	-1275	200
-1270	201	-1260	201.3	-1250	202	-1242	203	-1240	204.3
-1236	204.6	-1233	204.7	-1230	204.5	-1220	204.6	-1215	205
-1200	205								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-1380	.05	-1320	.08	-1288	.035	-1282	.08	-1233	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-1288	-1282	30	30	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-1380	-1305	204	T
-1247	-1200	204	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.06	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.02	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	200.30	Flow Area (m2)	27.63	19.34	37.12
E.G. Slope (m/m)	0.000356	Area (m2)	27.63	19.34	37.12
Q Total (m3/s)	40.81	Flow (m3/s)	8.92	22.30	9.59
Top Width (m)	55.29	Top Width (m)	17.11	6.00	32.18
Vel Total (m/s)	0.49	Avg. Vel. (m/s)	0.32	1.15	0.26
Max Chl Dpth (m)	3.42	Hydr. Depth (m)	1.63	3.22	1.15
Conv. Total (m3/s)	2163.9	Conv. (m3/s)	472.8	1182.6	508.4
Length Wtd. (m)	1.00	Wetted Per. (m)	17.25	6.18	32.35
Min Ch El (m)	198.60	Shear (N/m2)	5.59	10.92	4.00
Alpha	3.25	Stream Power (N/m s)	1.80	12.59	1.03
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	90.13	133.44	51.97
C & E Loss (m)	0.00	Cum SA (1000 m2)	83.92	39.01	63.62

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.58	Element	Left OB	Channel	Right OB

Vel Head (m)	0.16	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.42	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	201.35	Flow Area (m2)	34.43	21.74	50.63
E.G. Slope (m/m)	0.001364	Area (m2)	34.88	21.74	50.64
Q Total (m3/s)	108.10	Flow (m3/s)	25.21	53.10	29.79
Top Width (m)	60.49	Top Width (m)	19.11	6.00	35.38
Vel Total (m/s)	1.01	Avg. Vel. (m/s)	0.73	2.44	0.59
Max Chl Dpth (m)	3.82	Hydr. Depth (m)	2.03	3.62	1.45
Conv. Total (m3/s)	2926.4	Conv. (m3/s)	682.4	1437.5	806.4
Length Wtd. (m)	1.00	Wetted Per. (m)	17.25	6.18	35.20
Min Ch El (m)	198.60	Shear (N/m2)	26.71	47.10	19.25
Alpha	3.08	Stream Power (N/m s)	19.56	115.03	11.32
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	239.30	260.88	225.31
C & E Loss (m)	0.00	Cum SA (1000 m2)	158.48	39.01	148.39

BRIDGE

RIVER: RIVER-1
REACH: Reach-1 RS: 46.235

INPUT
Description: Proposed Portage Parkway Extension
Distance from Upstream XS = 1
Deck/Roadway Width = 25.7
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 8

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-1400	205.5		-1360	205.5		-1305	206	
-1305	206	203.45	-1280	206.4	203.5	-1247	206	203.55
-1247	206		-1180	205.5				

Upstream Bridge Cross Section Data
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-1380	205.2	-1375	205.1	-1370	204.5	-1360	204.5	-1340	204.4
-1330	204.2	-1320	204.4	-1318	204	-1310	203	-1305	202
-1300	201	-1295	200	-1290	199.3	-1288	199.2	-1287	198.8
-1285	198.6	-1284	198.6	-1282	199.2	-1280	199.4	-1275	200
-1270	201	-1260	201.3	-1250	202	-1242	203	-1240	204.3
-1236	204.6	-1233	204.7	-1230	204.5	-1220	204.6	-1215	205
-1200	205								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-1380	.05	-1320	.08	-1288	.035	-1282	.08	-1233	.05

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Bank Sta: Left   Right    Coeff Contr.   Expan.
         -1288   -1282            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -1380   -1305     204       T
   -1247   -1200     204       T

Downstream  Deck/Roadway Coordinates
    num=       8
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
   -1400   205.5           -1360   205.5           -1305     206
   -1305     206  203.45   -1280   206.4   203.5   -1247     206  203.55
   -1247     206           -1180   205.5

Downstream Bridge Cross Section Data
Station Elevation Data    num=      31
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   -1380   205.2   -1375   205.1   -1370   204.5   -1360   204.5   -1340   204.4
   -1330   204.2   -1320   204.4   -1318     204   -1310     203   -1305     202
   -1300     201   -1295     200   -1290   199.3   -1288   199.2   -1287   198.8
   -1285   198.6   -1284   198.6   -1282   199.2   -1280   199.4   -1275     200
   -1270     201   -1260   201.3   -1250     202   -1242     203   -1240   204.3
   -1236   204.6   -1233   204.7   -1230   204.5   -1220   204.6   -1215     205
   -1200     205

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
   -1380     .05   -1320     .08   -1288    .035   -1282     .08   -1233     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
         -1288   -1282            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -1380   -1305     204       T
   -1247   -1200     204       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 =     .98
Elevation at which weir flow begins        =
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT  Profile #100-year
```

E.G. US. (m)	202.06	Element	Inside BR US	Inside BR DS
W.S. US. (m)	202.02	E.G. Elev (m)	202.06	202.05
Q Total (m3/s)	40.81	W.S. Elev (m)	202.02	202.01
Q Bridge (m3/s)	40.81	Crit W.S. (m)	200.30	200.30
Q Weir (m3/s)		Max Chl Dpth (m)	3.42	3.41
Weir Sta Lft (m)		Vel Total (m/s)	0.49	0.49
Weir Sta Rgt (m)		Flow Area (m2)	84.06	83.52
Weir Submerg		Froude # Chl	0.21	0.21
Weir Max Depth (m)		Specif Force (m3)	94.86	94.06
Min El Weir Flow (m)	205.50	Hydr Depth (m)	1.52	1.52
Min El Prs (m)	203.55	W.P. Total (m)	55.77	55.69
Delta EG (m)	0.01	Conv. Total (m3/s)	2163.2	2146.0
Delta WS (m)	0.01	Top Width (m)	55.17	55.09
BR Open Area (m2)	169.49	Frctn Loss (m)	0.01	0.00
BR Open Vel (m/s)	0.49	C & E Loss (m)	0.00	0.00
BR Sluice Coef		Shear Total (N/m2)	5.26	5.32
BR Sel Method	Energy only	Power Total (N/m s)	2.55	2.60

BRIDGE OUTPUT Profile #Regional w red'n

E.G. US. (m)	202.58	Element	Inside BR US	Inside BR DS
W.S. US. (m)	202.42	E.G. Elev (m)	202.58	202.54
Q Total (m3/s)	108.10	W.S. Elev (m)	202.42	202.37
Q Bridge (m3/s)	108.10	Crit W.S. (m)	201.00	201.00
Q Weir (m3/s)		Max Chl Dpth (m)	3.82	3.77
Weir Sta Lft (m)		Vel Total (m/s)	1.01	1.04
Weir Sta Rgt (m)		Flow Area (m2)	106.55	103.74
Weir Submerg		Froude # Chl	0.29	0.43
Weir Max Depth (m)		Specif Force (m3)	146.44	141.83
Min El Weir Flow (m)	205.50	Hydr Depth (m)	1.84	1.79
Min El Prs (m)	203.55	W.P. Total (m)	59.08	58.58

Delta EG (m)	0.05	Conv. Total (m3/s)	2905.7
2814.3			
Delta WS (m)	0.06	Top Width (m)	58.00
57.96			
BR Open Area (m2)	169.49	Frctn Loss (m)	0.04
0.00			
BR Open Vel (m/s)	1.04	C & E Loss (m)	0.00
0.00			
BR Sluice Coef		Shear Total (N/m2)	24.48
25.62			
BR Sel Method	Energy only	Power Total (N/m s)	24.83
26.70			

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2325

INPUT
Description: Based on Bridge Section DS
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-1380	205.2	-1375	205.1	-1370	204.5	-1360	204.5	-1340	204.4
-1330	204.2	-1320	204.4	-1318	204	-1310	203	-1305	202
-1300	201	-1295	200	-1290	199.3	-1288	199.2	-1287	198.8
-1285	198.6	-1284	198.6	-1282	199.2	-1280	199.4	-1275	200
-1270	201	-1260	201.3	-1250	202	-1242	203	-1240	204.3
-1236	204.6	-1233	204.7	-1230	204.5	-1220	204.6	-1215	205
-1200	205								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-1380	.05	-1320	.08	-1288	.035	-1282	.08	-1233	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-1288	-1282	94	94	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-1380	-1305	204	T
-1247	-1200	204	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.05	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.01	Reach Len. (m)	94.00	94.00	94.00
Crit W.S. (m)		Flow Area (m2)	27.43	19.27	36.75
E.G. Slope (m/m)	0.000362	Area (m2)	27.43	19.27	36.75
Q Total (m3/s)	40.81	Flow (m3/s)	8.89	22.38	9.54
Top Width (m)	55.14	Top Width (m)	17.05	6.00	32.08
Vel Total (m/s)	0.49	Avg. Vel. (m/s)	0.32	1.16	0.26

Max Chl Dpth (m)	3.41	Hydr. Depth (m)	1.61	3.21	1.15
Conv. Total (m3/s)	2143.9	Conv. (m3/s)	467.2	1175.6	501.0
Length Wtd. (m)	94.00	Wetted Per. (m)	17.25	6.18	32.26
Min Ch El (m)	198.60	Shear (N/m2)	5.65	11.08	4.05
Alpha	3.25	Stream Power (N/m s)	1.83	12.87	1.05
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	89.30	132.86	50.86
C & E Loss (m)	0.02	Cum SA (1000 m2)	83.41	38.83	62.65

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.54	Element	Left OB	Channel	Right OB
Vel Head (m)	0.17	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.36	Reach Len. (m)	94.00	94.00	94.00
Crit W.S. (m)		Flow Area (m2)	33.43	21.39	48.57
E.G. Slope (m/m)	0.001488	Area (m2)	33.76	21.39	48.57
Q Total (m3/s)	108.10	Flow (m3/s)	25.06	53.96	29.08
Top Width (m)	59.73	Top Width (m)	18.82	6.00	34.91
Vel Total (m/s)	1.05	Avg. Vel. (m/s)	0.75	2.52	0.60
Max Chl Dpth (m)	3.76	Hydr. Depth (m)	1.97	3.56	1.39
Conv. Total (m3/s)	2802.3	Conv. (m3/s)	649.7	1398.8	753.8
Length Wtd. (m)	94.00	Wetted Per. (m)	17.25	6.18	35.11
Min Ch El (m)	198.60	Shear (N/m2)	28.28	50.53	20.19
Alpha	3.11	Stream Power (N/m s)	21.20	127.47	12.09
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	238.29	260.24	223.82
C & E Loss (m)	0.07	Cum SA (1000 m2)	157.96	38.83	147.34

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: RIVER-1
REACH: Reach-1 RS: 46.23

INPUT
Description: Section 46.23 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	38	204	52	201	63	200	90	199
100	198.2	113	199	118	200	126	204	160	204
160	206	210	206						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	38	.08	90	.035	113	.08	126	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	113	101	95	89	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.03	Element	Left OB	Channel
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035
W.S. Elev (m)	202.02	Reach Len. (m)	101.00	95.00
Crit W.S. (m)		Flow Area (m2)	87.23	78.68
E.G. Slope (m/m)	0.000033	Area (m2)	87.23	78.68
Q Total (m3/s)	40.81	Flow (m3/s)	9.99	29.10
Top Width (m)	74.81	Top Width (m)	42.76	23.00
Vel Total (m/s)	0.22	Avg. Vel. (m/s)	0.11	0.37
Max Chl Dpth (m)	3.82	Hydr. Depth (m)	2.04	3.42
Conv. Total (m3/s)	7145.7	Conv. (m3/s)	1748.9	5095.6
Length Wtd. (m)	97.05	Wetted Per. (m)	42.94	23.06
Min Ch El (m)	198.20	Shear (N/m2)	0.65	1.09
Alpha	2.03	Stream Power (N/m s)	0.07	0.40
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	83.91	128.25
C & E Loss (m)	0.00	Cum SA (1000 m2)	80.59	37.46

			Right OB	
			0.080	
			89.00	
			16.69	
			16.69	
			1.72	
			9.04	
			0.10	
			1.85	
			301.2	
			9.62	
			0.55	
			0.06	
			48.35	
			60.72	

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.43	Element	Left OB	Channel

Right OB					
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.40	Reach Len. (m)	101.00	95.00	89.00
Crit W.S. (m)		Flow Area (m2)	103.96	87.50	20.30
E.G. Slope (m/m)	0.000152	Area (m2)	103.96	87.50	20.30
Q Total (m3/s)	108.10	Flow (m3/s)	28.13	75.09	4.87
Top Width (m)	77.36	Top Width (m)	44.55	23.00	9.81
Vel Total (m/s)	0.51	Avg. Vel. (m/s)	0.27	0.86	0.24
Max Chl Dpth (m)	4.20	Hydr. Depth (m)	2.33	3.80	2.07
Conv. Total (m3/s)	8755.4	Conv. (m3/s)	2278.8	6082.1	394.4
Length Wtd. (m)	97.07	Wetted Per. (m)	44.77	23.06	10.47
Min Ch El (m)	198.20	Shear (N/m2)	3.47	5.67	2.90
Alpha	2.05	Stream Power (N/m s)	0.94	4.87	0.69
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	231.81	255.12	220.59
C & E Loss (m)	0.01	Cum SA (1000 m2)	154.99	37.46	145.24

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: RIVER-1
REACH: Reach-1 RS: 46.22

INPUT
Description: Section 46.22 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	12	201	22	200	36	199	52	198
72	197.5	77	198	79	199	87	203	102	203
112	199	114	198	132	197.5	146	198	152	199
172	202	175	203	192	204				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	36	.035	79	.08	112	.035	152	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
112	152	125	140	115	.1 .3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.02	Element	Left OB	Channel Right OB

Vel Head (m)	0.00	Wt. n-Val.	0.039	0.035	0.050
W.S. Elev (m)	202.02	Reach Len. (m)	125.00	140.00	115.00
Crit W.S. (m)		Flow Area (m2)	243.50	164.94	30.47
E.G. Slope (m/m)	0.000002	Area (m2)	243.50	164.94	30.47
Q Total (m3/s)	40.81	Flow (m3/s)	20.86	18.71	1.24
Top Width (m)	144.77	Top Width (m)	84.70	40.00	20.07
Vel Total (m/s)	0.09	Avg. Vel. (m/s)	0.09	0.11	0.04
Max Chl Dpth (m)	4.52	Hydr. Depth (m)	2.87	4.12	1.52
Conv. Total (m3/s)	26284.7	Conv. (m3/s)	13434.2	12051.5	799.0
Length Wtd. (m)	133.79	Wetted Per. (m)	86.51	40.33	20.30
Min Ch El (m)	197.50	Shear (N/m2)	0.07	0.10	0.04
Alpha	1.12	Stream Power (N/m s)	0.01	0.01	0.00
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	67.21	116.68	46.25
C & E Loss (m)	0.00	Cum SA (1000 m2)	74.16	34.47	59.42

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.040	0.035	0.050
W.S. Elev (m)	202.42	Reach Len. (m)	125.00	140.00	115.00
Crit W.S. (m)		Flow Area (m2)	277.60	180.74	38.63
E.G. Slope (m/m)	0.000012	Area (m2)	277.60	180.74	38.63
Q Total (m3/s)	108.10	Flow (m3/s)	55.43	48.71	3.96
Top Width (m)	149.31	Top Width (m)	88.06	40.00	21.26
Vel Total (m/s)	0.22	Avg. Vel. (m/s)	0.20	0.27	0.10
Max Chl Dpth (m)	4.92	Hydr. Depth (m)	3.15	4.52	1.82
Conv. Total (m3/s)	31148.0	Conv. (m3/s)	15972.4	14035.5	1140.2
Length Wtd. (m)	134.82	Wetted Per. (m)	90.08	40.33	21.55
Min Ch El (m)	197.50	Shear (N/m2)	0.36	0.53	0.21
Alpha	1.13	Stream Power (N/m s)	0.07	0.14	0.02
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	212.54	242.38	

217.97
  C & E Loss (m) 0.00 Cum SA (1000 m2) 148.29 34.47
143.85

Warning: Divided flow computed for this cross-section.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.214

INPUT
Description: Section 46.214 - Jane St & Hwy 7 Pond Outlet - In-Line Weir - U/S
Bounding Section
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	37	202	100	202	122	201	132	200
133	199	134	198	140	196.7	172	196.7	180	198
207	202	273	203	303	204				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	134	.035	180	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
134	180	1	1	1	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	123	202	F
190	303	202	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.02	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	202.02	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	197.02	Flow Area (m2)	34.28	235.78	54.65
E.G. Slope (m/m)	0.000001	Area (m2)	34.28	235.78	54.65
Q Total (m3/s)	19.06	Flow (m3/s)	0.30	17.82	0.93
Top Width (m)	172.41	Top Width (m)	97.87	46.00	28.55
Vel Total (m/s)	0.06	Avg. Vel. (m/s)	0.01	0.08	0.02
Max Chl Dpth (m)	5.32	Hydr. Depth (m)	0.35	5.13	1.91
Conv. Total (m3/s)	21341.3	Conv. (m3/s)	338.6	19956.5	1046.2
Length Wtd. (m)	1.00	Wetted Per. (m)	98.77	46.24	28.84
Min Ch El (m)	196.70	Shear (N/m2)	0.00	0.04	0.01
Alpha	1.56	Stream Power (N/m s)	0.00	0.00	0.00

Frctn Loss (m)		Cum Volume (1000 m3)	49.85	88.63 41.36
C & E Loss (m)		Cum SA (1000 m2)	62.75	28.45 56.63

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	202.41	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	197.69	Flow Area (m2)	75.06	253.64	70.71
E.G. Slope (m/m)	0.000019	Area (m2)	75.06	253.64	70.71
Q Total (m3/s)	108.10	Flow (m3/s)	4.99	98.51	4.60
Top Width (m)	212.40	Top Width (m)	112.23	46.00	54.17
Vel Total (m/s)	0.27	Avg. Vel. (m/s)	0.07	0.39	0.07
Max Chl Dpth (m)	5.71	Hydr. Depth (m)	0.67	5.51	1.31
Conv. Total (m3/s)	24731.7	Conv. (m3/s)	1141.8	22538.2	1051.7
Length Wtd. (m)	1.00	Wetted Per. (m)	113.14	46.24	54.47
Min Ch El (m)	196.70	Shear (N/m2)	0.12	1.03	0.24
Alpha	1.88	Stream Power (N/m s)	0.01	0.40	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	190.50	211.97	211.68
C & E Loss (m)		Cum SA (1000 m2)	135.77	28.45	139.52

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

INLINE STRUCTURE

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2135

INPUT
Description: Hum 13-5R. Jane St. & Hwy 7 Pond Outlet Weir x 45 m Drawings by Ander Engineering Ltd. (Dwg No. 85-101-5, 1986 & Figure 1, date/source unknown).

New HEC-RAS coding January 2004 by Acres
included coding of in-line in HEC-RAS.
Distance from Upstream XS = .5

Deck/Roadway Width = .25
Weir Coefficient = 1.72
Weir Embankment Coordinates num = 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
100	202	123	202	123.75	201.95	137.75	201.95	153	201.95
153	200.9	161	200.9	161	201.95	175.3	201.95	189.3	201.95
190	202	207	202						

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 =
Weir crest shape = Broad Crested

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.213

INPUT
Description: Section 46.213 - Jane St. & Hwy 7 Pond Outlet - In-Line Weir - D/S Bounding Section
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	37	202	100	202	122	201	132	200
133	199	134	198	140	196.7	172	196.7	180	198
207	202	273	203	303	204				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	134	.035	180	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
134	180	15	15	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	123	202	F
190	303	202	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.73	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	200.73	Reach Len. (m)	15.00	15.00	15.00
Crit W.S. (m)	197.02	Flow Area (m2)	6.12	176.25	19.89
E.G. Slope (m/m)	0.000002	Area (m2)	6.12	176.25	25.14
Q Total (m3/s)	19.06	Flow (m3/s)	0.13	18.34	0.58
Top Width (m)	73.71	Top Width (m)	9.29	46.00	18.42
Vel Total (m/s)	0.09	Avg. Vel. (m/s)	0.02	0.10	0.03
Max Chl Dpth (m)	4.03	Hydr. Depth (m)	0.66	3.83	1.99
Conv. Total (m3/s)	12764.2	Conv. (m3/s)	87.3	12286.7	

390.2					
Length Wtd. (m)	15.00	Wetted Per. (m)	10.16	46.24	
10.11					
Min Ch El (m)	196.70	Shear (N/m2)	0.01	0.08	
0.04					
Alpha	1.18	Stream Power (N/m s)	0.00	0.01	
0.00					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	49.85	88.50	
41.36					
C & E Loss (m)	0.00	Cum SA (1000 m2)	62.69	28.41	
56.61					

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.33	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	
0.080					
W.S. Elev (m)	202.32	Reach Len. (m)	15.00	15.00	
15.00					
Crit W.S. (m)	197.69	Flow Area (m2)	65.09	249.49	
66.09					
E.G. Slope (m/m)	0.000021	Area (m2)	65.09	249.49	
66.09					
Q Total (m3/s)	108.10	Flow (m3/s)	4.16	99.34	
4.60					
Top Width (m)	203.12	Top Width (m)	108.90	46.00	
48.22					
Vel Total (m/s)	0.28	Avg. Vel. (m/s)	0.06	0.40	
0.07					
Max Chl Dpth (m)	5.62	Hydr. Depth (m)	0.60	5.42	
1.37					
Conv. Total (m3/s)	23861.5	Conv. (m3/s)	918.7	21927.6	
1015.2					
Length Wtd. (m)	15.00	Wetted Per. (m)	109.80	46.24	
48.52					
Min Ch El (m)	196.70	Shear (N/m2)	0.12	1.09	
0.27					
Alpha	1.81	Stream Power (N/m s)	0.01	0.43	
0.02					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	190.50	211.77	
211.68					
C & E Loss (m)	0.00	Cum SA (1000 m2)	135.66	28.41	
139.47					

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: RIVER-1
REACH: Reach-1 RS: 46.212

INPUT
Description: Section 46.212 - Jane St. & Hwy 7 Pond Outlet - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	37	202	100	202	122	201	132	200
133	199	134	198	140	196.6	172	196.6	180	198
207	199	252	199.5	273	203	303	204		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	133	.035	207	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
133	207	55	45	10	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	149.5	202	F
160.5	303	202	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.73	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.035	
W.S. Elev (m)	200.72	Reach Len. (m)	55.00	45.00	10.00
Crit W.S. (m)	197.27	Flow Area (m2)		45.30	
E.G. Slope (m/m)	0.000033	Area (m2)	3.80	241.75	70.52
Q Total (m3/s)	19.06	Flow (m3/s)		19.06	
Top Width (m)	134.49	Top Width (m)	8.18	74.00	52.31
Vel Total (m/s)	0.42	Avg. Vel. (m/s)		0.42	
Max Chl Dpth (m)	4.12	Hydr. Depth (m)		4.12	
Conv. Total (m3/s)	3325.3	Conv. (m3/s)		3325.3	
Length Wtd. (m)	45.00	Wetted Per. (m)		11.00	
Min Ch El (m)	196.60	Shear (N/m2)		1.33	
Alpha	1.00	Stream Power (N/m s)		0.56	
Frctn Loss (m)		Cum Volume (1000 m3)	49.78	85.36	40.64
C & E Loss (m)		Cum SA (1000 m2)	62.56	27.51	56.07

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	202.32	Reach Len. (m)	55.00	45.00	10.00
Crit W.S. (m)	198.74	Flow Area (m2)	61.49	360.55	162.22
E.G. Slope (m/m)	0.000010	Area (m2)	61.49	360.55	162.22
Q Total (m3/s)	108.10	Flow (m3/s)	2.67	93.24	12.18
Top Width (m)	243.91	Top Width (m)	107.97	74.00	61.94
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.04	0.26	0.08
Max Chl Dpth (m)	5.72	Hydr. Depth (m)	0.57	4.87	2.62
Conv. Total (m3/s)	34102.2	Conv. (m3/s)	842.4	29416.7	3843.1
Length Wtd. (m)	45.00	Wetted Per. (m)	108.46	74.72	62.18
Min Ch El (m)	196.60	Shear (N/m2)	0.06	0.48	0.26
Alpha	1.71	Stream Power (N/m s)	0.00	0.12	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	189.55	207.19	209.97
C & E Loss (m)		Cum SA (1000 m2)	134.03	27.51	138.64

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2115

INPUT
Description: Hum 13-5R. Jane St & Hwy 7 Pond Outlet Culverts - Triple Cell - 3.0 m W x 1.5 m H x 23.2 m L Concrete Box Culverts. No drawings available (some info on Ander Eng Ltd Dwg 85-101-5, 1986) and York Regional Municipal Culvert Sheet.

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.
Distance from Upstream XS = 10
Deck/Roadway Width = 23.2
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	202	303	202

Upstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	37	202	100	202	122	201	132	200
133	199	134	198	140	196.6	172	196.6	180	198
207	199	252	199.5	273	203	303	204		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	133	.035	207	.08

Bank Sta: Left Right Coeff Contr. Expan.
133 207 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	149.5	202	F
160.5	303	202	F

Downstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	202	303	202

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	47	201	103	200	150	200	152	199
160	198	162	197	163	196.4	175	196.4	178	197
181	200	185	201	201	201	261	202	306	203

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	162	.035	178	.08

Bank Sta: Left Right Coeff Contr. Expan.
162 178 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	163	200.6	F
175	306	200.6	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	Box	1.5	3

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
10	23.2	.015	.015	0	.9	1

Number of Barrels = 3
Upstream Elevation = 196.6
Centerline Stations

Sta.	Sta.	Sta.
151.5	154.85	158.5

Downstream Elevation = 196.4
Centerline Stations

Sta.	Sta.	Sta.
165.5	168.85	172.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	19.06	Culv Full Len (m)	23.20
# Barrels	3	Culv Vel US (m/s)	1.41
Q Barrel (m3/s)	6.35	Culv Vel DS (m/s)	1.41
E.G. US. (m)	200.73	Culv Inv El Up (m)	196.60
W.S. US. (m)	200.72	Culv Inv El Dn (m)	196.40
E.G. DS (m)	200.52	Culv Frctn Ls (m)	0.03
W.S. DS (m)	200.51	Culv Exit Loss (m)	0.09
Delta EG (m)	0.21	Culv Entr Loss (m)	0.09
Delta WS (m)	0.21	Q Weir (m3/s)	
E.G. IC (m)	197.94	Weir Sta Lft (m)	
E.G. OC (m)	200.73	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	198.10	Weir Max Depth (m)	
Culv WS Outlet (m)	197.90	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.77	Min El Weir Flow (m)	202.00

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	43.23	Culv Full Len (m)	23.20
# Barrels	3	Culv Vel US (m/s)	3.20
Q Barrel (m3/s)	14.41	Culv Vel DS (m/s)	3.20
E.G. US. (m)	202.33	Culv Inv El Up (m)	196.60
W.S. US. (m)	202.32	Culv Inv El Dn (m)	196.40
E.G. DS (m)	201.23	Culv Frctn Ls (m)	0.13
W.S. DS (m)	201.20	Culv Exit Loss (m)	0.49
Delta EG (m)	1.09	Culv Entr Loss (m)	0.47
Delta WS (m)	1.13	Q Weir (m3/s)	64.87
E.G. IC (m)	202.20	Weir Sta Lft (m)	24.70
E.G. OC (m)	202.33	Weir Sta Rgt (m)	268.99
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	198.10	Weir Max Depth (m)	0.33
Culv WS Outlet (m)	197.90	Weir Avg Depth (m)	0.32
Culv Nml Depth (m)		Weir Flow Area (m2)	78.79
Culv Crt Depth (m)	1.33	Min El Weir Flow (m)	202.00

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.211

INPUT
Description: Section 46.211 - Jane St. & Hwy 7 Pond Outlet - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	47	201	103	200	150	200	152	199
160	198	162	197	163	196.4	175	196.4	178	197
181	200	185	201	201	201	261	202	306	203

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	162	.035	178	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
162	178	10	10	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	163	200.6	F
175	306	200.6	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.52	Element	Left OB	Channel
Vel Head (m)	0.01	Wt. n-Val.		0.035
W.S. Elev (m)	200.51	Reach Len. (m)	10.00	10.00
Crit W.S. (m)	197.04	Flow Area (m2)		49.29
E.G. Slope (m/m)	0.000028	Area (m2)	55.19	64.53
Q Total (m3/s)	19.06	Flow (m3/s)		19.06
Top Width (m)	108.47	Top Width (m)	87.44	16.00
Vel Total (m/s)	0.39	Avg. Vel. (m/s)		0.39
Max Chl Dpth (m)	4.11	Hydr. Depth (m)		4.11
Conv. Total (m3/s)	3612.6	Conv. (m3/s)		3612.6
Length Wtd. (m)	10.00	Wetted Per. (m)		12.00
Min Ch El (m)	196.40	Shear (N/m2)		1.12
Alpha	1.00	Stream Power (N/m s)		0.43
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	49.78	82.05
C & E Loss (m)	0.00	Cum SA (1000 m2)	59.93	25.48

40.64					
55.79					

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.23	Element	Left OB	Channel
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035
W.S. Elev (m)	201.20	Reach Len. (m)	10.00	10.00
Crit W.S. (m)	198.42	Flow Area (m2)	128.26	75.57

0.080					
10.00					
15.24					

E.G. Slope (m/m)	0.000151	Area (m2)	128.26	75.57	15.24
Q Total (m3/s)	108.10	Flow (m3/s)	32.87	73.91	1.31
Top Width (m)	170.55	Top Width (m)	119.66	16.00	34.89
Vel Total (m/s)	0.49	Avg. Vel. (m/s)	0.26	0.98	0.09
Max Chl Dpth (m)	4.80	Hydr. Depth (m)	1.07	4.72	0.44
Conv. Total (m3/s)	8807.5	Conv. (m3/s)	2678.6	6022.0	106.9
Length Wtd. (m)	10.00	Wetted Per. (m)	120.21	16.23	36.26
Min Ch El (m)	196.40	Shear (N/m2)	1.58	6.88	0.62
Alpha	2.77	Stream Power (N/m s)	0.40	6.73	0.05
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	189.55	198.58	209.97
C & E Loss (m)	0.01	Cum SA (1000 m2)	127.77	25.48	138.15

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: RIVER-1
REACH: Reach-1 RS: 46.21

INPUT
Description: Section 46.21 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	0	201	40	200	76	200	82	199
91	197	91.5	196.3	92.5	196.3	93	197	97	198
108	201	124	202	186	202	230	203		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	91	.035	93	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
91	93	30	30	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.51	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	200.51	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)		Flow Area (m2)	52.06	8.07	23.56

E.G. Slope (m/m)	0.000106	Area (m2)	52.06	8.07	23.56
Q Total (m3/s)	20.59	Flow (m3/s)	8.69	4.91	7.00
Top Width (m)	86.51	Top Width (m)	71.32	2.00	13.20
Vel Total (m/s)	0.25	Avg. Vel. (m/s)	0.17	0.61	0.30
Max Chl Dpth (m)	4.21	Hydr. Depth (m)	0.73	4.03	1.79
Conv. Total (m3/s)	1995.5	Conv. (m3/s)	841.8	475.7	678.0
Length Wtd. (m)	30.00	Wetted Per. (m)	71.62	2.72	13.65
Min Ch El (m)	196.30	Shear (N/m2)	0.76	3.10	1.80
Alpha	2.15	Stream Power (N/m s)	0.13	1.88	0.53
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	49.24	81.69	40.49
C & E Loss (m)	0.00	Cum SA (1000 m2)	59.14	25.39	55.70

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.22	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.17	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)		Flow Area (m2)	107.13	9.38	33.22
E.G. Slope (m/m)	0.000946	Area (m2)	107.13	9.38	33.22
Q Total (m3/s)	122.56	Flow (m3/s)	73.21	18.82	30.52
Top Width (m)	110.66	Top Width (m)	91.00	2.00	17.66
Vel Total (m/s)	0.82	Avg. Vel. (m/s)	0.68	2.01	0.92
Max Chl Dpth (m)	4.87	Hydr. Depth (m)	1.18	4.69	1.88
Conv. Total (m3/s)	3985.0	Conv. (m3/s)	2380.5	612.0	992.5
Length Wtd. (m)	30.00	Wetted Per. (m)	91.48	2.72	18.19
Min Ch El (m)	196.30	Shear (N/m2)	10.86	32.00	16.94
Alpha	1.65	Stream Power (N/m s)	7.42	64.19	15.57
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	188.38	198.16	209.72
C & E Loss (m)	0.00	Cum SA (1000 m2)	126.72	25.39	137.89

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: RIVER-1
REACH: Reach-1 RS: 46.202

INPUT
Description: Section 46.202 - Highway 7 - U/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	50	200	111	200	113	199	115.5	197
116	196	123	196	123.5	197	129	200	227	202
272	203								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	115.5	.035	123.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
115.5	123.5	70	70	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116	200.23	F
123	272	200.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.51	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	200.51	Reach Len. (m)	70.00	70.00	70.00
Crit W.S. (m)	196.96	Flow Area (m2)	45.47	35.54	17.28
E.G. Slope (m/m)	0.000039	Area (m2)	45.47	35.54	17.28
Q Total (m3/s)	20.59	Flow (m3/s)	3.56	15.57	1.46
Top Width (m)	129.01	Top Width (m)	90.76	8.00	30.25
Vel Total (m/s)	0.21	Avg. Vel. (m/s)	0.08	0.44	0.08
Max Chl Dpth (m)	4.51	Hydr. Depth (m)	0.50	4.44	0.57
Conv. Total (m3/s)	3297.3	Conv. (m3/s)	569.7	2493.6	234.0
Length Wtd. (m)	70.00	Wetted Per. (m)	91.70	9.24	31.02
Min Ch El (m)	196.00	Shear (N/m2)	0.19	1.47	0.21
Alpha	3.34	Stream Power (N/m s)	0.01	0.64	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	47.78	81.04	39.88

C & E Loss (m)		Cum SA (1000 m2)	56.71	25.24	55.05

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.20	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.14	Reach Len. (m)	70.00	70.00	70.00
Crit W.S. (m)	199.15	Flow Area (m2)	112.34	40.60	46.19
E.G. Slope (m/m)	0.000409	Area (m2)	112.34	40.60	46.19
Q Total (m3/s)	122.56	Flow (m3/s)	44.31	62.91	15.34
Top Width (m)	184.72	Top Width (m)	115.50	8.00	61.22
Vel Total (m/s)	0.62	Avg. Vel. (m/s)	0.39	1.55	0.33
Max Chl Dpth (m)	5.14	Hydr. Depth (m)	0.97	5.07	0.75
Conv. Total (m3/s)	6063.7	Conv. (m3/s)	2192.0	3112.5	759.1
Length Wtd. (m)	70.00	Wetted Per. (m)	116.58	9.24	62.00
Min Ch El (m)	196.00	Shear (N/m2)	3.86	17.61	2.98
Alpha	3.44	Stream Power (N/m s)	1.52	27.29	0.99
Frctn Loss (m)		Cum Volume (1000 m3)	185.08	197.41	208.53
C & E Loss (m)		Cum SA (1000 m2)	123.62	25.24	136.71

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2015

INPUT
Description: Hum 13-4RR. Highway 7 Culvert - 3.7 m W x 1.5 m H x 64 m L
Concrete Box Culvert. Based on drawings. July 2010

New HEC-RAS
coding January 2004 by Acres included coding of culvert in
HEC-RAS, including adjustments to roadway coding and hydraulic
loss coefficients.
Distance from Upstream XS = 5
Deck/Roadway Width = 64

Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201		50	200.45		95	200.23	
168	201		216	202		227	202.5	
272	203.5							

Upstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	50	200	111	200	113	199	115.5	197
116	196	123	196	123.5	197	129	200	227	202
272	203								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	115.5	.035	123.5	.05

Bank Sta: Left Right Coeff Contr. Expan.
115.5 123.5 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116	200.23	F
123	272	200.5	F

Downstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201		50	200.45		95	200.23	
168	201		216	202		227	202.5	
272	203.5							

Downstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	50	200	111	200	113	199	115.5	197
116	196	123	196	123.5	197	129	200	227	202
272	203								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	115.5	.035	123.5	.05

Bank Sta: Left Right Coeff Contr. Expan.
115.5 123.5 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116	199	F
123	272	199	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	Box	1.52	3.66

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
	5	64	.015	.015	0	.5	1

Upstream Elevation = 196
Centerline Station = 119.5
Downstream Elevation = 196
Centerline Station = 119.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	14.09	Culv Full Len (m)	64.00
# Barrels	1	Culv Vel US (m/s)	2.53
Q Barrel (m3/s)	14.09	Culv Vel DS (m/s)	2.53
E.G. US. (m)	200.51	Culv Inv El Up (m)	196.00
W.S. US. (m)	200.51	Culv Inv El Dn (m)	196.00
E.G. DS (m)	199.83	Culv Frctn Ls (m)	0.21
W.S. DS (m)	199.81	Culv Exit Loss (m)	0.31
Delta EG (m)	0.69	Culv Entr Loss (m)	0.16
Delta WS (m)	0.69	Q Weir (m3/s)	6.50
E.G. IC (m)	199.01	Weir Sta Lft (m)	44.67
E.G. OC (m)	200.51	Weir Sta Rgt (m)	121.40
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	197.52	Weir Max Depth (m)	0.28
Culv WS Outlet (m)	197.52	Weir Avg Depth (m)	0.15
Culv Nml Depth (m)		Weir Flow Area (m2)	11.41
Culv Crt Depth (m)	1.15	Min El Weir Flow (m)	200.23

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	2.55	Culv Full Len (m)	64.00
# Barrels	1	Culv Vel US (m/s)	0.46
Q Barrel (m3/s)	2.55	Culv Vel DS (m/s)	0.46
E.G. US. (m)	201.20	Culv Inv El Up (m)	196.00
W.S. US. (m)	201.14	Culv Inv El Dn (m)	196.00
E.G. DS (m)	201.19	Culv Frctn Ls (m)	0.01
W.S. DS (m)	201.12	Culv Exit Loss (m)	0.00
Delta EG (m)	0.01	Culv Entr Loss (m)	0.01
Delta WS (m)	0.01	Q Weir (m3/s)	120.02
E.G. IC (m)	201.19	Weir Sta Lft (m)	0.00
E.G. OC (m)	201.20	Weir Sta Rgt (m)	178.47
Culvert Control	Outlet	Weir Submerg	0.87
Culv WS Inlet (m)	197.52	Weir Max Depth (m)	0.99
Culv WS Outlet (m)	197.52	Weir Avg Depth (m)	0.61
Culv Nml Depth (m)		Weir Flow Area (m2)	109.34
Culv Crt Depth (m)	0.37	Min El Weir Flow (m)	200.23

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.201

INPUT
Description: Section 46.201 - Highway 7 - D/S Bounding Section - J.D. Barnes
2003 topo mapping

Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	50	200	111	200	113	199	115.5	197
116	196	123	196	123.5	197	129	200	227	202
272	203								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	115.5	.035	123.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
115.5	123.5	20	25	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116	199	F
123	272	199	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.83	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.81	Reach Len. (m)	20.00	25.00	30.00
Crit W.S. (m)	196.96	Flow Area (m2)	5.18	29.98	7.24
E.G. Slope (m/m)	0.000092	Area (m2)	5.18	29.98	7.24
Q Total (m3/s)	20.59	Flow (m3/s)	1.01	17.98	1.59
Top Width (m)	17.27	Top Width (m)	4.12	8.00	5.15
Vel Total (m/s)	0.49	Avg. Vel. (m/s)	0.20	0.60	0.22
Max Chl Dpth (m)	3.81	Hydr. Depth (m)	1.26	3.75	1.41
Conv. Total (m3/s)	2150.8	Conv. (m3/s)	106.0	1878.2	166.6
Length Wtd. (m)	25.07	Wetted Per. (m)	5.01	9.24	5.87
Min Ch El (m)	196.00	Shear (N/m2)	0.93	2.92	1.11
Alpha	1.36	Stream Power (N/m s)	0.18	1.75	0.24
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	47.78	79.37	39.88
C & E Loss (m)	0.00	Cum SA (1000 m2)	53.39	24.68	53.81

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.19	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.12	Reach Len. (m)	20.00	25.00	30.00
Crit W.S. (m)	199.00	Flow Area (m2)	110.67	40.48	45.31
E.G. Slope (m/m)	0.000421	Area (m2)	110.67	40.48	45.31
Q Total (m3/s)	122.56	Flow (m3/s)	43.85	63.52	15.19
Top Width (m)	184.01	Top Width (m)	115.50	8.00	60.51
Vel Total (m/s)	0.62	Avg. Vel. (m/s)	0.40	1.57	0.34
Max Chl Dpth (m)	5.12	Hydr. Depth (m)	0.96	5.06	0.75
Conv. Total (m3/s)	5976.8	Conv. (m3/s)	2138.2	3097.8	740.8
Length Wtd. (m)	23.94	Wetted Per. (m)	116.57	9.24	61.29
Min Ch El (m)	196.00	Shear (N/m2)	3.92	18.08	3.05
Alpha	3.46	Stream Power (N/m s)	1.55	28.36	1.02
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	185.08	188.48	208.53
C & E Loss (m)	0.02	Cum SA (1000 m2)	115.54	24.68	132.45

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.192

INPUT
Description: Section 46.192 - Private Driveway - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	5	200	30	199	56	199	60	197
61.5	195.9	65.5	195.9	67	197	85	200	95	200
95	203	135	203						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	60	.035	67	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
60	67	25	25	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	61.5	199	F
65.5	135	199.3	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.82	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.81	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)	197.29	Flow Area (m2)	36.67	25.75	23.75
E.G. Slope (m/m)	0.000053	Area (m2)	36.67	25.75	23.75
Q Total (m3/s)	20.59	Flow (m3/s)	4.30	11.98	4.31
Top Width (m)	74.22	Top Width (m)	50.34	7.00	16.88
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.12	0.47	0.18
Max Chl Dpth (m)	3.91	Hydr. Depth (m)	0.73	3.68	1.41
Conv. Total (m3/s)	2822.8	Conv. (m3/s)	590.1	1641.9	590.9
Length Wtd. (m)	25.00	Wetted Per. (m)	50.82	7.72	17.11
Min Ch El (m)	195.90	Shear (N/m2)	0.38	1.74	0.72
Alpha	2.38	Stream Power (N/m s)	0.04	0.81	0.13
Frctn Loss (m)		Cum Volume (1000 m3)	47.36	78.68	39.41
C & E Loss (m)		Cum SA (1000 m2)	52.84	24.49	53.48

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.17	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.13	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)	199.36	Flow Area (m2)	112.00	34.98	58.73
E.G. Slope (m/m)	0.000236	Area (m2)	112.00	34.98	58.73
Q Total (m3/s)	122.56	Flow (m3/s)	51.81	42.09	28.66
Top Width (m)	95.00	Top Width (m)	60.00	7.00	28.00
Vel Total (m/s)	0.60	Avg. Vel. (m/s)	0.46	1.20	0.49
Max Chl Dpth (m)	5.23	Hydr. Depth (m)	1.87	5.00	2.10
Conv. Total (m3/s)	7969.8	Conv. (m3/s)	3368.7	2737.1	1864.0

Length Wtd. (m)	25.00	Wetted Per. (m)	60.72	7.72	29.38
Min Ch El (m)	195.90	Shear (N/m2)	4.28	10.51	4.64
Alpha	1.81	Stream Power (N/m s)	1.98	12.64	2.26
Frctn Loss (m)		Cum Volume (1000 m3)	182.86	187.54	206.97
C & E Loss (m)		Cum SA (1000 m2)	113.78	24.49	131.12

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1915

INPUT
Description: Hum-MM. Private Driveway Culvert - 3.75m x 1.5m Box culvert - sizes determined from Site visit - July 2010

New HEC-RAS coding
January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 4
Deck/Roadway Width = 17
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 3

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
30	199	56	199	85	200

Upstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	5	200	30	199	56	199	60	197
61.5	195.9	65.5	195.9	67	197	85	200	95	200
95	203	135	203						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	60	.035	67	.05

Bank Sta: Left Right Coeff Contr. Expan.
60 67 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	61.5	199	F
65.5	135	199.3	F

Downstream Deck/Roadway Coordinates
num= 3

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
30	199	56	199	85	200

Downstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	5	200	30	199	56	199	60	197
61.5	195.9	65.5	195.9	67	197	85	200	95	200
95	203	135	203						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	60	.035	67	.05

Bank Sta: Left Right Coeff Contr. Expan.
60 67 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	61.5	198.5	F
65.5	135	198.5	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	Box	1.5	3.75

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
	4	17	.013	.024	0	.5	1

Upstream Elevation = 195.9
Centerline Station = 63.5
Downstream Elevation = 195.9
Centerline Station = 63.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	2.16	Culv Full Len (m)	17.00
# Barrels	1	Culv Vel US (m/s)	0.38
Q Barrel (m3/s)	2.16	Culv Vel DS (m/s)	0.38
E.G. US. (m)	199.82	Culv Inv El Up (m)	195.90
W.S. US. (m)	199.81	Culv Inv El Dn (m)	195.90
E.G. DS (m)	199.81	Culv Frctn Ls (m)	0.00
W.S. DS (m)	199.81	Culv Exit Loss (m)	0.00
Delta EG (m)	0.01	Culv Entr Loss (m)	0.00
Delta WS (m)	0.01	Q Weir (m3/s)	18.43
E.G. IC (m)	198.86	Weir Sta Lft (m)	9.51
E.G. OC (m)	199.82	Weir Sta Rgt (m)	79.76
Culvert Control	Outlet	Weir Submerg	0.99
Culv WS Inlet (m)	197.40	Weir Max Depth (m)	0.82
Culv WS Outlet (m)	197.40	Weir Avg Depth (m)	0.56
Culv Nml Depth (m)		Weir Flow Area (m2)	39.44
Culv Crt Depth (m)	0.32	Min El Weir Flow (m)	199.00

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported

inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	1.13	Culv Full Len (m)	17.00
# Barrels	1	Culv Vel US (m/s)	0.20
Q Barrel (m3/s)	1.13	Culv Vel DS (m/s)	0.20
E.G. US. (m)	201.17	Culv Inv El Up (m)	195.90
W.S. US. (m)	201.13	Culv Inv El Dn (m)	195.90
E.G. DS (m)	201.17	Culv Frctn Ls (m)	0.00
W.S. DS (m)	201.13	Culv Exit Loss (m)	0.00
Delta EG (m)	0.00	Culv Entr Loss (m)	0.00
Delta WS (m)	0.00	Q Weir (m3/s)	121.43
E.G. IC (m)	201.17	Weir Sta Lft (m)	0.00
E.G. OC (m)	201.17	Weir Sta Rgt (m)	95.00
Culvert Control	Outlet	Weir Submerg	0.99
Culv WS Inlet (m)	197.40	Weir Max Depth (m)	2.18
Culv WS Outlet (m)	197.40	Weir Avg Depth (m)	1.71
Culv Nml Depth (m)		Weir Flow Area (m2)	162.42
Culv Crt Depth (m)	0.21	Min El Weir Flow (m)	199.00

Warning: The weir over culvert is submerged.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.191

INPUT
Description: Section 46.191 - Private Driveway - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	5	200	30	199	56	199	60	197
61.5	195.9	65.5	195.9	67	197	85	200	95	200
95	203	135	203						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	60	.035	67	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
60	67	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	61.5	198.5	F
65.5	135	198.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.81	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.81	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	197.29	Flow Area (m2)	36.37	25.70	23.64
E.G. Slope (m/m)	0.000054	Area (m2)	36.37	25.70	23.64

Q Total (m3/s)	20.59	Flow (m3/s)	4.28	12.01	4.31
Top Width (m)	74.03	Top Width (m)	50.18	7.00	16.84
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.12	0.47	0.18
Max Chl Dpth (m)	3.91	Hydr. Depth (m)	0.72	3.67	1.40
Conv. Total (m3/s)	2807.9	Conv. (m3/s)	583.1	1637.3	587.5
Length Wtd. (m)	50.00	Wetted Per. (m)	50.67	7.72	17.08
Min Ch El (m)	195.90	Shear (N/m2)	0.38	1.76	0.73
Alpha	2.38	Stream Power (N/m s)	0.04	0.82	0.13
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	47.36	77.39	39.41
C & E Loss (m)	0.00	Cum SA (1000 m2)	51.59	24.32	53.05

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.17	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.13	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	199.36	Flow Area (m2)	111.98	34.98	58.72
E.G. Slope (m/m)	0.000237	Area (m2)	111.98	34.98	58.72
Q Total (m3/s)	122.56	Flow (m3/s)	51.80	42.10	28.66
Top Width (m)	95.00	Top Width (m)	60.00	7.00	28.00
Vel Total (m/s)	0.60	Avg. Vel. (m/s)	0.46	1.20	0.49
Max Chl Dpth (m)	5.23	Hydr. Depth (m)	1.87	5.00	2.10
Conv. Total (m3/s)	7968.1	Conv. (m3/s)	3367.7	2736.8	1863.5
Length Wtd. (m)	50.00	Wetted Per. (m)	60.72	7.72	29.38
Min Ch El (m)	195.90	Shear (N/m2)	4.28	10.51	4.64
Alpha	1.81	Stream Power (N/m s)	1.98	12.65	2.26
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	182.86	183.19	206.97
C & E Loss (m)	0.01	Cum SA (1000 m2)	112.28	24.32	130.42

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

water surface.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.19

INPUT
Description: Section 46.19 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	0	201	8	201	50	201	58	200
63	199	94	199	104	196.5	105	195.5	106	195.5
107	196.5	114	198	119	198.7	143	198.7	143	203
169	203								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	8	.025	50	.05	104	.035	107	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
104	107	45	45	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.81	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.81	Reach Len. (m)	45.00	45.00	45.00
Crit W.S. (m)		Flow Area (m2)	47.20	11.92	51.74
E.G. Slope (m/m)	0.000048	Area (m2)	47.20	11.92	51.74
Q Total (m3/s)	20.59	Flow (m3/s)	6.69	5.01	8.89
Top Width (m)	84.03	Top Width (m)	45.03	3.00	36.00
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.14	0.42	0.17
Max Chl Dpth (m)	4.31	Hydr. Depth (m)	1.05	3.97	1.44
Conv. Total (m3/s)	2981.7	Conv. (m3/s)	968.6	726.2	1286.8
Length Wtd. (m)	45.00	Wetted Per. (m)	45.42	3.83	37.31
Min Ch El (m)	195.50	Shear (N/m2)	0.49	1.46	0.65
Alpha	1.81	Stream Power (N/m s)	0.07	0.61	0.11
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	45.27	76.45	37.53
C & E Loss (m)	0.00	Cum SA (1000 m2)	49.21	24.07	51.73

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.15	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.13	Reach Len. (m)	45.00	45.00	45.00
Crit W.S. (m)		Flow Area (m2)	119.45	15.89	99.36
E.G. Slope (m/m)	0.000201	Area (m2)	119.45	15.89	99.36
Q Total (m3/s)	122.56	Flow (m3/s)	53.01	16.63	52.92
Top Width (m)	143.00	Top Width (m)	104.00	3.00	36.00
Vel Total (m/s)	0.52	Avg. Vel. (m/s)	0.44	1.05	0.53
Max Chl Dpth (m)	5.63	Hydr. Depth (m)	1.15	5.30	2.76
Conv. Total (m3/s)	8638.4	Conv. (m3/s)	3736.2	1172.4	3729.8
Length Wtd. (m)	45.00	Wetted Per. (m)	104.60	3.83	38.64
Min Ch El (m)	195.50	Shear (N/m2)	2.25	8.19	5.08
Alpha	1.31	Stream Power (N/m s)	1.00	8.58	2.70
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	177.07	181.92	203.02
C & E Loss (m)	0.00	Cum SA (1000 m2)	108.18	24.07	128.82

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.182

INPUT
Description: Section 46.182 - Private Driveway - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 47

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.972	.42	201.961	.55	201.96	1.85	201.935	8.17	201.804
21.62	201.526	31.13	201.301	35.82	201.196	38.11	201.147	43.98	201
47.21	201	54.76	201	59.23	201.022	59.93	201.025	61.24	201.019
63.83	201.008	65.54	201	67.48	200.312	68.6	200	69.51	199.67
71.2	199	80.47	198.706	97.37	198.231	101.25	198.152	103.18	198.11
108.63	198	109.89	197.509	111.25	197	113.61	196.424	114.44	196
115	195.5	117	195.5	119.57	196.761	120.39	197	120.93	197.262
122.38	198	123.56	198.575	124.53	199	125.86	199.005	126.15	199.005
126.32	199.005	128.81	199.016	129.09	199.016	133.53	199.074	152.28	199.311
155.51	199.353	179.8	199.659						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	43.98	.025	65.54	.05	111.25	.035	120.39	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
111.25	120.39	30	30	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent

```
       0     114   197.8       F
     118   179.8   198.1       F
Left Levee      Station=   59.93      Elevation= 201.025
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
  143.39  178.45     204
```

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.81	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.80	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)	197.06	Flow Area (m2)	57.30	33.00	21.18
E.G. Slope (m/m)	0.000028	Area (m2)	57.30	33.00	21.18
Q Total (m3/s)	20.59	Flow (m3/s)	7.39	11.17	2.03
Top Width (m)	75.60	Top Width (m)	42.11	9.14	24.35
Vel Total (m/s)	0.18	Avg. Vel. (m/s)	0.13	0.34	0.10
Max Chl Dpth (m)	4.30	Hydr. Depth (m)	1.36	3.61	0.87
Conv. Total (m3/s)	3897.4	Conv. (m3/s)	1399.5	2114.3	383.6
Length Wtd. (m)	30.00	Wetted Per. (m)	42.46	9.83	25.73
Min Ch El (m)	195.50	Shear (N/m2)	0.37	0.92	0.23
Alpha	2.02	Stream Power (N/m s)	0.05	0.31	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	42.92	75.43	35.89
C & E Loss (m)		Cum SA (1000 m2)	47.24	23.79	50.38

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.14	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.11	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)	198.95	Flow Area (m2)	117.48	44.95	53.01
E.G. Slope (m/m)	0.000169	Area (m2)	117.48	44.95	53.01
Q Total (m3/s)	122.56	Flow (m3/s)	55.11	46.00	21.45
Top Width (m)	105.23	Top Width (m)	71.74	9.14	24.35

Vel Total (m/s)	0.57	Avg. Vel. (m/s)	0.47	1.02	0.40
Max Chl Dpth (m)	5.61	Hydr. Depth (m)	1.64	4.92	2.18
Conv. Total (m3/s)	9427.7	Conv. (m3/s)	4239.3	3538.4	1650.0
Length Wtd. (m)	30.00	Wetted Per. (m)	72.29	9.83	29.65
Min Ch El (m)	195.50	Shear (N/m2)	2.69	7.58	2.96
Alpha	1.61	Stream Power (N/m s)	1.26	7.76	1.20
Frctn Loss (m)		Cum Volume (1000 m3)	171.74	180.55	199.59
C & E Loss (m)		Cum SA (1000 m2)	104.23	23.79	127.46

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1815

INPUT
Description: Hum-LL - Private Driveway Culvert - 3.23 m W x 2.1 m H x 20 m L Corrugated Metal Pipe Arch Culvert. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004
by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 20
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 68

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.814		8.43	201.594		9.83	201.579	
23.38	201.318		38.06	201.013		38.92	201.052	
39.19	201.044		39.55	201.046		40.67	201.053	
44.98	201.024		45.55	201		48.21	201	
51.41	201		53.82	201		57.05	201.013	
59.14	201.02		61.55	201.011		63.08	201.006	
64.24	201		66.61	200.06		66.78	200	
66.95	199.933		69.25	199		73.56	198.862	
78.46	198.707		78.57	198.703		91.01	198.328	
92.38	198.309		94.38	198.276		94.4	198.275	
94.48	198.274		104.2	198.082		107.92	198.006	
108.02	198.006		108.27	198.006		108.69	198.005	
109.45	198.005		110.23	198.004		110.59	198.004	
111.09	198.004		112.19	198.004		112.58	198.004	
113.44	198.003		114.64	198.003		115.23	198.003	
115.68	198.003		116.18	198.002		116.54	198.038	
119.63	198.468		121.93	198.762		122.56	198.775	
123.93	198.92		125.6	198.914		126.73	198.921	
128.12	198.95		128.92	198.942		130.41	198.978	
130.95	199		130.96	199		131.04	199	
131.13	199		131.47	199.005		131.56	199.007	

133.71	199.023		134.52	199.03		136.57	199.051				
136.8	199.053		177.16	199.555							

Upstream Bridge Cross Section Data
Station Elevation Data num= 47

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.972	.42	201.961	.55	201.96	1.85	201.935	8.17	201.804
21.62	201.526	31.13	201.301	35.82	201.196	38.11	201.147	43.98	201
47.21	201	54.76	201	59.23	201.022	59.93	201.025	61.24	201.019
63.83	201.008	65.54	201	67.48	200.312	68.6	200	69.51	199.67
71.2	199	80.47	198.706	97.37	198.231	101.25	198.152	103.18	198.11
108.63	198	109.89	197.509	111.25	197	113.61	196.424	114.44	196
115	195.5	117	195.5	119.57	196.761	120.39	197	120.93	197.262
122.38	198	123.56	198.575	124.53	199	125.86	199.005	126.15	199.005
126.32	199.005	128.81	199.016	129.09	199.016	133.53	199.074	152.28	199.311
155.51	199.353	179.8	199.659						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	43.98	.025	65.54	.05	111.25	.035	120.39	.05

Bank Sta: Left Right Coeff Contr. Expan.
111.25 120.39 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	114	197.8	F
118	179.8	198.1	F

Left Levee Station= 59.93 Elevation= 201.025
Blocked Obstructions num= 1

Sta L	Sta R	Elev
143.39	178.45	204

Downstream Deck/Roadway Coordinates
num= 68

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.814		8.43	201.594		9.83	201.579	
23.38	201.318		38.06	201.013		38.92	201.052	
39.19	201.044		39.55	201.046		40.67	201.053	
44.98	201.024		45.55	201		48.21	201	
51.41	201		53.82	201		57.05	201.013	
59.14	201.02		61.55	201.011		63.08	201.006	
64.24	201		66.61	200.06		66.78	200	
66.95	199.933		69.25	199		73.56	198.862	
78.46	198.707		78.57	198.703		91.01	198.328	
92.38	198.309		94.38	198.276		94.4	198.275	
94.48	198.274		104.2	198.082		107.92	198.006	
108.02	198.006		108.27	198.006		108.69	198.005	
109.45	198.005		110.23	198.004		110.59	198.004	
111.09	198.004		112.19	198.004		112.58	198.004	
113.44	198.003		114.64	198.003		115.23	198.003	
115.68	198.003		116.18	198.002		116.54	198.038	
119.63	198.468		121.93	198.762		122.56	198.775	
123.93	198.92		125.6	198.914		126.73	198.921	
128.12	198.95		128.92	198.942		130.41	198.978	
130.95	199		130.96	199		131.04	199	
131.13	199		131.47	199.005		131.56	199.007	
133.71	199.023		134.52	199.03		136.57	199.051	
136.8	199.053		177.16	199.555				

Downstream Bridge Cross Section Data
Station Elevation Data num= 63

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.672	10.15	201.391	16.44	201.227	19.11	201.198	28.76	201.012

```
   29.08 201.003   29.75 201.003   30.18 201.003   33.16 201.006   34.09 201.007
   34.71 201.007   38.11 201.008   40.91 201.007   42.47 201.009   46.32  201.01
   49.08  201.01   50.09  201.01   52.79 201.011   53.95 201.011   55.33  201.01
   55.52  201.01   57.16 201.007    59.2 201.008   61.08 201.003   61.53 201.002
   62.11     201   63.74 200.449   63.89 200.402   64.96     200   67.14 199.213
   67.66     199   85.51 198.472   98.03 198.095  102.22 198.037  104.14 198.005
  104.83     198  107.05 197.336  108.45     197   109.6 196.471  110.03 196.349
   110.3 196.132  110.55   195.7  111.55  195.42  112.65  195.42  113.45   195.7
  113.65 196.153  114.19 196.347  114.96 196.478  115.28 196.495  115.54 196.648
  115.97     197  117.96 197.685   118.9     198  119.49 198.157  122.24     199
  123.93 199.013  125.15 199.031  128.94  199.07  130.34 199.094  131.13 199.106
  131.15 199.106  139.61 199.169  174.54 199.456

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   28.76    .025   62.11     .05  108.45    .035  115.97     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
        108.45  115.97             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     110   197.8       F
     114  174.54   197.8       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
  139.13  174.54     204

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     Pipe Arch     2.1    3.23
FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                 5      20     .024     .024        0                   .9
      1
Upstream   Elevation =  195.5
           Centerline Station =  116
Downstream Elevation =  195.42
           Centerline Station =  112

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       1.13    Culv Full Len (m)        20.00
  # Barrels                    1    Culv Vel US (m/s)         0.22
  Q Barrel (m3/s)           1.13    Culv Vel DS (m/s)         0.22
  E.G. US. (m)            199.81    Culv Inv El Up (m)      195.50
  W.S. US. (m)            199.80    Culv Inv El Dn (m)      195.42
  E.G. DS (m)             199.81    Culv Frctn Ls (m)         0.00
  W.S. DS (m)             199.80    Culv Exit Loss (m)        0.00
  Delta EG (m)              0.00    Culv Entr Loss (m)        0.00
  Delta WS (m)              0.00    Q Weir (m3/s)            19.46
  E.G. IC (m)             199.19    Weir Sta Lft (m)         69.13
```

E.G. OC (m)	199.81	Weir Sta Rgt (m)	179.80
Culvert Control	Outlet	Weir Submerg	1.00
Culv WS Inlet (m)	197.60	Weir Max Depth (m)	1.81
Culv WS Outlet (m)	197.52	Weir Avg Depth (m)	1.18
Culv Nml Depth (m)		Weir Flow Area (m2)	89.52
Culv Crt Depth (m)	0.31	Min El Weir Flow (m)	198.01

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	3.10	Culv Full Len (m)	20.00
# Barrels	1	Culv Vel US (m/s)	0.59
Q Barrel (m3/s)	3.10	Culv Vel DS (m/s)	0.59
E.G. US. (m)	201.14	Culv Inv El Up (m)	195.50
W.S. US. (m)	201.11	Culv Inv El Dn (m)	195.42
E.G. DS (m)	201.11	Culv Frctn Ls (m)	0.01
W.S. DS (m)	201.09	Culv Exit Loss (m)	0.00
Delta EG (m)	0.02	Culv Entr Loss (m)	0.02
Delta WS (m)	0.03	Q Weir (m3/s)	119.46
E.G. IC (m)	201.12	Weir Sta Lft (m)	39.13
E.G. OC (m)	201.14	Weir Sta Rgt (m)	179.80
Culvert Control	Outlet	Weir Submerg	0.99
Culv WS Inlet (m)	197.60	Weir Max Depth (m)	3.12
Culv WS Outlet (m)	197.52	Weir Avg Depth (m)	1.84
Culv Nml Depth (m)		Weir Flow Area (m2)	194.21
Culv Crt Depth (m)	0.55	Min El Weir Flow (m)	198.01

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.181

INPUT
Description: Section 46.181 - Private Driveway - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 63

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.672	10.15	201.391	16.44	201.227	19.11	201.198	28.76	201.012
29.08	201.003	29.75	201.003	30.18	201.003	33.16	201.006	34.09	201.007
34.71	201.007	38.11	201.008	40.91	201.007	42.47	201.009	46.32	201.01
49.08	201.01	50.09	201.01	52.79	201.011	53.95	201.011	55.33	201.01
55.52	201.01	57.16	201.007	59.2	201.008	61.08	201.003	61.53	201.002
62.11	201	63.74	200.449	63.89	200.402	64.96	200	67.14	199.213
67.66	199	85.51	198.472	98.03	198.095	102.22	198.037	104.14	198.005
104.83	198	107.05	197.336	108.45	197	109.6	196.471	110.03	196.349
110.3	196.132	110.55	195.7	111.55	195.42	112.65	195.42	113.45	195.7
113.65	196.153	114.19	196.347	114.96	196.478	115.28	196.495	115.54	196.648
115.97	197	117.96	197.685	118.9	198	119.49	198.157	122.24	199
123.93	199.013	125.15	199.031	128.94	199.07	130.34	199.094	131.13	199.106
131.15	199.106	139.61	199.169	174.54	199.456				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	28.76	.025	62.11	.05	108.45	.035	115.97	.05

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

108.45	115.97	10	10	10	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	110	197.8	F
114	174.54	197.8	F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
139.13	174.54	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.81	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.80	Reach Len. (m)	10.00	10.00	10.00
Crit W.S. (m)	197.07	Flow Area (m2)	59.22	27.86	23.15
E.G. Slope (m/m)	0.000032	Area (m2)	59.22	27.86	23.15
Q Total (m3/s)	20.59	Flow (m3/s)	8.22	9.83	2.54
Top Width (m)	73.62	Top Width (m)	42.94	7.52	23.16
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.14	0.35	0.11
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.38	3.70	1.00
Conv. Total (m3/s)	3657.4	Conv. (m3/s)	1460.9	1746.0	450.5
Length Wtd. (m)	10.00	Wetted Per. (m)	43.24	8.57	24.11
Min Ch El (m)	195.42	Shear (N/m2)	0.43	1.01	0.30
Alpha	1.97	Stream Power (N/m s)	0.06	0.36	0.03
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	42.92	72.51	35.89
C & E Loss (m)	0.00	Cum SA (1000 m2)	45.97	23.54	49.66

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.11	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.09	Reach Len. (m)	10.00	10.00	10.00
Crit W.S. (m)	199.00	Flow Area (m2)	119.37	37.51	

52.88					
E.G. Slope (m/m)	0.000190	Area (m2)	119.37	37.51	
52.88					
Q Total (m3/s)	122.56	Flow (m3/s)	59.30	39.50	
23.76					
Top Width (m)	114.19	Top Width (m)	83.51	7.52	
23.16					
Vel Total (m/s)	0.58	Avg. Vel. (m/s)	0.50	1.05	
0.45					
Max Chl Dpth (m)	5.67	Hydr. Depth (m)	1.43	4.99	
2.28					
Conv. Total (m3/s)	8896.6	Conv. (m3/s)	4304.8	2867.1	
1724.7					
Length Wtd. (m)	10.00	Wetted Per. (m)	84.01	8.57	
25.39					
Min Ch El (m)	195.42	Shear (N/m2)	2.64	8.14	
3.88					
Alpha	1.51	Stream Power (N/m s)	1.31	8.58	
1.74					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	171.74	174.48	
199.59					
C & E Loss (m)	0.00	Cum SA (1000 m2)	101.90	23.54	
126.75					

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.18

INPUT
Description: Section 46.18 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 36

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.977	11.8	201.517	19.72	201.217	24.63	201.027	25.49	201
25.73	200.891	27.72	200	72.09	200	72.38	200.049	72.68	200
73.08	199.878	75.33	199	90.41	198.582	110.99	198	113.81	197.148
114.16	197	114.84	196.777	115.23	196.607	117.24	196	118.92	195.419
119.01	195.418	119.32	195.43	120.38	195.971	120.82	196	123.44	196.968
123.53	197	123.87	197.147	125.89	198	126.38	198.193	128.56	199
130.21	199.025	143.32	199.109	146.37	199.102	152.23	199.148	160.44	199.206
181.15	199.373								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	117.24	.035	120.82	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
117.24	120.82	25	25	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
146.08	181.15	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.80	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	
0.050					
W.S. Elev (m)	199.80	Reach Len. (m)	25.00	25.00	

25.00					
Crit W.S. (m)		Flow Area (m2)	64.59	14.65	
30.67					
E.G. Slope (m/m)	0.000038	Area (m2)	64.59	14.65	
30.67					
Q Total (m3/s)	20.59	Flow (m3/s)	10.15	6.30	
4.14					
Top Width (m)	72.80	Top Width (m)	43.96	3.58	
25.26					
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.16	0.43	
0.14					
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.47	4.09	
1.21					
Conv. Total (m3/s)	3360.8	Conv. (m3/s)	1657.3	1027.6	
676.0					
Length Wtd. (m)	25.00	Wetted Per. (m)	44.44	3.81	
26.52					
Min Ch El (m)	195.42	Shear (N/m2)	0.53	1.42	
0.43					
Alpha	2.06	Stream Power (N/m s)	0.08	0.61	
0.06					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	42.30	72.30	
35.62					
C & E Loss (m)	0.00	Cum SA (1000 m2)	45.53	23.49	
49.42					

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.11	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	
0.050					
W.S. Elev (m)	201.09	Reach Len. (m)	25.00	25.00	
25.00					
Crit W.S. (m)		Flow Area (m2)	172.08	19.25	
63.15					
E.G. Slope (m/m)	0.000189	Area (m2)	172.08	19.25	
63.15					
Q Total (m3/s)	122.56	Flow (m3/s)	70.32	22.26	
29.98					
Top Width (m)	122.99	Top Width (m)	94.15	3.58	
25.26					
Vel Total (m/s)	0.48	Avg. Vel. (m/s)	0.41	1.16	
0.47					
Max Chl Dpth (m)	5.67	Hydr. Depth (m)	1.83	5.38	
2.50					
Conv. Total (m3/s)	8920.1	Conv. (m3/s)	5117.8	1620.2	
2182.2					
Length Wtd. (m)	25.00	Wetted Per. (m)	94.89	3.81	
27.81					
Min Ch El (m)	195.42	Shear (N/m2)	3.36	9.36	
4.20					
Alpha	1.70	Stream Power (N/m s)	1.37	10.82	
2.00					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	170.28	174.20	
199.01					
C & E Loss (m)	0.00	Cum SA (1000 m2)	101.01	23.49	
126.51					

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: RIVER-1
REACH: Reach-1 RS: 46.172

INPUT
Description: Section 46.172 - Doughton Road - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 112

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.734	12.56	201.239	18.71	201	19.16	200.796	20.83	200
22.76	199.053	22.87	199	62.25	199	63.17	199.011	64.63	199.022
66.94	199.001	66.98	199	67.01	199	68.2	198.967	103.48	198
104.09	197.739	105.82	197	106.27	196.833	107.29	196.474	107.64	196.354
108.58	196	109	195.6	109.6	195.423	111	195.423	111.7	195.6
112.13	196	114.2	196.671	115.34	197	118.55	197.877	118.99	198
121.05	198.574	123.33	199	123.42	199.001	123.5	199.001	123.54	199.001
123.9	199.003	124.23	199.004	124.61	199.005	126.14	199.011	127.45	199.01
127.51	199.01	130.18	199.02	131.13	199.023	131.75	199.022	131.93	199.022
136.67	199.034	138.19	199.034	142.37	199.028	144.48	199.031	146.18	199.033
147.98	199.03	151.4	199.025	152.23	199.024	153.19	199.023	162.26	199.102
168.85	199.106	176.2	199.054	176.37	199.053	179.61	199.282	179.92	199.303
181.07	199.326	182.68	199.444	185.09	199.554	185.23	199.561	190.14	200
190.33	200.08	192.14	200.106	194.32	200.348	197.51	200.575	198.87	200.608
201.34	200.55	205.59	200.325	205.97	200.323	207.47	200.186	208.18	200.159
208.63	200.138	208.84	200.128	209.03	200.12	209.29	200.117	209.54	200.119
210.38	200.139	210.98	200.174	211.81	200.246	213.46	200.375	218.29	200.752
218.48	200.763	218.67	200.765	219.17	200.789	219.59	200.805	220.25	200.786
223.9	200.72	227.49	200.773	227.81	200.78	230.24	200.911	230.52	200.931
231.19	201	231.74	201.005	232.08	201.007	242.92	201.282	250.3	201.41
251.76	201.387	251.9	201.386	253.2	201.371	255.13	201.441	255.57	201.457
256.04	201.474	256.2	201.479	256.73	201.495	258.39	201.529	263.36	201.693
264.27	201.707	264.32	201.707						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	108.58	.035	112.13	.05

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
108.58 112.13 40 40 40 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	108.23	197.78	F
112.38	264.32	197.78	F

Right Levee Station= 198.87 Elevation= 200.608

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.80	Reach Len. (m)	40.00	40.00	40.00
Crit W.S. (m)	197.01	Flow Area (m2)	97.96	15.11	68.87

E.G. Slope (m/m)	0.000021	Area (m2)	97.96	15.11	68.87
Q Total (m3/s)	20.59	Flow (m3/s)	9.73	4.91	5.95
Top Width (m)	166.69	Top Width (m)	87.35	3.55	75.79
Vel Total (m/s)	0.11	Avg. Vel. (m/s)	0.10	0.32	0.09
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.12	4.26	0.91
Conv. Total (m3/s)	4455.0	Conv. (m3/s)	2105.7	1062.1	1287.3
Length Wtd. (m)	40.00	Wetted Per. (m)	87.93	3.92	76.22
Min Ch El (m)	195.42	Shear (N/m2)	0.23	0.81	0.19
Alpha	2.50	Stream Power (N/m s)	0.02	0.26	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	40.27	71.92	34.37
C & E Loss (m)		Cum SA (1000 m2)	43.89	23.40	48.16

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.10	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.09	Reach Len. (m)	40.00	40.00	40.00
Crit W.S. (m)	199.38	Flow Area (m2)	212.63	19.69	193.70
E.G. Slope (m/m)	0.000074	Area (m2)	212.63	19.69	193.70
Q Total (m3/s)	122.56	Flow (m3/s)	63.45	14.21	44.90
Top Width (m)	219.18	Top Width (m)	92.27	3.55	123.35
Vel Total (m/s)	0.29	Avg. Vel. (m/s)	0.30	0.72	0.23
Max Chl Dpth (m)	5.67	Hydr. Depth (m)	2.30	5.55	1.57
Conv. Total (m3/s)	14244.4	Conv. (m3/s)	7373.8	1652.0	5218.7
Length Wtd. (m)	40.00	Wetted Per. (m)	93.13	3.92	123.88
Min Ch El (m)	195.42	Shear (N/m2)	1.66	3.65	1.14
Alpha	1.52	Stream Power (N/m s)	0.49	2.64	0.26
Frctn Loss (m)		Cum Volume (1000 m3)	165.48	173.71	195.80
C & E Loss (m)		Cum SA (1000 m2)	98.68	23.40	124.65

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1715

INPUT
Description: Hum 13-4R. Doughton Road Culvert - 3.54 m W x 2.27 m H x 30 m L Corrugated Metal Pipe Arch Culvert. Drawing by Paul Theil (Dwg No. 8036P-A-17, February 1998) used to code culvert in HEC-RAS format..

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 30
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 146

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.659		17.1	201		18.56	200.215	
19.04	200		20.71	199.079		20.88	199	
58.5	199		58.75	199.001		59.61	199.002	
59.67	199.002		60.49	199.079		61.88	199.001	
62.77	199		62.78	198.999		62.87	198.999	
64.51	198.988		77.88	198.499		79.03	198.456	
80.45	198.394		80.53	198.393		80.55	198.393	
82.71	198.354		101.77	198.004		101.87	198.004	
102.35	198.004		102.49	198.003		103.08	198.003	
103.88	198.003		104.94	198.002		105.2	198.001	
105.36	198.001		105.37	198.001		105.48	198.001	
105.59	198.001		106.17	198		111.07	197.984	
112.06	197.981		112.22	197.981		112.33	197.981	
112.33	197.981		114.49	197.978		114.57	197.978	
114.65	197.978		115.8	197.978		118.45	197.973	
118.88	197.972		119.32	197.973		119.67	197.973	
120.76	197.97		121.29	197.971		125.31	197.974	
128.81	197.969		129.56	197.969		129.66	197.969	
131.93	197.969		135.28	197.977		135.33	197.977	
135.42	197.977		135.86	197.977		136.49	197.98	
136.85	197.98		138.97	197.983		140.58	197.983	
142.91	197.985		143.34	197.986		144	197.987	
148.3	197.988		148.81	197.988		150.8	197.989	
151.39	197.989		151.44	197.989		151.49	197.989	
152.06	197.99		152.7	197.99		156.88	197.993	
158.94	197.995		160.16	197.995		160.52	197.995	
163.7	197.998		163.89	197.998		166.05	198	
171.66	198.147		174	198.212		174.94	198.277	
175.14	198.281		175.27	198.285		175.43	198.29	
175.45	198.29		175.57	198.292		181.56	199	
181.89	199		188.35	199		188.45	199	
189.17	199		189.18	199		189.3	199	
189.37	199		189.43	199		190.46	199	
190.69	199		196.39	199		199.89	199	
200.58	199		201.89	199		202.2	199	
202.34	199		205.71	199		205.77	199	

206.03	199	207.51	199	207.73	199						
208.17	199	209.97	199	211.96	199.213						
212.01	199.214	213.13	199.214	220.85	199.754						
223.57	199.952	224.34	199.955	224.39	199.955						
224.45	199.955	225.21	199.96	227.97	199.964						
228.07	199.964	229.26	199.965	230.05	199.967						
232.33	199.971	235.53	199.979	235.78	199.979						
238.51	199.989	241.24	199.999	241.32	199.999						
241.46	199.999	241.56	200	242.02	200.028						
242.12	200.031	255.22	200.891	257.31	200.902						
257.33	200.902	259.53	200.742	259.59	200.74						
260.02	200.761	260.61	200.75	262.62	200.866						
263.38	200.931	263.45	200.931								

Upstream Bridge Cross Section Data

Station Elevation Data num= 112

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.734	12.56	201.239	18.71	201	19.16	200.796	20.83	200
22.76	199.053	22.87	199	62.25	199	63.17	199.011	64.63	199.022
66.94	199.001	66.98	199	67.01	199	68.2	198.967	103.48	198
104.09	197.739	105.82	197	106.27	196.833	107.29	196.474	107.64	196.354
108.58	196	109	195.6	109.6	195.423	111	195.423	111.7	195.6
112.13	196	114.2	196.671	115.34	197	118.55	197.877	118.99	198
121.05	198.574	123.33	199	123.42	199.001	123.5	199.001	123.54	199.001
123.9	199.003	124.23	199.004	124.61	199.005	126.14	199.011	127.45	199.01
127.51	199.01	130.18	199.02	131.13	199.023	131.75	199.022	131.93	199.022
136.67	199.034	138.19	199.034	142.37	199.028	144.48	199.031	146.18	199.033
147.98	199.03	151.4	199.025	152.23	199.024	153.19	199.023	162.26	199.102
168.85	199.106	176.2	199.054	176.37	199.053	179.61	199.282	179.92	199.303
181.07	199.326	182.68	199.444	185.09	199.554	185.23	199.561	190.14	200
190.33	200.08	192.14	200.106	194.32	200.348	197.51	200.575	198.87	200.608
201.34	200.55	205.59	200.325	205.97	200.323	207.47	200.186	208.18	200.159
208.63	200.138	208.84	200.128	209.03	200.12	209.29	200.117	209.54	200.119
210.38	200.139	210.98	200.174	211.81	200.246	213.46	200.375	218.29	200.752
218.48	200.763	218.67	200.765	219.17	200.789	219.59	200.805	220.25	200.786
223.9	200.72	227.49	200.773	227.81	200.78	230.24	200.911	230.52	200.931
231.19	201	231.74	201.005	232.08	201.007	242.92	201.282	250.3	201.41
251.76	201.387	251.9	201.386	253.2	201.371	255.13	201.441	255.57	201.457
256.04	201.474	256.2	201.479	256.73	201.495	258.39	201.529	263.36	201.693
264.27	201.707	264.32	201.707						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	108.58	.035	112.13	.05

Bank Sta: Left Right Coeff Contr. Expan.

108.58 112.13 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	108.23	197.78	F
112.38	264.32	197.78	F

Right Levee Station= 198.87 Elevation= 200.608

Downstream Deck/Roadway Coordinates

num= 146

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.659		17.1	201		18.56	200.215	
19.04	200		20.71	199.079		20.88	199	
58.5	199		58.75	199.001		59.61	199.002	
59.67	199.002		60.49	199.079		61.88	199.001	
62.77	199		62.78	198.999		62.87	198.999	
64.51	198.988		77.88	198.499		79.03	198.456	
80.45	198.394		80.53	198.393		80.55	198.393	

82.71	198.354	101.77	198.004	101.87	198.004
102.35	198.004	102.49	198.003	103.08	198.003
103.88	198.003	104.94	198.002	105.2	198.001
105.36	198.001	105.37	198.001	105.48	198.001
105.59	198.001	106.17	198	111.07	197.984
112.06	197.981	112.22	197.981	112.33	197.981
112.33	197.981	114.49	197.978	114.57	197.978
114.65	197.978	115.8	197.978	118.45	197.973
118.88	197.972	119.32	197.973	119.67	197.973
120.76	197.97	121.29	197.971	125.31	197.974
128.81	197.969	129.56	197.969	129.66	197.969
131.93	197.969	135.28	197.977	135.33	197.977
135.42	197.977	135.86	197.977	136.49	197.98
136.85	197.98	138.97	197.983	140.58	197.983
142.91	197.985	143.34	197.986	144	197.987
148.3	197.988	148.81	197.988	150.8	197.989
151.39	197.989	151.44	197.989	151.49	197.989
152.06	197.99	152.7	197.99	156.88	197.993
158.94	197.995	160.16	197.995	160.52	197.995
163.7	197.998	163.89	197.998	166.05	198
171.66	198.147	174	198.212	174.94	198.277
175.14	198.281	175.27	198.285	175.43	198.29
175.45	198.29	175.57	198.292	181.56	199
181.89	199	188.35	199	188.45	199
189.17	199	189.18	199	189.3	199
189.37	199	189.43	199	190.46	199
190.69	199	196.39	199	199.89	199
200.58	199	201.89	199	202.2	199
202.34	199	205.71	199	205.77	199
206.03	199	207.51	199	207.73	199
208.17	199	209.97	199	211.96	199.213
212.01	199.214	213.13	199.214	220.85	199.754
223.57	199.952	224.34	199.955	224.39	199.955
224.45	199.955	225.21	199.96	227.97	199.964
228.07	199.964	229.26	199.965	230.05	199.967
232.33	199.971	235.53	199.979	235.78	199.979
238.51	199.989	241.24	199.999	241.32	199.999
241.46	199.999	241.56	200	242.02	200.028
242.12	200.031	255.22	200.891	257.31	200.902
257.33	200.902	259.53	200.742	259.59	200.74
260.02	200.761	260.61	200.75	262.62	200.866
263.38	200.931	263.45	200.931		

Downstream Bridge Cross Section Data
Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.96	4.98	201.796	12.44	201.256	13.15	201.237	13.25	201.233
14.75	201.164	14.84	201.161	15.12	201.157	15.39	201.155	15.62	201.154
15.69	201.151	15.99	201	16.36	200.819	17.96	200	56.42	200
56.75	200.006	57.02	200.008	57.33	200.003	57.62	200	58.14	199.138
58.25	199.189	58.47	199	60.02	198.995	63.55	198.984	63.81	198.985
64	198.985	65.42	198.99	68.25	198.998	68.82	199	72	199.002
72.03	199.002	72.61	199.001	73.78	199.001	75.32	199	75.36	199
80.19	198.767	92.67	198.166	96.3	198	97.51	197.516	98.72	197
99.68	196.606	99.91	196.501	100.61	196.23	100.78	196	101.09	195.65
102	195.4	103	195.4	103.89	195.65	104.2	196	105.92	196.441
106.96	196.581	107.6	196.655	107.9	196.67	111.41	197	111.54	197.014
111.55	197.013	112.49	197.087	113.31	197.14	116.28	197.185	119.01	197.211
119.24	197.207	121.22	197.229	124.15	197.307	124.51	197.35	124.99	197.41
125.11	197.425	127.76	197.44	128.22	197.417	130.42	198	132.06	198.488
133.88	199	134.14	199.003	134.41	199.003	134.45	199.003	137.25	199.032
137.75	199.031	141.77	199.052	141.83	199.052	141.86	199.053	148.67	199.216
150.74	199.224	152.75	199.228	159.58	199.291	160.35	199.297	162.8	199.347

```
  166.55 199.342   166.7 199.342  167.68 199.362  170.27 199.374  170.75 199.383
  172.18 199.397  173.54 199.408  175.72 199.407  176.75 199.414  180.91  199.49
  186.98 199.604   187.2 199.611  193.04 199.639     200     200  200.45 200.012
  202.09 200.042  206.82 200.085  218.03   200.5  221.19 200.617  221.21 200.618
  221.33 200.618  221.54 200.615  221.57 200.615   229.4 200.491  229.74  200.48
  236.66 200.579  244.75 200.914  250.98 200.952  251.55 200.969  251.75 200.978
  251.93 200.979   253.5     201  255.98 201.045  256.93 201.053  257.81 201.067
  258.72 201.075  258.93 201.079

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05  100.78    .035   104.2     .05  133.88    .025

Bank Sta: Left   Right    Coeff Contr.   Expan.
        100.78   104.2            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0  100.49   197.5       F
  104.45  258.93   197.5       F
Right Levee     Station=  221.19      Elevation=  200.62

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     Pipe Arch    2.27    3.54
FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                 5      30     .024     .024        0                   .9
      1
Upstream   Elevation =  195.423
           Centerline Station =  110.35
Downstream Elevation =  195.4
           Centerline Station =  102.49

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       0.95    Culv Full Len (m)        30.00
  # Barrels                    1    Culv Vel US (m/s)         0.15
  Q Barrel (m3/s)           0.95    Culv Vel DS (m/s)         0.15
  E.G. US. (m)            199.80    Culv Inv El Up (m)      195.42
  W.S. US. (m)            199.80    Culv Inv El Dn (m)      195.40
  E.G. DS (m)             199.80    Culv Frctn Ls (m)         0.00
  W.S. DS (m)             199.80    Culv Exit Loss (m)        0.00
  Delta EG (m)              0.00    Culv Entr Loss (m)        0.00
  Delta WS (m)              0.00    Q Weir (m3/s)            19.64
  E.G. IC (m)             198.51    Weir Sta Lft (m)         21.23
  E.G. OC (m)             199.80    Weir Sta Rgt (m)        187.93
  Culvert Control         Outlet    Weir Submerg              1.00
  Culv WS Inlet (m)       197.69    Weir Max Depth (m)        1.83
  Culv WS Outlet (m)      197.67    Weir Avg Depth (m)        0.97
  Culv Nml Depth (m)                Weir Flow Area (m2)     161.62
  Culv Crt Depth (m)        0.28    Min El Weir Flow (m)    197.97
```

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	2.17	Culv Full Len (m)	30.00
# Barrels	1	Culv Vel US (m/s)	0.35
Q Barrel (m3/s)	2.17	Culv Vel DS (m/s)	0.35
E.G. US. (m)	201.10	Culv Inv El Up (m)	195.42
W.S. US. (m)	201.09	Culv Inv El Dn (m)	195.40
E.G. DS (m)	201.09	Culv Frctn Ls (m)	0.00
W.S. DS (m)	201.08	Culv Exit Loss (m)	0.00
Delta EG (m)	0.01	Culv Entr Loss (m)	0.01
Delta WS (m)	0.01	Q Weir (m3/s)	120.40
E.G. IC (m)	201.09	Weir Sta Lft (m)	16.33
E.G. OC (m)	201.10	Weir Sta Rgt (m)	235.46
Culvert Control	Outlet	Weir Submerg	1.00
Culv WS Inlet (m)	197.69	Weir Max Depth (m)	3.12
Culv WS Outlet (m)	197.67	Weir Avg Depth (m)	1.85
Culv Nml Depth (m)		Weir Flow Area (m2)	405.36
Culv Crt Depth (m)	0.43	Min El Weir Flow (m)	197.97

Warning: The weir over culvert is submerged.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.171

INPUT
Description: Section 46.171 - Doughton Road - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.96	4.98	201.796	12.44	201.256	13.15	201.237	13.25	201.233
14.75	201.164	14.84	201.161	15.12	201.157	15.39	201.155	15.62	201.154
15.69	201.151	15.99	201	16.36	200.819	17.96	200	56.42	200
56.75	200.006	57.02	200.008	57.33	200.003	57.62	200	58.14	199.138
58.25	199.189	58.47	199	60.02	198.995	63.55	198.984	63.81	198.985
64	198.985	65.42	198.99	68.25	198.998	68.82	199	72	199.002
72.03	199.002	72.61	199.001	73.78	199.001	75.32	199	75.36	199
80.19	198.767	92.67	198.166	96.3	198	97.51	197.516	98.72	197
99.68	196.606	99.91	196.501	100.61	196.23	100.78	196	101.09	195.65
102	195.4	103	195.4	103.89	195.65	104.2	196	105.92	196.441
106.96	196.581	107.6	196.655	107.9	196.67	111.41	197	111.54	197.014
111.55	197.013	112.49	197.087	113.31	197.14	116.28	197.185	119.01	197.211
119.24	197.207	121.22	197.229	124.15	197.307	124.51	197.35	124.99	197.41
125.11	197.425	127.76	197.44	128.22	197.417	130.42	198	132.06	198.488
133.88	199	134.14	199.003	134.41	199.003	134.45	199.003	137.25	199.032
137.75	199.031	141.77	199.052	141.83	199.052	141.86	199.053	148.67	199.216
150.74	199.224	152.75	199.228	159.58	199.291	160.35	199.297	162.8	199.347
166.55	199.342	166.7	199.342	167.68	199.362	170.27	199.374	170.75	199.383
172.18	199.397	173.54	199.408	175.72	199.407	176.75	199.414	180.91	199.49
186.98	199.604	187.2	199.611	193.04	199.639	200	200	200.45	200.012
202.09	200.042	206.82	200.085	218.03	200.5	221.19	200.617	221.21	200.618
221.33	200.618	221.54	200.615	221.57	200.615	229.4	200.491	229.74	200.48
236.66	200.579	244.75	200.914	250.98	200.952	251.55	200.969	251.75	200.978

```
  251.93 200.979   253.5     201  255.98 201.045  256.93 201.053  257.81 201.067
  258.72 201.075  258.93 201.079

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05  100.78    .035   104.2     .05  133.88    .025

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        100.78   104.2                 20      20      20             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0  100.49   197.5       F
  104.45  258.93   197.5       F
Right Levee     Station=  221.19      Elevation=  200.62

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           199.80    Element                Left OB    Channel
Right OB
  Vel Head (m)              0.00    Wt. n-Val.              0.050      0.035
0.045
  W.S. Elev (m)           199.80    Reach Len. (m)          20.00      20.00
20.00
  Crit W.S. (m)           197.05    Flow Area (m2)          53.47      14.56
103.52
  E.G. Slope (m/m)      0.000013    Area (m2)               53.47      14.56
103.52
  Q Total (m3/s)            20.59   Flow (m3/s)              4.42       3.69
12.48
  Top Width (m)           138.41    Top Width (m)           43.04       3.42
91.95
  Vel Total (m/s)           0.12    Avg. Vel. (m/s)          0.08       0.25
0.12
  Max Chl Dpth (m)          4.40    Hydr. Depth (m)          1.24       4.26
1.13
  Conv. Total (m3/s)      5677.0    Conv. (m3/s)          1218.0     1018.1
3441.0
  Length Wtd. (m)           20.00   Wetted Per. (m)         43.98       3.80
92.28
  Min Ch El (m)           195.40    Shear (N/m2)             0.16       0.49
0.14
  Alpha                     1.51    Stream Power (N/m s)     0.01       0.13
0.02
  Frctn Loss (m)            0.00    Cum Volume (1000 m3)    40.27      65.14
34.37
  C & E Loss (m)            0.00    Cum SA (1000 m2)        41.29      23.26
44.80



Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #Regional w red'n


  E.G. Elev (m)           201.09    Element                Left OB    Channel
Right OB
  Vel Head (m)              0.01    Wt. n-Val.              0.050      0.035
0.037
  W.S. Elev (m)           201.08    Reach Len. (m)          20.00      20.00
20.00
```

Crit W.S. (m)	198.40	Flow Area (m2)	152.90	18.95	256.04
E.G. Slope (m/m)	0.000047	Area (m2)	152.90	18.95	256.04
Q Total (m3/s)	122.56	Flow (m3/s)	30.86	10.88	80.82
Top Width (m)	243.10	Top Width (m)	84.95	3.42	154.73
Vel Total (m/s)	0.29	Avg. Vel. (m/s)	0.20	0.57	0.32
Max Chl Dpth (m)	5.68	Hydr. Depth (m)	1.80	5.54	1.65
Conv. Total (m3/s)	17786.0	Conv. (m3/s)	4478.4	1578.9	11728.6
Length Wtd. (m)	20.00	Wetted Per. (m)	86.27	3.80	155.09
Min Ch El (m)	195.40	Shear (N/m2)	0.83	2.32	0.77
Alpha	1.28	Stream Power (N/m s)	0.17	1.33	0.24
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	165.48	157.18	195.80
C & E Loss (m)	0.00	Cum SA (1000 m2)	95.14	23.26	119.09

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.17

INPUT
Description: Section 46.17 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 116

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.688	1.92	202.495	4.4	202.266	4.48	202.251	4.75	202.184
4.79	202.176	6.6	202	12.45	201.979	17.91	201.166	18.18	201.154
19.37	201.103	21.4	201	23.54	200.628	24.48	200.486	25.02	200.437
25.18	200.42	27.13	200.345	28.69	200.283	51.47	200.233	52.85	200.015
52.9	200.016	53.01	200.016	53.18	200.017	53.5	200.019	53.65	200.018
55.08	200	55.93	199.504	57.96	199	58.81	198.999	60.02	198.998
60.13	198.998	60.21	198.998	60.95	199	66.84	199.005	72.96	199.008
73.69	199.009	73.9	199.009	74.3	199.009	84.33	199.001	84.69	199
87.85	198.724	88.8	198.65	91.93	198.411	92.06	198.399	92.24	198.395
94.4	198.329	97.14	198.228	101.19	198	104.3	197.667	105.19	197.601
106.64	197.457	107.07	197.401	107.61	197.33	109.57	197.016	109.72	197
111.4	196.518	112.75	196.275	112.89	196.246	114	196	115.21	195.596
116.81	195.074	118.88	195.516	119.22	195.58	121	195.98	121.83	196
122.59	196.161	122.66	196.178	126.09	197	126.52	197.207	127.48	197.726
128.12	198	128.84	198.316	128.95	198.391	130.41	199	131.35	199.029
131.66	199.042	131.84	199.047	145.77	199.679	145.82	199.68	148.15	199.686
148.22	199.687	150.32	199.708	150.42	199.708	155.89	199.771	163.77	199.844
166.6	199.87	172.77	199.998	172.98	200	173.86	200	177.76	200.001
180.71	200.001	182.41	200.001	187.06	200	189.66	200	190.48	200
191.66	199.999	192.68	200	193.35	200	195.14	200.052	210.59	200.774
213.61	200.883	216.46	200.997	216.77	200.998	216.8	201	218.28	201.01
220.35	201.021	223.37	201.004	223.38	201.003	223.46	201.003	223.87	201.001
224	201.001	224.1	201.001	224.26	201.001	247.41	201.031	254.26	201.314

261.99 201.319

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	114	.035	121.83	.05	130.41	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
114	121.83	25	25	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
224	254.26	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.046
W.S. Elev (m)	199.80	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)		Flow Area (m2)	78.43	33.06	29.72
E.G. Slope (m/m)	0.000016	Area (m2)	78.43	33.06	29.72
Q Total (m3/s)	20.59	Flow (m3/s)	7.48	9.53	3.58
Top Width (m)	103.45	Top Width (m)	58.57	7.83	37.04
Vel Total (m/s)	0.15	Avg. Vel. (m/s)	0.10	0.29	0.12
Max Chl Dpth (m)	4.72	Hydr. Depth (m)	1.34	4.22	0.80
Conv. Total (m3/s)	5225.2	Conv. (m3/s)	1897.9	2417.7	909.5
Length Wtd. (m)	25.00	Wetted Per. (m)	58.93	8.08	37.62
Min Ch El (m)	195.07	Shear (N/m2)	0.20	0.62	0.12
Alpha	2.08	Stream Power (N/m s)	0.02	0.18	0.01
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	38.95	64.66	33.04
C & E Loss (m)	0.00	Cum SA (1000 m2)	40.27	23.15	43.51

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.09	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.032
W.S. Elev (m)	201.08	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)		Flow Area (m2)	179.99	43.06	129.50

E.G. Slope (m/m)	0.000069	Area (m2)	179.99	43.06	129.50
Q Total (m3/s)	122.56	Flow (m3/s)	45.88	31.16	45.52
Top Width (m)	204.08	Top Width (m)	94.08	7.83	102.17
Vel Total (m/s)	0.35	Avg. Vel. (m/s)	0.25	0.72	0.35
Max Chl Dpth (m)	6.00	Hydr. Depth (m)	1.91	5.50	1.27
Conv. Total (m3/s)	14769.6	Conv. (m3/s)	5529.1	3754.9	5485.6
Length Wtd. (m)	25.00	Wetted Per. (m)	94.56	8.08	102.85
Min Ch El (m)	195.07	Shear (N/m2)	1.29	3.60	0.85
Alpha	1.68	Stream Power (N/m s)	0.33	2.61	0.30
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	162.15	156.56	191.95
C & E Loss (m)	0.00	Cum SA (1000 m2)	93.35	23.15	116.52

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: RIVER-1
REACH: Reach-1 RS: 46.162

INPUT
Description: Section 46.162 - Private Roadway - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 109

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.192	1.24	201.169	3.79	201.018	4.16	201	4.19	201
4.59	201	4.76	201	7.68	200.999	11.04	200.998	13.8	200.998
16.96	200.999	17.05	200.985	18.41	200.657	20.17	200.244	20.23	200.243
23.96	200	24.33	200	24.56	200	24.59	200	24.88	200
26.07	200.001	26.81	200.001	26.89	200.001	27.42	200.001	28.48	200.001
30.58	200.002	32.04	200.002	32.36	200.002	32.54	200.002	32.61	200.002
32.89	200.003	34.51	199.895	34.73	199.893	44.5	199.802	46.83	199.776
54.07	199.447	58.78	199.43	64.92	199.322	69.2	199.246	76.37	199.103
81.58	199.008	81.84	199	87.1	198.433	90.24	198	91.32	197.577
93.35	197	93.64	196.919	94.7	196.457	95.67	196.041	95.77	196
95.88	195.96	97	195.074	98.92	195.074	100.12	195.765	100.4	196
101.1	196.258	101.63	196.43	103.42	197	104.06	197.319	105.45	198
106.48	198.488	107.42	199	110.59	199.341	122.09	199.985	122.25	199.995
122.4	200	122.41	200	122.46	200	122.47	200	122.58	200
123.04	200	129.01	200	130.19	200	140.85	200	144.86	200
145.37	200	145.55	200	145.59	200	148.08	200	150.4	200
151.72	200.029	154.44	200.045	164.08	200.101	179.01	200.467	180.22	200.507
181.74	200.559	183.87	200.633	184.02	200.638	184.28	200.645	187.85	200.734
192.91	200.868	197.74	201	200.12	201.06	203.17	201.141	203.19	201.141
203.79	201.145	209.64	201.071	209.78	201.07	219.82	201.072	226.92	201.085
234.49	201.039	242.9	201.219	248.47	201.125	248.56	201.126	248.94	201.13
253.08	201.56	254.15	201.702	256.45	201.992	256.6	202		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	95.77	.035	100.4	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
95.77	100.4	30	30	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	96	198.8	F
100	256.6	198.8	F

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
154.44	183.87	204	209.64	248.47	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.79	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)	196.65	Flow Area (m2)	41.88	20.60	20.89
E.G. Slope (m/m)	0.000060	Area (m2)	41.88	20.60	20.89
Q Total (m3/s)	20.59	Flow (m3/s)	5.72	11.40	3.46
Top Width (m)	73.08	Top Width (m)	50.24	4.63	18.21
Vel Total (m/s)	0.25	Avg. Vel. (m/s)	0.14	0.55	0.17
Max Chl Dpth (m)	4.72	Hydr. Depth (m)	0.83	4.45	1.15
Conv. Total (m3/s)	2655.0	Conv. (m3/s)	737.6	1470.6	446.8
Length Wtd. (m)	30.00	Wetted Per. (m)	50.67	5.22	18.88
Min Ch El (m)	195.07	Shear (N/m2)	0.49	2.33	0.65
Alpha	2.94	Stream Power (N/m s)	0.07	1.29	0.11
Frctn Loss (m)		Cum Volume (1000 m3)	37.44	63.99	32.41
C & E Loss (m)		Cum SA (1000 m2)	38.91	22.99	42.82

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.05	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)	198.81	Flow Area (m2)	135.12	26.43	

85.01					
E.G. Slope (m/m)	0.000245	Area (m2)	135.12	26.43	
85.01					
Q Total (m3/s)	122.56	Flow (m3/s)	54.28	34.89	
33.39					
Top Width (m)	167.01	Top Width (m)	92.51	4.63	
69.87					
Vel Total (m/s)	0.50	Avg. Vel. (m/s)	0.40	1.32	
0.39					
Max Chl Dpth (m)	5.98	Hydr. Depth (m)	1.46	5.71	
1.22					
Conv. Total (m3/s)	7825.2	Conv. (m3/s)	3465.7	2227.8	
2131.7					
Length Wtd. (m)	30.00	Wetted Per. (m)	93.05	5.22	
71.97					
Min Ch El (m)	195.07	Shear (N/m2)	3.49	12.19	
2.84					
Alpha	2.47	Stream Power (N/m s)	1.40	16.10	
1.12					
Frctn Loss (m)		Cum Volume (1000 m3)	158.21	155.69	
189.26					
C & E Loss (m)		Cum SA (1000 m2)	91.01	22.99	
114.37					

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1615

INPUT
Description: Hum 13-KK. Paradise Convention Centre Culvert - 3.23 m W x 2.1 m H x 20 m L Corrugated Metal Pipe Arch Culvert. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 20
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 126

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.017		9.94	201		10.9	201	
11.2	200.998		11.24	200.998		11.49	200.997	
11.55	200.996		11.63	200.996		11.72	200.995	
11.81	200.995		12.69	200.991		13.63	200.995	
13.69	200.995		13.79	200.995		13.91	200.995	
14.12	200.995		14.43	200.995		15.32	200.994	
16.77	200.993		17.25	200.993		17.58	200.992	
17.88	200.988		18.13	200.991		18.74	201	
19.67	201		20.75	201		22.23	201	
22.68	201		23	201		25.78	200.523	
29.88	200		30.35	200		30.39	200	
30.42	200		30.46	200		30.91	200	
31.74	200		31.8	200		31.81	200	
32.21	199.978		32.38	199.976		37.76	199.901	
45.3	199.796		45.48	199.793		46.6	199.774	

47.47	199.76	48.2	199.747	48.73	199.737
52.37	199.712	62.24	199.953	80.06	199.792
80.14	199.784	82.52	199.86	83.52	199.767
86.47	199.141	86.75	199.129	86.83	199.126
86.88	199.126	87.13	199.124	87.38	199.123
92.32	199.013	93.07	199.015	93.82	199.013
94.29	199.014	95.15	199.016	97.02	199.018
99.48	199.024	101.85	199.025	101.94	199.025
102.27	199.026	102.57	199.026	108.65	199.546
109.85	199.579	110.34	199.599	111.74	199.692
113.68	199.827	113.8	199.834	114.21	199.865
114.64	199.898	115.6	200	115.65	200
115.87	200	115.88	200	116.22	200
133.27	200.001	141.62	200.001	151.28	200
152.5	200	152.57	200	152.67	200
153.56	200.001	154.38	200	157.21	200.062
161.12	200.085	198.43	201	198.44	201
198.44	201	198.46	201	198.85	201.004
198.89	201.004	199.24	201.005	201.34	201.009
203.5	201.021	204.2	201.024	204.77	201.027
206.84	201.024	207.23	201.023	207.31	201.023
207.75	201.023	208.37	201.022	211.58	201.02
227.39	201.113	228.72	201.124	234.54	201.088
245.86	201	245.92	201	245.93	201
245.97	201	247.18	201	247.71	201
247.87	201	248.82	201.063	250.46	201.201
257.76	202	258.46	202.763	258.74	203

Upstream Bridge Cross Section Data
Station Elevation Data num= 109

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.192	1.24	201.169	3.79	201.018	4.16	201	4.19	201
4.59	201	4.76	201	7.68	200.999	11.04	200.998	13.8	200.998
16.96	200.999	17.05	200.985	18.41	200.657	20.17	200.244	20.23	200.243
23.96	200	24.33	200	24.56	200	24.59	200	24.88	200
26.07	200.001	26.81	200.001	26.89	200.001	27.42	200.001	28.48	200.001
30.58	200.002	32.04	200.002	32.36	200.002	32.54	200.002	32.61	200.002
32.89	200.003	34.51	199.895	34.73	199.893	44.5	199.802	46.83	199.776
54.07	199.447	58.78	199.43	64.92	199.322	69.2	199.246	76.37	199.103
81.58	199.008	81.84	199	87.1	198.433	90.24	198	91.32	197.577
93.35	197	93.64	196.919	94.7	196.457	95.67	196.041	95.77	196
95.88	195.96	97	195.074	98.92	195.074	100.12	195.765	100.4	196
101.1	196.258	101.63	196.43	103.42	197	104.06	197.319	105.45	198
106.48	198.488	107.42	199	110.59	199.341	122.09	199.985	122.25	199.995
122.4	200	122.41	200	122.46	200	122.47	200	122.58	200
123.04	200	129.01	200	130.19	200	140.85	200	144.86	200
145.37	200	145.55	200	145.59	200	148.08	200	150.4	200
151.72	200.029	154.44	200.045	164.08	200.101	179.01	200.467	180.22	200.507
181.74	200.559	183.87	200.633	184.02	200.638	184.28	200.645	187.85	200.734
192.91	200.868	197.74	201	200.12	201.06	203.17	201.141	203.19	201.141
203.79	201.145	209.64	201.071	209.78	201.07	219.82	201.072	226.92	201.085
234.49	201.039	242.9	201.219	248.47	201.125	248.56	201.126	248.94	201.13
253.08	201.56	254.15	201.702	256.45	201.992	256.6	202		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	95.77	.035	100.4	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
95.77	100.4	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	96	198.8	F

100 256.6 198.8 F

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
154.44	183.87	204	209.64	248.47	204

Downstream Deck/Roadway Coordinates

num= 126

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.017		9.94	201		10.9	201	
11.2	200.998		11.24	200.998		11.49	200.997	
11.55	200.996		11.63	200.996		11.72	200.995	
11.81	200.995		12.69	200.991		13.63	200.995	
13.69	200.995		13.79	200.995		13.91	200.995	
14.12	200.995		14.43	200.995		15.32	200.994	
16.77	200.993		17.25	200.993		17.58	200.992	
17.88	200.988		18.13	200.991		18.74	201	
19.67	201		20.75	201		22.23	201	
22.68	201		23	201		25.78	200.523	
29.88	200		30.35	200		30.39	200	
30.42	200		30.46	200		30.91	200	
31.74	200		31.8	200		31.81	200	
32.21	199.978		32.38	199.976		37.76	199.901	
45.3	199.796		45.48	199.793		46.6	199.774	
47.47	199.76		48.2	199.747		48.73	199.737	
52.37	199.712		62.24	199.953		80.06	199.792	
80.14	199.784		82.52	199.86		83.52	199.767	
86.47	199.141		86.75	199.129		86.83	199.126	
86.88	199.126		87.13	199.124		87.38	199.123	
92.32	199.013		93.07	199.015		93.82	199.013	
94.29	199.014		95.15	199.016		97.02	199.018	
99.48	199.024		101.85	199.025		101.94	199.025	
102.27	199.026		102.57	199.026		108.65	199.546	
109.85	199.579		110.34	199.599		111.74	199.692	
113.68	199.827		113.8	199.834		114.21	199.865	
114.64	199.898		115.6	200		115.65	200	
115.87	200		115.88	200		116.22	200	
133.27	200.001		141.62	200.001		151.28	200	
152.5	200		152.57	200		152.67	200	
153.56	200.001		154.38	200		157.21	200.062	
161.12	200.085		198.43	201		198.44	201	
198.44	201		198.46	201		198.85	201.004	
198.89	201.004		199.24	201.005		201.34	201.009	
203.5	201.021		204.2	201.024		204.77	201.027	
206.84	201.024		207.23	201.023		207.31	201.023	
207.75	201.023		208.37	201.022		211.58	201.02	
227.39	201.113		228.72	201.124		234.54	201.088	
245.86	201		245.92	201		245.93	201	
245.97	201		247.18	201		247.71	201	
247.87	201		248.82	201.063		250.46	201.201	
257.76	202		258.46	202.763		258.74	203	

Downstream Bridge Cross Section Data

Station Elevation Data num= 97

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.234	6.98	201.333	9.75	201.336	9.77	201.336	17.8	201.001
17.86	201.001	18.1	201.001	19.36	201.001	20.8	201.001	25.37	201
25.69	201	26.12	201	29.2	201	35.72	200.103	36.41	200
36.94	199.99	50.43	199.898	66.47	200.295	73.43	200.347	83.13	199.309
84.14	199	88.09	198.41	90.41	198	91.93	197.362	92.38	197.153
92.68	197	92.7	196.996	92.92	196.907	94.09	196.435	94.82	196.155
94.98	196.097	95.34	196	95.45	195.993	95.5	195.993	95.57	195.99
95.6	195.99	95.68	195.987	95.95	195.983	96.08	195.977	96.09	195.977
96.4	195.5	97.3	195.055	98.25	195.055	98.61	195.055	99.49	195.4

```
  100.35     196  100.36 196.016  100.39 196.018   100.4 196.019  101.12 196.161
  101.26 196.181   101.4 196.224  101.65 196.305  102.38 196.618   102.6 196.702
  103.35     197  103.53 197.076  104.33   197.5  105.15     198   105.7 198.366
  106.74     199  112.96 199.847  113.59 200.124  114.14     200  115.59     200
  121.06     200  128.26 200.001  134.61 200.001  134.71 200.001  134.82 200.001
  140.07 200.001  142.39 200.001  148.34 200.001  158.18 200.001   158.9 200.001
  160.19     200  160.29     200  163.09 200.057  163.77 200.072  188.65 200.623
  188.78 200.626   191.1 200.678  193.84 200.742  203.22 200.935  204.53 200.978
  204.69  200.98  205.35     201  205.36     201  205.87     201  205.94     201
  205.95     201  210.51 200.999  213.45     201  228.33 201.138  239.76 201.423
  255.77 201.644  259.74     202

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   95.34    .035  100.35     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
         95.34  100.35            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0      96   198.8       F
     100  259.74   198.8       F
Left Levee      Station=   73.43      Elevation=  200.35
Blocked Obstructions     num=       2
   Sta L   Sta R    Elev   Sta L   Sta R    Elev
  112.96  193.84     204  213.45  255.77     204

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         =     199
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     Pipe Arch     2.1    3.23
FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                 5      20     .024     .024        0                   .9
      1
Upstream   Elevation =  195.074
           Centerline Station =  98
Downstream Elevation =  195.055
           Centerline Station =  98

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       3.51    Culv Full Len (m)        20.00
  # Barrels                    1    Culv Vel US (m/s)         0.67
  Q Barrel (m3/s)           3.51    Culv Vel DS (m/s)         0.67
  E.G. US. (m)            199.80    Culv Inv El Up (m)      195.07
  W.S. US. (m)            199.79    Culv Inv El Dn (m)      195.05
  E.G. DS (m)             199.76    Culv Frctn Ls (m)         0.01
  W.S. DS (m)             199.75    Culv Exit Loss (m)        0.01
  Delta EG (m)              0.04    Culv Entr Loss (m)        0.02
  Delta WS (m)              0.04    Q Weir (m3/s)            17.08
  E.G. IC (m)             198.77    Weir Sta Lft (m)         45.02
```

E.G. OC (m)	199.80	Weir Sta Rgt (m)	113.29
Culvert Control	Outlet	Weir Submerg	0.91
Culv WS Inlet (m)	197.17	Weir Max Depth (m)	0.79
Culv WS Outlet (m)	197.16	Weir Avg Depth (m)	0.41
Culv Nml Depth (m)		Weir Flow Area (m2)	17.62
Culv Crt Depth (m)	0.59	Min El Weir Flow (m)	199.02

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	1.98	Culv Full Len (m)	20.00
# Barrels	1	Culv Vel US (m/s)	0.38
Q Barrel (m3/s)	1.98	Culv Vel DS (m/s)	0.38
E.G. US. (m)	201.08	Culv Inv El Up (m)	195.07
W.S. US. (m)	201.05	Culv Inv El Dn (m)	195.05
E.G. DS (m)	201.07	Culv Frctn Ls (m)	0.00
W.S. DS (m)	200.99	Culv Exit Loss (m)	0.00
Delta EG (m)	0.01	Culv Entr Loss (m)	0.01
Delta WS (m)	0.06	Q Weir (m3/s)	118.27
E.G. IC (m)	201.07	Weir Sta Lft (m)	2.73
E.G. OC (m)	201.08	Weir Sta Rgt (m)	209.64
Culvert Control	Outlet	Weir Submerg	0.98
Culv WS Inlet (m)	197.17	Weir Max Depth (m)	2.07
Culv WS Outlet (m)	197.16	Weir Avg Depth (m)	1.03
Culv Nml Depth (m)		Weir Flow Area (m2)	175.13
Culv Crt Depth (m)	0.43	Min El Weir Flow (m)	199.02

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.161

INPUT
Description: Section 46.161 - Private Roadway - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 97

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.234	6.98	201.333	9.75	201.336	9.77	201.336	17.8	201.001
17.86	201.001	18.1	201.001	19.36	201.001	20.8	201.001	25.37	201
25.69	201	26.12	201	29.2	201	35.72	200.103	36.41	200
36.94	199.99	50.43	199.898	66.47	200.295	73.43	200.347	83.13	199.309
84.14	199	88.09	198.41	90.41	198	91.93	197.362	92.38	197.153
92.68	197	92.7	196.996	92.92	196.907	94.09	196.435	94.82	196.155
94.98	196.097	95.34	196	95.45	195.993	95.5	195.993	95.57	195.99
95.6	195.99	95.68	195.987	95.95	195.983	96.08	195.977	96.09	195.977
96.4	195.5	97.3	195.055	98.25	195.055	98.61	195.055	99.49	195.4
100.35	196	100.36	196.016	100.39	196.018	100.4	196.019	101.12	196.161
101.26	196.181	101.4	196.224	101.65	196.305	102.38	196.618	102.6	196.702
103.35	197	103.53	197.076	104.33	197.5	105.15	198	105.7	198.366
106.74	199	112.96	199.847	113.59	200.124	114.14	200	115.59	200
121.06	200	128.26	200.001	134.61	200.001	134.71	200.001	134.82	200.001
140.07	200.001	142.39	200.001	148.34	200.001	158.18	200.001	158.9	200.001

```
  160.19     200  160.29     200  163.09 200.057  163.77 200.072  188.65 200.623
  188.78 200.626   191.1 200.678  193.84 200.742  203.22 200.935  204.53 200.978
  204.69  200.98  205.35     201  205.36     201  205.87     201  205.94     201
  205.95     201  210.51 200.999  213.45     201  228.33 201.138  239.76 201.423
  255.77 201.644  259.74     202

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   95.34    .035  100.35     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         95.34  100.35              115     115     110             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0      96   198.8       F
     100  259.74   198.8       F
Left Levee      Station=   73.43      Elevation=  200.35
Blocked Obstructions     num=       2
   Sta L   Sta R    Elev   Sta L   Sta R    Elev
  112.96  193.84     204  213.45  255.77     204

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           199.76    Element                Left OB    Channel
Right OB
  Vel Head (m)              0.01    Wt. n-Val.              0.050      0.035
0.050
  W.S. Elev (m)           199.75    Reach Len. (m)         115.00     115.00
110.00
  Crit W.S. (m)           196.68    Flow Area (m2)          22.94      21.69
18.04
  E.G. Slope (m/m)      0.000066    Area (m2)               22.94      21.69
18.04
  Q Total (m3/s)            20.59   Flow (m3/s)              4.56      12.33
3.70
  Top Width (m)             33.18   Top Width (m)           16.30       5.01
11.87
  Vel Total (m/s)           0.33    Avg. Vel. (m/s)          0.20       0.57
0.21
  Max Chl Dpth (m)          4.69    Hydr. Depth (m)          1.41       4.33
1.52
  Conv. Total (m3/s)      2543.9    Conv. (m3/s)            563.8     1523.0
457.0
  Length Wtd. (m)         114.24    Wetted Per. (m)         16.84       5.63
12.65
  Min Ch El (m)           195.05    Shear (N/m2)             0.87       2.48
0.92
  Alpha                     1.94    Stream Power (N/m s)     0.17       1.41
0.19
  Frctn Loss (m)            0.01    Cum Volume (1000 m3)    37.44      63.00
32.41
  C & E Loss (m)            0.00    Cum SA (1000 m2)        37.91      22.85
42.37


Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #Regional w red'n
```

E.G. Elev (m)	201.07	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.08	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (m)	200.99	Reach Len. (m)	115.00	115.00
110.00				
Crit W.S. (m)	198.80	Flow Area (m2)	85.42	27.90
35.07				
E.G. Slope (m/m)	0.000494	Area (m2)	85.42	27.90
35.07				
Q Total (m3/s)	122.56	Flow (m3/s)	44.76	51.49
26.31				
Top Width (m)	94.74	Top Width (m)	66.04	5.01
23.68				
Vel Total (m/s)	0.83	Avg. Vel. (m/s)	0.52	1.85
0.75				
Max Chl Dpth (m)	5.93	Hydr. Depth (m)	1.29	5.57
1.48				
Conv. Total (m3/s)	5517.0	Conv. (m3/s)	2014.8	2317.8
1184.4				
Length Wtd. (m)	113.39	Wetted Per. (m)	66.70	5.63
25.86				
Min Ch El (m)	195.05	Shear (N/m2)	6.20	24.00
6.56				
Alpha	2.42	Stream Power (N/m s)	3.25	44.28
4.92				
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	158.21	149.95
189.26				
C & E Loss (m)	0.03	Cum SA (1000 m2)	88.64	22.85
112.97				

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.15

INPUT
Description: Section 46.15 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 127

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.186	1.5	202.211	3.88	202.172	12.6	202	18.62	201.651
19.7	201.593	24.97	201.562	31.47	201.499	34.76	201.41	37.06	201.349
38.71	201.307	40.01	201.275	46.43	201.234	53.66	201.182	63.04	201.024
64.83	201	71.77	201	81.8	201.001	98.39	201	98.42	201
98.43	201	98.62	201	99	201	99.33	201	102.54	201
105.72	201	107.82	201	116.56	201	116.8	201	116.89	201
117.43	201	120.19	201	129	201.384	129.41	201.366	129.47	201.361
130.32	201.338	132.46	201.25	145.66	201.39	149.94	201.365	150.29	201.371
150.32	201.371	150.34	201.37	165.5	201.241	174.71	201.093	174.73	201.093
178.62	201.002	178.71	201	179.11	200.997	180.09	200.997	180.29	200.997
182.91	200.994	183.59	200.992	187.46	200.99	189.73	200.989	193.41	200.986
196.61	200.981	201.38	200.993	202.28	200.998	202.8	201	202.82	201.001
204.7	201.012	204.87	201.012	207.02	201	215.88	200.597	217.98	200.503
229.1	200	239.57	200	240.14	200	240.35	200	240.69	200
241.46	200.001	244.02	200.003	244.52	200.003	247.88	200	252.68	199.697

253.79	199.631	254.22	199.606	254.25	199.604	254.45	199.589	254.57	199.581
254.58	199.58	257.09	199.519	293.77	199	311.44	198.052	312.46	198
313.91	197.526	315.84	197	316.71	196.647	317.76	196	318.28	195.859
320.41	195.022	323.03	195.56	324.63	196	325.3	196.405	326.37	197
327.54	197.629	328.2	198	330.14	198.631	330.95	199	332.88	199.124
334.89	199.177	336.12	199.217	343.97	199.5	348.81	199.629	349.11	199.635
350.43	199.664	351.55	199.685	352.86	199.711	358.34	199.849	358.57	199.852
363.52	199.98	371.23	199.957	379.73	199.99	380.54	199.992	381.05	199.993
381.68	199.994	381.77	199.994	381.97	199.994	381.98	199.994	382.55	199.994
383.23	199.994	383.28	199.994	383.63	199.994	388.93	199.98	393.62	199.989
395.11	199.992	396.07	199.992						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	293.77	.08	317.76	.035	324.63	.08	330.95	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
317.76	324.63	50	50	.1	.3

Left Levee Station= 145.66 Elevation= 201.39

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
38.64	61.59	204	257.09	293.77	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.75	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.061
W.S. Elev (m)	199.74	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	196.48	Flow Area (m2)	37.70	29.14	20.59
E.G. Slope (m/m)	0.000044	Area (m2)	37.70	29.14	20.59
Q Total (m3/s)	20.59	Flow (m3/s)	3.98	14.03	2.58
Top Width (m)	65.42	Top Width (m)	29.11	6.87	29.44
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.11	0.48	0.13
Max Chl Dpth (m)	4.72	Hydr. Depth (m)	1.30	4.24	0.70
Conv. Total (m3/s)	3113.9	Conv. (m3/s)	602.0	2122.3	389.5
Length Wtd. (m)	50.00	Wetted Per. (m)	30.50	7.16	30.16
Min Ch El (m)	195.02	Shear (N/m2)	0.53	1.74	0.29
Alpha	2.92	Stream Power (N/m s)	0.06	0.84	0.04
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	33.96	60.08	30.28
C & E Loss (m)	0.00	Cum SA (1000 m2)	35.30	22.16	40.10

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.01	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.071	0.035	0.032
W.S. Elev (m)	200.99	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	198.74	Flow Area (m2)	107.71	37.69	100.58
E.G. Slope (m/m)	0.000161	Area (m2)	107.71	37.69	100.58
Q Total (m3/s)	122.56	Flow (m3/s)	28.62	41.35	52.59
Top Width (m)	156.70	Top Width (m)	78.39	6.87	71.44
Vel Total (m/s)	0.50	Avg. Vel. (m/s)	0.27	1.10	0.52
Max Chl Dpth (m)	5.96	Hydr. Depth (m)	1.37	5.49	1.41
Conv. Total (m3/s)	9655.4	Conv. (m3/s)	2254.7	3257.8	4142.8
Length Wtd. (m)	50.00	Wetted Per. (m)	82.30	7.16	73.15
Min Ch El (m)	195.02	Shear (N/m2)	2.07	8.32	2.17
Alpha	2.18	Stream Power (N/m s)	0.55	9.12	1.14
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	147.10	146.18	181.80
C & E Loss (m)	0.01	Cum SA (1000 m2)	80.33	22.16	107.73

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.142

INPUT
Description: Section 46.142 - Private Roadway - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 54

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.236	12.59	201	21	200.671	22.43	200.623	37.81	200
39.38	200	40.23	200	42.31	200.027	44.55	200.047	44.93	200.051
45.27	200.048	49.43	200	56.95	199.696	56.96	199.695	56.98	199.695
85.47	199.453	94.46	199	96.11	198.897	108.79	198	110.82	197.095
111.08	197	111.27	196.916	113.02	196	115.02	195.28	116.06	195
116.72	194.83	117.13	194.83	117.19	194.83	117.27	194.83	118.2	195
120.05	195.7	120.42	195.827	121	196	123.66	196.903	123.94	197

```
  124.59 197.177  124.93 197.245  126.67     198  128.21 198.693  128.78     199
  131.04 199.231  132.73   199.5  140.22 199.865  142.99     200  146.99 200.195
  153.53   200.5  153.55   200.5  156.96 200.577  157.48 200.588  173.76 200.995
  173.97     201  179.85 201.266  181.95 201.351  185.83   201.5

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   94.46     .08  113.02    .035     121     .08  142.99    .025

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        113.02     121               60      60      60             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0  115.11   199.5       F
  119.14  185.83   199.5       F
Left Levee      Station=   44.93      Elevation= 200.051
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
   56.98   96.11     204
```

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.75	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	199.74	Reach Len. (m)	60.00	60.00	60.00
Crit W.S. (m)	196.40	Flow Area (m2)	27.82	35.17	21.08
E.G. Slope (m/m)	0.000037	Area (m2)	27.82	35.17	21.08
Q Total (m3/s)	20.59	Flow (m3/s)	2.80	15.95	1.83
Top Width (m)	42.64	Top Width (m)	18.02	7.98	16.65
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.10	0.45	0.09
Max Chl Dpth (m)	4.91	Hydr. Depth (m)	1.54	4.41	1.27
Conv. Total (m3/s)	3380.5	Conv. (m3/s)	460.2	2619.3	301.0
Length Wtd. (m)	60.00	Wetted Per. (m)	19.39	8.35	17.26
Min Ch El (m)	194.83	Shear (N/m2)	0.52	1.53	0.44
Alpha	2.69	Stream Power (N/m s)	0.05	0.69	0.04
Frctn Loss (m)		Cum Volume (1000 m3)	32.32	58.47	29.24
C & E Loss (m)		Cum SA (1000 m2)	34.12	21.79	38.95

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.00	Element	Left OB	Channel	

Right OB					
Vel Head (m)	0.08	Wt. n-Val.	0.071	0.035	0.069
W.S. Elev (m)	200.91	Reach Len. (m)	60.00	60.00	60.00
Crit W.S. (m)	199.50	Flow Area (m2)	76.41	44.53	56.71
E.G. Slope (m/m)	0.000350	Area (m2)	76.41	44.53	56.71
Q Total (m3/s)	122.56	Flow (m3/s)	28.44	72.59	21.53
Top Width (m)	116.53	Top Width (m)	59.07	7.98	49.48
Vel Total (m/s)	0.69	Avg. Vel. (m/s)	0.37	1.63	0.38
Max Chl Dpth (m)	6.08	Hydr. Depth (m)	1.29	5.58	1.15
Conv. Total (m3/s)	6554.2	Conv. (m3/s)	1521.0	3881.9	1151.2
Length Wtd. (m)	60.00	Wetted Per. (m)	62.81	8.35	50.12
Min Ch El (m)	194.83	Shear (N/m2)	4.17	18.28	3.88
Alpha	3.43	Stream Power (N/m s)	1.55	29.80	1.47
Frctn Loss (m)		Cum Volume (1000 m3)	142.50	144.12	177.87
C & E Loss (m)		Cum SA (1000 m2)	76.89	21.79	104.71

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1415

INPUT
Description: Hum 13-JJ. Private Driveway Culvert - 3.23 m W x 2.1 m H x 52 m L Corrugated Metal Pipe Arch Culvert. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004
by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 52
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 76

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.501		9.03	201.276		10.69	201.235	
11.93	201.205		15.26	201.124		15.65	201.116	
17.33	201.085		18.3	201.067		21.82	201	
22.59	200.991		22.61	200.991		24.72	200.975	
26.52	200.961		27.55	200.966		33.24	200.845	
34.76	200.824		37.08	200.776		39.72	200.726	
44.95	200.557		45.1	200.554		54.53	200.18	
61.95	200		72.68	199.814		72.97	199.813	

73.26	199.813	73.34	199.813	76.99	199.789
82.12	199.738	84.44	199.737	86.82	199.742
87.45	199.733	88.14	199.722	88.29	199.72
94.48	199.736	95.23	199.732	95.99	199.728
96.52	199.728	97.04	199.728	97.15	199.728
97.87	199.727	98.58	199.727	100.35	199.739
106	199.685	107.51	199.675	109.42	199.671
109.55	199.67	110.18	199.672	116.42	199.732
116.58	199.736	116.81	199.741	117.04	199.746
117.21	199.75	120.07	199.82	125.43	199.969
126.11	199.987	126.2	199.988	126.71	200
126.77	200.001	127.26	200.002	127.65	200.002
133.77	200.118	138.89	200.206	139.11	200.209
140.01	200.216	140.99	200.224	148.28	200.355
148.4	200.357	153.83	200.495	154.42	200.496
154.61	200.497	155.83	200.5	162.15	200.643
176.54	201	177.09	201.017	191.23	201.5
191.27	201.5				

Upstream Bridge Cross Section Data
Station Elevation Data num= 54

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.236	12.59	201	21	200.671	22.43	200.623	37.81	200
39.38	200	40.23	200	42.31	200.027	44.55	200.047	44.93	200.051
45.27	200.048	49.43	200	56.95	199.696	56.96	199.695	56.98	199.695
85.47	199.453	94.46	199	96.11	198.897	108.79	198	110.82	197.095
111.08	197	111.27	196.916	113.02	196	115.02	195.28	116.06	195
116.72	194.83	117.13	194.83	117.19	194.83	117.27	194.83	118.2	195
120.05	195.7	120.42	195.827	121	196	123.66	196.903	123.94	197
124.59	197.177	124.93	197.245	126.67	198	128.21	198.693	128.78	199
131.04	199.231	132.73	199.5	140.22	199.865	142.99	200	146.99	200.195
153.53	200.5	153.55	200.5	156.96	200.577	157.48	200.588	173.76	200.995
173.97	201	179.85	201.266	181.95	201.351	185.83	201.5		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	94.46	.08	113.02	.035	121	.08	142.99	.025

Bank Sta: Left	Right	Coeff Contr.	Expan.
113.02	121	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	115.11	199.5	F
119.14	185.83	199.5	F

Left Levee Station= 44.93 Elevation= 200.051
Blocked Obstructions num= 1

Sta L	Sta R	Elev
56.98	96.11	204

Downstream Deck/Roadway Coordinates
num= 76

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.501		9.03	201.276		10.69	201.235	
11.93	201.205		15.26	201.124		15.65	201.116	
17.33	201.085		18.3	201.067		21.82	201	
22.59	200.991		22.61	200.991		24.72	200.975	
26.52	200.961		27.55	200.966		33.24	200.845	
34.76	200.824		37.08	200.776		39.72	200.726	
44.95	200.557		45.1	200.554		54.53	200.18	
61.95	200		72.68	199.814		72.97	199.813	
73.26	199.813		73.34	199.813		76.99	199.789	
82.12	199.738		84.44	199.737		86.82	199.742	
87.45	199.733		88.14	199.722		88.29	199.72	

94.48	199.736	95.23	199.732	95.99	199.728
96.52	199.728	97.04	199.728	97.15	199.728
97.87	199.727	98.58	199.727	100.35	199.739
106	199.685	107.51	199.675	109.42	199.671
109.55	199.67	110.18	199.672	116.42	199.732
116.58	199.736	116.81	199.741	117.04	199.746
117.21	199.75	120.07	199.82	125.43	199.969
126.11	199.987	126.2	199.988	126.71	200
126.77	200.001	127.26	200.002	127.65	200.002
133.77	200.118	138.89	200.206	139.11	200.209
140.01	200.216	140.99	200.224	148.28	200.355
148.4	200.357	153.83	200.495	154.42	200.496
154.61	200.497	155.83	200.5	162.15	200.643
176.54	201	177.09	201.017	191.23	201.5
191.27	201.5				

Downstream Bridge Cross Section Data
Station Elevation Data num= 102

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.964	2.43	201.92	2.94	201.91	3.53	201.894	4.38	201.869
5.84	201.802	10.38	201.593	13.97	201.399	14.53	201.37	16.68	201.262
16.97	201.25	18.86	201.161	21.88	201.012	22.13	201.011	23.05	201.004
26.53	201	27.47	200.995	28.29	200.997	28.76	200.997	28.82	200.997
29.15	200.996	33.62	200.993	33.7	200.993	37.58	200.533	37.75	200.516
37.79	200.514	38.56	200.515	42.31	200.545	48.93	200.615	49.07	200.618
50.33	200.646	50.39	200.649	61.33	200.328	70.12	200.012	72.92	200.006
73.26	200.005	73.27	200.005	73.46	200.005	73.47	200.004	78.8	200.01
78.81	200.01	80.68	200	84.14	199.945	85.98	199.929	88.28	199.936
92.02	199.995	93.24	199.991	94.47	199.996	95.37	200	97.6	200.002
98.34	200.002	99.45	200.003	100.7	200.002	101.57	200.001	102.44	200
103.62	199.631	105.8	199	106.7	198.73	108.53	198.229	108.84	198.134
109.24	198	109.55	197.899	109.76	197.822	111.11	197	111.52	196.37
111.75	196	111.95	195.708	112.46	195	117.89	194.823	120.59	194.823
122.27	194.884	125.1	195	126.97	195.253	128.35	195.435	132.42	195.983
132.63	195.986	132.82	196	134.16	196.531	134.6	196.682	135.45	197
135.58	197.071	137.13	198	137.6	198.204	137.71	198.254	139.23	199
140.32	199.45	141.61	200	146.06	200.194	161.96	200.967	165.01	200.972
168.03	200.99	169.39	200.999	169.49	201	169.5	201.001	169.55	201.001
170.18	201.005	170.26	201.005	170.49	201.006	172.16	201.006	179.97	201.133
180.44	201.14	194	201.345						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	105.8	.08	112.46	.035	125.1	.08	139.23	.025

Bank Sta: Left Right Coeff Contr. Expan.
112.46 125.1 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116.68	197	F
120.7	194	197	F

Left Levee Station= 50.33 Elevation= 200.65

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 Pipe Arch 2.1 3.23
FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	5	52	.024	.024	0	.9	1

Upstream Elevation = 194.88
Centerline Station = 117.13
Downstream Elevation = 194.82
Centerline Station = 118.7

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	20.31	Culv Full Len (m)	52.00
# Barrels	1	Culv Vel US (m/s)	3.87
Q Barrel (m3/s)	20.31	Culv Vel DS (m/s)	3.87
E.G. US. (m)	199.75	Culv Inv El Up (m)	194.88
W.S. US. (m)	199.74	Culv Inv El Dn (m)	194.82
E.G. DS (m)	197.45	Culv Frctn Ls (m)	0.87
W.S. DS (m)	197.43	Culv Exit Loss (m)	0.75
Delta EG (m)	2.30	Culv Entr Loss (m)	0.69
Delta WS (m)	2.31	Q Weir (m3/s)	0.28
E.G. IC (m)	198.58	Weir Sta Lft (m)	96.11
E.G. OC (m)	199.75	Weir Sta Rgt (m)	117.14
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	196.98	Weir Max Depth (m)	0.08
Culv WS Outlet (m)	196.92	Weir Avg Depth (m)	0.04
Culv Nml Depth (m)		Weir Flow Area (m2)	0.88
Culv Crt Depth (m)	1.65	Min El Weir Flow (m)	199.67

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	19.10	Culv Full Len (m)	52.00
# Barrels	1	Culv Vel US (m/s)	3.64
Q Barrel (m3/s)	19.10	Culv Vel DS (m/s)	3.64
E.G. US. (m)	200.99	Culv Inv El Up (m)	194.88
W.S. US. (m)	200.91	Culv Inv El Dn (m)	194.82
E.G. DS (m)	199.10	Culv Frctn Ls (m)	0.77
W.S. DS (m)	198.95	Culv Exit Loss (m)	0.52
Delta EG (m)	1.89	Culv Entr Loss (m)	0.61
Delta WS (m)	1.97	Q Weir (m3/s)	103.46
E.G. IC (m)	200.94	Weir Sta Lft (m)	22.23
E.G. OC (m)	200.99	Weir Sta Rgt (m)	173.77
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	196.98	Weir Max Depth (m)	1.33
Culv WS Outlet (m)	196.92	Weir Avg Depth (m)	0.67
Culv Nml Depth (m)		Weir Flow Area (m2)	75.53
Culv Crt Depth (m)	1.57	Min El Weir Flow (m)	199.67

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.141

INPUT
Description: Section 46.141 - Private Roadway - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 102

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.964	2.43	201.92	2.94	201.91	3.53	201.894	4.38	201.869
5.84	201.802	10.38	201.593	13.97	201.399	14.53	201.37	16.68	201.262
16.97	201.25	18.86	201.161	21.88	201.012	22.13	201.011	23.05	201.004
26.53	201	27.47	200.995	28.29	200.997	28.76	200.997	28.82	200.997
29.15	200.996	33.62	200.993	33.7	200.993	37.58	200.533	37.75	200.516
37.79	200.514	38.56	200.515	42.31	200.545	48.93	200.615	49.07	200.618
50.33	200.646	50.39	200.649	61.33	200.328	70.12	200.012	72.92	200.006
73.26	200.005	73.27	200.005	73.46	200.005	73.47	200.004	78.8	200.01
78.81	200.01	80.68	200	84.14	199.945	85.98	199.929	88.28	199.936
92.02	199.995	93.24	199.991	94.47	199.996	95.37	200	97.6	200.002
98.34	200.002	99.45	200.003	100.7	200.002	101.57	200.001	102.44	200
103.62	199.631	105.8	199	106.7	198.73	108.53	198.229	108.84	198.134
109.24	198	109.55	197.899	109.76	197.822	111.11	197	111.52	196.37
111.75	196	111.95	195.708	112.46	195	117.89	194.823	120.59	194.823
122.27	194.884	125.1	195	126.97	195.253	128.35	195.435	132.42	195.983
132.63	195.986	132.82	196	134.16	196.531	134.6	196.682	135.45	197
135.58	197.071	137.13	198	137.6	198.204	137.71	198.254	139.23	199
140.32	199.45	141.61	200	146.06	200.194	161.96	200.967	165.01	200.972
168.03	200.99	169.39	200.999	169.49	201	169.5	201.001	169.55	201.001
170.18	201.005	170.26	201.005	170.49	201.006	172.16	201.006	179.97	201.133
180.44	201.14	194	201.345						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	105.8	.08	112.46	.035	125.1	.08	139.23	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
112.46	125.1	30	25	20	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116.68	197	F
120.7	194	197	F

Left Levee Station= 50.33 Elevation= 200.65

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	197.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	197.43	Reach Len. (m)	30.00	25.00	20.00
Crit W.S. (m)	196.22	Flow Area (m2)	2.13	32.14	17.40
E.G. Slope (m/m)	0.000104	Area (m2)	2.13	32.14	17.40
Q Total (m3/s)	20.59	Flow (m3/s)	0.20	17.45	2.93
Top Width (m)	25.79	Top Width (m)	2.06	12.64	11.09
Vel Total (m/s)	0.40	Avg. Vel. (m/s)	0.10	0.54	0.17
Max Chl Dpth (m)	2.61	Hydr. Depth (m)	1.03	2.54	1.57
Conv. Total (m3/s)	2017.4	Conv. (m3/s)	20.0	1710.0	287.3

Length Wtd. (m)	24.73	Wetted Per. (m)	3.25	12.65	11.46
Min Ch El (m)	194.82	Shear (N/m2)	0.67	2.60	1.55
Alpha	1.60	Stream Power (N/m s)	0.06	1.41	0.26
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	32.32	57.70	29.24
C & E Loss (m)	0.00	Cum SA (1000 m2)	33.52	21.17	38.11

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 OUTPUT Profile #Regional w red'n

			Left OB	Channel	Right OB
E.G. Elev (m)	199.10	Element			
Vel Head (m)	0.15	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	198.95	Reach Len. (m)	30.00	25.00	20.00
Crit W.S. (m)	197.00	Flow Area (m2)	8.15	51.27	36.30
E.G. Slope (m/m)	0.000693	Area (m2)	8.15	51.27	36.30
Q Total (m3/s)	122.56	Flow (m3/s)	2.73	98.06	21.77
Top Width (m)	33.15	Top Width (m)	6.49	12.64	14.02
Vel Total (m/s)	1.28	Avg. Vel. (m/s)	0.33	1.91	0.60
Max Chl Dpth (m)	4.12	Hydr. Depth (m)	1.26	4.06	2.59
Conv. Total (m3/s)	4654.5	Conv. (m3/s)	103.7	3724.1	826.7
Length Wtd. (m)	24.71	Wetted Per. (m)	7.94	12.65	14.76
Min Ch El (m)	194.82	Shear (N/m2)	6.98	27.57	16.72
Alpha	1.83	Stream Power (N/m s)	2.34	52.73	10.03
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	142.50	138.63	177.87
C & E Loss (m)	0.03	Cum SA (1000 m2)	74.93	21.17	102.81

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.14

INPUT
Description: Section 46.14 - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 77

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.098	2.06	202	3.77	201.783	3.8	201.785	6.14	201.803
8.42	201.79	12.49	201.689	12.69	201.684	17.83	201.529	20.79	201.459
33.23	201.049	35.11	201.034	39.84	201.001	39.85	201.001	39.89	201.001
39.92	201.001	39.96	201.001	40.1	201	53.76	200.745	58.1	200.647
58.57	200.638	64.09	200.501	64.12	200.501	64.22	200.5	71.26	200.142
74.41	200	75.87	199.864	77.75	199.81	88.67	199.239	90.92	199.19
94.02	199.106	98.67	199.004	98.73	199.004	98.82	199.004	98.97	199.004
104.41	199	106.38	198.532	109.25	198	111.6	197.01	111.62	197
111.64	196.992	113.27	196.326	114.07	196	114.61	195.85	116.18	195.444
117.28	195	120.38	194.954	124.47	194.898	126.14	194.877	129.68	194.823
133.94	194.919	135.82	194.961	137.74	195	138.12	195.172	139.11	196
139.82	196.864	139.93	197	140.61	197.763	140.81	197.95	140.88	198
141	198.098	142.31	199	145.61	199.973	145.72	200	159.64	200.564
168.75	200.894	180.93	200.961	188.25	200.988	188.75	200.981	190	200.965
190.01	200.965	192.12	200.994	192.14	200.994	192.16	200.994	192.55	201
208.35	201.2341	216.71	201.358						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	104.41	.08	117.28	.035	137.74	.08	142.31	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
117.28	137.74	37.5	37.5	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
145.61	208.35	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	197.44	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	197.44	Reach Len. (m)	37.50	37.50	37.50
Crit W.S. (m)		Flow Area (m2)	8.58	51.63	3.58
E.G. Slope (m/m)	0.000050	Area (m2)	8.58	51.63	3.58
Q Total (m3/s)	20.59	Flow (m3/s)	0.86	19.41	0.32
Top Width (m)	29.73	Top Width (m)	6.69	20.46	2.58
Vel Total (m/s)	0.32	Avg. Vel. (m/s)	0.10	0.38	0.09
Max Chl Dpth (m)	2.61	Hydr. Depth (m)	1.28	2.52	1.39
Conv. Total (m3/s)	2899.4	Conv. (m3/s)	121.2	2733.6	44.6
Length Wtd. (m)	37.50	Wetted Per. (m)	7.13	20.46	3.58
Min Ch El (m)	194.82	Shear (N/m2)	0.59	1.25	0.49
Alpha	1.28	Stream Power (N/m s)	0.06	0.47	0.04
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	32.16	56.66	29.03
C & E Loss (m)	0.05	Cum SA (1000 m2)	33.39	20.76	37.98

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	199.06	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	198.97	Reach Len. (m)	37.50	37.50	37.50
Crit W.S. (m)		Flow Area (m2)	22.93	83.00	8.88
E.G. Slope (m/m)	0.000346	Area (m2)	22.93	83.00	8.88
Q Total (m3/s)	122.56	Flow (m3/s)	7.63	112.26	2.66
Top Width (m)	37.73	Top Width (m)	12.74	20.46	4.53
Vel Total (m/s)	1.07	Avg. Vel. (m/s)	0.33	1.35	0.30
Max Chl Dpth (m)	4.15	Hydr. Depth (m)	1.80	4.06	1.96
Conv. Total (m3/s)	6585.2	Conv. (m3/s)	410.2	6031.9	143.1
Length Wtd. (m)	37.50	Wetted Per. (m)	13.40	20.46	6.07
Min Ch El (m)	194.82	Shear (N/m2)	5.81	13.78	4.97
Alpha	1.48	Stream Power (N/m s)	1.94	18.64	1.49
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	142.03	136.95	177.42
C & E Loss (m)	0.05	Cum SA (1000 m2)	74.64	20.76	102.62

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: RIVER-1
REACH: Reach-1 RS: 46.132

INPUT
Description: Section 46.132 - Private Driveway - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 158

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

0	203.031	4.21	203	6.29	202.04	6.39	202	6.47	201.973
9.02	201	11.19	200.218	11.79	200	11.95	199.995	12.11	199.991
13.73	199.942	14.44	199.957	15.58	200	22.02	200.459	23.3	200.5
23.73	200.501	23.84	200.501	23.88	200.501	24.1	200.505	27.21	200.56
39.78	200.546	43.86	200.559	45.36	200.616	45.59	200.618	46.09	200.615
60.3	200.512	60.52	200.5	67.58	200.314	71.78	200.282	75.54	200.281
75.73	200.287	78.77	200	79.96	199.843	80.54	199.765	86.79	199
91.14	198.248	92.76	198	92.82	197.999	92.88	197.999	93.81	197.998
94.59	197.998	95.38	197.998	96.45	197.998	97.49	197.997	103.13	197.995
104.78	197.997	105.78	197.996	106.85	197.997	107.61	198	112.33	198.851
112.89	199	113.63	199	115.71	199.001	116.33	199.001	118.64	199
119.62	198.642	121.42	198	123.03	197.538	125.2	197.319	125.59	197.265
126.04	197.198	126.29	197.179	126.45	197.149	126.85	197.083	127.29	197.085
127.33	197.08	127.37	197.076	127.89	197.013	129.85	197.011	129.95	197.01
130.35	197.01	132.11	197.014	132.3	197.012	133.91	197.011	134.07	197.009
134.24	197.009	134.44	197.009	134.47	197.009	135.58	197.018	136.75	197.007
136.96	197.005	136.98	197.005	137.16	197.005	137.18	197.005	138.6	197.011
138.83	197.009	139.36	197.005	139.64	197.003	139.73	197	140.03	196.913
140.21	196.887	140.28	196.867	140.33	196.854	140.58	196.76	141.61	196.467
141.72	196.455	143.1	196	143.4	195.948	145.84	195	146.14	194.87
146.23	194.823	146.44	194.865	147.11	195	147.76	195.231	149.57	196
150.75	196.979	150.78	197	150.81	197.022	151.68	198	152.7	198.573
153.48	199	153.61	199.01	158.04	199.446	163.24	199.854	164.21	199.935
164.49	199.957	164.51	199.958	165.41	199.996	165.46	199.999	165.53	200
165.55	200.004	165.69	200.013	165.92	200.013	166.1	200.023	167.24	200.039
167.72	200.033	168.11	200.078	168.16	200.077	168.21	200.076	168.33	200.077
170.66	200.113	172.93	200.103	175.92	200.024	175.95	200.023	177.95	200.045
177.96	200.044	177.97	200.043	177.97	200.042	188.98	200.112	192.6	200.049
195.25	200	195.28	200	196.41	200	197.16	200	197.45	200
197.5	200	200.28	200	201.07	200	201.93	200	202.05	200
213.45	200.076	216.09	200.093	218.17	200.105	219.59	200.114	220.81	200.121
221.65	200.128	222.07	200.132	227.76	200.187				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	139.73	.08	145.84	.035	147.11	.08	151.68	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
145.84	147.11	27.5	27.5	.3	.5

Left Levee Station= 118.64 Elevation= 199

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	197.38	Element	Left OB	Channel	Right OB
Vel Head (m)	0.54	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	196.84	Reach Len. (m)	27.50	27.50	27.50
Crit W.S. (m)	196.84	Flow Area (m2)	4.72	2.45	3.76
E.G. Slope (m/m)	0.010373	Area (m2)	4.72	2.45	3.76
Q Total (m3/s)	20.59	Flow (m3/s)	5.25	10.72	4.62
Top Width (m)	10.22	Top Width (m)	5.47	1.27	3.47
Vel Total (m/s)	1.88	Avg. Vel. (m/s)	1.11	4.38	1.23
Max Chl Dpth (m)	2.02	Hydr. Depth (m)	0.86	1.93	1.08
Conv. Total (m3/s)	202.2	Conv. (m3/s)	51.6	105.2	

45.4					
Length Wtd. (m)	27.50	Wetted Per. (m)	5.78	1.33	3.97
Min Ch El (m)	194.82	Shear (N/m2)	83.04	187.78	96.36
Alpha	3.00	Stream Power (N/m s)	92.33	822.29	118.32
Frctn Loss (m)	0.06	Cum Volume (1000 m3)	31.91	55.64	28.89
C & E Loss (m)	0.24	Cum SA (1000 m2)	33.16	20.35	37.86

Warning: The energy equation could not be 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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.97	Element	Left OB	Channel	Right OB
Vel Head (m)	0.61	Wt. n-Val.	0.061	0.035	0.080
W.S. Elev (m)	198.35	Reach Len. (m)	27.50	27.50	27.50
Crit W.S. (m)	198.35	Flow Area (m2)	36.11	4.37	10.17
E.G. Slope (m/m)	0.009790	Area (m2)	36.11	4.37	10.17
Q Total (m3/s)	122.56	Flow (m3/s)	76.73	27.32	18.52
Top Width (m)	31.87	Top Width (m)	25.40	1.27	5.19
Vel Total (m/s)	2.42	Avg. Vel. (m/s)	2.12	6.26	1.82
Max Chl Dpth (m)	3.53	Hydr. Depth (m)	1.42	3.44	1.96
Conv. Total (m3/s)	1238.7	Conv. (m3/s)	775.5	276.1	187.1
Length Wtd. (m)	27.50	Wetted Per. (m)	25.90	1.33	6.29
Min Ch El (m)	194.82	Shear (N/m2)	133.89	316.13	155.28
Alpha	2.06	Stream Power (N/m s)	284.46	1978.05	282.66

Frctn Loss (m)	0.07	Cum Volume (1000 m3)	140.93	135.31 177.06
C & E Loss (m)	0.25	Cum SA (1000 m2)	73.92	20.35 102.44

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 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: RIVER-1
REACH: Reach-1 RS: 46.13

INPUT
Description: Section 46.13 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 127

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203.03	.53	203	.96	202.775	2.6	202	4.3	201.009
4.31	201	4.46	200.95	7.15	200	9.26	199.922	13.37	199.838
14.21	199.82	16.49	199.886	21.16	199.987	21.18	200	21.39	200.001
21.4	200.001	21.83	200.002	29.6	200.151	34.56	200.228	35.93	200.238
37.21	200.246	37.34	200.247	39.62	200.26	42.15	200.288	44.35	200.296
46.4	200.303	51.59	200.321	52.9	200.324	54.35	200.328	55.76	200.33
57.13	200.323	58.65	200.312	59.48	200.303	60.41	200.293	60.51	200.291
60.64	200.291	60.78	200.29	60.92	200.29	61.05	200.289	62.88	200.27
65.13	200.241	68.92	200.17	71.75	200.101	75.66	200	75.68	200
76.81	199.771	77.55	199.623	80.95	199	83.24	198.448	85.09	198
86.6	197.995	87.61	197.991	98.22	197.954	101.88	197.965	111.06	198
112.99	198.592	115.45	198.783	118.53	198.292	118.71	198.22	118.81	198.215
119.38	198	122.2	197.044	122.33	197	122.49	196.957	126.05	196
126.98	195.7	127.15	195.657	128.79	195.261	129.74	195.021	129.84	195.018
129.93	195.011	129.96	195.01	130.02	195	131.97	194.859	144.15	194
145.77	193.62	148.15	193	148.36	192.929	148.69	192.82	149.6	192.963
149.87	193	150.14	193.206	150.99	194	151.39	194.702	151.52	195
151.69	195.371	152.08	196	152.24	196.027	152.47	196.039	152.56	196.043
152.62	196.045	152.67	196.044	152.68	196.044	152.79	196.042	152.82	196.041
152.98	196.035	154.35	196.467	155.01	196.685	155.45	196.85	155.58	196.893
155.62	196.908	155.76	196.973	155.82	197	155.89	197.042	157.56	198
161.85	198.688	163.59	199	164.11	199.021	168.85	199.177	171.26	199.182
173.88	199.243	176.15	199.295	177.78	199.33	179.26	199.361	183.65	199.389
188.79	199.423	194.86	199.511	194.9	199.511	201.21	199.575	206.07	199.623
222.21	200	223.15	200.01	223.53	200.01	223.62	200.01	223.66	200.01
224.17	200.01	236.77	200.272						

```
Manning's n Values         num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05  119.38     .08  148.15    .035  149.87     .08  157.56     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        148.15  149.87               25      25      25             .1       .3
Left Levee      Station=  115.45      Elevation= 198.783
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
     171     229     204

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           195.74    Element                Left OB    Channel
Right OB
  Vel Head (m)              0.06    Wt. n-Val.              0.080      0.035
0.080
  W.S. Elev (m)           195.67    Reach Len. (m)          25.00      25.00
25.00
  Crit W.S. (m)           194.77    Flow Area (m2)          26.30       4.75
3.20
  E.G. Slope (m/m)      0.000918    Area (m2)               26.30       4.75
3.20
  Q Total (m3/s)            20.59   Flow (m3/s)             11.46       7.97
1.17
  Top Width (m)             24.79   Top Width (m)           21.07       1.72
2.01
  Vel Total (m/s)           0.60    Avg. Vel. (m/s)          0.44       1.68
0.36
  Max Chl Dpth (m)          2.85    Hydr. Depth (m)          1.25       2.76
1.59
  Conv. Total (m3/s)       679.6    Conv. (m3/s)            378.2      262.9
38.5
  Length Wtd. (m)           25.00   Wetted Per. (m)         21.31       1.76
3.40
  Min Ch El (m)           192.82    Shear (N/m2)            11.11      24.26
8.48
  Alpha                     3.32    Stream Power (N/m s)     4.84      40.67
3.08
  Frctn Loss (m)            0.03    Cum Volume (1000 m3)    31.48      55.54
28.80
  C & E Loss (m)            0.01    Cum SA (1000 m2)        32.80      20.31
37.79



Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #Regional w red'n


  E.G. Elev (m)           198.50    Element                Left OB    Channel
Right OB
  Vel Head (m)              0.12    Wt. n-Val.              0.080      0.035
0.080
  W.S. Elev (m)           198.38    Reach Len. (m)          25.00      25.00
25.00
  Crit W.S. (m)           196.37    Flow Area (m2)          95.68       9.40
18.58
  E.G. Slope (m/m)      0.001047    Area (m2)               95.68       9.40
```

18.58					
Q Total (m3/s)	122.56	Flow (m3/s)	84.80	26.54	
11.23					
Top Width (m)	41.93	Top Width (m)	30.16	1.72	
10.05					
Vel Total (m/s)	0.99	Avg. Vel. (m/s)	0.89	2.82	
0.60					
Max Chl Dpth (m)	5.56	Hydr. Depth (m)	3.17	5.47	
1.85					
Conv. Total (m3/s)	3787.8	Conv. (m3/s)	2620.7	820.1	
347.0					
Length Wtd. (m)	25.00	Wetted Per. (m)	30.81	1.76	
12.08					
Min Ch El (m)	192.82	Shear (N/m2)	31.89	54.76	
15.79					
Alpha	2.34	Stream Power (N/m s)	28.26	154.56	
9.54					
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	139.11	135.12	
176.67					
C & E Loss (m)	0.00	Cum SA (1000 m2)	73.16	20.31	
102.23					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.122

INPUT
Description: Section 46.122 - Peelar Road - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 153

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203.853	.23	203.855	.93	203.865	1.01	203.866	2.78	203.939
3.03	203.939	3.37	203.951	3.73	203.964	5.01	203.946	5.31	203.936
5.61	203.945	6.98	204	8.21	203.442	9.46	203	9.88	202.784
11.44	202	13.15	201.154	13.44	201	14.01	200.722	15.52	200
17.01	199.481	18.02	199	20.35	198.365	21.48	198.229	22.2	198.229
22.48	198.242	22.55	198.253	23.36	198.361	25.19	198.587	26.16	198.662
26.31	198.67	26.95	198.656	27.03	198.655	28	198.645	29.49	198.666
32.66	198.758	32.85	198.766	33.38	198.788	36.68	199	43.6	199.165
43.64	199.166	44.06	199.173	44.1	199.174	45.22	199.23	45.29	199.233
49.48	199.327	54.88	199.38	58.89	199.448	59.82	199.441	62.67	199.521
66.36	199.453	67.01	199.441	68.92	199.378	69.47	199.357	72.61	199.214
73.37	199.196	73.56	199.181	74.94	199	75.77	198.822	76.04	198.77
77.37	198.575	78.16	198.426	78.34	198.376	78.46	198.351	79.57	198
79.94	197.998	80.59	197.996	83.89	197.984	85.16	197.985	85.23	197.984
85.29	197.984	86.24	197.981	86.6	197.98	86.93	197.981	86.99	197.981
92.12	197.978	92.67	197.975	93.8	197.973	96.51	197.968	109.87	197.327
112.55	197.295	123.04	197.978	123.43	197.979	124.91	197.982	126.71	197.996
126.79	197.996	127.47	198	130.8	198	132.4	198	133.05	198
133.1	198	133.26	198	134.36	198	135.44	198	135.67	198
136.01	198	136.06	198	136.92	198	136.94	198	138.2	197.725
141.43	197	143.11	196.356	143.45	196.246	143.63	196.196	144.35	196
145.45	195.701	148.42	195	151.6	194.377	153.04	194	154.48	193.345
154.54	193.311	155.34	193	155.73	192.919	157.65	192.63	159.49	192.987
159.52	193	159.55	193.013	161.56	194	162.02	194.215	163.58	195
164.59	195.492	165.53	196	165.88	196.23	167.15	197	169.04	197.525

```
  170.01     198  170.48 198.005  171.29  198.01  171.61 198.012  176.33 198.211
   181.2 198.381  185.45 198.603  188.51  198.84  190.44 198.995  190.51     199
  192.15 199.001  192.24 199.001  192.28 199.001  192.41 199.001  192.81 199.001
   194.2 199.001  195.83 199.001  195.94 199.001  196.05 199.001  200.13 199.042
  211.06 199.149  222.84 199.423  229.22 199.464  230.38 199.482  231.47 199.497
  235.25 199.523  240.57 199.568  242.89 199.629

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05  155.34    .035  159.52     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        155.34  159.52               38      38      38             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0  155.42   196.7       F
  159.34  242.89   196.7       F
Left Levee      Station=  136.92      Elevation=     198

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           195.70    Element                 Left OB    Channel
Right OB
  Vel Head (m)              0.19    Wt. n-Val.                          0.035

  W.S. Elev (m)           195.50    Reach Len. (m)           38.00      38.00
38.00
  Crit W.S. (m)           194.21    Flow Area (m2)                      10.61

  E.G. Slope (m/m)      0.001248    Area (m2)                 9.67      11.27
6.39
  Q Total (m3/s)            20.59   Flow (m3/s)                         20.59

  Top Width (m)             18.32   Top Width (m)             9.05       4.18
5.09
  Vel Total (m/s)           1.94    Avg. Vel. (m/s)                      1.94

  Max Chl Dpth (m)          2.87    Hydr. Depth (m)                      2.71

  Conv. Total (m3/s)       582.8    Conv. (m3/s)                        582.8

  Length Wtd. (m)           38.00   Wetted Per. (m)                      3.98

  Min Ch El (m)           192.63    Shear (N/m2)                        32.62

  Alpha                     1.00    Stream Power (N/m s)                63.31

  Frctn Loss (m)                    Cum Volume (1000 m3)     31.03      55.34
28.68
  C & E Loss (m)                    Cum SA (1000 m2)         32.42      20.24
37.70



Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #Regional w red'n


  E.G. Elev (m)           198.47    Element                 Left OB    Channel
Right OB
```

Vel Head (m)	0.16	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	198.31	Reach Len. (m)	38.00	38.00	38.00
Crit W.S. (m)	196.70	Flow Area (m2)	78.09	23.01	30.08
E.G. Slope (m/m)	0.000790	Area (m2)	78.09	23.01	30.08
Q Total (m3/s)	122.56	Flow (m3/s)	44.00	57.01	21.55
Top Width (m)	102.88	Top Width (m)	78.97	4.18	19.73
Vel Total (m/s)	0.93	Avg. Vel. (m/s)	0.56	2.48	0.72
Max Chl Dpth (m)	5.68	Hydr. Depth (m)	0.99	5.50	1.52
Conv. Total (m3/s)	4359.4	Conv. (m3/s)	1564.9	2027.9	766.6
Length Wtd. (m)	38.00	Wetted Per. (m)	79.79	4.25	20.90
Min Ch El (m)	192.63	Shear (N/m2)	7.59	42.00	11.15
Alpha	3.51	Stream Power (N/m s)	4.27	104.06	7.99
Frctn Loss (m)		Cum Volume (1000 m3)	136.94	134.72	176.06
C & E Loss (m)		Cum SA (1000 m2)	71.80	20.24	101.86

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1215

INPUT
Description: Hum 13-3R. Peelar Road Culvert - 3.72 m W x 2.35 m H x 30 m L Corrugated Metal Pipe Arch Culvert. No drawings available. Size estimated from HEC-2 coding.

HEC-2 to HEC-RAS conversion
January 2004 by Acres included recoding of culvert to HEC-RAS format, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 3
Deck/Roadway Width = 30
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 157

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	198.649		1.52	198.401		2.47	198	
2.8	198		2.85	198		3.5	198	
3.74	198		4.59	198		13.86	198	
15.45	198		15.74	198		17.17	198	
18.02	197.999		19.18	197.875		22.99	197.861	
24.53	197.999		28.09	197.999		28.15	197.999	
28.28	197.999		28.43	197.999		28.64	197.999	

29.19	197.999	31.03	197.999	31.34	197.999
32.15	197.999	32.89	197.999	34.84	197.999
34.92	197.999	37.18	197.998	37.71	197.998
38.66	197.998	41.94	197.997	43.56	197.997
44.75	197.997	45.96	197.997	46.74	197.997
49.78	197.996	50.07	197.995	52.53	197.995
54.64	197.995	55.11	197.995	55.42	197.995
55.76	197.995	57.94	197.995	59.43	197.994
60.73	197.994	61.45	197.993	62	197.993
64.12	197.992	64.22	197.992	64.28	197.992
65.61	197.989	67.27	197.991	68.33	197.991
71.97	197.999	72.26	198	73.27	198.017
76.65	198.059	77.23	198.092	78.18	198.119
80.03	198.063	81.1	198	81.68	197.998
81.8	197.997	82.79	197.994	83.16	197.992
83.96	197.989	86.33	197.985	91.22	197.968
99.31	197.849	99.61	197.847	100.72	197.846
105.6	197.845	107.24	197.851	115.83	197.928
117.78	197.909	118.71	197.903	119.04	197.903
119.4	197.899	121.59	197.885	122.03	197.885
124.28	197.863	124.74	197.388	125.47	197.26
125.59	197.264	125.6	197.264	127.02	197.214
127.16	197.211	127.78	197.201	139.62	197
140.18	196.992	140.89	196.988	141.46	196.989
142	196.987	142.75	196.987	143.84	196.986
143.94	196.986	150.74	196.962	158.29	196.957
158.39	196.957	160.98	196.955	164.67	196.924
165.88	196.912	167.31	196.935	168.65	196.948
168.79	196.948	168.84	196.949	169.49	196.951
170.16	196.951	171.53	196.952	172.2	196.956
172.58	196.955	172.76	196.956	172.87	196.955
172.93	196.955	174	196.962	174.57	196.956
175.1	196.959	175.75	196.962	178.58	196.956
180.14	196.971	182.32	196.983	182.65	196.984
182.82	196.987	183.42	196.997	183.61	197
186.18	197.165	192.25	197.667	192.7	197.681
193.37	197.689	193.89	197.919	194.46	197.92
195.12	197.925	196.24	197.935	198.9	197.945
202.32	197.938	208.58	197.985	210.37	197.994
210.52	198	211.83	198.115	211.87	198.116
222.47	198.877	223.67	198.88	226.51	198.911
228.79	198.924	230.7	198.93	232.45	198.935
237.16	198.966	237.24	198.966	237.7	198.968
238.12	198.971	239.89	198.978	239.96	198.978
240.04	198.979	240.24	198.978	240.47	198.98
240.87	199				

Upstream Bridge Cross Section Data
Station Elevation Data num= 153

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203.853	.23	203.855	.93	203.865	1.01	203.866	2.78	203.939
3.03	203.939	3.37	203.951	3.73	203.964	5.01	203.946	5.31	203.936
5.61	203.945	6.98	204	8.21	203.442	9.46	203	9.88	202.784
11.44	202	13.15	201.154	13.44	201	14.01	200.722	15.52	200
17.01	199.481	18.02	199	20.35	198.365	21.48	198.229	22.2	198.229
22.48	198.242	22.55	198.253	23.36	198.361	25.19	198.587	26.16	198.662
26.31	198.67	26.95	198.656	27.03	198.655	28	198.645	29.49	198.666
32.66	198.758	32.85	198.766	33.38	198.788	36.68	199	43.6	199.165
43.64	199.166	44.06	199.173	44.1	199.174	45.22	199.23	45.29	199.233
49.48	199.327	54.88	199.38	58.89	199.448	59.82	199.441	62.67	199.521
66.36	199.453	67.01	199.441	68.92	199.378	69.47	199.357	72.61	199.214
73.37	199.196	73.56	199.181	74.94	199	75.77	198.822	76.04	198.77
77.37	198.575	78.16	198.426	78.34	198.376	78.46	198.351	79.57	198

79.94	197.998	80.59	197.996	83.89	197.984	85.16	197.985	85.23	197.984
85.29	197.984	86.24	197.981	86.6	197.98	86.93	197.981	86.99	197.981
92.12	197.978	92.67	197.975	93.8	197.973	96.51	197.968	109.87	197.327
112.55	197.295	123.04	197.978	123.43	197.979	124.91	197.982	126.71	197.996
126.79	197.996	127.47	198	130.8	198	132.4	198	133.05	198
133.1	198	133.26	198	134.36	198	135.44	198	135.67	198
136.01	198	136.06	198	136.92	198	136.94	198	138.2	197.725
141.43	197	143.11	196.356	143.45	196.246	143.63	196.196	144.35	196
145.45	195.701	148.42	195	151.6	194.377	153.04	194	154.48	193.345
154.54	193.311	155.34	193	155.73	192.919	157.65	192.63	159.49	192.987
159.52	193	159.55	193.013	161.56	194	162.02	194.215	163.58	195
164.59	195.492	165.53	196	165.88	196.23	167.15	197	169.04	197.525
170.01	198	170.48	198.005	171.29	198.01	171.61	198.012	176.33	198.211
181.2	198.381	185.45	198.603	188.51	198.84	190.44	198.995	190.51	199
192.15	199.001	192.24	199.001	192.28	199.001	192.41	199.001	192.81	199.001
194.2	199.001	195.83	199.001	195.94	199.001	196.05	199.001	200.13	199.042
211.06	199.149	222.84	199.423	229.22	199.464	230.38	199.482	231.47	199.497
235.25	199.523	240.57	199.568	242.89	199.629				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	155.34	.035	159.52	.05

Bank Sta: Left Right Coeff Contr. Expan.

155.34	159.52	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	155.42	196.7	F
159.34	242.89	196.7	F

Left Levee Station= 136.92 Elevation= 198

Downstream Deck/Roadway Coordinates

num= 157

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	198.649		1.52	198.401		2.47	198	
2.8	198		2.85	198		3.5	198	
3.74	198		4.59	198		13.86	198	
15.45	198		15.74	198		17.17	198	
18.02	197.999		19.18	197.875		22.99	197.861	
24.53	197.999		28.09	197.999		28.15	197.999	
28.28	197.999		28.43	197.999		28.64	197.999	
29.19	197.999		31.03	197.999		31.34	197.999	
32.15	197.999		32.89	197.999		34.84	197.999	
34.92	197.999		37.18	197.998		37.71	197.998	
38.66	197.998		41.94	197.997		43.56	197.997	
44.75	197.997		45.96	197.997		46.74	197.997	
49.78	197.996		50.07	197.995		52.53	197.995	
54.64	197.995		55.11	197.995		55.42	197.995	
55.76	197.995		57.94	197.995		59.43	197.994	
60.73	197.994		61.45	197.993		62	197.993	
64.12	197.992		64.22	197.992		64.28	197.992	
65.61	197.989		67.27	197.991		68.33	197.991	
71.97	197.999		72.26	198		73.27	198.017	
76.65	198.059		77.23	198.092		78.18	198.119	
80.03	198.063		81.1	198		81.68	197.998	
81.8	197.997		82.79	197.994		83.16	197.992	
83.96	197.989		86.33	197.985		91.22	197.968	
99.31	197.849		99.61	197.847		100.72	197.846	
105.6	197.845		107.24	197.851		115.83	197.928	
117.78	197.909		118.71	197.903		119.04	197.903	
119.4	197.899		121.59	197.885		122.03	197.885	
124.28	197.863		124.74	197.388		125.47	197.26	
125.59	197.264		125.6	197.264		127.02	197.214	

127.16	197.211	127.78	197.201	139.62	197
140.18	196.992	140.89	196.988	141.46	196.989
142	196.987	142.75	196.987	143.84	196.986
143.94	196.986	150.74	196.962	158.29	196.957
158.39	196.957	160.98	196.955	164.67	196.924
165.88	196.912	167.31	196.935	168.65	196.948
168.79	196.948	168.84	196.949	169.49	196.951
170.16	196.951	171.53	196.952	172.2	196.956
172.58	196.955	172.76	196.956	172.87	196.955
172.93	196.955	174	196.962	174.57	196.956
175.1	196.959	175.75	196.962	178.58	196.956
180.14	196.971	182.32	196.983	182.65	196.984
182.82	196.987	183.42	196.997	183.61	197
186.18	197.165	192.25	197.667	192.7	197.681
193.37	197.689	193.89	197.919	194.46	197.92
195.12	197.925	196.24	197.935	198.9	197.945
202.32	197.938	208.58	197.985	210.37	197.994
210.52	198	211.83	198.115	211.87	198.116
222.47	198.877	223.67	198.88	226.51	198.911
228.79	198.924	230.7	198.93	232.45	198.935
237.16	198.966	237.24	198.966	237.7	198.968
238.12	198.971	239.89	198.978	239.96	198.978
240.04	198.979	240.24	198.978	240.47	198.98
240.87	199				

Downstream Bridge Cross Section Data
Station Elevation Data num= 193

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.116	.09	201.103	.16	201.086	2.46	201.134	2.97	201
4.37	200.471	4.61	200.366	5.6	200.081	5.84	200	5.96	199.911
5.99	199.908	6.02	199.896	6.07	199.878	6.15	199.835	7.19	199.231
7.68	199	8.13	198.755	8.5	198.631	8.62	198.603	9.26	198.509
9.72	198.47	10.14	198.456	10.23	198.452	10.32	198.448	11.96	198.458
17.93	198.627	18.79	198.683	20.17	198.853	21.45	198.905	21.67	198.908
22.9	198.868	23.49	198.882	23.72	198.871	24.78	198.788	24.93	198.787
28.22	198.487	32.27	198.564	32.41	198.559	32.55	198.553	32.7	198.554
34.55	198.443	36.02	198.405	47.41	198.657	48.15	198.664	48.64	198.668
48.8	198.663	49	198.655	56.83	198.515	56.94	198.515	57.21	198.506
57.47	198.5	59.64	198.564	60.7	198.535	64.04	198.604	69.34	198.85
70.1	198.861	70.3	198.882	70.32	198.882	71.57	199	74.15	199
75.35	199	76.07	199	76.75	199	77.12	199	78.35	199
79.35	199	79.82	199	81.11	199	81.15	199	81.23	199
81.33	199	81.52	199	84.17	199	85.18	199	86.83	199
86.9	199	86.98	199	91.42	199	92.96	199	96.93	199
97.22	199	97.61	199	98.45	199	98.47	199	98.92	199
99.22	199	101.39	199	102.08	199	102.12	199	102.14	199
103.01	199	103.02	199	106.1	198.877	110.03	198.634	110.07	198.631
110.12	198.629	110.16	198.627	112.11	198.13	112.47	198.125	114.53	198.075
115.89	198.061	116.61	198.058	116.85	198.054	117.55	198.032	119.12	198
121.6	197.696	125.61	197.384	130.31	197	130.42	196.977	131.19	196.835
134.73	196.198	135.06	196.126	135.92	196	136.57	195.912	137.53	195.823
137.73	195.805	139.61	195.582	141.72	195.474	142.72	195.431	142.83	195.423
146.3	195	146.85	194.937	146.93	194.922	147.7	194.851	147.91	194.818
150.84	194.094	151.01	194.05	151.08	194.036	151.14	194.027	151.23	194
151.49	193.87	152.54	193.041	152.6	193	152.61	192.999	152.94	192.956
153.08	192.961	153.39	192.841	153.59	192.827	154.01	192	154.29	191.839
154.31	191.823	154.36	191.841	154.5	191.889	154.85	192	155.27	192.599
155.43	192.632	156.55	192.853	157.2	192.963	157.33	193	157.71	193.1
157.92	193.149	158.07	193.188	158.44	193.273	159.2	193.41	159.73	193.495
161.66	194	161.73	194.024	162.6	194.305	162.76	194.371	163.8	195
164.8	195.636	165.37	196	166.09	196.414	167	197	168.71	197.76
169.29	198	170.4	198.016	170.43	198.017	170.57	198.018	172.02	198.031
174.94	198.052	176.13	198.07	176.47	198.141	179.95	198.291	191.32	198.853

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  196.68     199  198.11 199.013  201.12 199.029  202.88 199.024  217.21 199.414
  218.54 199.448  219.63 199.477  219.66 199.478  219.79 199.484  219.93 199.488
  227.87 199.454  235.99 199.769  237.56 199.797   238.2   199.8  238.42 199.808
  238.61 199.813  239.21 199.826  239.73 199.834

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   152.6    .035  157.33     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
         152.6  157.33             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   152.9  196.51       F
  156.88  239.73  196.51       F
Left Levee      Station=  103.02      Elevation=     199

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     Pipe Arch    2.35    3.72
FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                 3      30     .024     .024        0                    .9
      1
Upstream   Elevation =  192.63
           Centerline Station =  157.4
Downstream Elevation =  192.37
           Centerline Station =  154.9

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      20.59    Culv Full Len (m)
  # Barrels                   1    Culv Vel US (m/s)        3.64
  Q Barrel (m3/s)          20.59    Culv Vel DS (m/s)        4.09
  E.G. US. (m)            195.70    Culv Inv El Up (m)      192.63
  W.S. US. (m)            195.50    Culv Inv El Dn (m)      192.37
  E.G. DS (m)             194.62    Culv Frctn Ls (m)         0.00
  W.S. DS (m)             193.92    Culv Exit Loss (m)        0.16
  Delta EG (m)              1.08    Culv Entr Loss (m)        0.61
  Delta WS (m)              1.58    Q Weir (m3/s)
  E.G. IC (m)             195.55    Weir Sta Lft (m)
  E.G. OC (m)             195.70    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
  Culv WS Inlet (m)       194.41    Weir Max Depth (m)
  Culv WS Outlet (m)      193.92    Weir Avg Depth (m)
  Culv Nml Depth (m)        1.90    Weir Flow Area (m2)
  Culv Crt Depth (m)        1.53    Min El Weir Flow (m)    196.92


CULVERT OUTPUT  Profile #Regional w red'n  Culv Group:  Culvert #1
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Q Culv Group (m3/s)	10.85	Culv Full Len (m)	30.00
# Barrels	1	Culv Vel US (m/s)	1.62
Q Barrel (m3/s)	10.85	Culv Vel DS (m/s)	1.62
E.G. US. (m)	198.47	Culv Inv El Up (m)	192.63
W.S. US. (m)	198.31	Culv Inv El Dn (m)	192.37
E.G. DS (m)	198.23	Culv Frctn Ls (m)	0.07
W.S. DS (m)	198.14	Culv Exit Loss (m)	0.04
Delta EG (m)	0.24	Culv Entr Loss (m)	0.12
Delta WS (m)	0.17	Q Weir (m3/s)	111.71
E.G. IC (m)	198.34	Weir Sta Lft (m)	19.96
E.G. OC (m)	198.47	Weir Sta Rgt (m)	182.92
Culvert Control	Outlet	Weir Submerg	0.64
Culv WS Inlet (m)	194.98	Weir Max Depth (m)	1.56
Culv WS Outlet (m)	194.72	Weir Avg Depth (m)	0.74
Culv Nml Depth (m)		Weir Flow Area (m2)	80.97
Culv Crt Depth (m)	1.08	Min El Weir Flow (m)	196.92

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.121

INPUT
Description: Section 46.121 - Peelar Road - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 193

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.116	.09	201.103	.16	201.086	2.46	201.134	2.97	201
4.37	200.471	4.61	200.366	5.6	200.081	5.84	200	5.96	199.911
5.99	199.908	6.02	199.896	6.07	199.878	6.15	199.835	7.19	199.231
7.68	199	8.13	198.755	8.5	198.631	8.62	198.603	9.26	198.509
9.72	198.47	10.14	198.456	10.23	198.452	10.32	198.448	11.96	198.458
17.93	198.627	18.79	198.683	20.17	198.853	21.45	198.905	21.67	198.908
22.9	198.868	23.49	198.882	23.72	198.871	24.78	198.788	24.93	198.787
28.22	198.487	32.27	198.564	32.41	198.559	32.55	198.553	32.7	198.554
34.55	198.443	36.02	198.405	47.41	198.657	48.15	198.664	48.64	198.668
48.8	198.663	49	198.655	56.83	198.515	56.94	198.515	57.21	198.506
57.47	198.5	59.64	198.564	60.7	198.535	64.04	198.604	69.34	198.85
70.1	198.861	70.3	198.882	70.32	198.882	71.57	199	74.15	199
75.35	199	76.07	199	76.75	199	77.12	199	78.35	199
79.35	199	79.82	199	81.11	199	81.15	199	81.23	199
81.33	199	81.52	199	84.17	199	85.18	199	86.83	199
86.9	199	86.98	199	91.42	199	92.96	199	96.93	199
97.22	199	97.61	199	98.45	199	98.47	199	98.92	199
99.22	199	101.39	199	102.08	199	102.12	199	102.14	199
103.01	199	103.02	199	106.1	198.877	110.03	198.634	110.07	198.631
110.12	198.629	110.16	198.627	112.11	198.13	112.47	198.125	114.53	198.075
115.89	198.061	116.61	198.058	116.85	198.054	117.55	198.032	119.12	198
121.6	197.696	125.61	197.384	130.31	197	130.42	196.977	131.19	196.835
134.73	196.198	135.06	196.126	135.92	196	136.57	195.912	137.53	195.823
137.73	195.805	139.61	195.582	141.72	195.474	142.72	195.431	142.83	195.423
146.3	195	146.85	194.937	146.93	194.922	147.7	194.851	147.91	194.818
150.84	194.094	151.01	194.05	151.08	194.036	151.14	194.027	151.23	194
151.49	193.87	152.54	193.041	152.6	193	152.61	192.999	152.94	192.956
153.08	192.961	153.39	192.841	153.59	192.827	154.01	192	154.29	191.839
154.31	191.823	154.36	191.841	154.5	191.889	154.85	192	155.27	192.599
155.43	192.632	156.55	192.853	157.2	192.963	157.33	193	157.71	193.1
157.92	193.149	158.07	193.188	158.44	193.273	159.2	193.41	159.73	193.495
161.66	194	161.73	194.024	162.6	194.305	162.76	194.371	163.8	195
164.8	195.636	165.37	196	166.09	196.414	167	197	168.71	197.76
169.29	198	170.4	198.016	170.43	198.017	170.57	198.018	172.02	198.031

```
  174.94 198.052  176.13  198.07  176.47 198.141  179.95 198.291  191.32 198.853
  196.68     199  198.11 199.013  201.12 199.029  202.88 199.024  217.21 199.414
  218.54 199.448  219.63 199.477  219.66 199.478  219.79 199.484  219.93 199.488
  227.87 199.454  235.99 199.769  237.56 199.797   238.2   199.8  238.42 199.808
  238.61 199.813  239.21 199.826  239.73 199.834

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   152.6    .035  157.33     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         152.6  157.33               20      20      20             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   152.9  196.51       F
  156.88  239.73  196.51       F
Left Levee      Station=  103.02      Elevation=     199

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           194.62    Element                 Left OB    Channel
Right OB
  Vel Head (m)              0.69    Wt. n-Val.                          0.035

  W.S. Elev (m)           193.92    Reach Len. (m)           20.00      20.00
20.00
  Crit W.S. (m)           193.92    Flow Area (m2)                       5.58

  E.G. Slope (m/m)      0.014163    Area (m2)                 0.54       6.30
1.90
  Q Total (m3/s)            20.59   Flow (m3/s)                         20.59

  Top Width (m)             9.97    Top Width (m)             1.21       4.73
4.03
  Vel Total (m/s)           3.69    Avg. Vel. (m/s)                      3.69

  Max Chl Dpth (m)          2.10    Hydr. Depth (m)                      1.40

  Conv. Total (m3/s)       173.0    Conv. (m3/s)                        173.0

  Length Wtd. (m)           20.00   Wetted Per. (m)                      4.93

  Min Ch El (m)           191.82    Shear (N/m2)                        157.14

  Alpha                     1.00    Stream Power (N/m s)                580.15

  Frctn Loss (m)            0.24    Cum Volume (1000 m3)     31.03      55.08
28.68
  C & E Loss (m)            0.15    Cum SA (1000 m2)         32.22      20.07
37.53



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 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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.23	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	198.14	Reach Len. (m)	20.00	20.00	20.00
Crit W.S. (m)	196.51	Flow Area (m2)	68.57	26.25	37.11
E.G. Slope (m/m)	0.000574	Area (m2)	68.57	26.25	37.11
Q Total (m3/s)	122.56	Flow (m3/s)	46.17	49.79	26.60
Top Width (m)	64.38	Top Width (m)	40.52	4.73	19.13
Vel Total (m/s)	0.93	Avg. Vel. (m/s)	0.67	1.90	0.72
Max Chl Dpth (m)	6.32	Hydr. Depth (m)	1.69	5.55	1.94
Conv. Total (m3/s)	5115.7	Conv. (m3/s)	1927.2	2078.2	1110.4
Length Wtd. (m)	20.00	Wetted Per. (m)	41.16	5.69	20.27
Min Ch El (m)	191.82	Shear (N/m2)	9.38	25.96	10.30
Alpha	2.02	Stream Power (N/m s)	6.31	49.24	7.39
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	136.94	131.43	176.06
C & E Loss (m)	0.03	Cum SA (1000 m2)	69.53	20.07	101.12

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: RIVER-1
REACH: Reach-1 RS: 46.12

INPUT
Description: Section 46.12 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 121

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204.017	.64	204	1.57	203.584	2.88	203	4.16	202.234
4.52	202	5.56	201.407	6.37	201	10.22	201	14.03	201
15.11	201.341	17.03	201.774	17.39	201.08	19.08	201.047	20.72	201

24.05	200.087	24.34	200	25.06	199.958	40.15	199.007	40.26	199.007
42.43	199.003	42.76	199.003	45.21	199.27	45.36	199.272	47	199.255
47.99	199.251	57.78	199.012	58.42	199.012	60	199.011	66.24	199
66.68	199	66.83	199	67.45	199	68.32	199	70.6	199
78.32	199	82.38	198.38	85.31	198	86.68	197.459	88	197
88.9	197	89.01	197	89.06	197	89.47	197	90.05	197
90.13	197	90.19	197	92.58	197	93.92	197	95.28	197
98.06	197	98.16	197	98.96	197	104.19	196.364	106.24	196.391
109.27	196	109.29	195.994	109.82	195.992	109.83	195.992	110.07	195.99
110.19	195.988	111.79	195.978	112.9	195.816	112.97	195.809	116.66	195.626
117.36	195.562	117.5	195.552	118.97	195.46	120.07	195.413	121.94	195.336
125.09	195	127.14	194.798	128.66	194.593	128.86	194.565	129.9	194.436
130.12	194.409	133.39	194	134.46	193.993	134.62	193.992	134.65	193.992
134.67	193.992	136.01	193.914	142.87	193.531	143.04	193.525	143.27	193.512
144.35	193.401	148.02	193	149.07	192.548	150.54	192	150.66	191.955
150.99	191.823	151.13	191.883	151.39	192	153.89	192.96	154.01	193
154.32	193.077	156.61	193.626	157.62	193.852	158.11	194	159.55	194.326
162.27	195	164.16	195.858	164.18	195.863	164.2	195.868	164.23	195.877
164.52	196	165.52	196.466	165.69	196.535	166.77	196.945	166.9	197
167	197.043	168.84	198	179.75	198.43	194.54	199	199.89	199.172
218.12	199.701	222.85	199.836	227.56	199.963	228.52	200	228.56	200
228.84	200								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	148.02	.035	154.01	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
148.02	154.01	35	38	40	.1	.3

Left Levee Station= 45.21 Elevation= 199.27

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	193.92	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.40	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (m)	193.51	Reach Len. (m)	35.00	38.00
40.00				
Crit W.S. (m)	193.51	Flow Area (m2)	1.22	6.62
0.55				
E.G. Slope (m/m)	0.009935	Area (m2)	1.22	6.62
0.55				
Q Total (m3/s)	20.59	Flow (m3/s)	0.97	19.19
0.43				
Top Width (m)	12.93	Top Width (m)	4.80	5.99
2.14				
Vel Total (m/s)	2.46	Avg. Vel. (m/s)	0.80	2.90
0.79				
Max Chl Dpth (m)	1.69	Hydr. Depth (m)	0.25	1.10
0.26				
Conv. Total (m3/s)	206.6	Conv. (m3/s)	9.7	192.5
4.3				
Length Wtd. (m)	37.95	Wetted Per. (m)	4.83	6.44
2.20				
Min Ch El (m)	191.82	Shear (N/m2)	24.55	100.14
24.27				
Alpha	1.31	Stream Power (N/m s)	19.52	290.43
19.16				
Frctn Loss (m)	0.15	Cum Volume (1000 m3)	31.02	54.95
28.65				
C & E Loss (m)	0.07	Cum SA (1000 m2)	32.16	19.96

37.46

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 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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.19	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	198.17	Reach Len. (m)	35.00	38.00	40.00
Crit W.S. (m)	194.95	Flow Area (m2)	170.19	34.50	46.06
E.G. Slope (m/m)	0.000121	Area (m2)	170.19	34.50	46.06
Q Total (m3/s)	122.56	Flow (m3/s)	71.65	33.24	17.68
Top Width (m)	89.13	Top Width (m)	64.02	5.99	19.13
Vel Total (m/s)	0.49	Avg. Vel. (m/s)	0.42	0.96	0.38
Max Chl Dpth (m)	6.35	Hydr. Depth (m)	2.66	5.76	2.41
Conv. Total (m3/s)	11128.4	Conv. (m3/s)	6505.3	3018.1	1605.0
Length Wtd. (m)	37.26	Wetted Per. (m)	64.42	6.44	20.03
Min Ch El (m)	191.82	Shear (N/m2)	3.14	6.37	2.74
Alpha	1.58	Stream Power (N/m s)	1.32	6.14	1.05
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	134.55	130.82	175.23
C & E Loss (m)	0.05	Cum SA (1000 m2)	68.48	19.96	100.74

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.

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.11

INPUT
Description: Station 46.11 - Highway 407 - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 157

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204.194	7.42	204	8.35	203.615	9.72	203	10.51	202.654
11.9	202	13.52	201.278	13.79	201.12	14.04	201	14.65	200.732
16.39	200	19.18	199.003	19.19	199	19.21	199	19.73	199
20.17	199	20.27	199	21.54	199.137	21.57	199.136	22.93	199.296
27.45	199.348	31.63	199.351	31.74	199.347	35.8	199.168	40.37	199.056
40.58	199.048	41.65	199	41.8	199	43.05	199	44.74	199
45.85	199	51.4	198.797	51.94	198.785	52.27	198.776	52.69	198.777
53.03	198.784	53.16	198.787	53.2	198.788	53.37	198.79	53.4	198.791
61.25	199	65.25	199	67.89	199	69.57	199	71.3	199
72.99	198.774	81.96	199	82.48	199	82.91	199	87.13	199
87.27	199	89.8	199.348	92.33	199.42	92.43	199.422	92.63	199.428
92.82	199.435	93.33	199.424	96.19	199	96.38	199	96.8	199
96.94	199	97.06	198.997	97.07	198.997	97.08	198.997	97.09	198.997
97.3	198.997	98.11	198.973	108.25	198.335	110.22	198.302	111.36	198.277
114.19	198.195	116.72	198.145	119.02	198.024	119.8	198.022	120.85	198.023
124.59	198.036	124.96	198.033	126.47	198.02	128.17	198.004	128.71	198.001
128.74	198	129.24	197.91	129.28	197.902	129.33	197.895	131.38	197.515
132.26	197.384	132.42	197.378	134.55	197.078	134.78	197.085	136.08	197.005
136.09	197.005	136.2	197	137.94	196.567	140.2	196	140.31	195.965
140.65	195.808	142.27	195.002	142.28	195	142.86	194.747	143.59	194.559
143.95	194.432	145.52	194	147.05	193.476	147.49	193.353	148.41	193
149.22	192.702	149.63	192.585	149.8	192	150	191.725	153.14	191.725
153.57	191.725	156	191.725	156.2	192	156.84	193	157.12	193.11
157.35	193.215	158.69	194	160.15	194.705	160.84	195	161.92	195.417
163.52	196	165.53	196.656	166.54	197	169.15	197.405	171.98	197.769
172.73	197.841	173.74	198	174.74	198.01	174.77	198.01	175.33	198.016
176.17	198.026	176.63	198.028	178.63	198.05	178.89	198.05	193.15	198.522
195.72	198.556	198.31	198.69	202.36	198.883	204.46	199	222.27	199.574
235.58	200	245.55	200.352	249	200.514	250.09	200.573	255.18	200.87
257.13	200.961	257.34	200.963	257.9	200.992	261.45	200.989	261.74	200.99
264.23	200.975	264.53	200.978	266.78	200.994	266.87	201	268.79	201.048
272.01	201.138	283.95	201.338						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	149.8	.035	156.2	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
149.8	156.2	235	235	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	149.5	200.65	F
156.5	283.95	200.5	F

Left Levee Station= 92.82 Elevation= 199.435

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	193.64	Element	Left OB	Channel	

Right OB					
Vel Head (m)	0.16	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	193.48	Reach Len. (m)	235.00	235.00	235.00
Crit W.S. (m)	192.75	Flow Area (m2)	0.32	11.17	0.37
E.G. Slope (m/m)	0.002016	Area (m2)	1.36	11.17	0.88
Q Total (m3/s)	20.59	Flow (m3/s)	0.16	20.17	0.26
Top Width (m)	10.76	Top Width (m)	2.76	6.40	1.60
Vel Total (m/s)	1.74	Avg. Vel. (m/s)	0.51	1.81	0.69
Max Chl Dpth (m)	1.75	Hydr. Depth (m)	1.05	1.74	1.24
Conv. Total (m3/s)	458.6	Conv. (m3/s)	3.6	449.3	5.7
Length Wtd. (m)	235.00	Wetted Per. (m)	0.74	6.68	0.56
Min Ch El (m)	191.73	Shear (N/m2)	8.37	33.04	13.26
Alpha	1.06	Stream Power (N/m s)	4.24	59.70	9.12
Frctn Loss (m)		Cum Volume (1000 m3)	30.97	54.61	28.63
C & E Loss (m)		Cum SA (1000 m2)	32.03	19.73	37.39

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.13	Element	Left OB	Channel	Right OB
Vel Head (m)	0.49	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	197.64	Reach Len. (m)	235.00	235.00	235.00
Crit W.S. (m)	195.01	Flow Area (m2)	1.56	37.83	1.62
E.G. Slope (m/m)	0.001191	Area (m2)	40.24	37.83	28.33
Q Total (m3/s)	122.56	Flow (m3/s)	1.77	118.50	2.29
Top Width (m)	40.33	Top Width (m)	19.12	6.40	14.81
Vel Total (m/s)	2.99	Avg. Vel. (m/s)	1.13	3.13	1.41
Max Chl Dpth (m)	5.92	Hydr. Depth (m)	5.22	5.91	5.41
Conv. Total (m3/s)	3551.8	Conv. (m3/s)	51.4	3434.2	66.3
Length Wtd. (m)	235.00	Wetted Per. (m)	0.74	6.68	0.56
Min Ch El (m)	191.73	Shear (N/m2)	24.55	66.13	34.06
Alpha	1.07	Stream Power (N/m s)	27.80	207.16	

47.99
  Frctn Loss (m) Cum Volume (1000 m3) 130.87 129.45 173.74
  C & E Loss (m) Cum SA (1000 m2) 67.03 19.73 100.06

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1015

INPUT
Description: Hum 13-2R. Highway 407 Culvert - 6.0 m W x 4.3 m H x 215 m L Concrete Box Culvert. Drawings by MTO (WP 140-87-08, Sheet 76, 1993) used to code in new culvert not previously coded in HEC-2.

HEC-2 to HEC-RAS conversion January 2004 by Acres
included coding of culvert to HEC-RAS format, including adjustments to roadway coding and hydraulic loss coefficients.
Distance from Upstream XS = 12
Deck/Roadway Width = 215
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 146

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	204.208		4.75	204.007		4.97	204.007	
5.27	204.006		5.82	204.006		6.46	204.006	
7.86	204.005		8.62	204.005		8.71	204.005	
8.78	204.005		15.85	204.005		16.29	204.005	
17.76	204.004		17.9	204.004		18.19	204.004	
18.94	204.004		19.1	204.004		19.28	204.004	
20.12	204.004		21.34	204.004		21.76	204.004	
23.12	204.003		23.2	204.003		23.24	204.003	
23.33	204.003		23.38	204.003		23.44	204.003	
23.71	204.003		26.02	204.003		26.83	204.003	
28.53	204.003		34.85	204.001		37.83	204	
37.89	204		37.96	204		37.98	204	
38.02	204		43.02	203.56		47.14	203.538	
50.92	203.25		56.58	203.216		56.61	203.216	
56.64	203.216		56.83	203.213		57.93	203.201	
60.55	203.159		62.45	203.15		64.39	203.13	
64.6	203.129		64.76	203.127		69.02	203.102	
72.02	203.093		74.17	203.074		74.23	203.074	
75.29	203.068		75.83	203.062		76.16	203.061	
76.51	203.057		76.78	203.053		83.95	203	
84.95	202.936		85.88	202.932		86.17	202.919	
91.34	202.663		92.19	202.66		93.67	202.607	
93.81	202.601		95.31	202.52		102.69	202.429	
106.82	202.107		109.74	202.092		114.1	202.071	
117.19	202.043		117.24	202.043		117.39	202.042	
117.45	202.041		118.91	202.033		121.76	202	
126.9	201.626		135.34	201.601		138.96	201.498	
146.46	201.017		146.74	201.017		147.02	201.017	
147.32	201.017		148.59	201.016		150.04	201.016	
150.78	201.016		152	201.015		152.08	201.014	
152.54	201.014		153.09	201.014		153.16	201.014	

157.65 201.014	158.63 201.014	159.79 201.014
159.86 201.014	159.95 201.014	163.62 201.013
167.46 201.011	171.93 201.294	176.54 201.237
179.73 201.007	180.03 201.007	180.13 201.007
182.08 201.007	183.45 201.007	196.02 201.006
199.93 201.005	200.98 201.005	201.21 201.005
203.84 201.005	219.13 201.005	223.98 201.005
224.97 201.005	225.02 201.005	225.67 201.005
226.17 201.005	226.62 201.005	226.68 201.005
228.24 201.005	228.93 201.005	238.94 201.006
244.81 201.005	246.52 201.005	249.44 201.005
251.75 201.154	255.03 201.173	256.62 201.006
259.78 201.005	260.65 201.005	262.23 201.005
262.29 201.005	262.38 201.005	265.7 201.004
265.92 201.004	266.14 201.004	266.66 201.004
268.21 201.004	270.47 201.004	270.83 201.004
271.72 201.005	271.99 201.005	272.99 201.005
279.13 201.004	279.54 201.004	

Upstream Bridge Cross Section Data
Station Elevation Data num= 157

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204.194	7.42	204	8.35	203.615	9.72	203	10.51	202.654
11.9	202	13.52	201.278	13.79	201.12	14.04	201	14.65	200.732
16.39	200	19.18	199.003	19.19	199	19.21	199	19.73	199
20.17	199	20.27	199	21.54	199.137	21.57	199.136	22.93	199.296
27.45	199.348	31.63	199.351	31.74	199.347	35.8	199.168	40.37	199.056
40.58	199.048	41.65	199	41.8	199	43.05	199	44.74	199
45.85	199	51.4	198.797	51.94	198.785	52.27	198.776	52.69	198.777
53.03	198.784	53.16	198.787	53.2	198.788	53.37	198.79	53.4	198.791
61.25	199	65.25	199	67.89	199	69.57	199	71.3	199
72.99	198.774	81.96	199	82.48	199	82.91	199	87.13	199
87.27	199	89.8	199.348	92.33	199.42	92.43	199.422	92.63	199.428
92.82	199.435	93.33	199.424	96.19	199	96.38	199	96.8	199
96.94	199	97.06	198.997	97.07	198.997	97.08	198.997	97.09	198.997
97.3	198.997	98.11	198.973	108.25	198.335	110.22	198.302	111.36	198.277
114.19	198.195	116.72	198.145	119.02	198.024	119.8	198.022	120.85	198.023
124.59	198.036	124.96	198.033	126.47	198.02	128.17	198.004	128.71	198.001
128.74	198	129.24	197.91	129.28	197.902	129.33	197.895	131.38	197.515
132.26	197.384	132.42	197.378	134.55	197.078	134.78	197.085	136.08	197.005
136.09	197.005	136.2	197	137.94	196.567	140.2	196	140.31	195.965
140.65	195.808	142.27	195.002	142.28	195	142.86	194.747	143.59	194.559
143.95	194.432	145.52	194	147.05	193.476	147.49	193.353	148.41	193
149.22	192.702	149.63	192.585	149.8	192	150	191.725	153.14	191.725
153.57	191.725	156	191.725	156.2	192	156.84	193	157.12	193.11
157.35	193.215	158.69	194	160.15	194.705	160.84	195	161.92	195.417
163.52	196	165.53	196.656	166.54	197	169.15	197.405	171.98	197.769
172.73	197.841	173.74	198	174.74	198.01	174.77	198.01	175.33	198.016
176.17	198.026	176.63	198.028	178.63	198.05	178.89	198.05	193.15	198.522
195.72	198.556	198.31	198.69	202.36	198.883	204.46	199	222.27	199.574
235.58	200	245.55	200.352	249	200.514	250.09	200.573	255.18	200.87
257.13	200.961	257.34	200.963	257.9	200.992	261.45	200.989	261.74	200.99
264.23	200.975	264.53	200.978	266.78	200.994	266.87	201	268.79	201.048
272.01	201.138	283.95	201.338						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	149.8	.035	156.2	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
149.8	156.2	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent

```
       0   149.5  200.65       F
   156.5  283.95   200.5       F
Left Levee      Station=   92.82      Elevation= 199.435

Downstream  Deck/Roadway Coordinates
    num=     146
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0 204.208            4.75 204.007            4.97 204.007
    5.27 204.006            5.82 204.006            6.46 204.006
    7.86 204.005            8.62 204.005            8.71 204.005
    8.78 204.005           15.85 204.005           16.29 204.005
   17.76 204.004            17.9 204.004           18.19 204.004
   18.94 204.004            19.1 204.004           19.28 204.004
   20.12 204.004           21.34 204.004           21.76 204.004
   23.12 204.003            23.2 204.003           23.24 204.003
   23.33 204.003           23.38 204.003           23.44 204.003
   23.71 204.003           26.02 204.003           26.83 204.003
   28.53 204.003           34.85 204.001           37.83     204
   37.89     204           37.96     204           37.98     204
   38.02     204           43.02  203.56           47.14 203.538
   50.92  203.25           56.58 203.216           56.61 203.216
   56.64 203.216           56.83 203.213           57.93 203.201
   60.55 203.159           62.45  203.15           64.39  203.13
    64.6 203.129           64.76 203.127           69.02 203.102
   72.02 203.093           74.17 203.074           74.23 203.074
   75.29 203.068           75.83 203.062           76.16 203.061
   76.51 203.057           76.78 203.053           83.95     203
   84.95 202.936           85.88 202.932           86.17 202.919
   91.34 202.663           92.19  202.66           93.67 202.607
   93.81 202.601           95.31  202.52          102.69 202.429
  106.82 202.107          109.74 202.092           114.1 202.071
  117.19 202.043          117.24 202.043          117.39 202.042
  117.45 202.041          118.91 202.033          121.76     202
   126.9 201.626          135.34 201.601          138.96 201.498
  146.46 201.017          146.74 201.017          147.02 201.017
  147.32 201.017          148.59 201.016          150.04 201.016
  150.78 201.016             152 201.015          152.08 201.014
  152.54 201.014          153.09 201.014          153.16 201.014
  157.65 201.014          158.63 201.014          159.79 201.014
  159.86 201.014          159.95 201.014          163.62 201.013
  167.46 201.011          171.93 201.294          176.54 201.237
  179.73 201.007          180.03 201.007          180.13 201.007
  182.08 201.007          183.45 201.007          196.02 201.006
  199.93 201.005          200.98 201.005          201.21 201.005
  203.84 201.005          219.13 201.005          223.98 201.005
  224.97 201.005          225.02 201.005          225.67 201.005
  226.17 201.005          226.62 201.005          226.68 201.005
  228.24 201.005          228.93 201.005          238.94 201.006
  244.81 201.005          246.52 201.005          249.44 201.005
  251.75 201.154          255.03 201.173          256.62 201.006
  259.78 201.005          260.65 201.005          262.23 201.005
  262.29 201.005          262.38 201.005           265.7 201.004
  265.92 201.004          266.14 201.004          266.66 201.004
  268.21 201.004          270.47 201.004          270.83 201.004
  271.72 201.005          271.99 201.005          272.99 201.005
  279.13 201.004          279.54 201.004

Downstream Bridge Cross Section Data
Station Elevation Data    num=     122
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 202.016     1.7 202.008    3.31     202    6.36 201.056    6.55     201
    9.56 200.072    9.81     200    10.8 199.702    11.4 199.711   13.91 199.257
   20.78 199.071   21.41 199.041   21.73 199.035   22.13 199.012   28.32 199.055
```

```
   30.43 199.043   30.53 199.043   30.61     199   34.33  198.39   36.83     198
   38.26 197.761   38.91 197.735   42.59 197.626   45.28 197.715   49.27 197.928
   49.51 197.912   49.64 197.913   50.24     198   54.26 198.904   54.69     199
   55.54 199.006    55.6 199.007   56.47 199.015   56.56 199.016   58.01 199.028
   58.36 199.031   64.08 199.075   66.11 199.058   71.53 199.016   73.74     199
   78.09 198.205   79.43     198    80.3 197.717   82.64     197   84.16 196.504
   85.78     196   87.38 195.494   88.82     195   90.55 194.411   91.82     194
   93.73 193.361   95.06     193   96.61 192.832   96.99 192.821   97.75 192.766
   99.02 192.647  104.34 192.001  104.36 192.001  104.39     192   107.5     192
     108   191.6     114   191.6   114.5     192  116.67     192  119.53 192.809
  120.23     193  120.93 193.226  123.26     194  125.52 194.789  126.17     195
  129.05 195.811     130     196  130.82 196.156  134.81     197  136.27 197.006
  139.91 197.009  140.26  197.01  149.58  197.28  159.19 197.543  159.78 197.568
  160.61 197.581  161.67 197.609  161.81 197.612  162.94 197.638   163.7 197.652
  169.85 197.681  172.35 197.776  174.11 197.816  175.39 197.838  176.32 197.837
   176.8 197.835  177.83 197.831  178.38 197.827  178.95 197.822  180.79 197.795
  184.91 197.765  186.04 197.738  186.65 197.724  187.33 197.708  192.06 197.647
  192.56 197.637  195.08 197.575  199.98  197.49  201.37 197.459  203.14 197.409
  207.72 197.255  214.28  197.01  214.52     197  219.09 196.443  220.61 196.279
  221.92 196.225  229.69  196.45  231.97 196.372  232.71 196.357  233.41 196.345
  235.42 196.321  237.27 196.318  238.24 196.334  239.43 196.362  242.98 196.554
  248.74 196.965   250.8     197

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   107.5    .035   114.5     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
         107.5   114.5             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   107.5     200       F
   114.5   250.8     200       F
Left Levee      Station=   64.08      Elevation= 199.075
Right Levee     Station=  175.39      Elevation= 197.838

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     4.3       6
FHWA Chart # 58- Rectangular concrete
FHWA Scale # 2 - Side tapered; More favorable edges
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
               12     215     .015     .015        0                  .5
      1
Upstream   Elevation =  191.725
           Centerline Station =  153
Downstream Elevation =  191.6
           Centerline Station =  111

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      20.59    Culv Full Len (m)
```

# Barrels	1	Culv Vel US (m/s)	2.24
Q Barrel (m3/s)	20.59	Culv Vel DS (m/s)	3.23
E.G. US. (m)	193.64	Culv Inv El Up (m)	191.73
W.S. US. (m)	193.48	Culv Inv El Dn (m)	191.60
E.G. DS (m)	193.07	Culv Frctn Ls (m)	0.00
W.S. DS (m)	192.59	Culv Exit Loss (m)	0.13
Delta EG (m)	0.57	Culv Entr Loss (m)	0.13
Delta WS (m)	0.89	Q Weir (m3/s)	
E.G. IC (m)	193.62	Weir Sta Lft (m)	
E.G. OC (m)	193.64	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	193.26	Weir Max Depth (m)	
Culv WS Outlet (m)	192.66	Weir Avg Depth (m)	
Culv Nml Depth (m)	1.92	Weir Flow Area (m2)	
Culv Crt Depth (m)	1.06	Min El Weir Flow (m)	201.01

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	122.56	Culv Full Len (m)	119.53
# Barrels	1	Culv Vel US (m/s)	4.75
Q Barrel (m3/s)	122.56	Culv Vel DS (m/s)	5.85
E.G. US. (m)	198.13	Culv Inv El Up (m)	191.73
W.S. US. (m)	197.64	Culv Inv El Dn (m)	191.60
E.G. DS (m)	196.35	Culv Frctn Ls (m)	0.45
W.S. DS (m)	194.78	Culv Exit Loss (m)	0.48
Delta EG (m)	1.78	Culv Entr Loss (m)	0.58
Delta WS (m)	2.86	Q Weir (m3/s)	
E.G. IC (m)	198.26	Weir Sta Lft (m)	
E.G. OC (m)	198.13	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	196.03	Weir Max Depth (m)	
Culv WS Outlet (m)	195.09	Weir Avg Depth (m)	
Culv Nml Depth (m)	4.30	Weir Flow Area (m2)	
Culv Crt Depth (m)	3.49	Min El Weir Flow (m)	201.01

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.
Note: During supercritical analysis, the culvert direct step method went to critical depth. The program then assumed
critical depth at the outlet.
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: 46.10

INPUT
Description: Station 46.10 - Highway 407 - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.016	1.7	202.008	3.31	202	6.36	201.056	6.55	201
9.56	200.072	9.81	200	10.8	199.702	11.4	199.711	13.91	199.257

20.78	199.071	21.41	199.041	21.73	199.035	22.13	199.012	28.32	199.055
30.43	199.043	30.53	199.043	30.61	199	34.33	198.39	36.83	198
38.26	197.761	38.91	197.735	42.59	197.626	45.28	197.715	49.27	197.928
49.51	197.912	49.64	197.913	50.24	198	54.26	198.904	54.69	199
55.54	199.006	55.6	199.007	56.47	199.015	56.56	199.016	58.01	199.028
58.36	199.031	64.08	199.075	66.11	199.058	71.53	199.016	73.74	199
78.09	198.205	79.43	198	80.3	197.717	82.64	197	84.16	196.504
85.78	196	87.38	195.494	88.82	195	90.55	194.411	91.82	194
93.73	193.361	95.06	193	96.61	192.832	96.99	192.821	97.75	192.766
99.02	192.647	104.34	192.001	104.36	192.001	104.39	192	107.5	192
108	191.6	114	191.6	114.5	192	116.67	192	119.53	192.809
120.23	193	120.93	193.226	123.26	194	125.52	194.789	126.17	195
129.05	195.811	130	196	130.82	196.156	134.81	197	136.27	197.006
139.91	197.009	140.26	197.01	149.58	197.28	159.19	197.543	159.78	197.568
160.61	197.581	161.67	197.609	161.81	197.612	162.94	197.638	163.7	197.652
169.85	197.681	172.35	197.776	174.11	197.816	175.39	197.838	176.32	197.837
176.8	197.835	177.83	197.831	178.38	197.827	178.95	197.822	180.79	197.795
184.91	197.765	186.04	197.738	186.65	197.724	187.33	197.708	192.06	197.647
192.56	197.637	195.08	197.575	199.98	197.49	201.37	197.459	203.14	197.409
207.72	197.255	214.28	197.01	214.52	197	219.09	196.443	220.61	196.279
221.92	196.225	229.69	196.45	231.97	196.372	232.71	196.357	233.41	196.345
235.42	196.321	237.27	196.318	238.24	196.334	239.43	196.362	242.98	196.554
248.74	196.965	250.8	197						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	107.5	.035	114.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
107.5	114.5	130	200	160	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	107.5	200	F
114.5	250.8	200	F

Left Levee Station= 64.08 Elevation= 199.075
Right Levee Station= 175.39 Elevation= 197.838

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	193.07	Element	Left OB	Channel	Right OB
Vel Head (m)	0.48	Wt. n-Val.		0.035	
W.S. Elev (m)	192.59	Reach Len. (m)	130.00	200.00	160.00
Crit W.S. (m)	192.59	Flow Area (m2)		6.72	
E.G. Slope (m/m)	0.012821	Area (m2)	3.28	6.72	1.89
Q Total (m3/s)	20.59	Flow (m3/s)		20.59	
Top Width (m)	19.24	Top Width (m)	7.99	7.00	4.25
Vel Total (m/s)	3.07	Avg. Vel. (m/s)		3.07	
Max Chl Dpth (m)	0.99	Hydr. Depth (m)		0.96	
Conv. Total (m3/s)	181.8	Conv. (m3/s)		181.8	
Length Wtd. (m)	199.34	Wetted Per. (m)		7.28	
Min Ch El (m)	191.60	Shear (N/m2)		115.98	

Alpha	1.00	Stream Power (N/m s)			355.55
Frctn Loss (m)	1.06	Cum Volume (1000 m3)	30.97	52.54	28.63
C & E Loss (m)	0.13	Cum SA (1000 m2)	30.77	18.15	36.70

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 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, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	196.35	Element	Left OB	Channel	Right OB
Vel Head (m)	1.57	Wt. n-Val.		0.035	
W.S. Elev (m)	194.78	Reach Len. (m)	130.00	200.00	160.00
Crit W.S. (m)	194.78	Flow Area (m2)		22.09	
E.G. Slope (m/m)	0.008591	Area (m2)	34.85	22.09	18.94
Q Total (m3/s)	122.56	Flow (m3/s)		122.56	
Top Width (m)	36.05	Top Width (m)	18.04	7.00	11.00
Vel Total (m/s)	5.55	Avg. Vel. (m/s)		5.55	
Max Chl Dpth (m)	3.18	Hydr. Depth (m)		3.16	
Conv. Total (m3/s)	1322.3	Conv. (m3/s)		1322.3	
Length Wtd. (m)	184.22	Wetted Per. (m)		7.28	
Min Ch El (m)	191.60	Shear (N/m2)		255.57	
Alpha	1.00	Stream Power (N/m s)		1418.26	
Frctn Loss (m)	0.11	Cum Volume (1000 m3)	130.87	122.47	173.74
C & E Loss (m)	0.77	Cum SA (1000 m2)	62.66	18.15	97.02

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, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.09

INPUT
Description: Section 46.09 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	199.5	20	198	60	198	92	191	93	190
95	189	99	189	100	190	102	191	146	192
173	194	210	196	255	197				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	93	.035	100	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
93	100	80	95	125	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	191.07	Element	Left OB	Channel	Right OB
Vel Head (m)	0.22	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	190.85	Reach Len. (m)	80.00	95.00	125.00
Crit W.S. (m)		Flow Area (m2)	0.36	11.45	0.72
E.G. Slope (m/m)	0.003188	Area (m2)	0.36	11.45	0.72
Q Total (m3/s)	24.80	Flow (m3/s)	0.18	24.18	0.43
Top Width (m)	9.55	Top Width (m)	0.85	7.00	1.70
Vel Total (m/s)	1.98	Avg. Vel. (m/s)	0.51	2.11	0.59

Max Chl Dpth (m)	1.85	Hydr. Depth (m)	0.43	1.64	0.43
Conv. Total (m3/s)	439.2	Conv. (m3/s)	3.2	428.3	7.6
Length Wtd. (m)	95.20	Wetted Per. (m)	1.20	7.65	1.90
Min Ch El (m)	189.00	Shear (N/m2)	9.40	46.80	11.89
Alpha	1.11	Stream Power (N/m s)	4.77	98.81	7.05
Frctn Loss (m)	0.21	Cum Volume (1000 m3)	30.73	50.72	28.42
C & E Loss (m)	0.02	Cum SA (1000 m2)	30.19	16.75	36.23

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	194.31	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	194.28	Reach Len. (m)	80.00	95.00	125.00
Crit W.S. (m)		Flow Area (m2)	28.44	35.49	165.48
E.G. Slope (m/m)	0.000218	Area (m2)	28.44	35.49	165.48
Q Total (m3/s)	133.76	Flow (m3/s)	11.93	41.61	80.23
Top Width (m)	101.27	Top Width (m)	16.01	7.00	78.25
Vel Total (m/s)	0.58	Avg. Vel. (m/s)	0.42	1.17	0.48
Max Chl Dpth (m)	5.28	Hydr. Depth (m)	1.78	5.07	2.11
Conv. Total (m3/s)	9065.7	Conv. (m3/s)	808.3	2820.1	5437.3
Length Wtd. (m)	115.54	Wetted Per. (m)	16.78	7.65	78.58
Min Ch El (m)	189.00	Shear (N/m2)	3.62	9.90	4.50
Alpha	1.72	Stream Power (N/m s)	1.52	11.61	2.18
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	126.76	116.71	158.99
C & E Loss (m)	0.01	Cum SA (1000 m2)	60.44	16.75	89.88

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: RIVER-1
REACH: Reach-1 RS: 46.082

INPUT
Description: Section 46.082 - Jane Steet - U/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	196	50	195	94	194	116	192	122	189
123	188.7	129	188.7	129.5	189	132	189.5	175	190
192	191	220	192	225	193	267	194	300	195

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	122	.035	129.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
122	129.5	75	75	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	122.5	196.5	F
129.5	300	193.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	190.84	Element	Left OB	Channel	Right OB
Vel Head (m)	0.17	Wt. n-Val.		0.035	
W.S. Elev (m)	190.68	Reach Len. (m)	75.00	75.00	75.00
Crit W.S. (m)	189.80	Flow Area (m2)		13.72	
E.G. Slope (m/m)	0.001663	Area (m2)	2.81	14.60	47.27
Q Total (m3/s)	24.80	Flow (m3/s)		24.80	
Top Width (m)	67.85	Top Width (m)	3.35	7.50	56.99
Vel Total (m/s)	1.81	Avg. Vel. (m/s)		1.81	
Max Chl Dpth (m)	1.98	Hydr. Depth (m)		1.96	
Conv. Total (m3/s)	607.9	Conv. (m3/s)		607.9	
Length Wtd. (m)	75.00	Wetted Per. (m)		7.11	
Min Ch El (m)	188.70	Shear (N/m2)		31.50	
Alpha	1.00	Stream Power (N/m s)		56.93	
Frctn Loss (m)		Cum Volume (1000 m3)	30.61	49.48	25.42
C & E Loss (m)		Cum SA (1000 m2)	30.03	16.06	32.56

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	194.30	Element	Left OB	Channel	

Right OB					
Vel Head (m)	0.01	Wt. n-Val.		0.035	0.050
W.S. Elev (m)	194.29	Reach Len. (m)	75.00	75.00	75.00
Crit W.S. (m)	192.06	Flow Area (m2)		39.01	393.75
E.G. Slope (m/m)	0.000051	Area (m2)	52.93	41.70	393.75
Q Total (m3/s)	133.76	Flow (m3/s)		24.89	108.87
Top Width (m)	195.26	Top Width (m)	40.72	7.50	147.04
Vel Total (m/s)	0.31	Avg. Vel. (m/s)		0.64	0.28
Max Chl Dpth (m)	5.59	Hydr. Depth (m)		5.57	2.68
Conv. Total (m3/s)	18640.6	Conv. (m3/s)		3469.1	15171.5
Length Wtd. (m)	75.00	Wetted Per. (m)		7.11	147.25
Min Ch El (m)	188.70	Shear (N/m2)		2.77	1.35
Alpha	1.44	Stream Power (N/m s)		1.77	0.37
Frctn Loss (m)		Cum Volume (1000 m3)	123.50	113.05	124.03
C & E Loss (m)		Cum SA (1000 m2)	58.18	16.06	75.80

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.0815

INPUT
Description: Hum 13-1R. Jane Street. 6.0 m W x 4.3 m H x 65 m L Concrete Box Culvert. Previous drawings by Ducan Hopper (1964) are out of date. Culvert modified as part of Highway 407, but no drawings available. Field observations used to update previous HEC-2 coding.

HEC-2 to HEC-RAS conversion January 2004 by Acres
included recoding of culvert to HEC-RAS format, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 65
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 5

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	200		126	196.5		235	193.5	
267	194		300	195				

Upstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

0	196	50	195	94	194	116	192	122	189
123	188.7	129	188.7	129.5	189	132	189.5	175	190
192	191	220	192	225	193	267	194	300	195

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	122	.035	129.5	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
122	129.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	122.5	196.5	F
129.5	300	193.5	F

Downstream Deck/Roadway Coordinates num= 5

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	200		126	196.5		235	193.5	
267	194		300	195				

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	196	50	195	94	194	116	192	122	189
123	188.7	129	188.7	129.5	189	132	189.5	175	190
192	191	220	192	225	193	267	194	300	195

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	122	.035	129.5	.08	225	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
122	129.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	122.5	196.5	F
129.5	300	191.8	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 = 193.5
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	4.3	6

FHWA Chart # 58- Rectangular concrete
FHWA Scale # 2 - Side tapered; More favorable edges
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	5	65	.015	.015	0	.5	1

Upstream Elevation = 188.7
Centerline Station = 126
Downstream Elevation = 188.7
Centerline Station = 126

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	24.80	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	2.57
Q Barrel (m3/s)	24.80	Culv Vel DS (m/s)	3.02
E.G. US. (m)	190.84	Culv Inv El Up (m)	188.70
W.S. US. (m)	190.68	Culv Inv El Dn (m)	188.70
E.G. DS (m)	190.42	Culv Frctn Ls (m)	0.00
W.S. DS (m)	190.07	Culv Exit Loss (m)	0.12
Delta EG (m)	0.43	Culv Entr Loss (m)	0.20
Delta WS (m)	0.61	Q Weir (m3/s)	
E.G. IC (m)	190.84	Weir Sta Lft (m)	
E.G. OC (m)	190.81	Weir Sta Rgt (m)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (m)	190.31	Weir Max Depth (m)	
Culv WS Outlet (m)	190.07	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	1.20	Min El Weir Flow (m)	193.50

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	104.27	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	4.54
Q Barrel (m3/s)	104.27	Culv Vel DS (m/s)	5.54
E.G. US. (m)	194.30	Culv Inv El Up (m)	188.70
W.S. US. (m)	194.29	Culv Inv El Dn (m)	188.70
E.G. DS (m)	191.93	Culv Frctn Ls (m)	0.06
W.S. DS (m)	191.80	Culv Exit Loss (m)	1.47
Delta EG (m)	2.37	Culv Entr Loss (m)	0.72
Delta WS (m)	2.49	Q Weir (m3/s)	29.50
E.G. IC (m)	194.30	Weir Sta Lft (m)	205.90
E.G. OC (m)	194.25	Weir Sta Rgt (m)	276.93
Culvert Control	Inlet	Weir Submerg	0.00
Culv WS Inlet (m)	192.53	Weir Max Depth (m)	0.80
Culv WS Outlet (m)	191.83	Weir Avg Depth (m)	0.43
Culv Nml Depth (m)		Weir Flow Area (m2)	30.77
Culv Crt Depth (m)	3.13	Min El Weir Flow (m)	193.50

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.081

INPUT
Description: Section 46.081 - Jane Steet - D/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	196	50	195	94	194	116	192	122	189
123	188.7	129	188.7	129.5	189	132	189.5	175	190
192	191	220	192	225	193	267	194	300	195

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	122	.035	129.5	.08	225	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
122	129.5	185	175	145	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent

0	122.5	196.5	F
129.5	300	191.8	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	190.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.		0.035	
W.S. Elev (m)	190.07	Reach Len. (m)	185.00	175.00	145.00
Crit W.S. (m)	189.80	Flow Area (m2)		9.46	
E.G. Slope (m/m)	0.005752	Area (m2)	1.14	10.03	15.71
Q Total (m3/s)	24.80	Flow (m3/s)		24.80	
Top Width (m)	56.27	Top Width (m)	2.13	7.50	46.64
Vel Total (m/s)	2.62	Avg. Vel. (m/s)		2.62	
Max Chl Dpth (m)	1.37	Hydr. Depth (m)		1.35	
Conv. Total (m3/s)	326.9	Conv. (m3/s)		326.9	
Length Wtd. (m)	166.20	Wetted Per. (m)		7.11	
Min Ch El (m)	188.70	Shear (N/m2)		75.07	
Alpha	1.00	Stream Power (N/m s)		196.84	
Frctn Loss (m)	1.19	Cum Volume (1000 m3)	30.61	48.52	25.42
C & E Loss (m)	0.11	Cum SA (1000 m2)	29.82	15.50	28.67

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.93	Element	Left OB	Channel	Right OB
Vel Head (m)	0.13	Wt. n-Val.		0.035	0.080
W.S. Elev (m)	191.80	Reach Len. (m)	185.00	175.00	145.00
Crit W.S. (m)	191.80	Flow Area (m2)		21.59	125.59
E.G. Slope (m/m)	0.001613	Area (m2)	7.84	23.03	125.59
Q Total (m3/s)	133.76	Flow (m3/s)		51.97	81.79

Top Width (m)	98.00	Top Width (m)	5.60	7.50	84.90
Vel Total (m/s)	0.91	Avg. Vel. (m/s)		2.41	0.65
Max Chl Dpth (m)	3.10	Hydr. Depth (m)		3.08	1.48
Conv. Total (m3/s)	3330.5	Conv. (m3/s)		1294.0	2036.5
Length Wtd. (m)	155.29	Wetted Per. (m)		7.11	85.00
Min Ch El (m)	188.70	Shear (N/m2)		48.07	23.37
Alpha	3.04	Stream Power (N/m s)		115.71	15.22
Frctn Loss (m)	0.24	Cum Volume (1000 m3)	123.50	106.93	124.03
C & E Loss (m)	0.04	Cum SA (1000 m2)	56.44	15.50	67.10

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.07

INPUT
Description: Section 46.07 - J.D. Barnes 2003 topo mapping
Section 46.06
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	193	15	190	20	189	24	188	25	188
25	187.7	27	187.7	27	188	30	188	64	189
70	190	102	193	146	193	157	194		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	25	.035	27	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
25	27	95	165	125	.1 .3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	189.12	Element	Left OB	Channel	Right OB
Vel Head (m)	0.13	Wt. n-Val.	0.080	0.035	

W.S. Elev (m)	188.99	Reach Len. (m)	95.00	165.00
Crit W.S. (m)		Flow Area (m2)	2.93	2.57
E.G. Slope (m/m)	0.009195	Area (m2)	2.93	2.57
Q Total (m3/s)	24.80	Flow (m3/s)	2.44	7.00
Top Width (m)	43.47	Top Width (m)	4.94	2.00
Vel Total (m/s)	0.99	Avg. Vel. (m/s)	0.83	2.72
Max Chl Dpth (m)	1.29	Hydr. Depth (m)	0.59	1.29
Conv. Total (m3/s)	258.6	Conv. (m3/s)	25.4	73.0
Length Wtd. (m)	133.79	Wetted Per. (m)	5.07	2.60
Min Ch El (m)	187.70	Shear (N/m2)	52.17	89.20
Alpha	2.58	Stream Power (N/m s)	43.42	242.64
Frctn Loss (m)	1.22	Cum Volume (1000 m3)	30.23	47.42
C & E Loss (m)	0.01	Cum SA (1000 m2)	29.16	14.67

Warning: The energy loss was 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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.31	Element	Left OB	Channel
Vel Head (m)	0.06	Wt. n-Val.	0.080	0.035
W.S. Elev (m)	191.26	Reach Len. (m)	95.00	165.00
Crit W.S. (m)		Flow Area (m2)	27.00	7.11
E.G. Slope (m/m)	0.001526	Area (m2)	27.00	7.11
Q Total (m3/s)	133.76	Flow (m3/s)	18.22	15.53
Top Width (m)	74.67	Top Width (m)	16.28	2.00
Vel Total (m/s)	0.85	Avg. Vel. (m/s)	0.67	2.18
Max Chl Dpth (m)	3.56	Hydr. Depth (m)	1.66	3.56
Conv. Total (m3/s)	3423.9	Conv. (m3/s)	466.3	397.4
Length Wtd. (m)	117.48	Wetted Per. (m)	16.62	2.60
Min Ch El (m)	187.70	Shear (N/m2)	24.31	40.94
Alpha	1.53	Stream Power (N/m s)	16.40	89.38

Frctn Loss (m)	0.05	Cum Volume (1000 m3)	120.28	104.29 106.05
C & E Loss (m)	0.01	Cum SA (1000 m2)	54.41	14.67 56.86

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: RIVER-1
REACH: Reach-1 RS: 46.06

INPUT
Description: Section 46.06 - J.D. Barnes 2003 topo mapping
Section 46.06
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	192	25	191	47	190	55	188	114	187
118	186.9	119	186.4	121	186.4	122	186.9	125	187
142	192	187	192	217	192	222	191	255	191
257	192	275	193						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	118	.035	122	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
118	122	130	165	145 .1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
142	275	192.1	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	187.89	Element	Left OB	Channel Right OB
Vel Head (m)	0.23	Wt. n-Val.	0.080	0.035 0.080
W.S. Elev (m)	187.66	Reach Len. (m)	130.00	165.00 145.00
Crit W.S. (m)	187.66	Flow Area (m2)	15.80	4.55 2.88
E.G. Slope (m/m)	0.008997	Area (m2)	15.80	4.55 2.88
Q Total (m3/s)	24.80	Flow (m3/s)	9.60	12.93 2.27
Top Width (m)	52.35	Top Width (m)	43.09	4.00 5.25
Vel Total (m/s)	1.07	Avg. Vel. (m/s)	0.61	2.84 0.79
Max Chl Dpth (m)	1.26	Hydr. Depth (m)	0.37	1.14 0.55
Conv. Total (m3/s)	261.4	Conv. (m3/s)	101.2	136.3 23.9
Length Wtd. (m)	156.17	Wetted Per. (m)	43.10	4.24 5.35
Min Ch El (m)	186.40	Shear (N/m2)	32.35	94.77

47.56				
Alpha	3.88	Stream Power (N/m s)	19.65	269.37
37.36				
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	29.34	46.83
21.47				
C & E Loss (m)	0.07	Cum SA (1000 m2)	26.88	14.17
20.03				

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 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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.25	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035
0.080				
W.S. Elev (m)	191.23	Reach Len. (m)	130.00	165.00
145.00				
Crit W.S. (m)		Flow Area (m2)	271.80	18.82
43.27				
E.G. Slope (m/m)	0.000217	Area (m2)	271.80	18.82
51.07				
Q Total (m3/s)	133.76	Flow (m3/s)	98.07	21.40
14.29				
Top Width (m)	154.77	Top Width (m)	98.77	4.00
52.00				
Vel Total (m/s)	0.40	Avg. Vel. (m/s)	0.36	1.14
0.33				
Max Chl Dpth (m)	4.83	Hydr. Depth (m)	2.75	4.71
2.49				
Conv. Total (m3/s)	9083.5	Conv. (m3/s)	6659.4	1453.4
970.7				
Length Wtd. (m)	148.83	Wetted Per. (m)	99.05	4.24
18.00				
Min Ch El (m)	186.40	Shear (N/m2)	5.84	9.45
5.11				
Alpha	1.96	Stream Power (N/m s)	2.11	10.75
1.69				
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	106.09	102.15
95.21				
C & E Loss (m)	0.00	Cum SA (1000 m2)	48.95	14.17
50.09				

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.05

INPUT
Description: Section 46.05 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	193	30	192	72	191	90	186	93	185
95	184.8	100	184.5	123	184.5	128	184.8	150	189
170	190	190	191	210	192	217	191	260	190
280	190	292	193						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	95	.035	128	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
95	128	70	70	65 .1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
210	292	192.1	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	187.52	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	187.52	Reach Len. (m)	70.00	70.00	65.00
Crit W.S. (m)	184.93	Flow Area (m2)	15.47	98.20	19.40
E.G. Slope (m/m)	0.000015	Area (m2)	15.47	98.20	19.40
Q Total (m3/s)	24.80	Flow (m3/s)	0.96	22.69	1.15
Top Width (m)	57.73	Top Width (m)	10.48	33.00	14.25
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.06	0.23	0.06
Max Chl Dpth (m)	3.02	Hydr. Depth (m)	1.48	2.98	1.36
Conv. Total (m3/s)	6342.1	Conv. (m3/s)	245.0	5802.9	294.2
Length Wtd. (m)	69.23	Wetted Per. (m)	10.86	33.02	14.51
Min Ch El (m)	184.50	Shear (N/m2)	0.21	0.45	0.20
Alpha	1.42	Stream Power (N/m s)	0.01	0.10	0.01
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	27.31	38.36	19.85
C & E Loss (m)	0.00	Cum SA (1000 m2)	23.40	11.12	

18.62

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.24	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	191.23	Reach Len. (m)	70.00	70.00	65.00
Crit W.S. (m)	185.72	Flow Area (m2)	79.98	220.47	144.74
E.G. Slope (m/m)	0.000024	Area (m2)	79.98	220.47	203.68
Q Total (m3/s)	133.76	Flow (m3/s)	8.82	110.04	14.90
Top Width (m)	201.52	Top Width (m)	32.51	33.00	136.02
Vel Total (m/s)	0.30	Avg. Vel. (m/s)	0.11	0.50	0.10
Max Chl Dpth (m)	6.73	Hydr. Depth (m)	2.46	6.68	2.18
Conv. Total (m3/s)	27150.8	Conv. (m3/s)	1790.8	22336.0	3024.0
Length Wtd. (m)	68.38	Wetted Per. (m)	33.36	33.02	66.98
Min Ch El (m)	184.50	Shear (N/m2)	0.57	1.59	0.51
Alpha	2.29	Stream Power (N/m s)	0.06	0.79	0.05
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	83.22	82.41	76.74
C & E Loss (m)	0.00	Cum SA (1000 m2)	40.42	11.12	36.45

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.04

INPUT
Description: Section 46.04 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

0	192	38	192	65	191	107	190	120	189
126	185	127	184	130	184	131	184.5	135	185
148	189	190	189.5	205	189	220	189	232	192

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	126	.035	131	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
126	131	115	100	70	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
190	232	190	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	187.52	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	187.48	Reach Len. (m)	115.00	100.00	70.00
Crit W.S. (m)	185.46	Flow Area (m2)	4.60	16.64	20.88
E.G. Slope (m/m)	0.000306	Area (m2)	4.60	16.64	20.88
Q Total (m3/s)	24.80	Flow (m3/s)	1.03	17.32	6.44
Top Width (m)	20.77	Top Width (m)	3.72	5.00	12.05
Vel Total (m/s)	0.59	Avg. Vel. (m/s)	0.22	1.04	0.31
Max Chl Dpth (m)	3.48	Hydr. Depth (m)	1.24	3.33	1.73
Conv. Total (m3/s)	1417.3	Conv. (m3/s)	58.7	990.2	368.4
Length Wtd. (m)	98.06	Wetted Per. (m)	4.47	5.53	12.45
Min Ch El (m)	184.00	Shear (N/m2)	3.09	9.03	5.03
Alpha	2.26	Stream Power (N/m s)	0.69	9.40	1.55
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	26.61	34.34	18.54
C & E Loss (m)	0.00	Cum SA (1000 m2)	22.90	9.79	17.76

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.23	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080

W.S. Elev (m)	191.19	Reach Len. (m)	115.00	100.00	70.00
Crit W.S. (m)	187.49	Flow Area (m2)	76.88	35.22	233.69
E.G. Slope (m/m)	0.000190	Area (m2)	76.88	35.22	233.69
Q Total (m3/s)	133.76	Flow (m3/s)	14.46	47.70	71.61
Top Width (m)	169.03	Top Width (m)	66.26	5.00	97.78
Vel Total (m/s)	0.39	Avg. Vel. (m/s)	0.19	1.35	0.31
Max Chl Dpth (m)	7.19	Hydr. Depth (m)	1.16	7.04	2.39
Conv. Total (m3/s)	9694.4	Conv. (m3/s)	1047.8	3457.0	5189.6
Length Wtd. (m)	95.43	Wetted Per. (m)	67.52	5.53	98.69
Min Ch El (m)	184.00	Shear (N/m2)	2.13	11.89	4.42
Alpha	4.73	Stream Power (N/m s)	0.40	16.10	1.35
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	77.73	73.46	62.53
C & E Loss (m)	0.01	Cum SA (1000 m2)	36.96	9.79	28.86

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: RIVER-1
REACH: Reach-1 RS: 46.032

INPUT
Description: Section 46.032 - CNR - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	191.25	6	191	9.7	190	13.7	189.8	58	189
88.3	188	109.3	185	121.7	184.2	125	184	181.4	182.6
195.4	182.6	209	184	287.6	185	289.7	187	297.1	188
316	189	328	189	334	185.4	350	192		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	125	.035	209	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
125	209	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	182.9	189.8	F
193.9	350	191.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	187.49	Element	Left OB	Channel	Right OB
Vel Head (m)	0.08	Wt. n-Val.		0.035	
W.S. Elev (m)	187.41	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	184.15	Flow Area (m2)		52.87	
E.G. Slope (m/m)	0.000242	Area (m2)	65.97	354.71	240.20
Q Total (m3/s)	66.97	Flow (m3/s)		66.97	
Top Width (m)	208.45	Top Width (m)	32.54	84.00	91.91
Vel Total (m/s)	1.27	Avg. Vel. (m/s)		1.27	
Max Chl Dpth (m)	4.81	Hydr. Depth (m)		4.81	
Conv. Total (m3/s)	4301.8	Conv. (m3/s)		4301.8	
Length Wtd. (m)	50.00	Wetted Per. (m)		11.00	
Min Ch El (m)	182.60	Shear (N/m2)		11.42	
Alpha	1.00	Stream Power (N/m s)		14.47	
Frctn Loss (m)		Cum Volume (1000 m3)	22.55	15.77	9.41
C & E Loss (m)		Cum SA (1000 m2)	20.82	5.34	14.12

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.22	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035	
W.S. Elev (m)	191.22	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	185.84	Flow Area (m2)	375.67	554.11	
E.G. Slope (m/m)	0.000007	Area (m2)	375.67	674.68	709.24
Q Total (m3/s)	200.64	Flow (m3/s)	26.82	173.83	
Top Width (m)	347.26	Top Width (m)	124.16	84.00	139.10
Vel Total (m/s)	0.22	Avg. Vel. (m/s)	0.07	0.31	
Max Chl Dpth (m)	8.62	Hydr. Depth (m)	3.03	8.04	
Conv. Total (m3/s)	73340.5	Conv. (m3/s)	9801.9	63538.5	
Length Wtd. (m)	50.00	Wetted Per. (m)	124.57	68.92	

Min Ch El (m)	182.60	Shear (N/m2)	0.22	0.59
Alpha	1.85	Stream Power (N/m s)	0.02	0.19
Frctn Loss (m)		Cum Volume (1000 m3)	51.71	37.97
29.53				
C & E Loss (m)		Cum SA (1000 m2)	26.01	5.34
20.57				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.0315

INPUT
Description: Hum 13-1RR. CNR Culvert. Twin 3.0 m W x 3.5 m H x 32 m L
Structural Steel Plate Arch Culverts. No drawings available.
Size estimated from HEC-2 coding.

HEC-2 to HEC-RAS conversion
January 2004 by Acres included recoding of culvert to HEC-RAS format, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 13
Deck/Roadway Width = 32
Weir Coefficient = 1.4

Upstream Deck/Roadway Coordinates
num= 10

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	191.2		5	191		8.7	190	
12.7	189.8		16.6	190		25	190.3	
115.5	191		274.1	192		335	192.5	
350	192.65							

Upstream Bridge Cross Section Data
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	191.25	6	191	9.7	190	13.7	189.8	58	189
88.3	188	109.3	185	121.7	184.2	125	184	181.4	182.6
195.4	182.6	209	184	287.6	185	289.7	187	297.1	188
316	189	328	189	334	185.4	350	192		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	125	.035	209	.08

Bank Sta: Left Right Coeff Contr. Expan.
125 209 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	182.9	189.8	F
193.9	350	191.5	F

Downstream Deck/Roadway Coordinates
num= 10

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	191.2		5	191		8.7	190	

12.7	189.8	16.6	190	25	190.3
115.5	191	274.1	192	335	192.5
350	192.65				

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	191.2	6	191	9.7	190	13.7	189.8	58	189
88.3	188	109.3	185	121.7	184.2	125	184	170	183.2
171	182.6	180	182.6	181	183.2	195	184	310	190

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	170	.035	181	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
170	181	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	170	187	F
181	310	187	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 = 190.5
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	Ellipse	3.5	3

FHWA Chart # 30- Vertical Ellipse; Concrete
FHWA Scale # 1 - Square edge with headwall
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	13	32	.024	.024	0	.7	1

Number of Barrels = 2
Upstream Elevation = 182.6
Centerline Stations

Sta.	Sta.
185.4	191.4

Downstream Elevation = 182.6
Centerline Stations

Sta.	Sta.
172	178

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	66.97	Culv Full Len (m)	
# Barrels	2	Culv Vel US (m/s)	4.07
Q Barrel (m3/s)	33.49	Culv Vel DS (m/s)	5.02
E.G. US. (m)	187.49	Culv Inv El Up (m)	182.60
W.S. US. (m)	187.41	Culv Inv El Dn (m)	182.60
E.G. DS (m)	184.99	Culv Frctn Ls (m)	0.00
W.S. DS (m)	184.22	Culv Exit Loss (m)	1.53
Delta EG (m)	2.50	Culv Entr Loss (m)	0.59
Delta WS (m)	3.19	Q Weir (m3/s)	
E.G. IC (m)	187.09	Weir Sta Lft (m)	

E.G. OC (m)	187.49	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	186.05	Weir Max Depth (m)	
Culv WS Outlet (m)	185.24	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	2.64	Min El Weir Flow (m)	190.50

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	112.90	Culv Full Len (m)	29.43
# Barrels	2	Culv Vel US (m/s)	6.84
Q Barrel (m3/s)	56.45	Culv Vel DS (m/s)	7.01
E.G. US. (m)	191.22	Culv Inv El Up (m)	182.60
W.S. US. (m)	191.22	Culv Inv El Dn (m)	182.60
E.G. DS (m)	187.51	Culv Frctn Ls (m)	1.06
W.S. DS (m)	185.89	Culv Exit Loss (m)	0.89
Delta EG (m)	3.71	Culv Entr Loss (m)	1.67
Delta WS (m)	5.32	Q Weir (m3/s)	87.74
E.G. IC (m)	191.21	Weir Sta Lft (m)	0.68
E.G. OC (m)	191.22	Weir Sta Rgt (m)	150.71
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	186.10	Weir Max Depth (m)	1.40
Culv WS Outlet (m)	185.89	Weir Avg Depth (m)	0.51
Culv Nml Depth (m)		Weir Flow Area (m2)	76.97
Culv Crt Depth (m)	3.25	Min El Weir Flow (m)	190.50

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.031

INPUT
Description: Section 46.031 - CNR - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	191.2	6	191	9.7	190	13.7	189.8	58	189
88.3	188	109.3	185	121.7	184.2	125	184	170	183.2
171	182.6	180	182.6	181	183.2	195	184	310	190

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	170	.035	181	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
170	181	90	110	75	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	170	187	F
181	310	187	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	184.99	Element	Left OB	Channel	Right OB
Vel Head (m)	0.77	Wt. n-Val.		0.035	
W.S. Elev (m)	184.22	Reach Len. (m)	90.00	110.00	75.00

Crit W.S. (m)	184.22	Flow Area (m2)		17.18	
E.G. Slope (m/m)	0.010691	Area (m2)	28.11	17.18	9.07
Q Total (m3/s)	66.97	Flow (m3/s)		66.97	
Top Width (m)	77.69	Top Width (m)	48.55	11.00	18.14
Vel Total (m/s)	3.90	Avg. Vel. (m/s)		3.90	
Max Chl Dpth (m)	1.62	Hydr. Depth (m)		1.56	
Conv. Total (m3/s)	647.7	Conv. (m3/s)		647.7	
Length Wtd. (m)	102.88	Wetted Per. (m)		11.33	
Min Ch El (m)	182.60	Shear (N/m2)		158.94	
Alpha	1.00	Stream Power (N/m s)		619.61	
Frctn Loss (m)	0.24	Cum Volume (1000 m3)	22.55	6.82	9.41
C & E Loss (m)	0.37	Cum SA (1000 m2)	18.79	2.97	11.37

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 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, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	187.51	Element	Left OB	Channel	Right OB
Vel Head (m)	1.62	Wt. n-Val.		0.035	
W.S. Elev (m)	185.89	Reach Len. (m)	90.00	110.00	75.00
Crit W.S. (m)	185.89	Flow Area (m2)		35.64	
E.G. Slope (m/m)	0.008428	Area (m2)	128.00	35.64	66.50
Q Total (m3/s)	200.64	Flow (m3/s)		200.64	
Top Width (m)	128.26	Top Width (m)	66.96	11.00	

50.30					
Vel Total (m/s)	5.63	Avg. Vel. (m/s)			5.63
Max Chl Dpth (m)	3.29	Hydr. Depth (m)			3.24
Conv. Total (m3/s)	2185.5	Conv. (m3/s)			2185.5
Length Wtd. (m)	101.96	Wetted Per. (m)			11.33
Min Ch El (m)	182.60	Shear (N/m2)			259.91
Alpha	1.00	Stream Power (N/m s)			1463.36
Frctn Loss (m)	0.23	Cum Volume (1000 m3)	51.71		11.26
29.53					
C & E Loss (m)	0.78	Cum SA (1000 m2)	21.23		2.97
15.83					

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 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, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.03

INPUT
Description: Section 46.03 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	189	17	183	34	182.3	35	182	39	182
40	182.3	43	183	88	182.5	89	181.5	93	181.5
94	182.5	96	183	100	184	103	185	138	187
187	188								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	88	.035	94	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
88	94	185	205	150	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent

0 43 183.1 F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	184.04	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	184.00	Reach Len. (m)	185.00	205.00	150.00
Crit W.S. (m)	183.28	Flow Area (m2)	96.30	14.00	4.49
E.G. Slope (m/m)	0.000995	Area (m2)	96.30	14.00	4.49
Q Total (m3/s)	66.97	Flow (m3/s)	45.19	20.35	1.43
Top Width (m)	85.83	Top Width (m)	73.83	6.00	6.00
Vel Total (m/s)	0.58	Avg. Vel. (m/s)	0.47	1.45	0.32
Max Chl Dpth (m)	2.50	Hydr. Depth (m)	1.30	2.33	0.75
Conv. Total (m3/s)	2122.9	Conv. (m3/s)	1432.3	645.2	45.4
Length Wtd. (m)	184.84	Wetted Per. (m)	74.19	6.83	6.18
Min Ch El (m)	181.50	Shear (N/m2)	12.67	20.00	7.10
Alpha	2.33	Stream Power (N/m s)	5.94	29.09	2.26
Frctn Loss (m)	0.32	Cum Volume (1000 m3)	16.95	5.11	8.90
C & E Loss (m)	0.01	Cum SA (1000 m2)	13.29	2.03	10.47

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	185.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	185.39	Reach Len. (m)	185.00	205.00	150.00
Crit W.S. (m)	183.85	Flow Area (m2)	201.48	22.32	16.79
E.G. Slope (m/m)	0.000999	Area (m2)	201.48	22.32	16.79
Q Total (m3/s)	200.64	Flow (m3/s)	149.42	44.40	6.81
Top Width (m)	99.53	Top Width (m)	77.76	6.00	15.77
Vel Total (m/s)	0.83	Avg. Vel. (m/s)	0.74	1.99	

0.41				
Max Chl Dpth (m)	3.89	Hydr. Depth (m)	2.59	3.72
1.06				
Conv. Total (m3/s)	6347.1	Conv. (m3/s)	4726.9	1404.7
215.6				
Length Wtd. (m)	181.78	Wetted Per. (m)	78.36	6.83
16.13				
Min Ch El (m)	181.50	Shear (N/m2)	25.20	32.03
10.20				
Alpha	1.86	Stream Power (N/m s)	18.69	63.72
4.14				
Frctn Loss (m)	0.29	Cum Volume (1000 m3)	36.88	8.07
26.40				
C & E Loss (m)	0.01	Cum SA (1000 m2)	14.72	2.03
13.35				

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: RIVER-1
REACH: Reach-1 RS: 46.02

INPUT
Description: Section 46.02 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	189	18	183	41	182	44	181.7	44	181
46	181	47	181.7	50	182	70	183	78	185
90	186	120	187	150	188				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	44	.035	47	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
44	47	110	120	110	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	183.71	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.13	Wt. n-Val.	0.080	0.035
0.080				
W.S. Elev (m)	183.57	Reach Len. (m)	110.00	120.00
110.00				
Crit W.S. (m)		Flow Area (m2)	30.30	7.36
27.25				
E.G. Slope (m/m)	0.003860	Area (m2)	30.30	7.36
27.25				
Q Total (m3/s)	66.97	Flow (m3/s)	24.89	19.90
22.18				
Top Width (m)	56.00	Top Width (m)	27.71	3.00
25.29				
Vel Total (m/s)	1.03	Avg. Vel. (m/s)	0.82	2.70
0.81				
Max Chl Dpth (m)	2.57	Hydr. Depth (m)	1.09	2.45

1.08					
Conv. Total (m3/s)	1077.9	Conv. (m3/s)	400.7	320.3	356.9
Length Wtd. (m)	113.76	Wetted Per. (m)	27.84	3.92	25.40
Min Ch El (m)	181.00	Shear (N/m2)	41.19	71.11	40.62
Alpha	2.48	Stream Power (N/m s)	33.85	192.16	33.06
Frctn Loss (m)	0.34	Cum Volume (1000 m3)	5.24	2.92	6.52
C & E Loss (m)	0.00	Cum SA (1000 m2)	3.89	1.11	8.12

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	185.15	Element	Left OB	Channel	Right OB
Vel Head (m)	0.16	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	184.99	Reach Len. (m)	110.00	120.00	110.00
Crit W.S. (m)		Flow Area (m2)	72.73	11.63	67.24
E.G. Slope (m/m)	0.003026	Area (m2)	72.73	11.63	67.24
Q Total (m3/s)	200.64	Flow (m3/s)	85.86	37.73	77.05
Top Width (m)	65.95	Top Width (m)	31.98	3.00	30.97
Vel Total (m/s)	1.32	Avg. Vel. (m/s)	1.18	3.24	1.15
Max Chl Dpth (m)	3.99	Hydr. Depth (m)	2.27	3.88	2.17
Conv. Total (m3/s)	3647.3	Conv. (m3/s)	1560.7	685.9	1400.7
Length Wtd. (m)	112.32	Wetted Per. (m)	32.34	3.92	31.26
Min Ch El (m)	181.00	Shear (N/m2)	66.75	88.03	63.84
Alpha	1.76	Stream Power (N/m s)	78.79	285.62	73.15
Frctn Loss (m)	0.25	Cum Volume (1000 m3)	11.52	4.59	20.10
C & E Loss (m)	0.01	Cum SA (1000 m2)	4.57	1.11	9.85

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.01

INPUT

Description: Section 46.01 - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	189	14	188	20	182	33	181	34	180.4
37	180.4	38	182	87	183	98	185	106	186
126	187	180	188						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	33	.035	38	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
33	38	95	105	95	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	183.36	Element	Left OB	Channel	Right OB
Vel Head (m)	0.14	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	183.22	Reach Len. (m)	95.00	105.00	95.00
Crit W.S. (m)		Flow Area (m2)	23.16	13.02	35.59
E.G. Slope (m/m)	0.002412	Area (m2)	23.16	13.02	35.59
Q Total (m3/s)	66.97	Flow (m3/s)	19.18	30.43	17.36
Top Width (m)	69.45	Top Width (m)	14.22	5.00	50.23
Vel Total (m/s)	0.93	Avg. Vel. (m/s)	0.83	2.34	0.49
Max Chl Dpth (m)	2.82	Hydr. Depth (m)	1.63	2.60	0.71
Conv. Total (m3/s)	1363.7	Conv. (m3/s)	390.6	619.7	353.4
Length Wtd. (m)	100.25	Wetted Per. (m)	14.77	6.05	50.26
Min Ch El (m)	180.40	Shear (N/m2)	37.08	50.86	16.75
Alpha	3.15	Stream Power (N/m s)	30.72	118.91	8.17
Frctn Loss (m)	0.19	Cum Volume (1000 m3)	2.30	1.70	3.06
C & E Loss (m)	0.00	Cum SA (1000 m2)	1.59	0.63	3.97

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	184.89	Element	Left OB	Channel	Right OB
Vel Head (m)	0.13	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	184.76	Reach Len. (m)	95.00	105.00	95.00
Crit W.S. (m)		Flow Area (m2)	46.23	20.71	119.40
E.G. Slope (m/m)	0.001702	Area (m2)	46.23	20.71	119.40

Q Total (m3/s)	200.64	Flow (m3/s)	46.54	55.43	98.67
Top Width (m)	79.46	Top Width (m)	15.76	5.00	58.69
Vel Total (m/s)	1.08	Avg. Vel. (m/s)	1.01	2.68	0.83
Max Chl Dpth (m)	4.36	Hydr. Depth (m)	2.93	4.14	2.03
Conv. Total (m3/s)	4863.7	Conv. (m3/s)	1128.2	1343.8	2391.7
Length Wtd. (m)	98.47	Wetted Per. (m)	16.95	6.05	58.86
Min Ch El (m)	180.40	Shear (N/m2)	45.53	57.11	33.85
Alpha	2.20	Stream Power (N/m s)	45.84	152.85	27.97
Frctn Loss (m)	0.16	Cum Volume (1000 m3)	4.97	2.65	9.84
C & E Loss (m)	0.01	Cum SA (1000 m2)	1.94	0.63	4.92

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.00

INPUT
Description: Section 46.00 - J.D. Barnes 2003 topo mapping (This section location corresponds to D/S HEC-RAS model section 475.53)

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	188	20	187	40	182	55	181	57	180
60	180	62	181	73	182	95	183	103	184
110	185	123	187	180	187				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	55	.035	62	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
55	62	0	0	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	183.18	Element	Left OB	Channel	Right OB
Vel Head (m)	0.14	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	183.04	Reach Len. (m)			
Crit W.S. (m)	182.26	Flow Area (m2)	25.26	19.28	28.83
E.G. Slope (m/m)	0.001480	Area (m2)	25.26	19.28	28.83
Q Total (m3/s)	66.97	Flow (m3/s)	14.53	39.87	12.57
Top Width (m)	59.48	Top Width (m)	19.16	7.00	33.32
Vel Total (m/s)	0.91	Avg. Vel. (m/s)	0.58	2.07	

0.44					
Max Chl Dpth (m)	3.04	Hydr. Depth (m)	1.32	2.75	
0.87					
Conv. Total (m3/s)	1740.6	Conv. (m3/s)	377.6	1036.3	
326.7					
Length Wtd. (m)		Wetted Per. (m)	19.32	7.47	
33.39					
Min Ch El (m)	180.00	Shear (N/m2)	18.98	37.46	
12.53					
Alpha	3.19	Stream Power (N/m s)	10.92	77.47	
5.47					
Frctn Loss (m)		Cum Volume (1000 m3)			
C & E Loss (m)		Cum SA (1000 m2)			

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	184.73	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.19	Wt. n-Val.	0.080	0.035	
0.080					
W.S. Elev (m)	184.54	Reach Len. (m)			
Crit W.S. (m)	183.38	Flow Area (m2)	58.50	29.78	
87.66					
E.G. Slope (m/m)	0.001535	Area (m2)	58.50	29.78	
87.66					
Q Total (m3/s)	200.64	Flow (m3/s)	49.83	83.80	
67.01					
Top Width (m)	76.94	Top Width (m)	25.16	7.00	
44.78					
Vel Total (m/s)	1.14	Avg. Vel. (m/s)	0.85	2.81	
0.76					
Max Chl Dpth (m)	4.54	Hydr. Depth (m)	2.33	4.25	
1.96					
Conv. Total (m3/s)	5120.9	Conv. (m3/s)	1271.8	2138.8	
1710.3					
Length Wtd. (m)		Wetted Per. (m)	25.51	7.47	
44.95					
Min Ch El (m)	180.00	Shear (N/m2)	34.53	60.00	
29.36					
Alpha	2.83	Stream Power (N/m s)	29.41	168.84	
22.44					
Frctn Loss (m)		Cum Volume (1000 m3)			
C & E Loss (m)		Cum SA (1000 m2)			

SUMMARY OF MANNING'S N VALUES

River:RIVER-1

Reach	River Sta.	n1	n2	n3	n4	n5	n6	n7

Reach-1 46.45 .05 .035 .08

Reach-1 46.44 .05 .035 .05

Reach-1 46.43 .05 .08 .035 .08 .05

Reach-1 46.42 .05 .08 .035 .08 .05

Reach-1 46.413 .05 .08 .035 .08 .05

Reach-1 46.4125 Inl Struct

Reach-1 46.412 .05 .08 .035 .08 .05

Reach-1 46.4115 Culvert

Reach-1 46.411 .05 .08 .035 .08 .05

Reach-1 46.41 .05 .08 .035 .08 .035
.08 .05

Reach-1 46.402 .05 .08 .035 .08 .05

Reach-1 46.4015 Culvert

Reach-1 46.401 .05 .08 .035 .08 .05

Reach-1 46.392 .05 .025 .05 .08 .035
.08 .05

Reach-1 46.3915 Mult Open

Reach-1 46.391 .05 .025 .05 .08 .05

Reach-1 46.39 .05 .025 .05 .08 .035
.08 .05

Reach-1 46.382 .025 .08 .035 .08 .05

Reach-1 46.3815 Culvert

Reach-1 46.381 .025 .05 .08 .035 .08
.05

Reach-1 46.36 .025 .05 .08 .035 .08
.05

Reach-1 46.35 .025 .05 .08 .035 .08
.05

Reach-1 46.34 .025 .05 .08 .035 .08
.05

Reach-1 46.33 .05 .08 .035 .08 .05

Reach-1 46.322 .05 .08 .035 .08 .05

Reach-1 46.3215 Culvert

Reach-1 46.321 .05 .08 .035 .08 .05

Reach-1 46.32 .05 .08 .035 .08 .05

Reach-1 46.312 .05 .08 .035 .08 .05

Reach-1 46.3115 Culvert

Reach-1 46.311 .05 .08 .035 .08 .05

Reach-1	46.31		.05	.08	.035	.08	.05
Reach-1	46.30		.05	.08	.035	.08	.025
.05							
Reach-1	46.292		.05	.08	.035	.08	.05
Reach-1	46.2915	Culvert					
Reach-1	46.291		.05	.08	.035	.08	.05
Reach-1	46.29		.05	.08	.035	.08	.05
Reach-1	46.282		.05	.08	.035	.08	.05
.025	.05						
Reach-1	46.2815	Culvert					
Reach-1	46.281		.05	.08	.035	.08	.05
.025	.05						
Reach-1	46.28		.05	.08	.035	.08	.05
.025	.05						
Reach-1	46.274		.05	.08	.035	.08	.05
Reach-1	46.2735	Bridge					
Reach-1	46.273		.05	.08	.035	.08	.05
Reach-1	46.272		.05	.08	.035	.08	.05
Reach-1	46.2715	Culvert					
Reach-1	46.271		.05	.05	.08	.035	.08
.05							
Reach-1	46.27		.08	.035	.08		
Reach-1	46.26		.05	.08	.035	.08	.05
Reach-1	46.25		.05	.08	.035	.08	.05
Reach-1	46.24		.05	.08	.035	.08	.05
Reach-1	46.2375		.05	.08	.035	.08	.05
Reach-1	46.235	Bridge					
Reach-1	46.2325		.05	.08	.035	.08	.05
Reach-1	46.23		.05	.08	.035	.08	.05
Reach-1	46.22		.08	.035	.08	.035	.05
Reach-1	46.214		.05	.035	.08		
Reach-1	46.2135	Inl Struct					
Reach-1	46.213		.05	.035	.08		
Reach-1	46.212		.05	.035	.08		
Reach-1	46.2115	Culvert					
Reach-1	46.211		.05	.035	.08		

Reach-1	46.21		.05	.035	.05	
Reach-1	46.202		.05	.035	.05	
Reach-1	46.2015	Culvert				
Reach-1	46.201		.05	.035	.05	
Reach-1	46.192		.05	.035	.05	
Reach-1	46.1915	Culvert				
Reach-1	46.191		.05	.035	.05	
Reach-1	46.19		.05	.025	.05	.035	.05
Reach-1	46.182		.05	.025	.05	.035	.05
Reach-1	46.1815	Culvert				
Reach-1	46.181		.05	.025	.05	.035	.05
Reach-1	46.18		.05	.035	.05	
Reach-1	46.172		.05	.035	.05	
Reach-1	46.1715	Culvert				
Reach-1	46.171		.05	.035	.05	.025	
Reach-1	46.17		.05	.035	.05	.025	
Reach-1	46.162		.05	.035	.05	
Reach-1	46.1615	Culvert				
Reach-1	46.161		.05	.035	.05	
Reach-1	46.15		.05	.08	.035	.08	.025
Reach-1	46.142		.05	.08	.035	.08	.025
Reach-1	46.1415	Culvert				
Reach-1	46.141		.05	.08	.035	.08	.025
Reach-1	46.14		.05	.08	.035	.08	.025
Reach-1	46.132		.05	.08	.035	.08	.05
Reach-1	46.13		.05	.08	.035	.08	.05
Reach-1	46.122		.05	.035	.05	
Reach-1	46.1215	Culvert				
Reach-1	46.121		.05	.035	.05	
Reach-1	46.12		.05	.035	.05	
Reach-1	46.11		.05	.035	.05	
Reach-1	46.1015	Culvert				

Reach-1	46.10	.05	.035	.05	
Reach-1	46.09	.05	.035	.05	
Reach-1	46.082	.05	.035	.05	
Reach-1	46.0815	Culvert			
Reach-1	46.081	.08	.035	.08	.05
Reach-1	46.07	.08	.035	.08	
Reach-1	46.06	.08	.035	.08	
Reach-1	46.05	.08	.035	.08	
Reach-1	46.04	.08	.035	.08	
Reach-1	46.032	.08	.035	.08	
Reach-1	46.0315	Culvert			
Reach-1	46.031	.08	.035	.08	
Reach-1	46.03	.08	.035	.08	
Reach-1	46.02	.08	.035	.08	
Reach-1	46.01	.08	.035	.08	
Reach-1	46.00	.08	.035	.08	

SUMMARY OF REACH LENGTHS

River: RIVER-1

Reach	River Sta.	Left	Channel	Right
Reach-1	46.45	180	180	170
Reach-1	46.44	130	130	125
Reach-1	46.43	100	100	95
Reach-1	46.42	295	240	190
Reach-1	46.413	5	5	5
Reach-1	46.4125	Inl Struct		
Reach-1	46.412	45	45	45
Reach-1	46.4115	Culvert		
Reach-1	46.411	80	80	90
Reach-1	46.41	140	140	120
Reach-1	46.402	100	100	100
Reach-1	46.4015	Culvert		
Reach-1	46.401	80	95	100
Reach-1	46.392	70	70	70
Reach-1	46.3915	Mult Open		
Reach-1	46.391	45	35	25
Reach-1	46.39	50	35	25
Reach-1	46.382	45	45	45
Reach-1	46.3815	Culvert		

Reach-1	46.381	260	275	290
Reach-1	46.36	150	150	150
Reach-1	46.35	120	120	120
Reach-1	46.34	225	205	190
Reach-1	46.33	130	130	130
Reach-1	46.322	50	50	50
Reach-1	46.3215	Culvert		
Reach-1	46.321	50	50	50
Reach-1	46.32	110	110	110
Reach-1	46.312	60	60	60
Reach-1	46.3115	Culvert		
Reach-1	46.311	150	150	150
Reach-1	46.31	150	150	150
Reach-1	46.30	110	110	110
Reach-1	46.292	55	55	55
Reach-1	46.2915	Culvert		
Reach-1	46.291	145	150	155
Reach-1	46.29	135	145	150
Reach-1	46.282	50	50	50
Reach-1	46.2815	Culvert		
Reach-1	46.281	40	40	40
Reach-1	46.28	50	50	50
Reach-1	46.274	1	1	1
Reach-1	46.2735	Bridge		
Reach-1	46.273	4	4	4
Reach-1	46.272	100	80	60
Reach-1	46.2715	Culvert		
Reach-1	46.271	55	60	70
Reach-1	46.27	100	110	120
Reach-1	46.26	115	120	120
Reach-1	46.25	140	130	125
Reach-1	46.24	54	51	45
Reach-1	46.2375	30	30	30
Reach-1	46.235	Bridge		
Reach-1	46.2325	94	94	94
Reach-1	46.23	101	95	89
Reach-1	46.22	125	140	115
Reach-1	46.214	1	1	1
Reach-1	46.2135	Inl Struct		
Reach-1	46.213	15	15	15
Reach-1	46.212	55	45	10
Reach-1	46.2115	Culvert		
Reach-1	46.211	10	10	10
Reach-1	46.21	30	30	30
Reach-1	46.202	70	70	70
Reach-1	46.2015	Culvert		
Reach-1	46.201	20	25	30
Reach-1	46.192	25	25	25
Reach-1	46.1915	Culvert		
Reach-1	46.191	50	50	50
Reach-1	46.19	45	45	45
Reach-1	46.182	30	30	30
Reach-1	46.1815	Culvert		
Reach-1	46.181	10	10	10
Reach-1	46.18	25	25	25
Reach-1	46.172	40	40	40
Reach-1	46.1715	Culvert		
Reach-1	46.171	20	20	20
Reach-1	46.17	25	25	25
Reach-1	46.162	30	30	30
Reach-1	46.1615	Culvert		
Reach-1	46.161	115	115	110
Reach-1	46.15	50	50	50

Reach-1	46.142	60	60	60
Reach-1	46.1415	Culvert		
Reach-1	46.141	30	25	20
Reach-1	46.14	37.5	37.5	37.5
Reach-1	46.132	27.5	27.5	27.5
Reach-1	46.13	25	25	25
Reach-1	46.122	38	38	38
Reach-1	46.1215	Culvert		
Reach-1	46.121	20	20	20
Reach-1	46.12	35	38	40
Reach-1	46.11	235	235	235
Reach-1	46.1015	Culvert		
Reach-1	46.10	130	200	160
Reach-1	46.09	80	95	125
Reach-1	46.082	75	75	75
Reach-1	46.0815	Culvert		
Reach-1	46.081	185	175	145
Reach-1	46.07	95	165	125
Reach-1	46.06	130	165	145
Reach-1	46.05	70	70	65
Reach-1	46.04	115	100	70
Reach-1	46.032	50	50	50
Reach-1	46.0315	Culvert		
Reach-1	46.031	90	110	75
Reach-1	46.03	185	205	150
Reach-1	46.02	110	120	110
Reach-1	46.01	95	105	95
Reach-1	46.00	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: RIVER-1

Reach	River Sta.	Contr.	Expan.
Reach-1	46.45	.1	.3
Reach-1	46.44	.1	.3
Reach-1	46.43	.1	.3
Reach-1	46.42	.1	.3
Reach-1	46.413	.3	.5
Reach-1	46.4125	Inl Struct	
Reach-1	46.412	.3	.5
Reach-1	46.4115	Culvert	
Reach-1	46.411	.3	.5
Reach-1	46.41	.1	.3
Reach-1	46.402	.3	.5
Reach-1	46.4015	Culvert	
Reach-1	46.401	.3	.5
Reach-1	46.392	.3	.5
Reach-1	46.3915	Mult Open	
Reach-1	46.391	.3	.5
Reach-1	46.39	.1	.3
Reach-1	46.382	.3	.5
Reach-1	46.3815	Culvert	
Reach-1	46.381	.3	.5
Reach-1	46.36	.1	.3
Reach-1	46.35	.1	.3
Reach-1	46.34	.1	.3
Reach-1	46.33	.1	.3
Reach-1	46.322	.3	.5

Reach-1	46.3215	Culvert		
Reach-1	46.321		.3	.5
Reach-1	46.32		.1	.3
Reach-1	46.312		.3	.5
Reach-1	46.3115	Culvert		
Reach-1	46.311		.3	.5
Reach-1	46.31		.1	.3
Reach-1	46.30		.1	.3
Reach-1	46.292		.3	.5
Reach-1	46.2915	Culvert		
Reach-1	46.291		.3	.5
Reach-1	46.29		.1	.3
Reach-1	46.282		.3	.5
Reach-1	46.2815	Culvert		
Reach-1	46.281		.3	.5
Reach-1	46.28		.1	.3
Reach-1	46.274		.3	.5
Reach-1	46.2735	Bridge		
Reach-1	46.273		.3	.5
Reach-1	46.272		.3	.5
Reach-1	46.2715	Culvert		
Reach-1	46.271		.3	.5
Reach-1	46.27		.1	.3
Reach-1	46.26		.1	.3
Reach-1	46.25		.1	.3
Reach-1	46.24		.1	.3
Reach-1	46.2375		.3	.5
Reach-1	46.235	Bridge		
Reach-1	46.2325		.3	.5
Reach-1	46.23		.1	.3
Reach-1	46.22		.1	.3
Reach-1	46.214		.3	.5
Reach-1	46.2135	Inl Struct		
Reach-1	46.213		.3	.5
Reach-1	46.212		.3	.5
Reach-1	46.2115	Culvert		
Reach-1	46.211		.3	.5
Reach-1	46.21		.1	.3
Reach-1	46.202		.3	.5
Reach-1	46.2015	Culvert		
Reach-1	46.201		.3	.5
Reach-1	46.192		.3	.5
Reach-1	46.1915	Culvert		
Reach-1	46.191		.3	.5
Reach-1	46.19		.1	.3
Reach-1	46.182		.3	.5
Reach-1	46.1815	Culvert		
Reach-1	46.181		.3	.5
Reach-1	46.18		.1	.3
Reach-1	46.172		.3	.5
Reach-1	46.1715	Culvert		
Reach-1	46.171		.3	.5
Reach-1	46.17		.1	.3
Reach-1	46.162		.3	.5
Reach-1	46.1615	Culvert		
Reach-1	46.161		.3	.5
Reach-1	46.15		.1	.3
Reach-1	46.142		.3	.5
Reach-1	46.1415	Culvert		
Reach-1	46.141		.3	.5
Reach-1	46.14		.1	.3
Reach-1	46.132		.3	.5
Reach-1	46.13		.1	.3

Reach-1	46.122		.3	.5
Reach-1	46.1215	Culvert		
Reach-1	46.121		.3	.5
Reach-1	46.12		.1	.3
Reach-1	46.11		.3	.5
Reach-1	46.1015	Culvert		
Reach-1	46.10		.3	.5
Reach-1	46.09		.1	.3
Reach-1	46.082		.3	.5
Reach-1	46.0815	Culvert		
Reach-1	46.081		.3	.5
Reach-1	46.07		.1	.3
Reach-1	46.06		.1	.3
Reach-1	46.05		.1	.3
Reach-1	46.04		.1	.3
Reach-1	46.032		.3	.5
Reach-1	46.0315	Culvert		
Reach-1	46.031		.3	.5
Reach-1	46.03		.1	.3
Reach-1	46.02		.1	.3
Reach-1	46.01		.1	.3
Reach-1	46.00		.1	.3

HEC-RAS HEC-RAS 5.0.0 February 2016
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

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

PROJECT DATA
Project Title: Black Creek Update (2016-02-26)
Project File : BlackCreekUpdate.prj
Run Date and Time: 6/30/2016 3:30:37 PM

Project in SI units

Project Description:
Main Humber River and Tributaries Digital Flood Plain Mapping
Hec-Ras File:
Black Creek Geometry.gxx covers Sheets HUM 13 (Converted Hec-2 file 46f1tbc.dat using new mapping), HUM 13A, HUM 13B & HUM 13C (New HEC-RAS based on new mapping)

PLAN DATA

Plan Title: Portage Parkway (Feb 2016 Alternative#3)
Plan File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.p07

Geometry Title: BlackCreek-PortageAlternative#3-Feb2016
Geometry File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.g05

Flow Title : Black Creek EXISTING Flows - April '10
Flow File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.f04

Plan Summary Information:

Number of: Cross Sections	=	86	Multiple Openings	=	1
Culverts	=	19	Inline Structures	=	2
Bridges	=	2	Lateral Structures	=	0

Computational Information
Water surface calculation tolerance = 0.003
Critical depth calculation tolerance = 0.003
Maximum number of iterations = 20

Maximum difference tolerance = 0.1
Flow tolerance factor = 0.001

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

FLOW DATA

Flow Title: Black Creek EXISTING Flows - April '10
Flow File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.f04

Flow Data (m3/s)

River	Reach	RS	2-year	5-year	10-year	25-year	50-year	100-year	Aug. 19th	Regional w red'n
RIVER-1	Reach-1	46.45	3.729	4.826	5.609	6.57	7.342	7.79	16.701	42.698
RIVER-1	Reach-1	46.413	1.611	2.011	2.244	2.66	3.591	4.753	10.797	42.698
RIVER-1	Reach-1	46.41	3.066	4.074	4.85	5.926	6.831	7.624	17.745	47.801
RIVER-1	Reach-1	46.36	6.209	8.542	10.169	12.321	14.297	16.307	41.071	66.485
RIVER-1	Reach-1	46.33	8.661	12.09	14.453	17.546	20.243	22.971	57.024	74.783
RIVER-1	Reach-1	46.30	10.769	15.139	18.134	22.036	25.353	28.697	70.731	81.913
RIVER-1	Reach-1	46.274	8.055	11.399	13.737	17.024	19.57	22.105	52.858	81.913
RIVER-1	Reach-1	46.25	15.029	21.487	25.936	31.807	36.287	40.806	96.524	108.096
RIVER-1	Reach-1	46.214	3.775	6.823	9.185	12.675	15.796	19.055	49.3	108.096
RIVER-1	Reach-1	46.21	7.789	11.08	13.186	15.823	17.823	20.589	50.389	122.563
RIVER-1	Reach-1	46.09	8.997	12.899	15.58	19.072	21.783	24.795	62.776	133.764
RIVER-1	Reach-1	46.032	19.481	29.214	36.46	51.57	58.851	66.972	191.204	200.643

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
RIVER-1	Reach-1	2-year		
Known WS = 181.99				
RIVER-1	Reach-1	5-year		
Known WS = 182.42				
RIVER-1	Reach-1	10-year		
Known WS = 182.66				
RIVER-1	Reach-1	25-year		
Known WS = 182.73				
RIVER-1	Reach-1	50-year		
Known WS = 182.89				
RIVER-1	Reach-1	100-year		
Known WS = 183.04				
RIVER-1	Reach-1	Aug. 19th		
Known WS = 184.54				
RIVER-1	Reach-1	Regional w red'n		
Known WS = 184.54				

GEOMETRY DATA

Geometry Title: BlackCreek-PortageAlternative#3-Feb2016
Geometry File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.g05

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.45

INPUT
Description: Section 46.45 - J.D. Barnes 2003 topo mapping - U/S Study Limit
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	209	30	208	75	207.5	84	206.5	85	206.5
90	207.5	130	208	136	209				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	75	.035	90	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
75	90	180	180	170	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	207.38	Element	Left OB	Channel	Right OB
Vel Head (m)	0.19	Wt. n-Val.		0.035	

W.S. Elev (m)	207.19	Reach Len. (m)	180.00	180.00
170.00				
Crit W.S. (m)	207.19	Flow Area (m2)		4.02
E.G. Slope (m/m)	0.017095	Area (m2)		4.02
Q Total (m3/s)	7.79	Flow (m3/s)		7.79
Top Width (m)	10.66	Top Width (m)		10.66
Vel Total (m/s)	1.94	Avg. Vel. (m/s)		1.94
Max Chl Dpth (m)	0.69	Hydr. Depth (m)		0.38
Conv. Total (m3/s)	59.6	Conv. (m3/s)		59.6
Length Wtd. (m)	179.49	Wetted Per. (m)		10.76
Min Ch El (m)	206.50	Shear (N/m2)		62.62
Alpha	1.00	Stream Power (N/m s)		121.33
Frctn Loss (m)	0.16	Cum Volume (1000 m3)	120.12	215.32
77.65				
C & E Loss (m)	0.05	Cum SA (1000 m2)	121.56	84.02
93.45				

Warning: The energy equation could not be 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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	208.17	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.22	Wt. n-Val.	0.050	0.035	
0.080					
W.S. Elev (m)	207.95	Reach Len. (m)	180.00	180.00	
170.00					
Crit W.S. (m)	207.95	Flow Area (m2)	8.94	14.69	
7.94					
E.G. Slope (m/m)	0.006925	Area (m2)	8.94	14.69	
7.94					
Q Total (m3/s)	42.70	Flow (m3/s)	5.47	34.19	
3.04					
Top Width (m)	90.74	Top Width (m)	40.10	15.00	

35.64					
Vel Total (m/s)	1.35	Avg. Vel. (m/s)	0.61	2.33	
0.38					
Max Chl Dpth (m)	1.45	Hydr. Depth (m)	0.22	0.98	
0.22					
Conv. Total (m3/s)	513.1	Conv. (m3/s)	65.7	410.9	
36.5					
Length Wtd. (m)	177.73	Wetted Per. (m)	40.10	15.15	
35.65					
Min Ch El (m)	206.50	Shear (N/m2)	15.13	65.81	
15.13					
Alpha	2.40	Stream Power (N/m s)	9.26	153.23	
5.79					
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	450.88	442.17	
387.61					
C & E Loss (m)	0.07	Cum SA (1000 m2)	335.15	84.42	
330.73					

Warning: The energy equation could not be 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: RIVER-1
REACH: Reach-1 RS: 46.44

INPUT
Description: Section 46.44 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	209	84	208	118	205	126	204	129	203.7
131	203.7	132	204	136	205	139	206	216	207
224	208	300	209						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	126	.035	132	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
126	132	130	130	125	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	205.29	Element	Left OB	Channel

Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	205.28	Reach Len. (m)	130.00	130.00	125.00
Crit W.S. (m)		Flow Area (m2)	6.69	8.88	3.24
E.G. Slope (m/m)	0.000274	Area (m2)	6.69	8.88	3.24
Q Total (m3/s)	7.79	Flow (m3/s)	1.57	5.42	0.80
Top Width (m)	22.02	Top Width (m)	11.18	6.00	4.84
Vel Total (m/s)	0.41	Avg. Vel. (m/s)	0.23	0.61	0.25
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.60	1.48	0.67
Conv. Total (m3/s)	470.5	Conv. (m3/s)	94.6	327.5	48.4
Length Wtd. (m)	129.13	Wetted Per. (m)	11.25	6.06	5.01
Min Ch El (m)	203.70	Shear (N/m2)	1.60	3.94	1.74
Alpha	1.61	Stream Power (N/m s)	0.37	2.41	0.43
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	119.52	214.15	77.38
C & E Loss (m)	0.00	Cum SA (1000 m2)	120.56	82.52	93.03

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.46	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	207.46	Reach Len. (m)	130.00	130.00	125.00
Crit W.S. (m)		Flow Area (m2)	57.86	21.94	92.22
E.G. Slope (m/m)	0.000074	Area (m2)	57.86	21.94	92.22
Q Total (m3/s)	42.70	Flow (m3/s)	13.64	12.70	16.35
Top Width (m)	129.50	Top Width (m)	35.84	6.00	87.66
Vel Total (m/s)	0.25	Avg. Vel. (m/s)	0.24	0.58	0.18
Max Chl Dpth (m)	3.76	Hydr. Depth (m)	1.61	3.66	1.05
Conv. Total (m3/s)	4969.1	Conv. (m3/s)	1587.5	1478.4	1903.2
Length Wtd. (m)	128.13	Wetted Per. (m)	36.02	6.06	87.98
Min Ch El (m)	203.70	Shear (N/m2)	1.16	2.62	0.76

Alpha	2.10	Stream Power (N/m s)	0.27	1.52
0.13				
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	444.87	438.87
379.09				
C & E Loss (m)	0.00	Cum SA (1000 m2)	328.31	82.53
320.25				

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.43

INPUT
Description: Section 46.43 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	95	210	95	208.3	105	208	116	205
143	204	145	203.5	149	203.5	150	204	177	205
180	206	187	207	231	208	310	208.6		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	105	.08	143	.035	150	.08	177	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
143	150	100	100	95	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	205.27	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035
0.080				
W.S. Elev (m)	205.27	Reach Len. (m)	100.00	100.00
95.00				
Crit W.S. (m)		Flow Area (m2)	20.95	11.65
20.93				
E.G. Slope (m/m)	0.000076	Area (m2)	20.95	11.65
20.93				
Q Total (m3/s)	7.79	Flow (m3/s)	1.88	4.00
1.91				
Top Width (m)	62.81	Top Width (m)	27.99	7.00
27.81				
Vel Total (m/s)	0.15	Avg. Vel. (m/s)	0.09	0.34
0.09				
Max Chl Dpth (m)	1.77	Hydr. Depth (m)	0.75	1.66
0.75				
Conv. Total (m3/s)	894.4	Conv. (m3/s)	215.7	459.5
219.3				
Length Wtd. (m)	99.26	Wetted Per. (m)	28.05	7.18
27.88				
Min Ch El (m)	203.50	Shear (N/m2)	0.56	1.21
0.56				
Alpha	3.05	Stream Power (N/m s)	0.05	0.41
0.05				
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	117.72	212.82
75.87				
C & E Loss (m)	0.00	Cum SA (1000 m2)	118.01	81.68
90.99				

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.46	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035	0.077
W.S. Elev (m)	207.45	Reach Len. (m)	100.00	100.00	95.00
Crit W.S. (m)		Flow Area (m2)	90.70	26.91	96.67
E.G. Slope (m/m)	0.000047	Area (m2)	90.70	26.91	96.67
Q Total (m3/s)	42.70	Flow (m3/s)	14.32	12.73	15.65
Top Width (m)	99.83	Top Width (m)	35.99	7.00	56.85
Vel Total (m/s)	0.20	Avg. Vel. (m/s)	0.16	0.47	0.16
Max Chl Dpth (m)	3.95	Hydr. Depth (m)	2.52	3.84	1.70
Conv. Total (m3/s)	6221.5	Conv. (m3/s)	2086.2	1854.9	2280.4
Length Wtd. (m)	98.70	Wetted Per. (m)	36.33	7.18	57.10
Min Ch El (m)	203.50	Shear (N/m2)	1.15	1.73	0.78
Alpha	2.13	Stream Power (N/m s)	0.18	0.82	0.13
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	435.21	435.70	367.29
C & E Loss (m)	0.00	Cum SA (1000 m2)	323.64	81.69	311.22

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.42

INPUT
Description: Section 46.42 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208.5	13	208	29	207	31	206	52	205
64	204	66	203.3	70	203.3	74	204	80	205
84	206	105	207	215	208	231	208.3		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	29	.08	64	.035	74	.08	105	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
64	74	295	240	190	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	205.27	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	205.26	Reach Len. (m)	295.00	240.00	190.00
Crit W.S. (m)		Flow Area (m2)	9.83	17.50	4.69
E.G. Slope (m/m)	0.000085	Area (m2)	9.83	17.50	4.69
Q Total (m3/s)	7.79	Flow (m3/s)	0.77	6.61	0.41
Top Width (m)	34.50	Top Width (m)	17.46	10.00	7.04
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.08	0.38	0.09
Max Chl Dpth (m)	1.96	Hydr. Depth (m)	0.56	1.75	0.67
Conv. Total (m3/s)	845.3	Conv. (m3/s)	83.6	717.4	44.3
Length Wtd. (m)	241.75	Wetted Per. (m)	17.51	10.18	7.15
Min Ch El (m)	203.30	Shear (N/m2)	0.47	1.43	0.55
Alpha	2.06	Stream Power (N/m s)	0.04	0.54	0.05
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	116.18	211.36	74.65
C & E Loss (m)	0.00	Cum SA (1000 m2)	115.74	80.83	89.34

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.077
W.S. Elev (m)	207.44	Reach Len. (m)	295.00	240.00	190.00
Crit W.S. (m)		Flow Area (m2)	79.45	39.30	55.78
E.G. Slope (m/m)	0.000067	Area (m2)	79.45	39.30	55.78
Q Total (m3/s)	42.70	Flow (m3/s)	13.58	22.59	6.53
Top Width (m)	131.42	Top Width (m)	42.04	10.00	79.38
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.17	0.57	0.12
Max Chl Dpth (m)	4.14	Hydr. Depth (m)	1.89	3.93	0.70
Conv. Total (m3/s)	5223.7	Conv. (m3/s)	1661.7	2763.2	798.8
Length Wtd. (m)	248.69	Wetted Per. (m)	42.35	10.18	79.62
Min Ch El (m)	203.30	Shear (N/m2)	1.23	2.53	

0.46				
Alpha	3.11	Stream Power (N/m s)	0.21	1.45
0.05				
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	426.70	432.39
360.05				
C & E Loss (m)	0.00	Cum SA (1000 m2)	319.74	80.84
304.75				

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: RIVER-1
REACH: Reach-1 RS: 46.413

INPUT
Description: Section 46.413 - Creditview Road - Inline Weir Section
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	203.05	144.7	203.05	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
128	146	5	5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	129.7	207.11	F
144.7	352	207.4	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	205.26	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.00	Wt. n-Val.		0.035
W.S. Elev (m)	205.26	Reach Len. (m)	5.00	5.00
5.00				
Crit W.S. (m)	203.27	Flow Area (m2)		33.11
E.G. Slope (m/m)	0.000009	Area (m2)	29.76	39.05
14.63				
Q Total (m3/s)	4.75	Flow (m3/s)		4.75
Top Width (m)	52.28	Top Width (m)	22.19	18.00
12.09				
Vel Total (m/s)	0.14	Avg. Vel. (m/s)		0.14
Max Chl Dpth (m)	2.21	Hydr. Depth (m)		2.21
Conv. Total (m3/s)	1603.4	Conv. (m3/s)		1603.4
Length Wtd. (m)	5.00	Wetted Per. (m)		15.00

Min Ch El (m)	203.05	Shear (N/m2)			0.19
Alpha	1.00	Stream Power (N/m s)			0.03
Frctn Loss (m)		Cum Volume (1000 m3)	110.34	204.58	72.81
C & E Loss (m)		Cum SA (1000 m2)	109.89	77.47	87.52

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.44	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.079	0.035	0.080
W.S. Elev (m)	207.44	Reach Len. (m)	5.00	5.00	5.00
Crit W.S. (m)	203.99	Flow Area (m2)	93.26	78.25	48.66
E.G. Slope (m/m)	0.000021	Area (m2)	93.26	78.25	48.66
Q Total (m3/s)	42.70	Flow (m3/s)	10.48	27.13	5.09
Top Width (m)	99.98	Top Width (m)	62.82	18.00	19.16
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.11	0.35	0.10
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.48	4.35	2.54
Conv. Total (m3/s)	9326.4	Conv. (m3/s)	2288.6	5926.3	1111.4
Length Wtd. (m)	5.00	Wetted Per. (m)	63.27	18.13	19.70
Min Ch El (m)	203.05	Shear (N/m2)	0.30	0.89	0.51
Alpha	2.15	Stream Power (N/m s)	0.03	0.31	0.05
Frctn Loss (m)		Cum Volume (1000 m3)	401.23	418.28	350.13
C & E Loss (m)		Cum SA (1000 m2)	304.27	77.48	295.39

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

INLINE STRUCTURE

RIVER: RIVER-1
REACH: Reach-1 RS: 46.4125

INPUT
Description: Hum 13B-4R. Creditview Road - 4 Cell - 3.0 m W x 1.5 m H x 41 m L Concrete Box Culverts and 6.5 m W Weir with Drop Inlet Structure.

Drawings by Urban Ecosystems Ltd. (DT-2 & G-4), 1999.

New
HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 1
Deck/Roadway Width = .5
Weir Coefficient = 1.75
Weir Embankment Coordinates num = 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	129.75	207.11	129.75	207	133.95	207
133.95	204.7	137.2	204.7	140.45	204.7	140.45	207	144.65	207
144.65	207.4	205	207.79	305	208.3	352	208.6		

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 =
Weir crest shape = Broad Crested

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.412

INPUT
Description: Section 46.412 - Creditview Road - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	203.05	144.7	203.05	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
128	146	45	45	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	129.7	207.11	F
144.7	352	207.4	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.91	Element	Left OB	Channel
Vel Head (m)	0.01	Wt. n-Val.		0.035
W.S. Elev (m)	203.91	Reach Len. (m)	45.00	45.00
Crit W.S. (m)	203.27	Flow Area (m2)		12.86
E.G. Slope (m/m)	0.000206	Area (m2)	2.99	14.75
Q Total (m3/s)	4.75	Flow (m3/s)		4.75

Top Width (m)	39.19	Top Width (m)	14.67	18.00	6.52
Vel Total (m/s)	0.37	Avg. Vel. (m/s)		0.37	
Max Chl Dpth (m)	0.86	Hydr. Depth (m)		0.86	
Conv. Total (m3/s)	331.5	Conv. (m3/s)		331.5	
Length Wtd. (m)	45.00	Wetted Per. (m)		15.00	
Min Ch El (m)	203.05	Shear (N/m2)		1.73	
Alpha	1.00	Stream Power (N/m s)		0.64	
Frctn Loss (m)		Cum Volume (1000 m3)	110.34	204.38	72.81
C & E Loss (m)		Cum SA (1000 m2)	109.80	77.38	87.47

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.37	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	
W.S. Elev (m)	207.37	Reach Len. (m)	45.00	45.00	45.00
Crit W.S. (m)	203.99	Flow Area (m2)	89.20	71.72	
E.G. Slope (m/m)	0.000032	Area (m2)	89.20	77.04	47.37
Q Total (m3/s)	42.70	Flow (m3/s)	12.31	30.39	
Top Width (m)	94.35	Top Width (m)	57.41	18.00	18.94
Vel Total (m/s)	0.27	Avg. Vel. (m/s)	0.14	0.42	
Max Chl Dpth (m)	4.32	Hydr. Depth (m)	1.55	4.29	
Conv. Total (m3/s)	7588.4	Conv. (m3/s)	2187.2	5401.2	
Length Wtd. (m)	45.00	Wetted Per. (m)	57.86	16.76	
Min Ch El (m)	203.05	Shear (N/m2)	0.48	1.33	
Alpha	1.89	Stream Power (N/m s)	0.07	0.56	
Frctn Loss (m)		Cum Volume (1000 m3)	401.23	417.70	350.13
C & E Loss (m)		Cum SA (1000 m2)	303.97	77.39	295.29

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.4115

INPUT
Description: Hum 13B-4R. Creditview Road - 4 Cell - 3.0 m W x 1.5 m H x 45 m L
Concrete Box Culverts and 6.5 m W Weir with Drop Inlet Structure.
Drawings by Urban Ecosystems Ltd. (DT-2 & G-4), 1999.

New
HEC-RAS coding January 2004 by Acres included coding of culvert
in HEC-RAS, including adjustments to roadway coding and hydraulic
loss coefficients.

Distance from Upstream XS = 10
Deck/Roadway Width = 25
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 11

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	208		60	207.5		129.7	207.11	
129.7	208.5		137.2	208.5		144.7	208.5	
144.7	207.4		205	207.79		265	208	
305	208.3		352	208.6				

Upstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	203.05	144.7	203.05	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
128	146	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	129.7	207.11	F
144.7	352	207.4	F

Downstream Deck/Roadway Coordinates
num= 11

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	208		60	207.5		129.7	207.11	
129.7	208.5		137.2	208.5		144.7	208.5	
144.7	207.4		205	207.79		265	208	
305	208.3		352	208.6				

Downstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	202.96	144.7	202.96	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

```
Bank Sta: Left   Right    Coeff Contr.   Expan.
          128     146            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   129.7   206.8       F
   144.7     352   206.8       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           Box     1.5       3
FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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      41     .015     .015        0                   .5
      1
Number of Barrels =  4
Upstream   Elevation =  203.05
Centerline Stations
    Sta.    Sta.    Sta.    Sta.
   132.1   135.5   138.9   142.3
Downstream Elevation =  202.96
Centerline Stations
    Sta.    Sta.    Sta.    Sta.
   132.1   135.5   138.9   142.3

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       4.75    Culv Full Len (m)
  # Barrels                    4    Culv Vel US (m/s)         0.47
  Q Barrel (m3/s)           1.19    Culv Vel DS (m/s)         0.42
  E.G. US. (m)            203.91    Culv Inv El Up (m)      203.05
  W.S. US. (m)            203.91    Culv Inv El Dn (m)      202.96
  E.G. DS (m)             203.90    Culv Frctn Ls (m)         0.01
  W.S. DS (m)             203.90    Culv Exit Loss (m)        0.00
  Delta EG (m)              0.01    Culv Entr Loss (m)        0.01
  Delta WS (m)              0.01    Q Weir (m3/s)
  E.G. IC (m)             203.46    Weir Sta Lft (m)
  E.G. OC (m)             203.91    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
  Culv WS Inlet (m)       203.90    Weir Max Depth (m)
  Culv WS Outlet (m)      203.90    Weir Avg Depth (m)
  Culv Nml Depth (m)        0.31    Weir Flow Area (m2)
  Culv Crt Depth (m)        0.25    Min El Weir Flow (m)    207.11


CULVERT OUTPUT  Profile #Regional w red'n  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      39.14    Culv Full Len (m)        41.00
  # Barrels                   4     Culv Vel US (m/s)         2.17
  Q Barrel (m3/s)           9.79    Culv Vel DS (m/s)         2.17
  E.G. US. (m)            207.37    Culv Inv El Up (m)      203.05
  W.S. US. (m)            207.37    Culv Inv El Dn (m)      202.96
```

E.G. DS (m)	206.91	Culv Frctn Ls (m)	0.11
W.S. DS (m)	206.90	Culv Exit Loss (m)	0.24
Delta EG (m)	0.47	Culv Entr Loss (m)	0.12
Delta WS (m)	0.46	Q Weir (m3/s)	3.55
E.G. IC (m)	204.84	Weir Sta Lft (m)	82.56
E.G. OC (m)	207.37	Weir Sta Rgt (m)	129.70
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	204.55	Weir Max Depth (m)	0.26
Culv WS Outlet (m)	204.46	Weir Avg Depth (m)	0.13
Culv Nml Depth (m)		Weir Flow Area (m2)	6.21
Culv Crt Depth (m)	1.03	Min El Weir Flow (m)	207.11

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.411

INPUT
Description: Section 46.411 - Creditview Road - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	202.96	144.7	202.96	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
128	146	80	80	90	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	129.7	206.8	F
144.7	352	206.8	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.90	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.035	
W.S. Elev (m)	203.90	Reach Len. (m)	80.00	80.00	90.00
Crit W.S. (m)	203.18	Flow Area (m2)		14.04	
E.G. Slope (m/m)	0.000153	Area (m2)	2.82	16.03	1.25
Q Total (m3/s)	4.75	Flow (m3/s)		4.75	
Top Width (m)	38.58	Top Width (m)	14.25	18.00	6.33
Vel Total (m/s)	0.34	Avg. Vel. (m/s)		0.34	
Max Chl Dpth (m)	0.94	Hydr. Depth (m)		0.94	

Conv. Total (m3/s)	383.6	Conv. (m3/s)		383.6
Length Wtd. (m)	80.76	Wetted Per. (m)		15.00
Min Ch El (m)	202.96	Shear (N/m2)		1.41
Alpha	1.00	Stream Power (N/m s)		0.48
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	110.34	204.20
72.81				
C & E Loss (m)	0.00	Cum SA (1000 m2)	109.15	76.57
87.18				

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.91	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	
0.080					
W.S. Elev (m)	206.90	Reach Len. (m)	80.00	80.00	
90.00					
Crit W.S. (m)	203.90	Flow Area (m2)	70.79	70.16	
38.91					
E.G. Slope (m/m)	0.000033	Area (m2)	70.79	70.16	
38.91					
Q Total (m3/s)	42.70	Flow (m3/s)	9.47	28.50	
4.72					
Top Width (m)	63.11	Top Width (m)	27.68	18.00	
17.43					
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.13	0.41	
0.12					
Max Chl Dpth (m)	3.94	Hydr. Depth (m)	2.56	3.90	
2.23					
Conv. Total (m3/s)	7384.4	Conv. (m3/s)	1638.0	4929.7	
816.7					
Length Wtd. (m)	81.46	Wetted Per. (m)	28.11	18.19	
17.89					
Min Ch El (m)	202.96	Shear (N/m2)	0.83	1.26	
0.71					
Alpha	2.05	Stream Power (N/m s)	0.11	0.51	
0.09					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	401.23	416.59	
350.13					
C & E Loss (m)	0.00	Cum SA (1000 m2)	302.06	76.58	
294.47					

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: RIVER-1
REACH: Reach-1 RS: 46.41

INPUT
Description: Section 46.41 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207.5	71	207	83	204	84	203.56	123	203.56
126	205	136	205	140	204	156	203.1	161	202.5
164	202.5	166	203	195	204	206	208	234	208.2

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	71	.08	83	.035	126	.08	156	.035
166	.08	195	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
156	166	140	140	120	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.89	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.043	0.035	0.080
W.S. Elev (m)	203.89	Reach Len. (m)	140.00	140.00	120.00
Crit W.S. (m)		Flow Area (m2)	18.40	11.85	11.37
E.G. Slope (m/m)	0.000130	Area (m2)	18.40	11.85	11.37
Q Total (m3/s)	7.62	Flow (m3/s)	2.38	4.30	0.94
Top Width (m)	90.06	Top Width (m)	54.38	10.00	25.68
Vel Total (m/s)	0.18	Avg. Vel. (m/s)	0.13	0.36	0.08
Max Chl Dpth (m)	1.39	Hydr. Depth (m)	0.34	1.19	0.44
Conv. Total (m3/s)	668.1	Conv. (m3/s)	208.8	376.9	82.5
Length Wtd. (m)	138.77	Wetted Per. (m)	54.54	10.10	25.69
Min Ch El (m)	202.50	Shear (N/m2)	0.43	1.50	0.56
Alpha	2.39	Stream Power (N/m s)	0.06	0.54	0.05
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	109.49	203.09	72.25
C & E Loss (m)	0.00	Cum SA (1000 m2)	106.40	75.45	85.74

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.91	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.044	0.035	0.077
W.S. Elev (m)	206.90	Reach Len. (m)	140.00	140.00	120.00
Crit W.S. (m)		Flow Area (m2)	240.60	42.04	110.32
E.G. Slope (m/m)	0.000008	Area (m2)	240.60	42.04	110.32
Q Total (m3/s)	47.80	Flow (m3/s)	30.75	8.57	8.48
Top Width (m)	131.60	Top Width (m)	84.62	10.00	36.99
Vel Total (m/s)	0.12	Avg. Vel. (m/s)	0.13	0.20	0.08
Max Chl Dpth (m)	4.40	Hydr. Depth (m)	2.84	4.20	2.98
Conv. Total (m3/s)	17337.4	Conv. (m3/s)	11152.2	3108.6	3076.7
Length Wtd. (m)	135.44	Wetted Per. (m)	85.54	10.10	37.51
Min Ch El (m)	202.50	Shear (N/m2)	0.21	0.31	0.22
Alpha	1.28	Stream Power (N/m s)	0.03	0.06	0.02
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	388.77	412.10	343.41
C & E Loss (m)	0.00	Cum SA (1000 m2)	297.57	75.46	292.03

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: RIVER-1
REACH: Reach-1 RS: 46.402

INPUT
Description: Section 46.402 - Highway 400 - U/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	212	21	206	97	205	104	203	105	202.4
115	202.4	116	203	125	205	136	206	187	206
250	206	270	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	97	.08	104	.035	116	.08	136	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
104	116	100	100	100	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	106	206.7	F
114.5	270	206.7	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.86	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.84	Reach Len. (m)	100.00	100.00	100.00
Crit W.S. (m)	202.83	Flow Area (m2)		12.26	
E.G. Slope (m/m)	0.000291	Area (m2)	1.24	16.71	1.60
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	18.74	Top Width (m)	2.95	12.00	3.79
Vel Total (m/s)	0.62	Avg. Vel. (m/s)		0.62	
Max Chl Dpth (m)	1.44	Hydr. Depth (m)		1.44	
Conv. Total (m3/s)	447.1	Conv. (m3/s)		447.1	
Length Wtd. (m)	100.00	Wetted Per. (m)		8.50	
Min Ch El (m)	202.40	Shear (N/m2)		4.11	
Alpha	1.00	Stream Power (N/m s)		2.56	
Frctn Loss (m)		Cum Volume (1000 m3)	108.12	201.09	71.47
C & E Loss (m)		Cum SA (1000 m2)	102.39	73.91	83.98

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.90	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.055	0.035	0.059
W.S. Elev (m)	206.90	Reach Len. (m)	100.00	100.00	100.00
Crit W.S. (m)	203.88	Flow Area (m2)	128.12	53.40	148.16
E.G. Slope (m/m)	0.000023	Area (m2)	128.12	53.40	148.16
Q Total (m3/s)	47.80	Flow (m3/s)	15.09	19.42	13.30
Top Width (m)	241.15	Top Width (m)	86.15	12.00	143.00
Vel Total (m/s)	0.14	Avg. Vel. (m/s)	0.12	0.36	0.09
Max Chl Dpth (m)	4.50	Hydr. Depth (m)	1.49	4.45	

1.04					
Conv. Total (m3/s)	9978.9	Conv. (m3/s)	3149.8	4053.4	2775.8
Length Wtd. (m)	100.00	Wetted Per. (m)	86.56	12.33	143.31
Min Ch El (m)	202.40	Shear (N/m2)	0.33	0.97	0.23
Alpha	2.87	Stream Power (N/m s)	0.04	0.35	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	362.96	405.42	327.90
C & E Loss (m)		Cum SA (1000 m2)	285.61	73.92	281.23

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.4015

INPUT
Description: Hum 13B-3R. Highway 400 - 3 Cell - 2.4 m W x 2.4 m H x 80 m L Concrete Box Culverts. Drawings by McCormick Rankin (Sheet 40 & 47, no date) used to code culvert in HEC-RAS format.

New
HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 14
Deck/Roadway Width = 80
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	206.5		189	207		270	207.8	

Upstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	212	21	206	97	205	104	203	105	202.4
115	202.4	116	203	125	205	136	206	187	206
250	206	270	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	97	.08	104	.035	116	.08	136	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
104	116	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	106	206.7	F
114.5	270	206.7	F

Downstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord

```
       0   206.5             189     207             270   207.8

Downstream Bridge Cross Section Data
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0     212      21     206      97     205     104     203     105   202.4
     115   202.4     116     203     125     205     136     206     187     206
     270   206.5

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05      21     .08     104    .035     116     .08     136     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
           104     116            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     106     206       F
   114.5     270     206       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           Box     2.4     2.4
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
                14      80     .015     .015        0                    .4
      1
Number of Barrels =  3
Upstream   Elevation =  202.4
Centerline Stations
    Sta.    Sta.    Sta.
   107.5   110.2   112.9
Downstream Elevation =  202.4
Centerline Stations
    Sta.    Sta.    Sta.
   107.5   110.2   112.9

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       7.62    Culv Full Len (m)
  # Barrels                    3    Culv Vel US (m/s)         0.74
  Q Barrel (m3/s)           2.54    Culv Vel DS (m/s)         0.75
  E.G. US. (m)            203.86    Culv Inv El Up (m)      202.40
  W.S. US. (m)            203.84    Culv Inv El Dn (m)      202.40
  E.G. DS (m)             203.82    Culv Frctn Ls (m)         0.01
  W.S. DS (m)             203.80    Culv Exit Loss (m)        0.01
  Delta EG (m)              0.04    Culv Entr Loss (m)        0.01
  Delta WS (m)              0.04    Q Weir (m3/s)
  E.G. IC (m)             203.16    Weir Sta Lft (m)
  E.G. OC (m)             203.86    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
```

Culv WS Inlet (m)	203.82	Weir Max Depth (m)	
Culv WS Outlet (m)	203.80	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.49	Min El Weir Flow (m)	206.70

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	31.75	Culv Full Len (m)	80.00
# Barrels	3	Culv Vel US (m/s)	1.84
Q Barrel (m3/s)	10.58	Culv Vel DS (m/s)	1.84
E.G. US. (m)	206.90	Culv Inv El Up (m)	202.40
W.S. US. (m)	206.90	Culv Inv El Dn (m)	202.40
E.G. DS (m)	206.55	Culv Frctn Ls (m)	0.12
W.S. DS (m)	206.54	Culv Exit Loss (m)	0.16
Delta EG (m)	0.35	Culv Entr Loss (m)	0.07
Delta WS (m)	0.36	Q Weir (m3/s)	16.05
E.G. IC (m)	205.08	Weir Sta Lft (m)	17.83
E.G. OC (m)	206.90	Weir Sta Rgt (m)	153.01
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	204.80	Weir Max Depth (m)	0.35
Culv WS Outlet (m)	204.80	Weir Avg Depth (m)	0.18
Culv Nml Depth (m)		Weir Flow Area (m2)	23.95
Culv Crt Depth (m)	1.26	Min El Weir Flow (m)	206.70

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.401

INPUT
Description: Section 46.401 - Highway 400 - D/S Bounding Section - J.D. Barnes
2003 topo mapping

Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	212	21	206	97	205	104	203	105	202.4
115	202.4	116	203	125	205	136	206	187	206
270	206.5								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	21	.08	104	.035	116	.08	136	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
104	116	80	95	100	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	106	206	F
114.5	270	206	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.82	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	

W.S. Elev (m)	203.80	Reach Len. (m)	80.00	95.00	100.00
Crit W.S. (m)	202.83	Flow Area (m2)		11.93	
E.G. Slope (m/m)	0.000318	Area (m2)	1.13	16.24	1.45
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	18.43	Top Width (m)	2.81	12.00	3.62
Vel Total (m/s)	0.64	Avg. Vel. (m/s)		0.64	
Max Chl Dpth (m)	1.40	Hydr. Depth (m)		1.40	
Conv. Total (m3/s)	427.4	Conv. (m3/s)		427.4	
Length Wtd. (m)	95.00	Wetted Per. (m)		8.50	
Min Ch El (m)	202.40	Shear (N/m2)		4.38	
Alpha	1.00	Stream Power (N/m s)		2.80	
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	108.12	200.50	71.47
C & E Loss (m)	0.00	Cum SA (1000 m2)	102.10	72.71	83.61

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.55	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.066
W.S. Elev (m)	206.54	Reach Len. (m)	80.00	95.00	100.00
Crit W.S. (m)	203.88	Flow Area (m2)	97.50	49.10	86.22
E.G. Slope (m/m)	0.000063	Area (m2)	97.50	49.10	86.22
Q Total (m3/s)	47.80	Flow (m3/s)	10.67	27.93	9.20
Top Width (m)	250.90	Top Width (m)	84.90	12.00	154.00
Vel Total (m/s)	0.21	Avg. Vel. (m/s)	0.11	0.57	0.11
Max Chl Dpth (m)	4.14	Hydr. Depth (m)	1.15	4.09	0.56
Conv. Total (m3/s)	6031.7	Conv. (m3/s)	1346.0	3524.5	1161.2
Length Wtd. (m)	90.36	Wetted Per. (m)	85.26	12.33	154.31
Min Ch El (m)	202.40	Shear (N/m2)	0.70	2.45	0.34
Alpha	4.60	Stream Power (N/m s)	0.08	1.39	0.04
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	362.96	398.01	327.90

C & E Loss (m)	0.00	Cum SA (1000 m2)	277.06	72.72	266.38

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: RIVER-1
REACH: Reach-1 RS: 46.392

INPUT
Description: Section 46.392 - Langstaff Road - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	15	206	30	206	103	206	106	205
130	205	135	203	136	202.5	145	202.5	147	203
153	205	175	205	191	210	203	210		

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.025	103	.05	130	.08	135	.035
147	.08	153	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
135	147	70	70	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	136.4	206.2	F
145	203	212.9	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.79	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.035	
W.S. Elev (m)	203.76	Reach Len. (m)	70.00	70.00	70.00
Crit W.S. (m)	202.93	Flow Area (m2)		10.86	
E.G. Slope (m/m)	0.000442	Area (m2)	0.73	14.40	0.87
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	16.20	Top Width (m)	1.91	12.00	2.29
Vel Total (m/s)	0.70	Avg. Vel. (m/s)		0.70	
Max Chl Dpth (m)	1.26	Hydr. Depth (m)		1.26	
Conv. Total (m3/s)	362.5	Conv. (m3/s)		362.5	
Length Wtd. (m)	70.00	Wetted Per. (m)		8.60	
Min Ch El (m)	202.50	Shear (N/m2)		5.48	

Alpha	1.00	Stream Power (N/m s)		3.85
Frctn Loss (m)		Cum Volume (1000 m3)	108.04	199.04
71.35				
C & E Loss (m)		Cum SA (1000 m2)	101.91	71.57
83.31				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.54	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.01	Wt. n-Val.	0.043	0.035
W.S. Elev (m)	206.53	Reach Len. (m)	70.00	70.00
70.00				
Crit W.S. (m)	203.97	Flow Area (m2)	99.87	40.07
E.G. Slope (m/m)	0.000081	Area (m2)	99.87	47.63
52.65				
Q Total (m3/s)	47.80	Flow (m3/s)	21.97	25.84
Top Width (m)	166.90	Top Width (m)	121.99	12.00
32.90				
Vel Total (m/s)	0.34	Avg. Vel. (m/s)	0.22	0.64
Max Chl Dpth (m)	4.03	Hydr. Depth (m)	0.82	4.01
Conv. Total (m3/s)	5302.3	Conv. (m3/s)	2436.5	2865.8
Length Wtd. (m)	70.00	Wetted Per. (m)	122.61	10.12
Min Ch El (m)	202.50	Shear (N/m2)	0.65	3.16
Alpha	2.12	Stream Power (N/m s)	0.14	2.04
Frctn Loss (m)		Cum Volume (1000 m3)	355.07	393.41
320.96				
C & E Loss (m)		Cum SA (1000 m2)	268.79	71.58
257.03				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

MULTIPLE OPENING

RIVER: RIVER-1
REACH: Reach-1 RS: 46.3915

INPUT
Description: Hum 13B-2R. Langstaff Road - 3 Cell - 2.4 m W x 2.4 m H x 60 m L Concrete Box Culverts. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004 by Acres
included coding of culvert in HEC-RAS, including adjustments to
roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 60
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 9

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	212.8		8	213	212	28	213.2	212.3
73	213.82	212.82	103	213.4	212.4	103	213.4	206
142	213		182	212		203	211.5	

Upstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	15	206	30	206	103	206	106	205
130	205	135	203	136	202.5	145	202.5	147	203
153	205	175	205	191	210	203	210		

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.025	103	.05	130	.08	135	.035
147	.08	153	.05						

Bank Sta: Left	Right	Coeff Contr.	Expan.
135	147	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	136.4	206.2	F
145	203	212.9	F

Downstream Deck/Roadway Coordinates
num= 9

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	212.8		8	213	212	28	213.2	212.3
73	213.82	212.82	103	213.4	212.4	103	213.4	206
142	213		182	212		203	211.5	

Downstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	15	206	30	206	103	206	106	205
130	205	135	203	136	202.4	145	202.4	147	203
153	205	175	205	191	210	203	210		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.025	103	.05	130	.08	153	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
135	147	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	136.4	206	F
145	203	211	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 Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Box	2.4	2.4

FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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
	5	60	.015	.015	0	.5	1

Number of Barrels = 3
Upstream Elevation = 202.5
Centerline Stations

Sta.	Sta.	Sta.
138	140.7	143.4

Downstream Elevation = 202.4
Centerline Stations

Sta.	Sta.	Sta.
138	140.7	143.4

Multiple Opening Stagnation Limits

	Upstream		Downstream	
Opening Type	Sta. Left	Sta. Right	Sta. Left	Sta. Right
Bridge	0	120	0	120
Culvert Group	120	203	120	203

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.391

INPUT
Description: Section 46.391 - Langstaff Road - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	15	206	30	206	103	206	106	205
130	205	135	203	136	202.4	145	202.4	147	203
153	205	175	205	191	210	203	210		

```
Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05      30    .025     103     .05     130     .08     153     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          135     147               45      35      25             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   136.4     206       F
     145     203     211       F

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           203.74    Element                Left OB    Channel
Right OB
  Vel Head (m)              0.02    Wt. n-Val.                         0.080

  W.S. Elev (m)           203.72    Reach Len. (m)          45.00      35.00
25.00
  Crit W.S. (m)           202.83    Flow Area (m2)                     11.34

  E.G. Slope (m/m)      0.002001    Area (m2)                0.65      14.92
0.77
  Q Total (m3/s)            7.62    Flow (m3/s)                        7.62

  Top Width (m)            15.95    Top Width (m)            1.80      12.00
2.16
  Vel Total (m/s)           0.67    Avg. Vel. (m/s)                    0.67

  Max Chl Dpth (m)          1.32    Hydr. Depth (m)                    1.32

  Conv. Total (m3/s)       170.4    Conv. (m3/s)                      170.4

  Length Wtd. (m)          35.03    Wetted Per. (m)                    8.60

  Min Ch El (m)           202.40    Shear (N/m2)                      25.87

  Alpha                     1.00    Stream Power (N/m s)              17.39

  Frctn Loss (m)            0.02    Cum Volume (1000 m3)    108.04    199.04
71.35
  C & E Loss (m)            0.01    Cum SA (1000 m2)        101.78     70.73
83.16



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 OUTPUT  Profile #Regional w red'n


  E.G. Elev (m)           206.45    Element                Left OB    Channel
Right OB
  Vel Head (m)              0.01    Wt. n-Val.               0.045     0.080

  W.S. Elev (m)           206.45    Reach Len. (m)          45.00      35.00
25.00
```

Crit W.S. (m)	203.87	Flow Area (m2)	89.27	40.15	
E.G. Slope (m/m)	0.000212	Area (m2)	89.27	47.64	49.80
Q Total (m3/s)	47.80	Flow (m3/s)	29.55	18.25	
Top Width (m)	166.29	Top Width (m)	121.67	12.00	32.62
Vel Total (m/s)	0.37	Avg. Vel. (m/s)	0.33	0.45	
Max Chl Dpth (m)	4.04	Hydr. Depth (m)	0.73	4.01	
Conv. Total (m3/s)	3284.9	Conv. (m3/s)	2030.9	1254.0	
Length Wtd. (m)	38.91	Wetted Per. (m)	122.27	10.17	
Min Ch El (m)	202.40	Shear (N/m2)	1.52	8.20	
Alpha	1.07	Stream Power (N/m s)	0.50	3.73	
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	355.07	393.41	320.96
C & E Loss (m)	0.00	Cum SA (1000 m2)	260.26	70.74	254.74

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: RIVER-1
REACH: Reach-1 RS: 46.39

INPUT
Description: Section 46.39 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	20	205	45	205	51	206.5	133	206.3
142	206	152	205	161	204	185	204	193	203
195	202.4	204	202.4	206	203	212	204	236	205
268	210								

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	51	.025	142	.05	185	.08	193	.035
206	.08	212	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
193	206	50	35	25	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	51	206.6	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.72	Element	Left OB	Channel

Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.71	Reach Len. (m)	50.00	35.00	25.00
Crit W.S. (m)	202.80	Flow Area (m2)	2.01	15.81	1.51
E.G. Slope (m/m)	0.000205	Area (m2)	2.01	15.81	1.51
Q Total (m3/s)	7.62	Flow (m3/s)	0.18	7.31	0.13
Top Width (m)	22.92	Top Width (m)	5.67	13.00	4.25
Vel Total (m/s)	0.39	Avg. Vel. (m/s)	0.09	0.46	0.09
Max Chl Dpth (m)	1.31	Hydr. Depth (m)	0.35	1.22	0.35
Conv. Total (m3/s)	531.8	Conv. (m3/s)	12.5	510.0	9.3
Length Wtd. (m)	35.09	Wetted Per. (m)	5.71	13.18	4.31
Min Ch El (m)	202.40	Shear (N/m2)	0.71	2.42	0.70
Alpha	1.32	Stream Power (N/m s)	0.06	1.12	0.06
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	107.98	198.50	71.32
C & E Loss (m)	0.00	Cum SA (1000 m2)	101.61	70.29	83.08

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.055	0.035	0.057
W.S. Elev (m)	206.44	Reach Len. (m)	50.00	35.00	25.00
Crit W.S. (m)	203.62	Flow Area (m2)	116.11	51.38	71.01
E.G. Slope (m/m)	0.000029	Area (m2)	166.83	51.38	71.01
Q Total (m3/s)	47.80	Flow (m3/s)	18.06	19.50	10.23
Top Width (m)	216.75	Top Width (m)	164.50	13.00	39.24
Vel Total (m/s)	0.20	Avg. Vel. (m/s)	0.16	0.38	0.14
Max Chl Dpth (m)	4.04	Hydr. Depth (m)	0.97	3.95	1.81
Conv. Total (m3/s)	8912.5	Conv. (m3/s)	3367.8	3636.7	1908.0
Length Wtd. (m)	40.73	Wetted Per. (m)	119.45	13.18	39.46

Min Ch El (m)	202.40	Shear (N/m2)	0.27	1.10	0.51
Alpha	1.80	Stream Power (N/m s)	0.04	0.42	0.07
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	349.30	391.68	319.45
C & E Loss (m)	0.00	Cum SA (1000 m2)	253.82	70.30	253.84

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: RIVER-1
REACH: Reach-1 RS: 46.382

INPUT
Description: Section 46.382 - Hwy 400 / Langstaff Rd Ramp - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	50	206.5	95	205	220	204	227	203
235	202.4	244	202.4	247	203	252	204	257	205
269	206	300	206	300	209.5				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	50	.08	227	.035	247	.08	257	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
227	247	45	45	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235.2	206.38	F
243.8	300	207.55	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.71	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.68	Reach Len. (m)	45.00	45.00	45.00
Crit W.S. (m)	202.83	Flow Area (m2)		11.03	
E.G. Slope (m/m)	0.000419	Area (m2)	1.63	22.36	1.17
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	28.20	Top Width (m)	4.78	20.00	3.42
Vel Total (m/s)	0.69	Avg. Vel. (m/s)		0.69	
Max Chl Dpth (m)	1.28	Hydr. Depth (m)		1.28	
Conv. Total (m3/s)	372.3	Conv. (m3/s)		372.3	

Length Wtd. (m)	45.00	Wetted Per. (m)			8.60
Min Ch El (m)	202.40	Shear (N/m2)			5.28
Alpha	1.00	Stream Power (N/m s)			3.65
Frctn Loss (m)		Cum Volume (1000 m3)	107.89	197.84	71.29
C & E Loss (m)		Cum SA (1000 m2)	101.35	69.71	82.98

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035	
W.S. Elev (m)	206.44	Reach Len. (m)	45.00	45.00	45.00
Crit W.S. (m)	203.86	Flow Area (m2)	294.88	65.54	
E.G. Slope (m/m)	0.000024	Area (m2)	294.88	77.58	49.53
Q Total (m3/s)	47.80	Flow (m3/s)	25.30	22.51	
Top Width (m)	248.32	Top Width (m)	175.32	20.00	53.00
Vel Total (m/s)	0.13	Avg. Vel. (m/s)	0.09	0.34	
Max Chl Dpth (m)	4.04	Hydr. Depth (m)	1.68	3.90	
Conv. Total (m3/s)	9847.2	Conv. (m3/s)	5211.0	4636.1	
Length Wtd. (m)	45.00	Wetted Per. (m)	175.42	16.82	
Min Ch El (m)	202.40	Shear (N/m2)	0.39	0.90	
Alpha	3.38	Stream Power (N/m s)	0.03	0.31	
Frctn Loss (m)		Cum Volume (1000 m3)	337.76	389.43	317.94
C & E Loss (m)		Cum SA (1000 m2)	245.32	69.72	252.69

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.3815

INPUT

Description: Hum 13B-1R. Hwy 400 / Langstaff Rd Ramp - 3 Cell - 2.4 m W x 2.4 m H x 38 m L Concrete Box Culverts. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004
by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 2
Deck/Roadway Width = 38
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	207		130	206.38		200	206	
230	207		260	208		285	209	
300	209.5							

Upstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	50	206.5	95	205	220	204	227	203
235	202.4	244	202.4	247	203	252	204	257	205
269	206	300	206	300	209.5				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	50	.08	227	.035	247	.08	257	.05

Bank Sta: Left Right Coeff Contr. Expan.
227 247 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235.2	206.38	F
243.8	300	207.55	F

Downstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	207		130	206.38		200	206	
230	207		260	208		285	209	
300	209.5							

Downstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	50	206.5	95	205	220	204	227	203
235	202.3	244	202.3	247	203	252	204	257	205
269	206	300	206	300	209.5				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	50	.05	220	.08	227	.035	247	.08
257	.05								

Bank Sta: Left Right Coeff Contr. Expan.
227 247 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235.2	205.5	F
243.8	300	205.5	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           Box     2.4     2.4
FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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
                 2      38     .015     .015        0                    .7
      1
Number of Barrels =  3
Upstream   Elevation =  202.4
Centerline Stations
    Sta.    Sta.    Sta.
   236.9   239.5   242.1
Downstream Elevation =  202.3
Centerline Stations
    Sta.    Sta.    Sta.
   236.9   239.5   242.1

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       7.62    Culv Full Len (m)
  # Barrels                    3    Culv Vel US (m/s)         0.85
  Q Barrel (m3/s)           2.54    Culv Vel DS (m/s)         0.79
  E.G. US. (m)            203.71    Culv Inv El Up (m)      202.40
  W.S. US. (m)            203.68    Culv Inv El Dn (m)      202.30
  E.G. DS (m)             203.66    Culv Frctn Ls (m)         0.01
  W.S. DS (m)             203.64    Culv Exit Loss (m)        0.01
  Delta EG (m)              0.05    Culv Entr Loss (m)        0.03
  Delta WS (m)              0.04    Q Weir (m3/s)
  E.G. IC (m)             203.19    Weir Sta Lft (m)
  E.G. OC (m)             203.71    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
  Culv WS Inlet (m)       203.64    Weir Max Depth (m)
  Culv WS Outlet (m)      203.64    Weir Avg Depth (m)
  Culv Nml Depth (m)        0.58    Weir Flow Area (m2)
  Culv Crt Depth (m)        0.49    Min El Weir Flow (m)    206.38


CULVERT OUTPUT  Profile #Regional w red'n  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      32.69    Culv Full Len (m)        38.00
  # Barrels                   3     Culv Vel US (m/s)         1.89
  Q Barrel (m3/s)          10.90    Culv Vel DS (m/s)         1.89
  E.G. US. (m)            206.45    Culv Inv El Up (m)      202.40
  W.S. US. (m)            206.44    Culv Inv El Dn (m)      202.30
  E.G. DS (m)             206.08    Culv Frctn Ls (m)         0.06
  W.S. DS (m)             206.08    Culv Exit Loss (m)        0.18
  Delta EG (m)              0.37    Culv Entr Loss (m)        0.13
  Delta WS (m)              0.37    Q Weir (m3/s)            15.11
  E.G. IC (m)             205.10    Weir Sta Lft (m)        116.40
  E.G. OC (m)             206.45    Weir Sta Rgt (m)        213.35
  Culvert Control         Outlet    Weir Submerg              0.00
  Culv WS Inlet (m)       204.80    Weir Max Depth (m)        0.44
  Culv WS Outlet (m)      204.70    Weir Avg Depth (m)        0.22
```

Culv Nml Depth (m)		Weir Flow Area (m2)	21.25
Culv Crt Depth (m)	1.28	Min El Weir Flow (m)	206.38

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.381

INPUT
Description: Section 46.381 - Hwy 400 / Langstaff Rd Ramp - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	50	206.5	95	205	220	204	227	203
235	202.3	244	202.3	247	203	252	204	257	205
269	206	300	206	300	209.5				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	50	.05	220	.08	227	.035	247	.08
257	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
227	247	260	275	290	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235.2	205.5	F
243.8	300	205.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.66	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.64	Reach Len. (m)	260.00	275.00	290.00
Crit W.S. (m)	202.73	Flow Area (m2)		11.52	
E.G. Slope (m/m)	0.000364	Area (m2)	1.43	22.93	1.02
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	27.67	Top Width (m)	4.47	20.00	3.20
Vel Total (m/s)	0.66	Avg. Vel. (m/s)		0.66	
Max Chl Dpth (m)	1.34	Hydr. Depth (m)		1.34	
Conv. Total (m3/s)	399.7	Conv. (m3/s)		399.7	
Length Wtd. (m)	275.05	Wetted Per. (m)		8.60	
Min Ch El (m)	202.30	Shear (N/m2)		4.78	
Alpha	1.00	Stream Power (N/m s)		3.16	

Frctn Loss (m)	0.11	Cum Volume (1000 m3)	107.89	197.66	71.29
C & E Loss (m)	0.00	Cum SA (1000 m2)	101.14	68.81	82.83

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.052	0.035	0.076
W.S. Elev (m)	206.08	Reach Len. (m)	260.00	275.00	290.00
Crit W.S. (m)	203.77	Flow Area (m2)	232.27	71.65	29.98
E.G. Slope (m/m)	0.000019	Area (m2)	232.27	71.65	29.98
Q Total (m3/s)	47.80	Flow (m3/s)	24.83	20.86	2.11
Top Width (m)	237.26	Top Width (m)	164.26	20.00	53.00
Vel Total (m/s)	0.14	Avg. Vel. (m/s)	0.11	0.29	0.07
Max Chl Dpth (m)	3.78	Hydr. Depth (m)	1.41	3.58	0.57
Conv. Total (m3/s)	10944.2	Conv. (m3/s)	5685.9	4775.6	482.6
Length Wtd. (m)	272.95	Wetted Per. (m)	164.35	20.11	53.31
Min Ch El (m)	202.30	Shear (N/m2)	0.26	0.67	0.11
Alpha	2.10	Stream Power (N/m s)	0.03	0.19	0.01
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	337.76	387.50	317.94
C & E Loss (m)	0.01	Cum SA (1000 m2)	237.68	68.82	250.30

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: RIVER-1
REACH: Reach-1 RS: 46.36

INPUT

Description: Section 46.36 - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207.4	29	207	39	205	50	202	52	201.6
57	201.6	59	202	71	205	130	205.8		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	29	.05	39	.08	50	.035	59	.08
71	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
50	59	150	150	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
110	130	208	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.54	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.51	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)		Flow Area (m2)	4.18	16.38	4.55
E.G. Slope (m/m)	0.000435	Area (m2)	4.18	16.38	4.55
Q Total (m3/s)	16.31	Flow (m3/s)	0.88	14.46	0.96
Top Width (m)	20.57	Top Width (m)	5.53	9.00	6.04
Vel Total (m/s)	0.65	Avg. Vel. (m/s)	0.21	0.88	0.21
Max Chl Dpth (m)	1.91	Hydr. Depth (m)	0.75	1.82	0.75
Conv. Total (m3/s)	782.3	Conv. (m3/s)	42.2	693.8	46.2
Length Wtd. (m)	150.00	Wetted Per. (m)	5.74	9.08	6.22
Min Ch El (m)	201.60	Shear (N/m2)	3.10	7.69	3.12
Alpha	1.65	Stream Power (N/m s)	0.65	6.79	0.66
Frctn Loss (m)	0.06	Cum Volume (1000 m3)	107.16	192.26	70.48
C & E Loss (m)	0.00	Cum SA (1000 m2)	99.84	64.83	81.49

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.05	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.079	0.035	0.068
W.S. Elev (m)	206.02	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)		Flow Area (m2)	30.26	38.95	

59.51					
E.G. Slope (m/m)	0.000195	Area (m2)	30.26	38.95	
66.55					
Q Total (m3/s)	66.49	Flow (m3/s)	9.17	41.00	
16.31					
Top Width (m)	96.08	Top Width (m)	16.08	9.00	
71.00					
Vel Total (m/s)	0.52	Avg. Vel. (m/s)	0.30	1.05	
0.27					
Max Chl Dpth (m)	4.42	Hydr. Depth (m)	1.88	4.33	
1.17					
Conv. Total (m3/s)	4764.1	Conv. (m3/s)	657.4	2937.7	
1169.1					
Length Wtd. (m)	150.00	Wetted Per. (m)	16.58	9.08	
51.37					
Min Ch El (m)	201.60	Shear (N/m2)	3.48	8.19	
2.21					
Alpha	2.68	Stream Power (N/m s)	1.06	8.62	
0.61					
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	303.63	372.29	
303.95					
C & E Loss (m)	0.00	Cum SA (1000 m2)	214.24	64.83	
232.32					

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.35

INPUT
Description: Section 46.35 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	206.8	29	206.5	35	206	49	202	52	201.4
56	201.4	59	202	79	205	100	205.5	100	208
139	208								

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	29	.05	35	.08	49	.035	59	.08
79	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
49	59	120	120	120	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.49	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	
0.080					
W.S. Elev (m)	203.46	Reach Len. (m)	120.00	120.00	
120.00					
Crit W.S. (m)		Flow Area (m2)	3.73	18.80	
7.11					
E.G. Slope (m/m)	0.000314	Area (m2)	3.73	18.80	

7.11					
Q Total (m3/s)	16.31	Flow (m3/s)	0.65	14.39	
1.27					
Top Width (m)	24.85	Top Width (m)	5.11	10.00	
9.74					
Vel Total (m/s)	0.55	Avg. Vel. (m/s)	0.17	0.77	
0.18					
Max Chl Dpth (m)	2.06	Hydr. Depth (m)	0.73	1.88	
0.73					
Conv. Total (m3/s)	920.5	Conv. (m3/s)	36.9	812.1	
71.5					
Length Wtd. (m)	120.00	Wetted Per. (m)	5.32	10.12	
9.84					
Min Ch El (m)	201.40	Shear (N/m2)	2.16	5.72	
2.22					
Alpha	1.72	Stream Power (N/m s)	0.38	4.38	
0.40					
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	106.57	189.62	
69.61					
C & E Loss (m)	0.00	Cum SA (1000 m2)	99.04	63.40	
80.31					

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.02	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	
0.075					
W.S. Elev (m)	205.99	Reach Len. (m)	120.00	120.00	
120.00					
Crit W.S. (m)		Flow Area (m2)	27.91	44.14	
65.49					
E.G. Slope (m/m)	0.000158	Area (m2)	27.91	44.14	
65.49					
Q Total (m3/s)	66.49	Flow (m3/s)	6.77	42.26	
17.45					
Top Width (m)	64.98	Top Width (m)	13.98	10.00	
41.00					
Vel Total (m/s)	0.48	Avg. Vel. (m/s)	0.24	0.96	
0.27					
Max Chl Dpth (m)	4.59	Hydr. Depth (m)	2.00	4.41	
1.60					
Conv. Total (m3/s)	5296.1	Conv. (m3/s)	539.0	3366.7	
1390.4					
Length Wtd. (m)	120.00	Wetted Per. (m)	14.54	10.12	
41.72					
Min Ch El (m)	201.40	Shear (N/m2)	2.97	6.74	
2.43					
Alpha	2.60	Stream Power (N/m s)	0.72	6.45	
0.65					
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	299.27	366.06	
294.04					
C & E Loss (m)	0.00	Cum SA (1000 m2)	211.98	63.41	
223.92					

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.34

INPUT
Description: Section 46.34 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	206.4	30	206.4	36	206	46	202	51	201.2
53	201.2	58	202	68	205	144	205.4		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	30	.05	36	.08	46	.035	58	.08
68	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
46	58	225	205	190	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
100	144	208	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.43	Reach Len. (m)	225.00	205.00	190.00
Crit W.S. (m)		Flow Area (m2)	2.56	22.77	3.41
E.G. Slope (m/m)	0.000242	Area (m2)	2.56	22.77	3.41
Q Total (m3/s)	16.31	Flow (m3/s)	0.38	15.41	0.52
Top Width (m)	20.34	Top Width (m)	3.58	12.00	4.77
Vel Total (m/s)	0.57	Avg. Vel. (m/s)	0.15	0.68	0.15
Max Chl Dpth (m)	2.23	Hydr. Depth (m)	0.72	1.90	0.72
Conv. Total (m3/s)	1047.3	Conv. (m3/s)	24.3	989.9	33.1
Length Wtd. (m)	204.98	Wetted Per. (m)	3.85	12.13	4.98
Min Ch El (m)	201.20	Shear (N/m2)	1.58	4.46	1.63
Alpha	1.35	Stream Power (N/m s)	0.23	3.02	0.25
Frctn Loss (m)	0.07	Cum Volume (1000 m3)	106.19	187.12	68.97
C & E Loss (m)	0.00	Cum SA (1000 m2)	98.52	62.08	79.44

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.01	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	

0.065					
W.S. Elev (m)	205.97	Reach Len. (m)	225.00	205.00	190.00
Crit W.S. (m)		Flow Area (m2)	19.74	53.28	53.20
E.G. Slope (m/m)	0.000144	Area (m2)	19.74	53.28	83.54
Q Total (m3/s)	66.49	Flow (m3/s)	4.46	49.09	12.94
Top Width (m)	107.93	Top Width (m)	9.93	12.00	86.00
Vel Total (m/s)	0.53	Avg. Vel. (m/s)	0.23	0.92	0.24
Max Chl Dpth (m)	4.77	Hydr. Depth (m)	1.99	4.44	1.27
Conv. Total (m3/s)	5531.4	Conv. (m3/s)	371.1	4084.1	1076.2
Length Wtd. (m)	205.80	Wetted Per. (m)	10.70	12.13	42.44
Min Ch El (m)	201.20	Shear (N/m2)	2.61	6.22	1.78
Alpha	2.31	Stream Power (N/m s)	0.59	5.73	0.43
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	296.41	360.22	285.10
C & E Loss (m)	0.00	Cum SA (1000 m2)	210.55	62.09	216.30

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.33

INPUT
Description: Section 46.33 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	67	205	75	202	78	201	83	201
86	202	97	205	115	205	115	208	180	208

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	67	.08	75	.035	86	.08	97	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
75	86	130	130	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.38	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.34	Reach Len. (m)	130.00	130.00	130.00
Crit W.S. (m)		Flow Area (m2)	2.38	22.69	

3.27				
E.G. Slope (m/m)	0.000450	Area (m2)	2.38	22.69
3.27				
Q Total (m3/s)	22.97	Flow (m3/s)	0.46	21.86
0.65				
Top Width (m)	19.46	Top Width (m)	3.56	11.00
4.90				
Vel Total (m/s)	0.81	Avg. Vel. (m/s)	0.19	0.96
0.20				
Max Chl Dpth (m)	2.34	Hydr. Depth (m)	0.67	2.06
0.67				
Conv. Total (m3/s)	1082.6	Conv. (m3/s)	21.7	1030.3
30.5				
Length Wtd. (m)	130.00	Wetted Per. (m)	3.80	11.32
5.08				
Min Ch El (m)	201.00	Shear (N/m2)	2.76	8.85
2.84				
Alpha	1.35	Stream Power (N/m s)	0.54	8.52
0.56				
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	105.64	182.46
68.34				
C & E Loss (m)	0.00	Cum SA (1000 m2)	97.72	59.72
78.52				

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.98	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.03	Wt. n-Val.	0.058	0.035	
0.070					
W.S. Elev (m)	205.95	Reach Len. (m)	130.00	130.00	
130.00					
Crit W.S. (m)		Flow Area (m2)	83.32	51.46	
44.07					
E.G. Slope (m/m)	0.000128	Area (m2)	83.32	51.46	
44.07					
Q Total (m3/s)	74.78	Flow (m3/s)	18.67	45.71	
10.40					
Top Width (m)	115.00	Top Width (m)	75.00	11.00	
29.00					
Vel Total (m/s)	0.42	Avg. Vel. (m/s)	0.22	0.89	
0.24					
Max Chl Dpth (m)	4.95	Hydr. Depth (m)	1.11	4.68	
1.52					
Conv. Total (m3/s)	6598.4	Conv. (m3/s)	1647.0	4033.4	
917.9					
Length Wtd. (m)	130.00	Wetted Per. (m)	76.49	11.32	
30.35					
Min Ch El (m)	201.00	Shear (N/m2)	1.37	5.72	
1.83					
Alpha	2.88	Stream Power (N/m s)	0.31	5.08	
0.43					
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	284.82	349.48	
272.98					
C & E Loss (m)	0.00	Cum SA (1000 m2)	200.99	59.73	
205.38					

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

water surface.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.322

INPUT
Description: Section 46.322 - Applewod Crescent - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	58	208	58	205.5	66	205.5	78.5	201.8
79.15	201	91	201	91.5	201.8	100.5	205.7	115	205.7
115	208	175	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	66	.08	78.5	.035	91.5	.08	100.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
78.5	91.5	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	78.5	205.6	F
91.5	175	205.6	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.035	
W.S. Elev (m)	203.30	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	201.71	Flow Area (m2)		29.45	
E.G. Slope (m/m)	0.000272	Area (m2)	3.80	29.45	2.60
Q Total (m3/s)	22.97	Flow (m3/s)		22.97	
Top Width (m)	21.53	Top Width (m)	5.07	13.00	3.46
Vel Total (m/s)	0.78	Avg. Vel. (m/s)		0.78	
Max Chl Dpth (m)	2.30	Hydr. Depth (m)		2.27	
Conv. Total (m3/s)	1393.0	Conv. (m3/s)		1393.0	
Length Wtd. (m)	50.00	Wetted Per. (m)		13.82	
Min Ch El (m)	201.00	Shear (N/m2)		5.68	
Alpha	1.00	Stream Power (N/m s)		4.43	
Frctn Loss (m)		Cum Volume (1000 m3)	105.24	179.07	67.96
C & E Loss (m)		Cum SA (1000 m2)	97.16	58.16	77.98

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.96	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.078	0.035	0.078
W.S. Elev (m)	205.92	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	202.54	Flow Area (m2)	31.65	63.45	22.63
E.G. Slope (m/m)	0.000153	Area (m2)	31.65	63.45	22.63
Q Total (m3/s)	74.78	Flow (m3/s)	7.79	61.95	5.04
Top Width (m)	57.00	Top Width (m)	20.50	13.00	23.50
Vel Total (m/s)	0.64	Avg. Vel. (m/s)	0.25	0.98	0.22
Max Chl Dpth (m)	4.92	Hydr. Depth (m)	1.54	4.88	0.96
Conv. Total (m3/s)	6043.9	Conv. (m3/s)	629.8	5006.6	407.5
Length Wtd. (m)	50.00	Wetted Per. (m)	21.45	13.82	24.52
Min Ch El (m)	201.00	Shear (N/m2)	2.22	6.89	1.39
Alpha	1.98	Stream Power (N/m s)	0.55	6.73	0.31
Frctn Loss (m)		Cum Volume (1000 m3)	277.34	342.01	268.64
C & E Loss (m)		Cum SA (1000 m2)	194.79	58.17	201.96

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.3215

INPUT
Description: Hum 13A-4R. Applewood Crescent - Twin Cell - 4.3 m W x 2.4 m H x 30 m L Concrete Box Culverts. Based on Drawings - July 2010

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.
Distance from Upstream XS = 10
Deck/Roadway Width = 30
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 2
Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord

58	205.6	115	205.6

Upstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	58	208	58	205.5	66	205.5	78.5	201.8
79.15	201	91	201	91.5	201.8	100.5	205.7	115	205.7
115	208	175	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	66	.08	78.5	.035	91.5	.08	100.5	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
78.5	91.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	78.5	205.6	F
91.5	175	205.6	F

Downstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
58	205.6	115	205.6

Downstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	58	208	58	205.5	66	205.5	78.5	201.8
79.15	200.6	91	200.6	91.5	201.8	100.5	205.7	115	205.7
115	208	175	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	66	.08	78.5	.035	91.5	.08	100.5	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
78.5	91.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	78.5	205	F
91.5	175	205	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	Box	2.44	4.27

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
10	30	.015	.015	0	.4	1

Number of Barrels = 2

Upstream Elevation = 201
Centerline Stations
Sta. Sta.
82.5 87.5
Downstream Elevation = 200.6
Centerline Stations
Sta. Sta.
82.5 87.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	22.97	Culv Full Len (m)	14.72
# Barrels	2	Culv Vel US (m/s)	1.21
Q Barrel (m3/s)	11.49	Culv Vel DS (m/s)	1.10
E.G. US. (m)	203.33	Culv Inv El Up (m)	201.00
W.S. US. (m)	203.30	Culv Inv El Dn (m)	200.60
E.G. DS (m)	203.25	Culv Frctn Ls (m)	0.01
W.S. DS (m)	203.23	Culv Exit Loss (m)	0.04
Delta EG (m)	0.08	Culv Entr Loss (m)	0.03
Delta WS (m)	0.07	Q Weir (m3/s)	
E.G. IC (m)	202.42	Weir Sta Lft (m)	
E.G. OC (m)	203.33	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	203.23	Weir Max Depth (m)	
Culv WS Outlet (m)	203.04	Weir Avg Depth (m)	
Culv Nml Depth (m)	0.59	Weir Flow Area (m2)	
Culv Crt Depth (m)	0.90	Min El Weir Flow (m)	205.60

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	58.92	Culv Full Len (m)	30.00
# Barrels	2	Culv Vel US (m/s)	2.83
Q Barrel (m3/s)	29.46	Culv Vel DS (m/s)	2.83
E.G. US. (m)	205.96	Culv Inv El Up (m)	201.00
W.S. US. (m)	205.92	Culv Inv El Dn (m)	200.60
E.G. DS (m)	205.36	Culv Frctn Ls (m)	0.08
W.S. DS (m)	205.31	Culv Exit Loss (m)	0.35
Delta EG (m)	0.59	Culv Entr Loss (m)	0.16
Delta WS (m)	0.61	Q Weir (m3/s)	15.87
E.G. IC (m)	204.55	Weir Sta Lft (m)	58.00
E.G. OC (m)	205.96	Weir Sta Rgt (m)	115.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	203.44	Weir Max Depth (m)	0.36
Culv WS Outlet (m)	203.04	Weir Avg Depth (m)	0.33
Culv Nml Depth (m)		Weir Flow Area (m2)	18.97
Culv Crt Depth (m)	1.69	Min El Weir Flow (m)	205.60

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.321

INPUT
Description: Section 46.322 - Applewod Crescent - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	58	208	58	205.5	66	205.5	78.5	201.8
79.15	200.6	91	200.6	91.5	201.8	100.5	205.7	115	205.7
115	208	175	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	66	.08	78.5	.035	91.5	.08	100.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
78.5	91.5	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	78.5	205	F
91.5	175	205	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.25	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.23	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	201.32	Flow Area (m2)		33.51	
E.G. Slope (m/m)	0.000189	Area (m2)	3.46	33.51	2.36
Q Total (m3/s)	22.97	Flow (m3/s)		22.97	
Top Width (m)	21.13	Top Width (m)	4.83	13.00	3.30
Vel Total (m/s)	0.69	Avg. Vel. (m/s)		0.69	
Max Chl Dpth (m)	2.63	Hydr. Depth (m)		2.58	
Conv. Total (m3/s)	1672.3	Conv. (m3/s)		1672.3	
Length Wtd. (m)	50.00	Wetted Per. (m)		14.51	
Min Ch El (m)	200.60	Shear (N/m2)		4.27	
Alpha	1.00	Stream Power (N/m s)		2.93	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	105.24	178.31	67.96
C & E Loss (m)	0.02	Cum SA (1000 m2)	96.91	57.51	77.81

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.36	Element	Left OB	Channel	Right OB

Vel Head (m)	0.05	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	205.31	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	202.15	Flow Area (m2)	20.82	60.55	14.22
E.G. Slope (m/m)	0.000215	Area (m2)	20.82	60.55	14.22
Q Total (m3/s)	74.78	Flow (m3/s)	5.40	65.79	3.58
Top Width (m)	32.96	Top Width (m)	11.86	13.00	8.10
Vel Total (m/s)	0.78	Avg. Vel. (m/s)	0.26	1.09	0.25
Max Chl Dpth (m)	4.71	Hydr. Depth (m)	1.76	4.66	1.76
Conv. Total (m3/s)	5095.7	Conv. (m3/s)	368.2	4483.2	244.3
Length Wtd. (m)	50.00	Wetted Per. (m)	12.37	14.51	8.83
Min Ch El (m)	200.60	Shear (N/m2)	3.56	8.81	3.40
Alpha	1.71	Stream Power (N/m s)	0.92	9.57	0.86
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	277.34	339.66	268.64
C & E Loss (m)	0.02	Cum SA (1000 m2)	193.98	57.52	201.17

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: RIVER-1
REACH: Reach-1 RS: 46.32

INPUT
Description: Section 46.32 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	45	208	45	205.5	52	205	66	201
68	200.6	69	200.6	71	201	84	205	102	206
102	208	152	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	52	.08	66	.035	71	.08	84	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
66	71	110	110	110	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.22	Element	Left OB	Channel	Right OB

Vel Head (m)	0.08	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.14	Reach Len. (m)	110.00	110.00	110.00
Crit W.S. (m)		Flow Area (m2)	7.98	11.88	7.41
E.G. Slope (m/m)	0.000838	Area (m2)	7.98	11.88	7.41
Q Total (m3/s)	22.97	Flow (m3/s)	2.94	17.31	2.72
Top Width (m)	19.42	Top Width (m)	7.48	5.00	6.94
Vel Total (m/s)	0.84	Avg. Vel. (m/s)	0.37	1.46	0.37
Max Chl Dpth (m)	2.54	Hydr. Depth (m)	1.07	2.38	1.07
Conv. Total (m3/s)	793.7	Conv. (m3/s)	101.6	598.2	94.0
Length Wtd. (m)	110.00	Wetted Per. (m)	7.78	5.08	7.26
Min Ch El (m)	200.60	Shear (N/m2)	8.43	19.21	8.38
Alpha	2.30	Stream Power (N/m s)	3.11	27.99	3.08
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	104.95	177.18	67.71
C & E Loss (m)	0.02	Cum SA (1000 m2)	96.60	57.06	77.55

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.12	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	205.21	Reach Len. (m)	110.00	110.00	110.00
Crit W.S. (m)		Flow Area (m2)	31.23	22.25	29.11
E.G. Slope (m/m)	0.000650	Area (m2)	31.23	22.25	29.11
Q Total (m3/s)	74.78	Flow (m3/s)	16.32	43.37	15.10
Top Width (m)	38.69	Top Width (m)	16.93	5.00	16.76
Vel Total (m/s)	0.91	Avg. Vel. (m/s)	0.52	1.95	0.52
Max Chl Dpth (m)	4.61	Hydr. Depth (m)	1.85	4.45	1.74
Conv. Total (m3/s)	2934.2	Conv. (m3/s)	640.2	1701.5	592.6
Length Wtd. (m)	110.00	Wetted Per. (m)	17.49	5.08	17.37
Min Ch El (m)	200.60	Shear (N/m2)	11.37	27.90	10.67
Alpha	2.83	Stream Power (N/m s)	5.94	54.38	

5.54					
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	276.04	337.59	267.56
C & E Loss (m)	0.02	Cum SA (1000 m2)	193.26	57.07	200.55

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: RIVER-1
REACH: Reach-1 RS: 46.312

INPUT
Description: Section 46.312 - Edgeley Blvd - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	43	207	43	204.6	49	204.6	52	204.1
60.5	201.1	61.15	200.6	72.85	200.6	73.5	201.1	82	204.1
84	204.7	90	204.7	90	207	150	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	49	.08	60.5	.035	73.5	.08	84	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
60.5	73.5	60	60	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	60.5	204.7	F
73.5	150	204.7	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.16	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.035	
W.S. Elev (m)	203.14	Reach Len. (m)	60.00	60.00	60.00
Crit W.S. (m)	201.31	Flow Area (m2)		32.69	
E.G. Slope (m/m)	0.000183	Area (m2)	5.89	32.69	5.89
Q Total (m3/s)	22.97	Flow (m3/s)		22.97	
Top Width (m)	24.56	Top Width (m)	5.78	13.00	5.78
Vel Total (m/s)	0.70	Avg. Vel. (m/s)		0.70	
Max Chl Dpth (m)	2.54	Hydr. Depth (m)		2.51	
Conv. Total (m3/s)	1697.5	Conv. (m3/s)		1697.5	
Length Wtd. (m)	60.00	Wetted Per. (m)		13.34	

Min Ch El (m)	200.60	Shear (N/m2)		4.40
Alpha	1.00	Stream Power (N/m s)		3.09
Frctn Loss (m)		Cum Volume (1000 m3)	104.19	174.73 66.98
C & E Loss (m)		Cum SA (1000 m2)	95.88	56.07 76.85

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.27	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.077	0.035	0.078
W.S. Elev (m)	205.23	Reach Len. (m)	60.00	60.00	60.00
Crit W.S. (m)	202.13	Flow Area (m2)	28.76	59.86	27.18
E.G. Slope (m/m)	0.000169	Area (m2)	28.76	59.86	27.18
Q Total (m3/s)	74.78	Flow (m3/s)	7.27	60.47	7.03
Top Width (m)	47.00	Top Width (m)	17.50	13.00	16.50
Vel Total (m/s)	0.65	Avg. Vel. (m/s)	0.25	1.01	0.26
Max Chl Dpth (m)	4.63	Hydr. Depth (m)	1.64	4.60	1.65
Conv. Total (m3/s)	5753.3	Conv. (m3/s)	559.6	4652.5	541.1
Length Wtd. (m)	60.00	Wetted Per. (m)	18.68	13.34	17.63
Min Ch El (m)	200.60	Shear (N/m2)	2.55	7.43	2.55
Alpha	2.01	Stream Power (N/m s)	0.65	7.51	0.66
Frctn Loss (m)		Cum Volume (1000 m3)	272.74	333.07	264.46
C & E Loss (m)		Cum SA (1000 m2)	191.37	56.08	198.72

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.3115

INPUT
Description: Hum 13A-3R. Edgeley Blvd - Twin Cell - 4.3 m W x 2.4 m H x 35 m L Concrete Box Culverts. July 2010

Drawing by Ander Engineering Ltd. (Dwg No. 88-150-7, October 1989) used to recode culvert in HEC-RAS format.

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 10
Deck/Roadway Width = 35
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
43	204.7	90	204.7

Upstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	43	207	43	204.6	49	204.6	52	204.1
60.5	201.1	61.15	200.6	72.85	200.6	73.5	201.1	82	204.1
84	204.7	90	204.7	90	207	150	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	49	.08	60.5	.035	73.5	.08	84	.05

Bank Sta: Left Right Coeff Contr. Expan.
60.5 73.5 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	60.5	204.7	F
73.5	150	204.7	F

Downstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
43	204.7	90	204.7

Downstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	43	207	43	204.6	49	204.6	52	204.1
60.5	201.1	61.15	200.5	72.85	200.5	73.5	201.1	82	204.1
84	204.7	90	204.7	90	207	150	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	49	.08	60.5	.035	73.5	.08	84	.05

Bank Sta: Left Right Coeff Contr. Expan.
60.5 73.5 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	60.5	203.5	F
73.5	150	203.5	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	Box	2.44	4.27

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
10	35	.015	.015	0	.4	1

Number of Barrels = 2
Upstream Elevation = 200.6
Centerline Stations

Sta.	Sta.
64.5	69.5

Downstream Elevation = 200.5
Centerline Stations

Sta.	Sta.
64.5	69.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	22.97	Culv Full Len (m)	35.00
# Barrels	2	Culv Vel US (m/s)	1.10
Q Barrel (m3/s)	11.49	Culv Vel DS (m/s)	1.10
E.G. US. (m)	203.16	Culv Inv El Up (m)	200.60
W.S. US. (m)	203.14	Culv Inv El Dn (m)	200.50
E.G. DS (m)	203.09	Culv Frctn Ls (m)	0.01
W.S. DS (m)	203.06	Culv Exit Loss (m)	0.04
Delta EG (m)	0.08	Culv Entr Loss (m)	0.02
Delta WS (m)	0.07	Q Weir (m3/s)	
E.G. IC (m)	202.03	Weir Sta Lft (m)	
E.G. OC (m)	203.16	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	203.04	Weir Max Depth (m)	
Culv WS Outlet (m)	202.94	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.90	Min El Weir Flow (m)	204.70

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	45.55	Culv Full Len (m)	35.00
# Barrels	2	Culv Vel US (m/s)	2.19
Q Barrel (m3/s)	22.77	Culv Vel DS (m/s)	2.19
E.G. US. (m)	205.27	Culv Inv El Up (m)	200.60
W.S. US. (m)	205.23	Culv Inv El Dn (m)	200.50
E.G. DS (m)	204.93	Culv Frctn Ls (m)	0.05
W.S. DS (m)	204.88	Culv Exit Loss (m)	0.19
Delta EG (m)	0.34	Culv Entr Loss (m)	0.10
Delta WS (m)	0.35	Q Weir (m3/s)	29.23
E.G. IC (m)	204.16	Weir Sta Lft (m)	43.00
E.G. OC (m)	205.27	Weir Sta Rgt (m)	90.00
Culvert Control	Outlet	Weir Submerg	0.31
Culv WS Inlet (m)	203.04	Weir Max Depth (m)	0.57
Culv WS Outlet (m)	202.94	Weir Avg Depth (m)	0.57
Culv Nml Depth (m)		Weir Flow Area (m2)	26.84
Culv Crt Depth (m)	1.43	Min El Weir Flow (m)	204.70

Warning: During the culvert inlet control computations, the program could not

balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.311

INPUT
Description: Section 46.311 - Edgeley Blvd - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	43	207	43	204.6	49	204.6	52	204.1
60.5	201.1	61.15	200.5	72.85	200.5	73.5	201.1	82	204.1
84	204.7	90	204.7	90	207	150	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	49	.08	60.5	.035	73.5	.08	84	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
60.5	73.5	150	150	150	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	60.5	203.5	F
73.5	150	203.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.09	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.06	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)	201.21	Flow Area (m2)		32.95	
E.G. Slope (m/m)	0.000181	Area (m2)	5.47	32.95	5.47
Q Total (m3/s)	22.97	Flow (m3/s)		22.97	
Top Width (m)	24.13	Top Width (m)	5.57	13.00	5.57
Vel Total (m/s)	0.70	Avg. Vel. (m/s)		0.70	
Max Chl Dpth (m)	2.56	Hydr. Depth (m)		2.53	
Conv. Total (m3/s)	1709.1	Conv. (m3/s)		1709.1	
Length Wtd. (m)	150.00	Wetted Per. (m)		13.47	
Min Ch El (m)	200.50	Shear (N/m2)		4.33	
Alpha	1.00	Stream Power (N/m s)		3.02	
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	104.19	173.81	66.98
C & E Loss (m)	0.00	Cum SA (1000 m2)	95.53	55.29	76.51

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.93	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.079	0.035	0.079
W.S. Elev (m)	204.88	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)	202.03	Flow Area (m2)	22.62	56.53	21.40
E.G. Slope (m/m)	0.000225	Area (m2)	22.62	56.53	21.40
Q Total (m3/s)	74.78	Flow (m3/s)	5.89	63.09	5.81
Top Width (m)	47.00	Top Width (m)	17.50	13.00	16.50
Vel Total (m/s)	0.74	Avg. Vel. (m/s)	0.26	1.12	0.27
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.29	4.35	1.30
Conv. Total (m3/s)	4981.9	Conv. (m3/s)	392.4	4202.6	386.9
Length Wtd. (m)	150.00	Wetted Per. (m)	18.33	13.47	17.28
Min Ch El (m)	200.50	Shear (N/m2)	2.73	9.27	2.74
Alpha	1.92	Stream Power (N/m s)	0.71	10.35	0.74
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	272.74	330.24	264.46
C & E Loss (m)	0.00	Cum SA (1000 m2)	190.32	55.30	197.73

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.31

INPUT
Description: Section 46.31 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	40	207	40	204.5	46	204.5	49	204
58	201	61	200.4	67	200.4	70	201	81	204
85	204.6	107	204.6	107	207	148	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	46	.08	58	.035	70	.08	85	.05

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

58 70 150 150 150 .1 .3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.06	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.04	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)		Flow Area (m2)	6.24	29.87	7.62
E.G. Slope (m/m)	0.000177	Area (m2)	6.24	29.87	7.62
Q Total (m3/s)	22.97	Flow (m3/s)	1.01	20.70	1.25
Top Width (m)	25.59	Top Width (m)	6.12	12.00	7.48
Vel Total (m/s)	0.53	Avg. Vel. (m/s)	0.16	0.69	0.16
Max Chl Dpth (m)	2.64	Hydr. Depth (m)	1.02	2.49	1.02
Conv. Total (m3/s)	1727.4	Conv. (m3/s)	76.2	1557.0	94.2
Length Wtd. (m)	150.00	Wetted Per. (m)	6.45	12.12	7.75
Min Ch El (m)	200.40	Shear (N/m2)	1.68	4.27	1.71
Alpha	1.58	Stream Power (N/m s)	0.27	2.96	0.28
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	103.31	169.10	66.00
C & E Loss (m)	0.00	Cum SA (1000 m2)	94.66	53.42	75.53

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.90	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.079	0.035	0.078
W.S. Elev (m)	204.84	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)		Flow Area (m2)	24.93	51.52	33.31
E.G. Slope (m/m)	0.000236	Area (m2)	24.93	51.52	33.31
Q Total (m3/s)	74.78	Flow (m3/s)	6.86	59.32	8.60
Top Width (m)	67.00	Top Width (m)	18.00	12.00	37.00
Vel Total (m/s)	0.68	Avg. Vel. (m/s)	0.28	1.15	0.26
Max Chl Dpth (m)	4.44	Hydr. Depth (m)	1.39	4.29	0.90
Conv. Total (m3/s)	4870.4	Conv. (m3/s)	446.6	3863.4	560.4
Length Wtd. (m)	150.00	Wetted Per. (m)	18.87	12.12	37.69

Min Ch El (m)	200.40	Shear (N/m2)	3.05	9.83	2.04
Alpha	2.30	Stream Power (N/m s)	0.84	11.32	0.53
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	269.18	322.13	260.36
C & E Loss (m)	0.00	Cum SA (1000 m2)	187.65	53.43	193.72

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.30

INPUT
Description: Section 46.30 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	20	207	20	205	46	205	56	201
59	200.3	65	200.3	68	201	80	204	83	204.7
119	205	119	207	146	207				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	46	.08	56	.035	68	.08	83	.025
119	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
56	68	110	110	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.03	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.99	Reach Len. (m)	110.00	110.00	110.00
Crit W.S. (m)		Flow Area (m2)	4.96	30.20	7.93
E.G. Slope (m/m)	0.000273	Area (m2)	4.96	30.20	7.93
Q Total (m3/s)	28.70	Flow (m3/s)	0.97	26.13	1.60
Top Width (m)	24.95	Top Width (m)	4.98	12.00	7.97
Vel Total (m/s)	0.67	Avg. Vel. (m/s)	0.20	0.87	0.20
Max Chl Dpth (m)	2.69	Hydr. Depth (m)	1.00	2.52	1.00
Conv. Total (m3/s)	1738.0	Conv. (m3/s)	58.8	1582.2	96.9
Length Wtd. (m)	110.00	Wetted Per. (m)	5.36	12.16	8.21
Min Ch El (m)	200.30	Shear (N/m2)	2.47	6.64	2.58
Alpha	1.54	Stream Power (N/m s)	0.48	5.74	0.52
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	102.47	164.60	

64.83					
C & E Loss (m)	0.00	Cum SA (1000 m2)	93.83	51.62	
74.38					

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.86	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	204.79	Reach Len. (m)	110.00	110.00	110.00
Crit W.S. (m)		Flow Area (m2)	17.92	51.73	29.18
E.G. Slope (m/m)	0.000297	Area (m2)	17.92	51.73	29.18
Q Total (m3/s)	81.91	Flow (m3/s)	5.62	66.89	9.40
Top Width (m)	46.79	Top Width (m)	9.47	12.00	25.32
Vel Total (m/s)	0.83	Avg. Vel. (m/s)	0.31	1.29	0.32
Max Chl Dpth (m)	4.49	Hydr. Depth (m)	1.89	4.31	1.15
Conv. Total (m3/s)	4752.3	Conv. (m3/s)	326.2	3880.5	545.6
Length Wtd. (m)	110.00	Wetted Per. (m)	10.19	12.16	25.77
Min Ch El (m)	200.30	Shear (N/m2)	5.12	12.39	3.30
Alpha	2.01	Stream Power (N/m s)	1.61	16.02	1.06
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	265.96	314.39	255.67
C & E Loss (m)	0.01	Cum SA (1000 m2)	185.59	51.63	189.05

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.292

INPUT
Description: Section 46.292 - Millway Avenue - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	25	207	25	204	40	204	50	201
50.5	200.3	63	200.3	64	201	72	204	75	204.5
85	204.7	85	207	142	207				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	40	.08	50	.035	64	.08	72	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
50	64	55	55	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	50.5	204.1	F
63	142	204.1	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.00	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.		0.035	
W.S. Elev (m)	202.96	Reach Len. (m)	55.00	55.00	55.00
Crit W.S. (m)	201.11	Flow Area (m2)		33.25	
E.G. Slope (m/m)	0.000248	Area (m2)	6.40	36.71	5.12
Q Total (m3/s)	28.70	Flow (m3/s)		28.70	
Top Width (m)	25.76	Top Width (m)	6.53	14.00	5.23
Vel Total (m/s)	0.86	Avg. Vel. (m/s)		0.86	
Max Chl Dpth (m)	2.66	Hydr. Depth (m)		2.66	
Conv. Total (m3/s)	1823.5	Conv. (m3/s)		1823.5	
Length Wtd. (m)	55.00	Wetted Per. (m)		12.50	
Min Ch El (m)	200.30	Shear (N/m2)		6.46	
Alpha	1.00	Stream Power (N/m s)		5.58	
Frctn Loss (m)		Cum Volume (1000 m3)	101.84	160.92	64.12
C & E Loss (m)		Cum SA (1000 m2)	93.19	50.19	73.65

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.82	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.071	0.035	0.078
W.S. Elev (m)	204.77	Reach Len. (m)	55.00	55.00	55.00
Crit W.S. (m)	201.94	Flow Area (m2)	34.37	62.12	21.52
E.G. Slope (m/m)	0.000204	Area (m2)	34.37	62.12	21.52
Q Total (m3/s)	81.91	Flow (m3/s)	9.53	66.62	5.76
Top Width (m)	60.00	Top Width (m)	25.00	14.00	21.00
Vel Total (m/s)	0.69	Avg. Vel. (m/s)	0.28	1.07	0.27

Max Chl Dpth (m)	4.47	Hydr. Depth (m)	1.37	4.44	1.02
Conv. Total (m3/s)	5735.1	Conv. (m3/s)	667.5	4664.5	403.1
Length Wtd. (m)	55.00	Wetted Per. (m)	26.22	14.58	21.66
Min Ch El (m)	200.30	Shear (N/m2)	2.62	8.52	1.99
Alpha	1.97	Stream Power (N/m s)	0.73	9.14	0.53
Frctn Loss (m)		Cum Volume (1000 m3)	263.09	308.13	252.88
C & E Loss (m)		Cum SA (1000 m2)	183.70	50.20	186.50

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2915

INPUT
Description: Hum 13A-2RR. Millway Avenue Culvert - Twin Cell - 4.3 m W x 2.4 m H x 30 m L Concrete Box Culverts. Based on drawings - July 2010

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 15
Deck/Roadway Width = 30
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
25	204.1		75	204.1		85	204.7	

Upstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	25	207	25	204	40	204	50	201
50.5	200.3	63	200.3	64	201	72	204	75	204.5
85	204.7	85	207	142	207				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	40	.08	50	.035	64	.08	72	.05

Bank Sta: Left Right Coeff Contr. Expan.
50 64 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	50.5	204.1	F
63	142	204.1	F

Downstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord

```
      25   204.1              75   204.1              85   204.7

Downstream Bridge Cross Section Data
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0     207      25     207      25     204      40     204      50     201
    50.5   200.2      63   200.2      64     201      72     204      75   204.5
      85   204.7      85     207     142     207

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05      40     .08      50    .035      64     .08      72     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
            50      64            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    50.5   203.4       F
      63     142   203.4       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           Box    2.44    4.27
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
               15      30     .015     .015        0                   .4
      1
Number of Barrels =  2
Upstream   Elevation =  200.3
Centerline Stations
    Sta.    Sta.
    54.3    59.3
Downstream Elevation =  200.2
Centerline Stations
    Sta.    Sta.
    54.3    59.3

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      28.70    Culv Full Len (m)        30.00
  # Barrels                   2     Culv Vel US (m/s)         1.38
  Q Barrel (m3/s)          14.35    Culv Vel DS (m/s)         1.38
  E.G. US. (m)            203.00    Culv Inv El Up (m)      200.30
  W.S. US. (m)            202.96    Culv Inv El Dn (m)      200.20
  E.G. DS (m)             202.88    Culv Frctn Ls (m)         0.02
  W.S. DS (m)             202.84    Culv Exit Loss (m)        0.06
  Delta EG (m)              0.11    Culv Entr Loss (m)        0.04
  Delta WS (m)              0.12    Q Weir (m3/s)
  E.G. IC (m)             201.97    Weir Sta Lft (m)
  E.G. OC (m)             203.00    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
```

Culv WS Inlet (m)	202.74	Weir Max Depth (m)	
Culv WS Outlet (m)	202.64	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	1.05	Min El Weir Flow (m)	204.10

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	36.85	Culv Full Len (m)	30.00
# Barrels	2	Culv Vel US (m/s)	1.77
Q Barrel (m3/s)	18.43	Culv Vel DS (m/s)	1.77
E.G. US. (m)	204.82	Culv Inv El Up (m)	200.30
W.S. US. (m)	204.77	Culv Inv El Dn (m)	200.20
E.G. DS (m)	204.63	Culv Frctn Ls (m)	0.03
W.S. DS (m)	204.57	Culv Exit Loss (m)	0.10
Delta EG (m)	0.20	Culv Entr Loss (m)	0.06
Delta WS (m)	0.20	Q Weir (m3/s)	45.06
E.G. IC (m)	204.15	Weir Sta Lft (m)	25.00
E.G. OC (m)	204.82	Weir Sta Rgt (m)	85.00
Culvert Control	Outlet	Weir Submerg	0.62
Culv WS Inlet (m)	202.74	Weir Max Depth (m)	0.72
Culv WS Outlet (m)	202.64	Weir Avg Depth (m)	0.63
Culv Nml Depth (m)		Weir Flow Area (m2)	37.94
Culv Crt Depth (m)	1.24	Min El Weir Flow (m)	204.10

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.291

INPUT
Description: Section 46.291 - Millway Avenue - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	25	207	25	204	40	204	50	201
50.5	200.2	63	200.2	64	201	72	204	75	204.5
85	204.7	85	207	142	207				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	40	.08	50	.035	64	.08	72	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
50	64	145	150	155	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	50.5	203.4	F
63	142	203.4	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.88	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.		0.035	

W.S. Elev (m)	202.84	Reach Len. (m)	145.00	150.00	155.00
Crit W.S. (m)	201.01	Flow Area (m2)		33.06	
E.G. Slope (m/m)	0.000252	Area (m2)	5.67	36.42	4.54
Q Total (m3/s)	28.70	Flow (m3/s)		28.70	
Top Width (m)	25.07	Top Width (m)	6.15	14.00	4.92
Vel Total (m/s)	0.87	Avg. Vel. (m/s)		0.87	
Max Chl Dpth (m)	2.64	Hydr. Depth (m)		2.64	
Conv. Total (m3/s)	1806.2	Conv. (m3/s)		1806.2	
Length Wtd. (m)	149.98	Wetted Per. (m)		12.50	
Min Ch El (m)	200.20	Shear (N/m2)		6.55	
Alpha	1.00	Stream Power (N/m s)		5.68	
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	101.84	159.73	64.12
C & E Loss (m)	0.00	Cum SA (1000 m2)	92.84	49.42	73.37

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.63	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.073	0.035	0.079
W.S. Elev (m)	204.57	Reach Len. (m)	145.00	150.00	155.00
Crit W.S. (m)	201.84	Flow Area (m2)	29.27	60.59	17.65
E.G. Slope (m/m)	0.000239	Area (m2)	29.27	60.59	17.65
Q Total (m3/s)	81.91	Flow (m3/s)	8.10	68.74	5.08
Top Width (m)	53.53	Top Width (m)	25.00	14.00	14.53
Vel Total (m/s)	0.76	Avg. Vel. (m/s)	0.28	1.13	0.29
Max Chl Dpth (m)	4.37	Hydr. Depth (m)	1.17	4.33	1.21
Conv. Total (m3/s)	5297.6	Conv. (m3/s)	523.6	4445.6	328.5
Length Wtd. (m)	149.85	Wetted Per. (m)	26.01	14.72	15.12
Min Ch El (m)	200.20	Shear (N/m2)	2.64	9.65	2.74
Alpha	1.88	Stream Power (N/m s)	0.73	10.95	0.79
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	263.09	304.18	252.88

C & E Loss (m)	0.00	Cum SA (1000 m2)	182.32	49.43 185.52

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.29

INPUT
Description: Section 46.29 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	30	207	30	204.5	54	204	64	201
71	200.2	78	201	86	204	110	205	156	205

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	54	.08	64	.035	78	.08	86	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
64	78	135	145	150	.1 .3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.84	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.80	Reach Len. (m)	135.00	145.00	150.00
Crit W.S. (m)		Flow Area (m2)	5.42	30.84	4.33
E.G. Slope (m/m)	0.000324	Area (m2)	5.42	30.84	4.33
Q Total (m3/s)	28.70	Flow (m3/s)	1.10	26.72	0.87
Top Width (m)	24.82	Top Width (m)	6.01	14.00	4.81
Vel Total (m/s)	0.71	Avg. Vel. (m/s)	0.20	0.87	0.20
Max Chl Dpth (m)	2.60	Hydr. Depth (m)	0.90	2.20	0.90
Conv. Total (m3/s)	1595.4	Conv. (m3/s)	61.4	1485.6	48.4
Length Wtd. (m)	144.88	Wetted Per. (m)	6.28	14.09	5.14
Min Ch El (m)	200.20	Shear (N/m2)	2.74	6.94	2.68
Alpha	1.40	Stream Power (N/m s)	0.56	6.02	0.54
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	101.04	154.68	63.43
C & E Loss (m)	0.00	Cum SA (1000 m2)	91.96	47.32	72.62

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.58	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.076	0.035	0.078
W.S. Elev (m)	204.52	Reach Len. (m)	135.00	145.00	150.00
Crit W.S. (m)		Flow Area (m2)	26.55	54.83	19.33
E.G. Slope (m/m)	0.000310	Area (m2)	26.55	54.83	19.33
Q Total (m3/s)	81.91	Flow (m3/s)	7.81	68.22	5.88
Top Width (m)	68.39	Top Width (m)	34.00	14.00	20.39
Vel Total (m/s)	0.81	Avg. Vel. (m/s)	0.29	1.24	0.30
Max Chl Dpth (m)	4.32	Hydr. Depth (m)	0.78	3.92	0.95
Conv. Total (m3/s)	4652.4	Conv. (m3/s)	443.6	3874.9	333.8
Length Wtd. (m)	144.53	Wetted Per. (m)	34.46	14.09	20.94
Min Ch El (m)	200.20	Shear (N/m2)	2.34	11.83	2.81
Alpha	1.97	Stream Power (N/m s)	0.69	14.72	0.85
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	259.04	295.53	250.02
C & E Loss (m)	0.01	Cum SA (1000 m2)	178.04	47.33	182.81

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.282

INPUT
Description: Section 46.282 - Pennsylvania Avenue - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	60	207	60	204	73	204	81	201
83	200.4	84	199.9	96	199.9	97	200.4	99	202
101	203	103	204	118	204	145	204	180	204.64
225	204.64								

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	83	.035	97	.08	103	.05
118	.025	145	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
83	97	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	83.5	204.1	F

96.5 225 204.05 F
Right Levee Station= 180 Elevation= 207

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.035	
W.S. Elev (m)	202.77	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	200.70	Flow Area (m2)		37.22	
E.G. Slope (m/m)	0.000181	Area (m2)	8.33	39.71	3.74
Q Total (m3/s)	28.70	Flow (m3/s)		28.70	
Top Width (m)	24.27	Top Width (m)	6.73	14.00	3.55
Vel Total (m/s)	0.77	Avg. Vel. (m/s)		0.77	
Max Chl Dpth (m)	2.87	Hydr. Depth (m)		2.86	
Conv. Total (m3/s)	2131.1	Conv. (m3/s)		2131.1	
Length Wtd. (m)	50.00	Wetted Per. (m)		13.12	
Min Ch El (m)	199.90	Shear (N/m2)		5.04	
Alpha	1.00	Stream Power (N/m s)		3.89	
Frctn Loss (m)		Cum Volume (1000 m3)	100.11	149.57	62.82
C & E Loss (m)		Cum SA (1000 m2)	91.10	45.29	71.99

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.54	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.076	0.035	0.048
W.S. Elev (m)	204.50	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	201.50	Flow Area (m2)	30.11	63.91	40.48
E.G. Slope (m/m)	0.000170	Area (m2)	30.11	63.91	40.48
Q Total (m3/s)	81.91	Flow (m3/s)	7.60	64.88	9.43
Top Width (m)	112.37	Top Width (m)	23.00	14.00	75.37
Vel Total (m/s)	0.61	Avg. Vel. (m/s)	0.25	1.02	0.23
Max Chl Dpth (m)	4.60	Hydr. Depth (m)	1.31	4.56	0.54

Conv. Total (m3/s)	6273.4	Conv. (m3/s)	582.2	4968.8	722.4
Length Wtd. (m)	50.00	Wetted Per. (m)	24.13	14.24	76.41
Min Ch El (m)	199.90	Shear (N/m2)	2.09	7.51	0.89
Alpha	2.23	Stream Power (N/m s)	0.53	7.62	0.21
Frctn Loss (m)		Cum Volume (1000 m3)	255.22	286.92	245.53
C & E Loss (m)		Cum SA (1000 m2)	174.20	45.30	175.63

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2815

INPUT
Description: Hum 13A-2R. Pennsylvania Avenue Culvert - Twin Cell - 5.7 m W x 2.4 m H x 40 m L Concrete Box Culverts. Drawing by Ander Engineering Ltd. (Dwg No. 85-102-9, December 1989) shows 4 Cell Culvert, but only two cells observed in field.

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 40
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 6

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	205	103	204	133	203.53
145	204	180	204	225	204

Upstream Bridge Cross Section Data
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	60	207	60	204	73	204	81	201
83	200.4	84	199.9	96	199.9	97	200.4	99	202
101	203	103	204	118	204	145	204	180	204.64
225	204.64								

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	83	.035	97	.08	103	.05
118	.025	145	.05						

Bank Sta: Left	Right	Coeff Contr.	Expan.
83	97	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	83.5	204.1	F
96.5	225	204.05	F

Right Levee Station= 180 Elevation= 207

Downstream Deck/Roadway Coordinates
num= 5

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	205	103	204	133	203.53
160	204	200	204		

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	73	204	81	201	83	200.4	84	199.8
96	199.8	97	200.4	99	202	101	203	103	204
118	204	145	204	160	204	200	204	200	206

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	83	.035	97	.08	103	.05
118	.025	145	.05						

Bank Sta: Left	Right	Coeff Contr.	Expan.
83	97	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	83.5	203.4	F
96.5	200	203.4	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	Box	3.05	4.57

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	40	.015	.015	0	.4	1

Number of Barrels = 2
Upstream Elevation = 199.3
Centerline Stations

Sta.	Sta.
87.5	92.5

Downstream Elevation = 199.2
Centerline Stations

Sta.	Sta.
87.5	92.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	28.70	Culv Full Len (m)	40.00
# Barrels	2	Culv Vel US (m/s)	1.03
Q Barrel (m3/s)	14.35	Culv Vel DS (m/s)	1.03
E.G. US. (m)	202.80	Culv Inv El Up (m)	199.30
W.S. US. (m)	202.77	Culv Inv El Dn (m)	199.20
E.G. DS (m)	202.75	Culv Frctn Ls (m)	0.01

W.S. DS (m)	202.72	Culv Exit Loss (m)	0.02
Delta EG (m)	0.06	Culv Entr Loss (m)	0.02
Delta WS (m)	0.06	Q Weir (m3/s)	
E.G. IC (m)	200.88	Weir Sta Lft (m)	
E.G. OC (m)	202.80	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	202.35	Weir Max Depth (m)	
Culv WS Outlet (m)	202.25	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	1.00	Min El Weir Flow (m)	204.05

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	39.54	Culv Full Len (m)	40.00
# Barrels	2	Culv Vel US (m/s)	1.42
Q Barrel (m3/s)	19.77	Culv Vel DS (m/s)	1.42
E.G. US. (m)	204.54	Culv Inv El Up (m)	199.30
W.S. US. (m)	204.50	Culv Inv El Dn (m)	199.20
E.G. DS (m)	204.42	Culv Frctn Ls (m)	0.02
W.S. DS (m)	204.38	Culv Exit Loss (m)	0.06
Delta EG (m)	0.12	Culv Entr Loss (m)	0.04
Delta WS (m)	0.12	Q Weir (m3/s)	42.37
E.G. IC (m)	202.56	Weir Sta Lft (m)	60.00
E.G. OC (m)	204.54	Weir Sta Rgt (m)	174.60
Culvert Control	Outlet	Weir Submerg	0.60
Culv WS Inlet (m)	202.35	Weir Max Depth (m)	0.54
Culv WS Outlet (m)	202.25	Weir Avg Depth (m)	0.39
Culv Nml Depth (m)		Weir Flow Area (m2)	45.04
Culv Crt Depth (m)	1.24	Min El Weir Flow (m)	204.05

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.281

INPUT
Description: Section 46.281 - Pennsylvania Avenue - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	73	204	81	201	83	200.4	84	199.8
96	199.8	97	200.4	99	202	101	203	103	204
118	204	145	204	160	204	200	204	200	206

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	83	.035	97	.08	103	.05
118	.025	145	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
83	97	40	40	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	83.5	203.4	F
96.5	200	203.4	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.75	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.035	
W.S. Elev (m)	202.72	Reach Len. (m)	40.00	40.00	40.00
Crit W.S. (m)	200.60	Flow Area (m2)		37.76	
E.G. Slope (m/m)	0.000174	Area (m2)	7.96	40.23	3.55
Q Total (m3/s)	28.70	Flow (m3/s)		28.70	
Top Width (m)	24.01	Top Width (m)	6.58	14.00	3.43
Vel Total (m/s)	0.76	Avg. Vel. (m/s)		0.76	
Max Chl Dpth (m)	2.92	Hydr. Depth (m)		2.90	
Conv. Total (m3/s)	2178.3	Conv. (m3/s)		2178.3	
Length Wtd. (m)	40.00	Wetted Per. (m)		13.17	
Min Ch El (m)	199.80	Shear (N/m2)		4.88	
Alpha	1.00	Stream Power (N/m s)		3.71	
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	100.11	148.68	62.82
C & E Loss (m)	0.01	Cum SA (1000 m2)	90.77	44.59	71.82

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.078	0.035	0.051
W.S. Elev (m)	204.38	Reach Len. (m)	40.00	40.00	40.00
Crit W.S. (m)	201.40	Flow Area (m2)	27.56	63.47	48.43
E.G. Slope (m/m)	0.000181	Area (m2)	27.56	63.47	48.43
Q Total (m3/s)	81.91	Flow (m3/s)	6.64	65.88	9.39
Top Width (m)	154.52	Top Width (m)	37.52	14.00	103.00
Vel Total (m/s)	0.59	Avg. Vel. (m/s)	0.24	1.04	0.19
Max Chl Dpth (m)	4.58	Hydr. Depth (m)	0.73	4.53	0.47

Conv. Total (m3/s)	6081.0	Conv. (m3/s)	493.2	4890.9	696.9
Length Wtd. (m)	40.00	Wetted Per. (m)	38.15	14.33	104.41
Min Ch El (m)	199.80	Shear (N/m2)	1.29	7.88	0.83
Alpha	2.54	Stream Power (N/m s)	0.31	8.18	0.16
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	255.22	283.59	245.53
C & E Loss (m)	0.02	Cum SA (1000 m2)	172.68	44.60	171.17

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: RIVER-1
REACH: Reach-1 RS: 46.28

INPUT
Description: Section 46.28 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	73	204	83	201	87	200	89	199.8
91	199.8	93	200	95	201	98	202	101	203
103	204	117	204	142	204	173	204	173	206

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	87	.035	93	.08	103	.05
117	.025	142	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
87	93	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.72	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.66	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)		Flow Area (m2)	13.23	16.76	8.45
E.G. Slope (m/m)	0.000516	Area (m2)	13.23	16.76	8.45
Q Total (m3/s)	28.70	Flow (m3/s)	4.56	21.53	2.60
Top Width (m)	22.51	Top Width (m)	9.53	6.00	6.98
Vel Total (m/s)	0.75	Avg. Vel. (m/s)	0.34	1.28	0.31
Max Chl Dpth (m)	2.86	Hydr. Depth (m)	1.39	2.79	

1.21					
Conv. Total (m3/s)	1262.7	Conv. (m3/s)	200.7	947.5	
114.6					
Length Wtd. (m)	50.00	Wetted Per. (m)	9.90	6.02	
7.49					
Min Ch El (m)	199.80	Shear (N/m2)	6.77	14.10	
5.72					
Alpha	2.27	Stream Power (N/m s)	2.33	18.12	
1.76					
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	99.69	147.54	
62.58					
C & E Loss (m)	0.02	Cum SA (1000 m2)	90.45	44.19	
71.61					

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.39	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.10	Wt. n-Val.	0.079	0.035	
0.065					
W.S. Elev (m)	204.29	Reach Len. (m)	50.00	50.00	
50.00					
Crit W.S. (m)		Flow Area (m2)	36.20	26.55	
43.35					
E.G. Slope (m/m)	0.000551	Area (m2)	36.20	26.55	
43.35					
Q Total (m3/s)	81.91	Flow (m3/s)	17.19	47.90	
16.83					
Top Width (m)	121.31	Top Width (m)	35.31	6.00	
80.00					
Vel Total (m/s)	0.77	Avg. Vel. (m/s)	0.47	1.80	
0.39					
Max Chl Dpth (m)	4.49	Hydr. Depth (m)	1.03	4.43	
0.54					
Conv. Total (m3/s)	3488.9	Conv. (m3/s)	732.0	2040.2	
716.8					
Length Wtd. (m)	50.00	Wetted Per. (m)	35.87	6.02	
81.09					
Min Ch El (m)	199.80	Shear (N/m2)	5.45	23.84	
2.89					
Alpha	3.32	Stream Power (N/m s)	2.59	43.01	
1.12					
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	253.94	281.79	
243.70					
C & E Loss (m)	0.02	Cum SA (1000 m2)	171.23	44.20	
167.51					

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: RIVER-1
REACH: Reach-1 RS: 46.274

INPUT
Description: Section 46.274 - Jane Street - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	76	204	83	201	90	200
94	199.34	98	199.34	102	200	106	201	116	204
130	204	205	204	205	206				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	76	.08	90	.035	106	.08	116	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	102	1	1	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	89	203.21	F
103	205	203.21	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.70	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.035
W.S. Elev (m)	202.69	Reach Len. (m)	0.50	0.50	0.50
Crit W.S. (m)	200.27	Flow Area (m2)	2.61	37.51	2.56
E.G. Slope (m/m)	0.000080	Area (m2)	18.61	37.51	13.48
Q Total (m3/s)	22.11	Flow (m3/s)	0.55	20.35	1.20
Top Width (m)	32.55	Top Width (m)	10.93	12.00	9.62
Vel Total (m/s)	0.52	Avg. Vel. (m/s)	0.21	0.54	0.47
Max Chl Dpth (m)	3.35	Hydr. Depth (m)	2.61	3.13	2.56
Conv. Total (m3/s)	2472.8	Conv. (m3/s)	61.6	2277.0	134.2
Length Wtd. (m)	0.50	Wetted Per. (m)	1.01	12.11	1.03
Min Ch El (m)	199.34	Shear (N/m2)	2.03	2.43	1.95
Alpha	1.06	Stream Power (N/m s)	0.43	1.32	0.91
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	98.89	146.18	62.03
C & E Loss (m)	0.04	Cum SA (1000 m2)	89.94	43.74	71.19

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.
Note: Multiple critical depths were found at this location. The critical depth

with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.36	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.076	0.035	0.047
W.S. Elev (m)	204.33	Reach Len. (m)	0.50	0.50	0.50
Crit W.S. (m)	201.18	Flow Area (m2)	55.22	57.27	63.24
E.G. Slope (m/m)	0.000123	Area (m2)	55.22	57.27	63.24
Q Total (m3/s)	81.91	Flow (m3/s)	12.21	51.19	18.52
Top Width (m)	181.64	Top Width (m)	66.64	12.00	103.00
Vel Total (m/s)	0.47	Avg. Vel. (m/s)	0.22	0.89	0.29
Max Chl Dpth (m)	4.99	Hydr. Depth (m)	0.83	4.77	0.61
Conv. Total (m3/s)	7377.3	Conv. (m3/s)	1099.3	4610.3	1667.7
Length Wtd. (m)	0.50	Wetted Per. (m)	67.33	12.11	103.90
Min Ch El (m)	199.34	Shear (N/m2)	0.99	5.72	0.74
Alpha	2.42	Stream Power (N/m s)	0.22	5.11	0.22
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	251.66	279.70	241.03
C & E Loss (m)	0.03	Cum SA (1000 m2)	168.68	43.75	162.94

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.

BRIDGE

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2735

INPUT
Description: Hum 13A-1R. Jane Street Culverts - Upstream In-Line Weir Coded as Bridge. Weir is 25 m L. Drawings by Ander Engineering Ltd. (85-101-7 & 85-101-1) 1985.

New HEC-RAS coding January 2004 by
Acres included coding of in-line weir (as a bridge) and culverts in HEC-RAS.
Distance from Upstream XS = .5
Deck/Roadway Width = .25
Weir Coefficient = 1.72
Upstream Deck/Roadway Coordinates
num= 8

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
76	204	204	83.5	204		83.5	203.21	
90	203.21	200.7	102	203.21	200.7	108.5	203.21	
108.5	204		116	204				

Upstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	76	204	83	201	90	200
94	199.34	98	199.34	102	200	106	201	116	204
130	204	205	204	205	206				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	76	.08	90	.035	106	.08	116	.05

Bank Sta: Left Right Coeff Contr. Expan.
90 102 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	89	203.21	F
103	205	203.21	F

Downstream Deck/Roadway Coordinates
num= 8

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
76	204	204	83.5	204		83.5	203.21	
90	203.21	200.7	102	203.21	200.7	108.5	203.21	
108.5	204		116	204				

Downstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	76	204	83	201	90	200
94	199.34	98	199.34	102	200	106	201	116	204
130	204	205	204	205	206				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	76	.08	90	.035	106	.08	116	.05

Bank Sta: Left Right Coeff Contr. Expan.
90 102 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	89	203.2	F
103	205	203.2	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 Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method

Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT Profile #100-year

E.G. US. (m)	202.70	Element	Inside BR US	Inside BR DS
W.S. US. (m)	202.69	E.G. Elev (m)	202.66	202.66
Q Total (m3/s)	22.11	W.S. Elev (m)	202.53	202.53
Q Bridge (m3/s)	22.11	Crit W.S. (m)	200.26	200.26
Q Weir (m3/s)		Max Chl Dpth (m)	3.19	3.19
Weir Sta Lft (m)		Vel Total (m/s)	1.62	1.62
Weir Sta Rgt (m)		Flow Area (m2)	13.69	13.69
Weir Submerg		Froude # Chl	0.29	0.29
Weir Max Depth (m)		Specif Force (m3)	36.80	36.77
Min El Weir Flow (m)	203.21	Hydr Depth (m)		
Min El Prs (m)	200.70	W.P. Total (m)	25.52	25.52
Delta EG (m)	0.10	Conv. Total (m3/s)	267.9	267.9
Delta WS (m)	0.10	Top Width (m)		
BR Open Area (m2)	13.69	Frctn Loss (m)	0.00	0.00
BR Open Vel (m/s)	1.62	C & E Loss (m)	0.00	0.06
BR Sluice Coef		Shear Total (N/m2)	35.80	35.80
BR Sel Method	Energy only	Power Total (N/m s)	57.81	57.81

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
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.

BRIDGE OUTPUT Profile #Regional w red'n

E.G. US. (m)	204.36	Element	Inside BR US	Inside BR DS
W.S. US. (m)	204.33	E.G. Elev (m)	204.33	

Q Total (m3/s)	81.91	W.S. Elev (m)	204.22
Q Bridge (m3/s)	21.37	Crit W.S. (m)	203.76
Q Weir (m3/s)		Max Chl Dpth (m)	4.87
Weir Sta Lft (m)		Vel Total (m/s)	1.16
Weir Sta Rgt (m)		Flow Area (m2)	70.81
Weir Submerg		Froude # Chl	0.22
Weir Max Depth (m)		Specif Force (m3)	84.03
Min El Weir Flow (m)	203.21	Hydr Depth (m)	0.40
Min El Prs (m)	200.70	W.P. Total (m)	204.85
Delta EG (m)	0.07	Conv. Total (m3/s)	1000.0
Delta WS (m)	0.08	Top Width (m)	177.53
BR Open Area (m2)	13.69	Frctn Loss (m)	0.00
BR Open Vel (m/s)	1.56	C & E Loss (m)	0.00
BR Sluice Coef		Shear Total (N/m2)	22.74
BR Sel Method	Energy only	Power Total (N/m s)	26.31

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
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: RIVER-1
REACH: Reach-1 RS: 46.273

INPUT
Description: Section 46.273 - Jane Street - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	76	204	83	201	90	200
94	199.34	98	199.34	102	200	106	201	116	204
130	204	205	204	205	206				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	76	.08	90	.035	106	.08	116	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	102	4	4	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	89	203.2	F
103	205	203.2	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.60	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.035
W.S. Elev (m)	202.59	Reach Len. (m)	4.00	4.00	4.00
Crit W.S. (m)	200.27	Flow Area (m2)	2.52	36.34	2.46
E.G. Slope (m/m)	0.000089	Area (m2)	17.56	36.34	12.56
Q Total (m3/s)	22.11	Flow (m3/s)	0.55	20.37	1.19
Top Width (m)	32.00	Top Width (m)	10.71	12.00	9.29
Vel Total (m/s)	0.53	Avg. Vel. (m/s)	0.22	0.56	0.48
Max Chl Dpth (m)	3.25	Hydr. Depth (m)	2.52	3.03	2.46
Conv. Total (m3/s)	2343.8	Conv. (m3/s)	57.8	2160.1	125.8
Length Wtd. (m)	4.00	Wetted Per. (m)	1.01	12.11	1.03
Min Ch El (m)	199.34	Shear (N/m2)	2.17	2.62	2.08
Alpha	1.06	Stream Power (N/m s)	0.47	1.47	1.00
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	98.89	146.16	62.03
C & E Loss (m)	0.01	Cum SA (1000 m2)	89.93	43.73	71.19

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.29	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.077	0.035	0.046
W.S. Elev (m)	204.26	Reach Len. (m)	4.00	4.00	4.00
Crit W.S. (m)	201.19	Flow Area (m2)	50.29	56.36	55.48
E.G. Slope (m/m)	0.000137	Area (m2)	50.29	56.36	55.48
Q Total (m3/s)	81.91	Flow (m3/s)	11.78	52.47	17.67
Top Width (m)	179.00	Top Width (m)	64.00	12.00	

103.00					
Vel Total (m/s)	0.51	Avg. Vel. (m/s)	0.23	0.93	
0.32					
Max Chl Dpth (m)	4.92	Hydr. Depth (m)	0.79	4.70	
0.54					
Conv. Total (m3/s)	7009.4	Conv. (m3/s)	1007.6	4489.5	
1512.3					
Length Wtd. (m)	4.00	Wetted Per. (m)	64.69	12.11	
103.82					
Min Ch El (m)	199.34	Shear (N/m2)	1.04	6.23	
0.72					
Alpha	2.29	Stream Power (N/m s)	0.24	5.80	
0.23					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	251.62	279.66	
240.99					
C & E Loss (m)	0.01	Cum SA (1000 m2)	168.62	43.73	
162.84					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.272

INPUT
Description: Section 46.272 - Jane Street - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	80	204	90	201	91	200
92	199.34	100	199.34	101	200	102	201	105	202
115	203	120	204	130	204	205	204	205	206

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	80	.08	91	.035	102	.08	120	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
91	101	100	80	60	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	92	204	F
100	205	204	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.60	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.04	Wt. n-Val.		0.035	
W.S. Elev (m)	202.56	Reach Len. (m)	100.00	80.00	
60.00					
Crit W.S. (m)	200.26	Flow Area (m2)		25.75	
E.G. Slope (m/m)	0.000190	Area (m2)	6.11	31.53	
6.80					
Q Total (m3/s)	22.11	Flow (m3/s)		22.11	

Top Width (m)	25.79	Top Width (m)	6.20	10.00
9.59				
Vel Total (m/s)	0.86	Avg. Vel. (m/s)		0.86
Max Chl Dpth (m)	3.22	Hydr. Depth (m)		3.22
Conv. Total (m3/s)	1604.0	Conv. (m3/s)		1604.0
Length Wtd. (m)	80.00	Wetted Per. (m)		8.00
Min Ch El (m)	199.34	Shear (N/m2)		5.99
Alpha	1.00	Stream Power (N/m s)		5.15
Frctn Loss (m)		Cum Volume (1000 m3)	98.84	146.03
61.99				
C & E Loss (m)		Cum SA (1000 m2)	89.90	43.69
71.15				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.28	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.06	Wt. n-Val.	0.075	0.035	
0.064					
W.S. Elev (m)	204.21	Reach Len. (m)	100.00	80.00	
60.00					
Crit W.S. (m)	201.54	Flow Area (m2)	31.20	48.07	
50.62					
E.G. Slope (m/m)	0.000260	Area (m2)	31.20	48.07	
50.62					
Q Total (m3/s)	81.91	Flow (m3/s)	7.25	61.47	
13.20					
Top Width (m)	177.45	Top Width (m)	63.45	10.00	
104.00					
Vel Total (m/s)	0.63	Avg. Vel. (m/s)	0.23	1.28	
0.26					
Max Chl Dpth (m)	4.87	Hydr. Depth (m)	0.49	4.81	
0.49					
Conv. Total (m3/s)	5079.3	Conv. (m3/s)	449.7	3811.3	
818.2					
Length Wtd. (m)	80.00	Wetted Per. (m)	64.30	10.40	
104.94					
Min Ch El (m)	199.34	Shear (N/m2)	1.24	11.79	
1.23					
Alpha	3.12	Stream Power (N/m s)	0.29	15.08	
0.32					
Frctn Loss (m)		Cum Volume (1000 m3)	251.46	279.45	
240.78					
C & E Loss (m)		Cum SA (1000 m2)	168.36	43.69	
162.42					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2715

INPUT
Description: Hum 13A-1R. Jane Street Culverts - Twin Cell - 2.44 m W x 2.135 m H x 59 m L Concrete Box Culverts and Single Cel 2.44 W x 1.22 m H x 59 m L. Drawings by Ander Engineering Ltd. (85-101-7 & 85-101-1) 1985.

New HEC-RAS coding January 2004 by Acres
included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.
Distance from Upstream XS = 5
Deck/Roadway Width = 59
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	204	173	204

Upstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	80	204	90	201	91	200
92	199.34	100	199.34	101	200	102	201	105	202
115	203	120	204	130	204	205	204	205	206

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	80	.08	91	.035	102	.08	120	.05

Bank Sta: Left Right Coeff Contr. Expan.
91 101 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	92	204	F
100	205	204	F

Downstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	204	173	204

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	3	204	30	204	67	204	71	203
74	201	77	200	79	198.983	91	198.983	93	200
97	201	105	202	106	203	107	203.6	165	203.8

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.05	71	.08	77	.035	93	.08
106	.05								

Bank Sta: Left Right Coeff Contr. Expan.
77 93 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent

```
       0      81   202.5       F
      89     165   202.5       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 =  2

Culvert Name     Shape      Rise    Span
Culvert #1           Box   2.135    2.44
FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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
                 5      59     .015     .015        0                   .5
      1
Number of Barrels =  2
Upstream   Elevation =  200.78
Centerline Stations
    Sta.    Sta.
    93.6    98.4
Downstream Elevation =  200.403
Centerline Stations
    Sta.    Sta.
    82.6    87.4

Culvert Name     Shape      Rise    Span
Culvert #2           Box    1.22    2.44
FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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
                 5      59     .015     .015        0                   .5
      1
Upstream   Elevation =  199.34
           Centerline Station =  96
Downstream Elevation =  198.983
           Centerline Station =  85

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      16.33    Culv Full Len (m)
  # Barrels                   2     Culv Vel US (m/s)        2.50
  Q Barrel (m3/s)           8.17    Culv Vel DS (m/s)        1.92
  E.G. US. (m)            202.60    Culv Inv El Up (m)     200.78
  W.S. US. (m)            202.56    Culv Inv El Dn (m)     200.40
  E.G. DS (m)             202.18    Culv Frctn Ls (m)        0.03
  W.S. DS (m)             202.14    Culv Exit Loss (m)       0.15
  Delta EG (m)              0.42    Culv Entr Loss (m)       0.16
  Delta WS (m)              0.42    Q Weir (m3/s)
  E.G. IC (m)             202.49    Weir Sta Lft (m)
  E.G. OC (m)             202.60    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
  Culv WS Inlet (m)       202.12    Weir Max Depth (m)
  Culv WS Outlet (m)      202.14    Weir Avg Depth (m)
  Culv Nml Depth (m)        0.95    Weir Flow Area (m2)
```

Culv Crt Depth (m)	1.05	Min El Weir Flow (m)	204.00

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	34.97	Culv Full Len (m)	59.00
# Barrels	2	Culv Vel US (m/s)	3.36
Q Barrel (m3/s)	17.48	Culv Vel DS (m/s)	3.36
E.G. US. (m)	204.28	Culv Inv El Up (m)	200.78
W.S. US. (m)	204.21	Culv Inv El Dn (m)	200.40
E.G. DS (m)	203.16	Culv Frctn Ls (m)	0.32
W.S. DS (m)	203.10	Culv Exit Loss (m)	0.52
Delta EG (m)	1.12	Culv Entr Loss (m)	0.29
Delta WS (m)	1.11	Q Weir (m3/s)	37.65
E.G. IC (m)	203.85	Weir Sta Lft (m)	25.09
E.G. OC (m)	204.28	Weir Sta Rgt (m)	205.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	202.92	Weir Max Depth (m)	0.28
Culv WS Outlet (m)	202.54	Weir Avg Depth (m)	0.28
Culv Nml Depth (m)		Weir Flow Area (m2)	49.52
Culv Crt Depth (m)	1.74	Min El Weir Flow (m)	204.00

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #2

Q Culv Group (m3/s)	5.77	Culv Full Len (m)	59.00
# Barrels	1	Culv Vel US (m/s)	1.94
Q Barrel (m3/s)	5.77	Culv Vel DS (m/s)	1.94
E.G. US. (m)	202.60	Culv Inv El Up (m)	199.34
W.S. US. (m)	202.56	Culv Inv El Dn (m)	198.98
E.G. DS (m)	202.18	Culv Frctn Ls (m)	0.17
W.S. DS (m)	202.14	Culv Exit Loss (m)	0.15
Delta EG (m)	0.42	Culv Entr Loss (m)	0.10
Delta WS (m)	0.42	Q Weir (m3/s)	
E.G. IC (m)	200.70	Weir Sta Lft (m)	
E.G. OC (m)	202.60	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	200.56	Weir Max Depth (m)	
Culv WS Outlet (m)	200.20	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.83	Min El Weir Flow (m)	204.00

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #2

Q Culv Group (m3/s)	9.30	Culv Full Len (m)	59.00
# Barrels	1	Culv Vel US (m/s)	3.12
Q Barrel (m3/s)	9.30	Culv Vel DS (m/s)	3.12
E.G. US. (m)	204.28	Culv Inv El Up (m)	199.34
W.S. US. (m)	204.21	Culv Inv El Dn (m)	198.98
E.G. DS (m)	203.16	Culv Frctn Ls (m)	0.43
W.S. DS (m)	203.10	Culv Exit Loss (m)	0.44
Delta EG (m)	1.12	Culv Entr Loss (m)	0.25
Delta WS (m)	1.11	Q Weir (m3/s)	37.65
E.G. IC (m)	201.50	Weir Sta Lft (m)	25.09
E.G. OC (m)	204.28	Weir Sta Rgt (m)	205.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	200.56	Weir Max Depth (m)	0.28
Culv WS Outlet (m)	200.20	Weir Avg Depth (m)	0.28
Culv Nml Depth (m)		Weir Flow Area (m2)	49.52
Culv Crt Depth (m)	1.14	Min El Weir Flow (m)	204.00

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.271

INPUT
Description: Section 46.271 - Jane Street - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	3	204	30	204	67	204	71	203
74	201	77	200	79	198.983	91	198.983	93	200
97	201	105	202	106	203	107	203.6	165	203.8

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.05	71	.08	77	.035	93	.08
106	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
77	93	55	60	70	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	81	202.5	F
89	165	202.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.18	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.		0.035	
W.S. Elev (m)	202.14	Reach Len. (m)	55.00	60.00	70.00
Crit W.S. (m)	199.90	Flow Area (m2)		25.28	
E.G. Slope (m/m)	0.000202	Area (m2)	5.91	48.52	11.72
Q Total (m3/s)	22.11	Flow (m3/s)		22.11	
Top Width (m)	32.86	Top Width (m)	4.71	16.00	12.14
Vel Total (m/s)	0.87	Avg. Vel. (m/s)		0.87	
Max Chl Dpth (m)	3.16	Hydr. Depth (m)		3.16	
Conv. Total (m3/s)	1554.9	Conv. (m3/s)		1554.9	
Length Wtd. (m)	61.12	Wetted Per. (m)		8.00	
Min Ch El (m)	198.98	Shear (N/m2)		6.26	
Alpha	1.00	Stream Power (N/m s)		5.48	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	98.84	145.37	61.99
C & E Loss (m)	0.00	Cum SA (1000 m2)	89.35	42.65	70.50

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	203.16	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.10	Reach Len. (m)	55.00	60.00	70.00
Crit W.S. (m)	201.18	Flow Area (m2)	11.12	63.85	23.81
E.G. Slope (m/m)	0.000256	Area (m2)	11.12	63.85	23.81
Q Total (m3/s)	81.91	Flow (m3/s)	3.09	71.92	6.91
Top Width (m)	35.57	Top Width (m)	6.40	16.00	13.17
Vel Total (m/s)	0.83	Avg. Vel. (m/s)	0.28	1.13	0.29
Max Chl Dpth (m)	4.12	Hydr. Depth (m)	1.74	3.99	1.81
Conv. Total (m3/s)	5123.8	Conv. (m3/s)	193.1	4498.4	432.2
Length Wtd. (m)	61.45	Wetted Per. (m)	7.18	16.49	13.79
Min Ch El (m)	198.98	Shear (N/m2)	3.88	9.71	4.33
Alpha	1.63	Stream Power (N/m s)	1.08	10.93	1.26
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	251.46	275.11	240.78
C & E Loss (m)	0.05	Cum SA (1000 m2)	164.87	42.65	158.91

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.27

INPUT
Description: Section 46.27 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	10	204	40	204	63	206	73	206
78	204	90	203	100	200	103	199	104	198.9
105	198.9	106	199	112	200	120	203	147	203.5

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	103	.035	106	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
103	106	100	110	120	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.16	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.13	Reach Len. (m)	100.00	110.00	120.00
Crit W.S. (m)		Flow Area (m2)	15.46	9.59	21.84
E.G. Slope (m/m)	0.000315	Area (m2)	15.46	9.59	21.84
Q Total (m3/s)	22.11	Flow (m3/s)	4.42	10.53	7.16
Top Width (m)	24.78	Top Width (m)	10.10	3.00	11.68
Vel Total (m/s)	0.47	Avg. Vel. (m/s)	0.29	1.10	0.33
Max Chl Dpth (m)	3.23	Hydr. Depth (m)	1.53	3.20	1.87
Conv. Total (m3/s)	1245.8	Conv. (m3/s)	248.9	593.5	403.5
Length Wtd. (m)	110.32	Wetted Per. (m)	10.58	3.01	12.15
Min Ch El (m)	198.90	Shear (N/m2)	4.51	9.84	5.55
Alpha	2.81	Stream Power (N/m s)	1.29	10.80	1.82
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	98.25	143.63	60.82
C & E Loss (m)	0.00	Cum SA (1000 m2)	88.95	42.08	69.67

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	203.07	Element	Left OB	Channel	Right OB
Vel Head (m)	0.22	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.85	Reach Len. (m)	100.00	110.00	120.00
Crit W.S. (m)		Flow Area (m2)	23.61	11.75	30.96
E.G. Slope (m/m)	0.001819	Area (m2)	23.61	11.75	30.96
Q Total (m3/s)	81.91	Flow (m3/s)	18.65	35.52	27.74
Top Width (m)	29.11	Top Width (m)	12.51	3.00	13.61

Vel Total (m/s)	1.24	Avg. Vel. (m/s)	0.79	3.02 0.90
Max Chl Dpth (m)	3.95	Hydr. Depth (m)	1.89	3.92 2.28
Conv. Total (m3/s)	1920.7	Conv. (m3/s)	437.4	832.9 650.4
Length Wtd. (m)	110.39	Wetted Per. (m)	13.09	3.01 14.21
Min Ch El (m)	198.90	Shear (N/m2)	32.18	69.66 38.87
Alpha	2.87	Stream Power (N/m s)	25.42	210.51 34.83
Frctn Loss (m)	0.14	Cum Volume (1000 m3)	250.51	272.84 238.86
C & E Loss (m)	0.02	Cum SA (1000 m2)	164.35	42.08 157.97

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: RIVER-1
REACH: Reach-1 RS: 46.26

INPUT
Description: Section 46.26 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	15	204	24	200	30	199	32	198.8
34	198.8	36	199	47	202	54	202.5	64	202.5
64	205	109	205						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	15	.08	30	.035	36	.08	54	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
30	36	115	120	120	.1 .3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.14	Element	Left OB	Channel Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035 0.080
W.S. Elev (m)	202.12	Reach Len. (m)	115.00	120.00 120.00
Crit W.S. (m)		Flow Area (m2)	20.75	19.51 17.90
E.G. Slope (m/m)	0.000137	Area (m2)	20.75	19.51 17.90
Q Total (m3/s)	22.11	Flow (m3/s)	4.56	14.31 3.24
Top Width (m)	29.42	Top Width (m)	10.77	6.00 12.65
Vel Total (m/s)	0.38	Avg. Vel. (m/s)	0.22	0.73 0.18

Max Chl Dpth (m)	3.32	Hydr. Depth (m)	1.93	3.25	1.41
Conv. Total (m3/s)	1885.7	Conv. (m3/s)	389.2	1220.6	276.0
Length Wtd. (m)	119.31	Wetted Per. (m)	11.30	6.02	13.06
Min Ch El (m)	198.80	Shear (N/m2)	2.48	4.37	1.85
Alpha	2.51	Stream Power (N/m s)	0.54	3.20	0.33
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	96.44	142.03	58.43
C & E Loss (m)	0.00	Cum SA (1000 m2)	87.90	41.58	68.21

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.92	Element	Left OB	Channel	Right OB
Vel Head (m)	0.14	Wt. n-Val.	0.080	0.035	0.079
W.S. Elev (m)	202.77	Reach Len. (m)	115.00	120.00	120.00
Crit W.S. (m)		Flow Area (m2)	28.30	23.44	31.41
E.G. Slope (m/m)	0.000882	Area (m2)	28.30	23.44	31.41
Q Total (m3/s)	81.91	Flow (m3/s)	17.72	49.23	14.97
Top Width (m)	46.24	Top Width (m)	12.24	6.00	28.00
Vel Total (m/s)	0.99	Avg. Vel. (m/s)	0.63	2.10	0.48
Max Chl Dpth (m)	3.97	Hydr. Depth (m)	2.31	3.91	1.12
Conv. Total (m3/s)	2758.4	Conv. (m3/s)	596.7	1657.7	504.0
Length Wtd. (m)	119.21	Wetted Per. (m)	12.91	6.02	28.69
Min Ch El (m)	198.80	Shear (N/m2)	18.95	33.67	9.47
Alpha	2.86	Stream Power (N/m s)	11.87	70.71	4.51
Frctn Loss (m)	0.09	Cum Volume (1000 m3)	247.91	270.90	235.12
C & E Loss (m)	0.01	Cum SA (1000 m2)	163.11	41.58	155.47

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: RIVER-1
REACH: Reach-1 RS: 46.25

INPUT
Description: Section 46.25 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	26	203	36	200	40	199	44	198.6
46	198.6	50	199	68	202	84	203	154	204

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	26	.08	40	.035	50	.08	68	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
40	50	140	130	125	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.11	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.08	Reach Len. (m)	140.00	130.00	125.00
Crit W.S. (m)		Flow Area (m2)	17.57	33.24	28.56
E.G. Slope (m/m)	0.000200	Area (m2)	17.57	33.24	28.56
Q Total (m3/s)	40.81	Flow (m3/s)	4.15	29.86	6.79
Top Width (m)	40.28	Top Width (m)	10.95	10.00	19.34
Vel Total (m/s)	0.51	Avg. Vel. (m/s)	0.24	0.90	0.24
Max Chl Dpth (m)	3.48	Hydr. Depth (m)	1.61	3.32	1.48
Conv. Total (m3/s)	2882.6	Conv. (m3/s)	293.5	2109.3	479.8
Length Wtd. (m)	130.55	Wetted Per. (m)	11.37	10.04	19.59
Min Ch El (m)	198.60	Shear (N/m2)	3.04	6.51	2.87
Alpha	2.29	Stream Power (N/m s)	0.72	5.84	0.68
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	94.24	138.87	55.65
C & E Loss (m)	0.00	Cum SA (1000 m2)	86.65	40.62	66.29

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.82	Element	Left OB	Channel	Right OB
Vel Head (m)	0.12	Wt. n-Val.	0.080	0.035	0.079
W.S. Elev (m)	202.70	Reach Len. (m)	140.00	130.00	125.00

Crit W.S. (m)		Flow Area (m2)	24.89	39.35	43.38
E.G. Slope (m/m)	0.000686	Area (m2)	24.89	39.35	43.38
Q Total (m3/s)	108.10	Flow (m3/s)	12.25	73.20	22.65
Top Width (m)	52.11	Top Width (m)	12.98	10.00	29.12
Vel Total (m/s)	1.00	Avg. Vel. (m/s)	0.49	1.86	0.52
Max Chl Dpth (m)	4.10	Hydr. Depth (m)	1.92	3.94	1.49
Conv. Total (m3/s)	4127.5	Conv. (m3/s)	467.7	2795.0	864.8
Length Wtd. (m)	130.60	Wetted Per. (m)	13.50	10.04	29.39
Min Ch El (m)	198.60	Shear (N/m2)	12.40	26.36	9.93
Alpha	2.41	Stream Power (N/m s)	6.10	49.04	5.18
Frctn Loss (m)	0.11	Cum Volume (1000 m3)	244.85	267.13	230.63
C & E Loss (m)	0.01	Cum SA (1000 m2)	161.66	40.62	152.05

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.24

INPUT
Description: Section 46.24 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	13	203	30	200	34	199	36	198.4
38	198.4	43	199	52	202	60	203	80	204

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	13	.08	34	.035	43	.08	60	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
34	43	54	51	45	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.04	Reach Len. (m)	54.00	51.00	45.00
Crit W.S. (m)		Flow Area (m2)	21.96	30.66	13.87
E.G. Slope (m/m)	0.000261	Area (m2)	21.96	30.66	13.87
Q Total (m3/s)	40.81	Flow (m3/s)	5.51	31.77	3.53
Top Width (m)	33.88	Top Width (m)	15.56	9.00	

9.32					
Vel Total (m/s)	0.61	Avg. Vel. (m/s)	0.25	1.04	
0.25					
Max Chl Dpth (m)	3.64	Hydr. Depth (m)	1.41	3.41	
1.49					
Conv. Total (m3/s)	2524.6	Conv. (m3/s)	340.8	1965.4	
218.4					
Length Wtd. (m)	50.56	Wetted Per. (m)	15.86	9.12	
9.81					
Min Ch El (m)	198.40	Shear (N/m2)	3.55	8.61	
3.62					
Alpha	2.26	Stream Power (N/m s)	0.89	8.92	
0.92					
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	91.47	134.71	
52.99					
C & E Loss (m)	0.00	Cum SA (1000 m2)	84.80	39.39	
64.50					

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.70	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.21	Wt. n-Val.	0.080	0.035	
0.080					
W.S. Elev (m)	202.48	Reach Len. (m)	54.00	51.00	
45.00					
Crit W.S. (m)		Flow Area (m2)	29.37	34.63	
18.76					
E.G. Slope (m/m)	0.001139	Area (m2)	29.37	34.63	
18.76					
Q Total (m3/s)	108.10	Flow (m3/s)	16.92	81.25	
9.92					
Top Width (m)	39.91	Top Width (m)	18.06	9.00	
12.85					
Vel Total (m/s)	1.31	Avg. Vel. (m/s)	0.58	2.35	
0.53					
Max Chl Dpth (m)	4.08	Hydr. Depth (m)	1.63	3.85	
1.46					
Conv. Total (m3/s)	3202.9	Conv. (m3/s)	501.4	2407.6	
293.9					
Length Wtd. (m)	50.47	Wetted Per. (m)	18.40	9.12	
13.37					
Min Ch El (m)	198.40	Shear (N/m2)	17.83	42.40	
15.67					
Alpha	2.47	Stream Power (N/m s)	10.27	99.48	
8.29					
Frctn Loss (m)	0.06	Cum Volume (1000 m3)	241.05	262.33	
226.75					
C & E Loss (m)	0.02	Cum SA (1000 m2)	159.49	39.39	
149.42					

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2375

INPUT

Description: Based on Bridge Section US

Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-1380	205.2	-1375	205.1	-1370	204.5	-1360	204.5	-1340	204.4
-1330	204.2	-1320	204.4	-1318	204	-1310	203	-1305	202
-1300	201	-1295	200	-1290	199.3	-1288	199.2	-1287	198.8
-1285	198.6	-1284	198.6	-1282	199.2	-1280	199.4	-1275	200
-1270	201	-1260	201.3	-1250	202	-1242	203	-1240	204.3
-1236	204.6	-1233	204.7	-1230	204.5	-1220	204.6	-1215	205
-1200	205								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-1380	.05	-1320	.08	-1288	.035	-1282	.08	-1233	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-1288	-1282	30	30	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-1380	-1305	204	T
-1247	-1200	204	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.07	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.03	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	200.30	Flow Area (m2)	27.73	19.37	37.30
E.G. Slope (m/m)	0.000352	Area (m2)	27.73	19.37	37.30
Q Total (m3/s)	40.81	Flow (m3/s)	8.93	22.26	9.61
Top Width (m)	55.36	Top Width (m)	17.14	6.00	32.22
Vel Total (m/s)	0.48	Avg. Vel. (m/s)	0.32	1.15	0.26
Max Chl Dpth (m)	3.43	Hydr. Depth (m)	1.63	3.23	1.16
Conv. Total (m3/s)	2174.0	Conv. (m3/s)	475.6	1186.2	512.2
Length Wtd. (m)	1.00	Wetted Per. (m)	17.25	6.18	32.40
Min Ch El (m)	198.60	Shear (N/m2)	5.55	10.84	3.98
Alpha	3.25	Stream Power (N/m s)	1.79	12.45	1.03
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	90.13	133.44	51.84
C & E Loss (m)	0.00	Cum SA (1000 m2)	83.92	39.01	63.56

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.62	Element	Left OB	Channel	Right OB

Vel Head (m)	0.15	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.46	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	201.35	Flow Area (m2)	35.14	21.99	52.08
E.G. Slope (m/m)	0.001284	Area (m2)	35.68	21.99	52.11
Q Total (m3/s)	108.10	Flow (m3/s)	25.30	52.50	30.30
Top Width (m)	61.04	Top Width (m)	19.32	6.00	35.71
Vel Total (m/s)	0.99	Avg. Vel. (m/s)	0.72	2.39	0.58
Max Chl Dpth (m)	3.86	Hydr. Depth (m)	2.07	3.66	1.49
Conv. Total (m3/s)	3016.4	Conv. (m3/s)	705.9	1465.1	845.4
Length Wtd. (m)	1.00	Wetted Per. (m)	17.25	6.18	35.20
Min Ch El (m)	198.60	Shear (N/m2)	25.66	44.84	18.64
Alpha	3.05	Stream Power (N/m s)	18.47	107.05	10.84
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	239.30	260.88	225.15
C & E Loss (m)	0.01	Cum SA (1000 m2)	158.48	39.01	148.33

BRIDGE

RIVER: RIVER-1
REACH: Reach-1 RS: 46.235

INPUT
Description: Proposed Portage Parkway Extension
Distance from Upstream XS = 1
Deck/Roadway Width = 25.7
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 8

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-1400	205.3		-1360	205.3		-1305	205.5	
-1305	205.5	204	-1280	205.7	204	-1247	205.5	204
-1247	205.5		-1180	205.2				

Upstream Bridge Cross Section Data
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-1380	205.2	-1375	205.1	-1370	204.5	-1360	204.5	-1340	204.4
-1330	204.2	-1320	204.4	-1318	204	-1310	203	-1305	202
-1300	201	-1295	200	-1290	199.3	-1288	199.2	-1287	198.8
-1285	198.6	-1284	198.6	-1282	199.2	-1280	199.4	-1275	200
-1270	201	-1260	201.3	-1250	202	-1242	203	-1240	204.3
-1236	204.6	-1233	204.7	-1230	204.5	-1220	204.6	-1215	205
-1200	205								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-1380	.05	-1320	.08	-1288	.035	-1282	.08	-1233	.05

```
Bank Sta: Left   Right    Coeff Contr.   Expan.
         -1288   -1282            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -1380   -1305     204       T
   -1247   -1200     204       T

Downstream  Deck/Roadway Coordinates
    num=       8
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
   -1400   205.3           -1360   205.3           -1305   205.5
   -1305   205.5     204   -1280   205.7     204   -1247   205.5     204
   -1247   205.5           -1180   205.2

Downstream Bridge Cross Section Data
Station Elevation Data    num=      31
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   -1380   205.2   -1375   205.1   -1370   204.5   -1360   204.5   -1340   204.4
   -1330   204.2   -1320   204.4   -1318     204   -1310     203   -1305     202
   -1300     201   -1295     200   -1290   199.3   -1288   199.2   -1287   198.8
   -1285   198.6   -1284   198.6   -1282   199.2   -1280   199.4   -1275     200
   -1270     201   -1260   201.3   -1250     202   -1242     203   -1240   204.3
   -1236   204.6   -1233   204.7   -1230   204.5   -1220   204.6   -1215     205
   -1200     205

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
   -1380     .05   -1320     .08   -1288    .035   -1282     .08   -1233     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
         -1288   -1282            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -1380   -1305     204       T
   -1247   -1200     204       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 =     .98
Elevation at which weir flow begins        =
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Piers =  1

Pier Data
Pier Station     Upstream=   -1277    Downstream=   -1277
Upstream     num=       2
    Width   Elev    Width   Elev
       2     198        2     204
Downstream     num=       2
    Width   Elev    Width   Elev
       2     198        2     204

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
```

Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT Profile #100-year

E.G. US. (m)	202.07	Element	Inside BR US	Inside BR DS
W.S. US. (m)	202.03	E.G. Elev (m)	202.06	202.05
Q Total (m3/s)	40.81	W.S. Elev (m)	202.02	202.01
Q Bridge (m3/s)	40.81	Crit W.S. (m)	200.30	200.30
Q Weir (m3/s)		Max Chl Dpth (m)	3.42	3.41
Weir Sta Lft (m)		Vel Total (m/s)	0.51	0.52
Weir Sta Rgt (m)		Flow Area (m2)	79.45	78.88
Weir Submerg		Froude # Chl	0.21	0.22
Weir Max Depth (m)		Specif Force (m3)	89.84	89.01
Min El Weir Flow (m)	205.29	Hydr Depth (m)	1.49	1.49
Min El Prs (m)	204.00	W.P. Total (m)	58.27	58.16
Delta EG (m)	0.02	Conv. Total (m3/s)	2067.4	2049.9
Delta WS (m)	0.02	Top Width (m)	53.16	53.07
BR Open Area (m2)	189.80	Frctn Loss (m)	0.01	0.00
BR Open Vel (m/s)	0.52	C & E Loss (m)	0.00	0.00
BR Sluice Coef		Shear Total (N/m2)	5.21	5.27
BR Sel Method	Energy only	Power Total (N/m s)	2.68	2.73

BRIDGE OUTPUT Profile #Regional w red'n

E.G. US. (m)	202.62	Element	Inside BR US	Inside BR DS
W.S. US. (m)	202.46	E.G. Elev (m)	202.60	202.56
Q Total (m3/s)	108.10	W.S. Elev (m)	202.41	202.35
Q Bridge (m3/s)	108.10	Crit W.S. (m)	201.36	201.36
Q Weir (m3/s)		Max Chl Dpth (m)	3.81	3.75
Weir Sta Lft (m)		Vel Total (m/s)	1.07	

1.11			
Weir Sta Rgt (m)		Flow Area (m2)	100.81
97.63			
Weir Submerg		Froude # Chl	0.32
0.45			
Weir Max Depth (m)		Specif Force (m3)	140.12
135.07			
Min El Weir Flow (m)	205.29	Hydr Depth (m)	1.80
1.75			
Min El Prs (m)	204.00	W.P. Total (m)	62.36
61.63			
Delta EG (m)	0.08	Conv. Total (m3/s)	2735.5
2639.0			
Delta WS (m)	0.10	Top Width (m)	56.00
55.83			
BR Open Area (m2)	189.80	Frctn Loss (m)	0.04
0.01			
BR Open Vel (m/s)	1.11	C & E Loss (m)	0.00
0.02			
BR Sluice Coef		Shear Total (N/m2)	24.76
26.06			
BR Sel Method	Energy only	Power Total (N/m s)	26.55
28.86			

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2325

INPUT
Description: Based on Bridge Section DS
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-1380	205.2	-1375	205.1	-1370	204.5	-1360	204.5	-1340	204.4
-1330	204.2	-1320	204.4	-1318	204	-1310	203	-1305	202
-1300	201	-1295	200	-1290	199.3	-1288	199.2	-1287	198.8
-1285	198.6	-1284	198.6	-1282	199.2	-1280	199.4	-1275	200
-1270	201	-1260	201.3	-1250	202	-1242	203	-1240	204.3
-1236	204.6	-1233	204.7	-1230	204.5	-1220	204.6	-1215	205
-1200	205								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-1380	.05	-1320	.08	-1288	.035	-1282	.08	-1233	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-1288	-1282	94	94	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-1380	-1305	204	T
-1247	-1200	204	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.05	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.01	Reach Len. (m)	94.00	94.00	

94.00					
Crit W.S. (m)		Flow Area (m2)	27.43	19.27	
36.75					
E.G. Slope (m/m)	0.000362	Area (m2)	27.43	19.27	
36.75					
Q Total (m3/s)	40.81	Flow (m3/s)	8.89	22.38	
9.54					
Top Width (m)	55.14	Top Width (m)	17.05	6.00	
32.08					
Vel Total (m/s)	0.49	Avg. Vel. (m/s)	0.32	1.16	
0.26					
Max Chl Dpth (m)	3.41	Hydr. Depth (m)	1.61	3.21	
1.15					
Conv. Total (m3/s)	2143.9	Conv. (m3/s)	467.2	1175.6	
501.0					
Length Wtd. (m)	94.00	Wetted Per. (m)	17.25	6.18	
32.26					
Min Ch El (m)	198.60	Shear (N/m2)	5.65	11.08	
4.05					
Alpha	3.25	Stream Power (N/m s)	1.83	12.87	
1.05					
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	89.30	132.86	
50.86					
C & E Loss (m)	0.02	Cum SA (1000 m2)	83.41	38.83	
62.65					

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.54	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.17	Wt. n-Val.	0.080	0.035	
0.080					
W.S. Elev (m)	202.36	Reach Len. (m)	94.00	94.00	
94.00					
Crit W.S. (m)		Flow Area (m2)	33.43	21.39	
48.57					
E.G. Slope (m/m)	0.001488	Area (m2)	33.76	21.39	
48.57					
Q Total (m3/s)	108.10	Flow (m3/s)	25.06	53.96	
29.08					
Top Width (m)	59.73	Top Width (m)	18.82	6.00	
34.91					
Vel Total (m/s)	1.05	Avg. Vel. (m/s)	0.75	2.52	
0.60					
Max Chl Dpth (m)	3.76	Hydr. Depth (m)	1.97	3.56	
1.39					
Conv. Total (m3/s)	2802.3	Conv. (m3/s)	649.7	1398.8	
753.8					
Length Wtd. (m)	94.00	Wetted Per. (m)	17.25	6.18	
35.11					
Min Ch El (m)	198.60	Shear (N/m2)	28.28	50.53	
20.19					
Alpha	3.11	Stream Power (N/m s)	21.20	127.47	
12.09					
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	238.29	260.24	
223.82					

C & E Loss (m)	0.07	Cum SA (1000 m2)	157.96	38.83	147.34

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: RIVER-1
REACH: Reach-1 RS: 46.23

INPUT
Description: Section 46.23 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	38	204	52	201	63	200	90	199
100	198.2	113	199	118	200	126	204	160	204
160	206	210	206						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	38	.08	90	.035	113	.08	126	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	113	101	95	89	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.03	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.02	Reach Len. (m)	101.00	95.00	89.00
Crit W.S. (m)		Flow Area (m2)	87.23	78.68	16.69
E.G. Slope (m/m)	0.000033	Area (m2)	87.23	78.68	16.69
Q Total (m3/s)	40.81	Flow (m3/s)	9.99	29.10	1.72
Top Width (m)	74.81	Top Width (m)	42.76	23.00	9.04
Vel Total (m/s)	0.22	Avg. Vel. (m/s)	0.11	0.37	0.10
Max Chl Dpth (m)	3.82	Hydr. Depth (m)	2.04	3.42	1.85
Conv. Total (m3/s)	7145.7	Conv. (m3/s)	1748.9	5095.6	301.2
Length Wtd. (m)	97.05	Wetted Per. (m)	42.94	23.06	9.62
Min Ch El (m)	198.20	Shear (N/m2)	0.65	1.09	0.55
Alpha	2.03	Stream Power (N/m s)	0.07	0.40	0.06
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	83.91	128.25	48.35
C & E Loss (m)	0.00	Cum SA (1000 m2)	80.59	37.46	60.72

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.43	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.40	Reach Len. (m)	101.00	95.00	89.00
Crit W.S. (m)		Flow Area (m2)	103.96	87.50	20.30
E.G. Slope (m/m)	0.000152	Area (m2)	103.96	87.50	20.30
Q Total (m3/s)	108.10	Flow (m3/s)	28.13	75.09	4.87
Top Width (m)	77.36	Top Width (m)	44.55	23.00	9.81
Vel Total (m/s)	0.51	Avg. Vel. (m/s)	0.27	0.86	0.24
Max Chl Dpth (m)	4.20	Hydr. Depth (m)	2.33	3.80	2.07
Conv. Total (m3/s)	8755.4	Conv. (m3/s)	2278.8	6082.1	394.4
Length Wtd. (m)	97.07	Wetted Per. (m)	44.77	23.06	10.47
Min Ch El (m)	198.20	Shear (N/m2)	3.47	5.67	2.90
Alpha	2.05	Stream Power (N/m s)	0.94	4.87	0.69
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	231.81	255.12	220.59
C & E Loss (m)	0.01	Cum SA (1000 m2)	154.99	37.46	145.24

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: RIVER-1
REACH: Reach-1 RS: 46.22

INPUT
Description: Section 46.22 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	12	201	22	200	36	199	52	198
72	197.5	77	198	79	199	87	203	102	203
112	199	114	198	132	197.5	146	198	152	199
172	202	175	203	192	204				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	36	.035	79	.08	112	.035	152	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
112	152	125	140	115	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.02	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.039	0.035	0.050
W.S. Elev (m)	202.02	Reach Len. (m)	125.00	140.00	115.00
Crit W.S. (m)		Flow Area (m2)	243.50	164.94	30.47
E.G. Slope (m/m)	0.000002	Area (m2)	243.50	164.94	30.47
Q Total (m3/s)	40.81	Flow (m3/s)	20.86	18.71	1.24
Top Width (m)	144.77	Top Width (m)	84.70	40.00	20.07
Vel Total (m/s)	0.09	Avg. Vel. (m/s)	0.09	0.11	0.04
Max Chl Dpth (m)	4.52	Hydr. Depth (m)	2.87	4.12	1.52
Conv. Total (m3/s)	26284.7	Conv. (m3/s)	13434.2	12051.5	799.0
Length Wtd. (m)	133.79	Wetted Per. (m)	86.51	40.33	20.30
Min Ch El (m)	197.50	Shear (N/m2)	0.07	0.10	0.04
Alpha	1.12	Stream Power (N/m s)	0.01	0.01	0.00
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	67.21	116.68	46.25
C & E Loss (m)	0.00	Cum SA (1000 m2)	74.16	34.47	59.42

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.040	0.035	0.050
W.S. Elev (m)	202.42	Reach Len. (m)	125.00	140.00	115.00
Crit W.S. (m)		Flow Area (m2)	277.60	180.74	38.63
E.G. Slope (m/m)	0.000012	Area (m2)	277.60	180.74	38.63
Q Total (m3/s)	108.10	Flow (m3/s)	55.43	48.71	3.96
Top Width (m)	149.31	Top Width (m)	88.06	40.00	21.26
Vel Total (m/s)	0.22	Avg. Vel. (m/s)	0.20	0.27	0.10

Max Chl Dpth (m)	4.92	Hydr. Depth (m)	3.15	4.52	1.82
Conv. Total (m3/s)	31148.0	Conv. (m3/s)	15972.4	14035.5	1140.2
Length Wtd. (m)	134.82	Wetted Per. (m)	90.08	40.33	21.55
Min Ch El (m)	197.50	Shear (N/m2)	0.36	0.53	0.21
Alpha	1.13	Stream Power (N/m s)	0.07	0.14	0.02
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	212.54	242.38	217.97
C & E Loss (m)	0.00	Cum SA (1000 m2)	148.29	34.47	143.85

Warning: Divided flow computed for this cross-section.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.214

INPUT
Description: Section 46.214 - Jane St & Hwy 7 Pond Outlet - In-Line Weir - U/S
Bounding Section
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	37	202	100	202	122	201	132	200
133	199	134	198	140	196.7	172	196.7	180	198
207	202	273	203	303	204				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	134	.035	180	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
134	180	1	1	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	123	202	F
190	303	202	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.02	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	202.02	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	197.02	Flow Area (m2)	34.28	235.78	54.65
E.G. Slope (m/m)	0.000001	Area (m2)	34.28	235.78	54.65
Q Total (m3/s)	19.06	Flow (m3/s)	0.30	17.82	0.93
Top Width (m)	172.41	Top Width (m)	97.87	46.00	28.55
Vel Total (m/s)	0.06	Avg. Vel. (m/s)	0.01	0.08	

0.02					
Max Chl Dpth (m)	5.32	Hydr. Depth (m)	0.35	5.13	
1.91					
Conv. Total (m3/s)	21341.3	Conv. (m3/s)	338.6	19956.5	
1046.2					
Length Wtd. (m)	1.00	Wetted Per. (m)	98.77	46.24	
28.84					
Min Ch El (m)	196.70	Shear (N/m2)	0.00	0.04	
0.01					
Alpha	1.56	Stream Power (N/m s)	0.00	0.00	
0.00					
Frctn Loss (m)		Cum Volume (1000 m3)	49.85	88.63	
41.36					
C & E Loss (m)		Cum SA (1000 m2)	62.75	28.45	
56.63					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.42	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	
0.080					
W.S. Elev (m)	202.41	Reach Len. (m)	1.00	1.00	
1.00					
Crit W.S. (m)	197.69	Flow Area (m2)	75.06	253.64	
70.71					
E.G. Slope (m/m)	0.000019	Area (m2)	75.06	253.64	
70.71					
Q Total (m3/s)	108.10	Flow (m3/s)	4.99	98.51	
4.60					
Top Width (m)	212.40	Top Width (m)	112.23	46.00	
54.17					
Vel Total (m/s)	0.27	Avg. Vel. (m/s)	0.07	0.39	
0.07					
Max Chl Dpth (m)	5.71	Hydr. Depth (m)	0.67	5.51	
1.31					
Conv. Total (m3/s)	24731.7	Conv. (m3/s)	1141.8	22538.2	
1051.7					
Length Wtd. (m)	1.00	Wetted Per. (m)	113.14	46.24	
54.47					
Min Ch El (m)	196.70	Shear (N/m2)	0.12	1.03	
0.24					
Alpha	1.88	Stream Power (N/m s)	0.01	0.40	
0.02					
Frctn Loss (m)		Cum Volume (1000 m3)	190.50	211.97	
211.68					
C & E Loss (m)		Cum SA (1000 m2)	135.77	28.45	
139.52					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

INLINE STRUCTURE

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2135

INPUT
Description: Hum 13-5R. Jane St. & Hwy 7 Pond Outlet Weir x 45 m Drawings by Ander Engineering Ltd. (Dwg No. 85-101-5, 1986 & Figure 1, date/source unknown).

New HEC-RAS coding January 2004 by Acres
included coding of in-line in HEC-RAS.
Distance from Upstream XS = .5
Deck/Roadway Width = .25
Weir Coefficient = 1.72
Weir Embankment Coordinates num = 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
100	202	123	202	123.75	201.95	137.75	201.95	153	201.95
153	200.9	161	200.9	161	201.95	175.3	201.95	189.3	201.95
190	202	207	202						

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 =
Weir crest shape = Broad Crested

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.213

INPUT
Description: Section 46.213 - Jane St. & Hwy 7 Pond Outlet - In-Line Weir - D/S Bounding Section
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	37	202	100	202	122	201	132	200
133	199	134	198	140	196.7	172	196.7	180	198
207	202	273	203	303	204				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	134	.035	180	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
134	180	15	15	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	123	202	F
190	303	202	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.73	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	200.73	Reach Len. (m)	15.00	15.00	15.00
Crit W.S. (m)	197.02	Flow Area (m2)	6.12	176.25	19.89

E.G. Slope (m/m)	0.000002	Area (m2)	6.12	176.25	25.14
Q Total (m3/s)	19.06	Flow (m3/s)	0.13	18.34	0.58
Top Width (m)	73.71	Top Width (m)	9.29	46.00	18.42
Vel Total (m/s)	0.09	Avg. Vel. (m/s)	0.02	0.10	0.03
Max Chl Dpth (m)	4.03	Hydr. Depth (m)	0.66	3.83	1.99
Conv. Total (m3/s)	12764.2	Conv. (m3/s)	87.3	12286.7	390.2
Length Wtd. (m)	15.00	Wetted Per. (m)	10.16	46.24	10.11
Min Ch El (m)	196.70	Shear (N/m2)	0.01	0.08	0.04
Alpha	1.18	Stream Power (N/m s)	0.00	0.01	0.00
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	49.85	88.50	41.36
C & E Loss (m)	0.00	Cum SA (1000 m2)	62.69	28.41	56.61

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	202.32	Reach Len. (m)	15.00	15.00	15.00
Crit W.S. (m)	197.69	Flow Area (m2)	65.09	249.49	66.09
E.G. Slope (m/m)	0.000021	Area (m2)	65.09	249.49	66.09
Q Total (m3/s)	108.10	Flow (m3/s)	4.16	99.34	4.60
Top Width (m)	203.12	Top Width (m)	108.90	46.00	48.22
Vel Total (m/s)	0.28	Avg. Vel. (m/s)	0.06	0.40	0.07
Max Chl Dpth (m)	5.62	Hydr. Depth (m)	0.60	5.42	1.37
Conv. Total (m3/s)	23861.5	Conv. (m3/s)	918.7	21927.6	1015.2
Length Wtd. (m)	15.00	Wetted Per. (m)	109.80	46.24	48.52
Min Ch El (m)	196.70	Shear (N/m2)	0.12	1.09	0.27
Alpha	1.81	Stream Power (N/m s)	0.01	0.43	0.02
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	190.50	211.77	211.68
C & E Loss (m)	0.00	Cum SA (1000 m2)	135.66	28.41	

139.47

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: RIVER-1
REACH: Reach-1 RS: 46.212

INPUT
Description: Section 46.212 - Jane St. & Hwy 7 Pond Outlet - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	37	202	100	202	122	201	132	200
133	199	134	198	140	196.6	172	196.6	180	198
207	199	252	199.5	273	203	303	204		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	133	.035	207	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
133	207	55	45	10	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	149.5	202	F
160.5	303	202	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.73	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.035	
W.S. Elev (m)	200.72	Reach Len. (m)	55.00	45.00	10.00
Crit W.S. (m)	197.27	Flow Area (m2)		45.30	
E.G. Slope (m/m)	0.000033	Area (m2)	3.80	241.75	70.52
Q Total (m3/s)	19.06	Flow (m3/s)		19.06	
Top Width (m)	134.49	Top Width (m)	8.18	74.00	52.31
Vel Total (m/s)	0.42	Avg. Vel. (m/s)		0.42	
Max Chl Dpth (m)	4.12	Hydr. Depth (m)		4.12	
Conv. Total (m3/s)	3325.3	Conv. (m3/s)		3325.3	
Length Wtd. (m)	45.00	Wetted Per. (m)		11.00	
Min Ch El (m)	196.60	Shear (N/m2)		1.33	

Alpha	1.00	Stream Power (N/m s)			0.56
Frctn Loss (m)		Cum Volume (1000 m3)	49.78	85.36	40.64
C & E Loss (m)		Cum SA (1000 m2)	62.56	27.51	56.07

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	202.32	Reach Len. (m)	55.00	45.00	10.00
Crit W.S. (m)	198.74	Flow Area (m2)	61.49	360.55	162.22
E.G. Slope (m/m)	0.000010	Area (m2)	61.49	360.55	162.22
Q Total (m3/s)	108.10	Flow (m3/s)	2.67	93.24	12.18
Top Width (m)	243.91	Top Width (m)	107.97	74.00	61.94
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.04	0.26	0.08
Max Chl Dpth (m)	5.72	Hydr. Depth (m)	0.57	4.87	2.62
Conv. Total (m3/s)	34102.2	Conv. (m3/s)	842.4	29416.7	3843.1
Length Wtd. (m)	45.00	Wetted Per. (m)	108.46	74.72	62.18
Min Ch El (m)	196.60	Shear (N/m2)	0.06	0.48	0.26
Alpha	1.71	Stream Power (N/m s)	0.00	0.12	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	189.55	207.19	209.97
C & E Loss (m)		Cum SA (1000 m2)	134.03	27.51	138.64

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2115

INPUT
Description: Hum 13-5R. Jane St & Hwy 7 Pond Outlet Culverts - Triple Cell - 3.0 m W x 1.5 m H x 23.2 m L Concrete Box Culverts. No drawings available (some info on Ander Eng Ltd Dwg 85-101-5, 1986) and York Regional Municipal Culvert Sheet.

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 10
Deck/Roadway Width = 23.2
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	202	303	202

Upstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	37	202	100	202	122	201	132	200
133	199	134	198	140	196.6	172	196.6	180	198
207	199	252	199.5	273	203	303	204		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	133	.035	207	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
133	207	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	149.5	202	F
160.5	303	202	F

Downstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	202	303	202

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	47	201	103	200	150	200	152	199
160	198	162	197	163	196.4	175	196.4	178	197
181	200	185	201	201	201	261	202	306	203

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	162	.035	178	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
162	178	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	163	200.6	F
175	306	200.6	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 Box 1.5 3
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
	10	23.2	.015	.015	0	.9	1

Number of Barrels = 3
Upstream Elevation = 196.6
Centerline Stations

Sta.	Sta.	Sta.
151.5	154.85	158.5

Downstream Elevation = 196.4
Centerline Stations

Sta.	Sta.	Sta.
165.5	168.85	172.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	19.06	Culv Full Len (m)	23.20
# Barrels	3	Culv Vel US (m/s)	1.41
Q Barrel (m3/s)	6.35	Culv Vel DS (m/s)	1.41
E.G. US. (m)	200.73	Culv Inv El Up (m)	196.60
W.S. US. (m)	200.72	Culv Inv El Dn (m)	196.40
E.G. DS (m)	200.52	Culv Frctn Ls (m)	0.03
W.S. DS (m)	200.51	Culv Exit Loss (m)	0.09
Delta EG (m)	0.21	Culv Entr Loss (m)	0.09
Delta WS (m)	0.21	Q Weir (m3/s)	
E.G. IC (m)	197.94	Weir Sta Lft (m)	
E.G. OC (m)	200.73	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	198.10	Weir Max Depth (m)	
Culv WS Outlet (m)	197.90	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.77	Min El Weir Flow (m)	202.00

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	43.23	Culv Full Len (m)	23.20
# Barrels	3	Culv Vel US (m/s)	3.20
Q Barrel (m3/s)	14.41	Culv Vel DS (m/s)	3.20
E.G. US. (m)	202.33	Culv Inv El Up (m)	196.60
W.S. US. (m)	202.32	Culv Inv El Dn (m)	196.40
E.G. DS (m)	201.23	Culv Frctn Ls (m)	0.13
W.S. DS (m)	201.20	Culv Exit Loss (m)	0.49
Delta EG (m)	1.09	Culv Entr Loss (m)	0.47
Delta WS (m)	1.13	Q Weir (m3/s)	64.87
E.G. IC (m)	202.20	Weir Sta Lft (m)	24.70
E.G. OC (m)	202.33	Weir Sta Rgt (m)	268.99
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	198.10	Weir Max Depth (m)	0.33
Culv WS Outlet (m)	197.90	Weir Avg Depth (m)	0.32
Culv Nml Depth (m)		Weir Flow Area (m2)	78.79
Culv Crt Depth (m)	1.33	Min El Weir Flow (m)	202.00

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.211

INPUT
Description: Section 46.211 - Jane St. & Hwy 7 Pond Outlet - D/S Bounding
Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	47	201	103	200	150	200	152	199
160	198	162	197	163	196.4	175	196.4	178	197
181	200	185	201	201	201	261	202	306	203

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	162	.035	178	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
162	178	10	10	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	163	200.6	F
175	306	200.6	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.52	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.035	
W.S. Elev (m)	200.51	Reach Len. (m)	10.00	10.00	10.00
Crit W.S. (m)	197.04	Flow Area (m2)		49.29	
E.G. Slope (m/m)	0.000028	Area (m2)	55.19	64.53	6.54
Q Total (m3/s)	19.06	Flow (m3/s)		19.06	
Top Width (m)	108.47	Top Width (m)	87.44	16.00	5.03
Vel Total (m/s)	0.39	Avg. Vel. (m/s)		0.39	
Max Chl Dpth (m)	4.11	Hydr. Depth (m)		4.11	
Conv. Total (m3/s)	3612.6	Conv. (m3/s)		3612.6	
Length Wtd. (m)	10.00	Wetted Per. (m)		12.00	
Min Ch El (m)	196.40	Shear (N/m2)		1.12	
Alpha	1.00	Stream Power (N/m s)		0.43	
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	49.78	82.05	40.64
C & E Loss (m)	0.00	Cum SA (1000 m2)	59.93	25.48	55.79

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.23	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	201.20	Reach Len. (m)	10.00	10.00	10.00
Crit W.S. (m)	198.42	Flow Area (m2)	128.26	75.57	15.24
E.G. Slope (m/m)	0.000151	Area (m2)	128.26	75.57	15.24
Q Total (m3/s)	108.10	Flow (m3/s)	32.87	73.91	1.31
Top Width (m)	170.55	Top Width (m)	119.66	16.00	34.89
Vel Total (m/s)	0.49	Avg. Vel. (m/s)	0.26	0.98	0.09
Max Chl Dpth (m)	4.80	Hydr. Depth (m)	1.07	4.72	0.44
Conv. Total (m3/s)	8807.5	Conv. (m3/s)	2678.6	6022.0	106.9
Length Wtd. (m)	10.00	Wetted Per. (m)	120.21	16.23	36.26
Min Ch El (m)	196.40	Shear (N/m2)	1.58	6.88	0.62
Alpha	2.77	Stream Power (N/m s)	0.40	6.73	0.05
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	189.55	198.58	209.97
C & E Loss (m)	0.01	Cum SA (1000 m2)	127.77	25.48	138.15

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: RIVER-1
REACH: Reach-1 RS: 46.21

INPUT
Description: Section 46.21 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	0	201	40	200	76	200	82	199
91	197	91.5	196.3	92.5	196.3	93	197	97	198
108	201	124	202	186	202	230	203		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	91	.035	93	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
91	93	30	30	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.51	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	200.51	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)		Flow Area (m2)	52.06	8.07	23.56
E.G. Slope (m/m)	0.000106	Area (m2)	52.06	8.07	23.56
Q Total (m3/s)	20.59	Flow (m3/s)	8.69	4.91	7.00
Top Width (m)	86.51	Top Width (m)	71.32	2.00	13.20
Vel Total (m/s)	0.25	Avg. Vel. (m/s)	0.17	0.61	0.30
Max Chl Dpth (m)	4.21	Hydr. Depth (m)	0.73	4.03	1.79
Conv. Total (m3/s)	1995.5	Conv. (m3/s)	841.8	475.7	678.0
Length Wtd. (m)	30.00	Wetted Per. (m)	71.62	2.72	13.65
Min Ch El (m)	196.30	Shear (N/m2)	0.76	3.10	1.80
Alpha	2.15	Stream Power (N/m s)	0.13	1.88	0.53
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	49.24	81.69	40.49
C & E Loss (m)	0.00	Cum SA (1000 m2)	59.14	25.39	55.70

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.22	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.17	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)		Flow Area (m2)	107.13	9.38	33.22
E.G. Slope (m/m)	0.000946	Area (m2)	107.13	9.38	33.22
Q Total (m3/s)	122.56	Flow (m3/s)	73.21	18.82	30.52
Top Width (m)	110.66	Top Width (m)	91.00	2.00	17.66
Vel Total (m/s)	0.82	Avg. Vel. (m/s)	0.68	2.01	0.92
Max Chl Dpth (m)	4.87	Hydr. Depth (m)	1.18	4.69	1.88
Conv. Total (m3/s)	3985.0	Conv. (m3/s)	2380.5	612.0	992.5

Length Wtd. (m)	30.00	Wetted Per. (m)	91.48	2.72	18.19
Min Ch El (m)	196.30	Shear (N/m2)	10.86	32.00	16.94
Alpha	1.65	Stream Power (N/m s)	7.42	64.19	15.57
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	188.38	198.16	209.72
C & E Loss (m)	0.00	Cum SA (1000 m2)	126.72	25.39	137.89

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: RIVER-1
REACH: Reach-1 RS: 46.202

INPUT
Description: Section 46.202 - Highway 7 - U/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	50	200	111	200	113	199	115.5	197
116	196	123	196	123.5	197	129	200	227	202
272	203								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	115.5	.035	123.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
115.5	123.5	70	70	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116	200.23	F
123	272	200.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.51	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	200.51	Reach Len. (m)	70.00	70.00	70.00
Crit W.S. (m)	196.96	Flow Area (m2)	45.47	35.54	17.28
E.G. Slope (m/m)	0.000039	Area (m2)	45.47	35.54	17.28
Q Total (m3/s)	20.59	Flow (m3/s)	3.56	15.57	1.46
Top Width (m)	129.01	Top Width (m)	90.76	8.00	30.25
Vel Total (m/s)	0.21	Avg. Vel. (m/s)	0.08	0.44	0.08
Max Chl Dpth (m)	4.51	Hydr. Depth (m)	0.50	4.44	

0.57					
Conv. Total (m3/s)	3297.3	Conv. (m3/s)	569.7	2493.6	
234.0					
Length Wtd. (m)	70.00	Wetted Per. (m)	91.70	9.24	
31.02					
Min Ch El (m)	196.00	Shear (N/m2)	0.19	1.47	
0.21					
Alpha	3.34	Stream Power (N/m s)	0.01	0.64	
0.02					
Frctn Loss (m)		Cum Volume (1000 m3)	47.78	81.04	
39.88					
C & E Loss (m)		Cum SA (1000 m2)	56.71	25.24	
55.05					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.20	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.07	Wt. n-Val.	0.050	0.035	
0.050					
W.S. Elev (m)	201.14	Reach Len. (m)	70.00	70.00	
70.00					
Crit W.S. (m)	199.15	Flow Area (m2)	112.34	40.60	
46.19					
E.G. Slope (m/m)	0.000409	Area (m2)	112.34	40.60	
46.19					
Q Total (m3/s)	122.56	Flow (m3/s)	44.31	62.91	
15.34					
Top Width (m)	184.72	Top Width (m)	115.50	8.00	
61.22					
Vel Total (m/s)	0.62	Avg. Vel. (m/s)	0.39	1.55	
0.33					
Max Chl Dpth (m)	5.14	Hydr. Depth (m)	0.97	5.07	
0.75					
Conv. Total (m3/s)	6063.7	Conv. (m3/s)	2192.0	3112.5	
759.1					
Length Wtd. (m)	70.00	Wetted Per. (m)	116.58	9.24	
62.00					
Min Ch El (m)	196.00	Shear (N/m2)	3.86	17.61	
2.98					
Alpha	3.44	Stream Power (N/m s)	1.52	27.29	
0.99					
Frctn Loss (m)		Cum Volume (1000 m3)	185.08	197.41	
208.53					
C & E Loss (m)		Cum SA (1000 m2)	123.62	25.24	
136.71					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2015

INPUT
Description: Hum 13-4RR. Highway 7 Culvert - 3.7 m W x 1.5 m H x 64 m L
Concrete Box Culvert. Based on drawings. July 2010

New HEC-RAS
coding January 2004 by Acres included coding of culvert in
HEC-RAS, including adjustments to roadway coding and hydraulic
loss coefficients.
Distance from Upstream XS = 5
Deck/Roadway Width = 64
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201		50	200.45		95	200.23	
168	201		216	202		227	202.5	
272	203.5							

Upstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	50	200	111	200	113	199	115.5	197
116	196	123	196	123.5	197	129	200	227	202
272	203								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	115.5	.035	123.5	.05

Bank Sta: Left Right Coeff Contr. Expan.
115.5 123.5 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116	200.23	F
123	272	200.5	F

Downstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201		50	200.45		95	200.23	
168	201		216	202		227	202.5	
272	203.5							

Downstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	50	200	111	200	113	199	115.5	197
116	196	123	196	123.5	197	129	200	227	202
272	203								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	115.5	.035	123.5	.05

Bank Sta: Left Right Coeff Contr. Expan.
115.5 123.5 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116	199	F
123	272	199	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           Box    1.52    3.66
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
                 5      64     .015     .015        0                    .5
      1
Upstream   Elevation =  196
           Centerline Station =  119.5
Downstream Elevation =  196
           Centerline Station =  119.5

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      14.09    Culv Full Len (m)        64.00
  # Barrels                   1    Culv Vel US (m/s)         2.53
  Q Barrel (m3/s)          14.09    Culv Vel DS (m/s)         2.53
  E.G. US. (m)            200.51    Culv Inv El Up (m)      196.00
  W.S. US. (m)            200.51    Culv Inv El Dn (m)      196.00
  E.G. DS (m)             199.83    Culv Frctn Ls (m)         0.21
  W.S. DS (m)             199.81    Culv Exit Loss (m)        0.31
  Delta EG (m)              0.69    Culv Entr Loss (m)        0.16
  Delta WS (m)              0.69    Q Weir (m3/s)             6.50
  E.G. IC (m)             199.01    Weir Sta Lft (m)         44.67
  E.G. OC (m)             200.51    Weir Sta Rgt (m)        121.40
  Culvert Control         Outlet    Weir Submerg              0.00
  Culv WS Inlet (m)       197.52    Weir Max Depth (m)        0.28
  Culv WS Outlet (m)      197.52    Weir Avg Depth (m)        0.15
  Culv Nml Depth (m)                Weir Flow Area (m2)      11.41
  Culv Crt Depth (m)        1.15    Min El Weir Flow (m)    200.23


Warning: During the culvert inlet control computations, the program could not
balance the culvert/weir flow.  The reported
         inlet energy grade answer may not be valid.

CULVERT OUTPUT  Profile #Regional w red'n  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       2.55    Culv Full Len (m)        64.00
  # Barrels                    1    Culv Vel US (m/s)         0.46
  Q Barrel (m3/s)           2.55    Culv Vel DS (m/s)         0.46
  E.G. US. (m)            201.20    Culv Inv El Up (m)      196.00
  W.S. US. (m)            201.14    Culv Inv El Dn (m)      196.00
  E.G. DS (m)             201.19    Culv Frctn Ls (m)         0.01
  W.S. DS (m)             201.12    Culv Exit Loss (m)        0.00
  Delta EG (m)              0.01    Culv Entr Loss (m)        0.01
  Delta WS (m)              0.01    Q Weir (m3/s)           120.02
  E.G. IC (m)             201.19    Weir Sta Lft (m)          0.00
  E.G. OC (m)             201.20    Weir Sta Rgt (m)        178.47
  Culvert Control         Outlet    Weir Submerg              0.87
  Culv WS Inlet (m)       197.52    Weir Max Depth (m)        0.99
  Culv WS Outlet (m)      197.52    Weir Avg Depth (m)        0.61
```

Culv Nml Depth (m)		Weir Flow Area (m2)	109.34
Culv Crt Depth (m)	0.37	Min El Weir Flow (m)	200.23

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.201

INPUT
Description: Section 46.201 - Highway 7 - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	50	200	111	200	113	199	115.5	197
116	196	123	196	123.5	197	129	200	227	202
272	203								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	115.5	.035	123.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
115.5	123.5	20	25	30	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116	199	F
123	272	199	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.83	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.81	Reach Len. (m)	20.00	25.00	30.00
Crit W.S. (m)	196.96	Flow Area (m2)	5.18	29.98	7.24
E.G. Slope (m/m)	0.000092	Area (m2)	5.18	29.98	7.24
Q Total (m3/s)	20.59	Flow (m3/s)	1.01	17.98	1.59
Top Width (m)	17.27	Top Width (m)	4.12	8.00	5.15
Vel Total (m/s)	0.49	Avg. Vel. (m/s)	0.20	0.60	0.22
Max Chl Dpth (m)	3.81	Hydr. Depth (m)	1.26	3.75	1.41
Conv. Total (m3/s)	2150.8	Conv. (m3/s)	106.0	1878.2	166.6
Length Wtd. (m)	25.07	Wetted Per. (m)	5.01	9.24	5.87
Min Ch El (m)	196.00	Shear (N/m2)	0.93	2.92	1.11
Alpha	1.36	Stream Power (N/m s)	0.18	1.75	0.24

Frctn Loss (m)	0.00	Cum Volume (1000 m3)	47.78	79.37	39.88
C & E Loss (m)	0.00	Cum SA (1000 m2)	53.39	24.68	53.81

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.19	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.12	Reach Len. (m)	20.00	25.00	30.00
Crit W.S. (m)	199.00	Flow Area (m2)	110.67	40.48	45.31
E.G. Slope (m/m)	0.000421	Area (m2)	110.67	40.48	45.31
Q Total (m3/s)	122.56	Flow (m3/s)	43.85	63.52	15.19
Top Width (m)	184.01	Top Width (m)	115.50	8.00	60.51
Vel Total (m/s)	0.62	Avg. Vel. (m/s)	0.40	1.57	0.34
Max Chl Dpth (m)	5.12	Hydr. Depth (m)	0.96	5.06	0.75
Conv. Total (m3/s)	5976.8	Conv. (m3/s)	2138.2	3097.8	740.8
Length Wtd. (m)	23.94	Wetted Per. (m)	116.57	9.24	61.29
Min Ch El (m)	196.00	Shear (N/m2)	3.92	18.08	3.05
Alpha	3.46	Stream Power (N/m s)	1.55	28.36	1.02
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	185.08	188.48	208.53
C & E Loss (m)	0.02	Cum SA (1000 m2)	115.54	24.68	132.45

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.192

INPUT
Description: Section 46.192 - Private Driveway - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	5	200	30	199	56	199	60	197
61.5	195.9	65.5	195.9	67	197	85	200	95	200
95	203	135	203						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	60	.035	67	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
60	67	25	25	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	61.5	199	F
65.5	135	199.3	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.82	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.81	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)	197.29	Flow Area (m2)	36.67	25.75	23.75
E.G. Slope (m/m)	0.000053	Area (m2)	36.67	25.75	23.75
Q Total (m3/s)	20.59	Flow (m3/s)	4.30	11.98	4.31
Top Width (m)	74.22	Top Width (m)	50.34	7.00	16.88
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.12	0.47	0.18
Max Chl Dpth (m)	3.91	Hydr. Depth (m)	0.73	3.68	1.41
Conv. Total (m3/s)	2822.8	Conv. (m3/s)	590.1	1641.9	590.9
Length Wtd. (m)	25.00	Wetted Per. (m)	50.82	7.72	17.11
Min Ch El (m)	195.90	Shear (N/m2)	0.38	1.74	0.72
Alpha	2.38	Stream Power (N/m s)	0.04	0.81	0.13
Frctn Loss (m)		Cum Volume (1000 m3)	47.36	78.68	39.41
C & E Loss (m)		Cum SA (1000 m2)	52.84	24.49	53.48

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.17	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.13	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)	199.36	Flow Area (m2)	112.00	34.98	58.73
E.G. Slope (m/m)	0.000236	Area (m2)	112.00	34.98	

58.73					
Q Total (m3/s)	122.56	Flow (m3/s)	51.81	42.09	
28.66					
Top Width (m)	95.00	Top Width (m)	60.00	7.00	
28.00					
Vel Total (m/s)	0.60	Avg. Vel. (m/s)	0.46	1.20	
0.49					
Max Chl Dpth (m)	5.23	Hydr. Depth (m)	1.87	5.00	
2.10					
Conv. Total (m3/s)	7969.8	Conv. (m3/s)	3368.7	2737.1	
1864.0					
Length Wtd. (m)	25.00	Wetted Per. (m)	60.72	7.72	
29.38					
Min Ch El (m)	195.90	Shear (N/m2)	4.28	10.51	
4.64					
Alpha	1.81	Stream Power (N/m s)	1.98	12.64	
2.26					
Frctn Loss (m)		Cum Volume (1000 m3)	182.86	187.54	
206.97					
C & E Loss (m)		Cum SA (1000 m2)	113.78	24.49	
131.12					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1915

INPUT
Description: Hum-MM. Private Driveway Culvert - 3.75m x 1.5m Box culvert - sizes determined from Site visit - July 2010

New HEC-RAS coding
January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 4
Deck/Roadway Width = 17
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 3

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
30	199	56	199	85	200

Upstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	5	200	30	199	56	199	60	197
61.5	195.9	65.5	195.9	67	197	85	200	95	200
95	203	135	203						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	60	.035	67	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
60	67	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	61.5	199	F
65.5	135	199.3	F

Downstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
30	199		56	199		85	200	

Downstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	5	200	30	199	56	199	60	197
61.5	195.9	65.5	195.9	67	197	85	200	95	200
95	203	135	203						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	60	.035	67	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
60	67	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	61.5	198.5	F
65.5	135	198.5	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	Box	1.5	3.75

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
	4	17	.013	.024	0	.5	1

Upstream Elevation = 195.9
Centerline Station = 63.5
Downstream Elevation = 195.9
Centerline Station = 63.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	2.16	Culv Full Len (m)	17.00
# Barrels	1	Culv Vel US (m/s)	0.38
Q Barrel (m3/s)	2.16	Culv Vel DS (m/s)	0.38
E.G. US. (m)	199.82	Culv Inv El Up (m)	195.90
W.S. US. (m)	199.81	Culv Inv El Dn (m)	195.90
E.G. DS (m)	199.81	Culv Frctn Ls (m)	0.00
W.S. DS (m)	199.81	Culv Exit Loss (m)	0.00
Delta EG (m)	0.01	Culv Entr Loss (m)	0.00
Delta WS (m)	0.01	Q Weir (m3/s)	18.43
E.G. IC (m)	198.86	Weir Sta Lft (m)	9.51

E.G. OC (m)	199.82	Weir Sta Rgt (m)	79.76
Culvert Control	Outlet	Weir Submerg	0.99
Culv WS Inlet (m)	197.40	Weir Max Depth (m)	0.82
Culv WS Outlet (m)	197.40	Weir Avg Depth (m)	0.56
Culv Nml Depth (m)		Weir Flow Area (m2)	39.44
Culv Crt Depth (m)	0.32	Min El Weir Flow (m)	199.00

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	1.13	Culv Full Len (m)	17.00
# Barrels	1	Culv Vel US (m/s)	0.20
Q Barrel (m3/s)	1.13	Culv Vel DS (m/s)	0.20
E.G. US. (m)	201.17	Culv Inv El Up (m)	195.90
W.S. US. (m)	201.13	Culv Inv El Dn (m)	195.90
E.G. DS (m)	201.17	Culv Frctn Ls (m)	0.00
W.S. DS (m)	201.13	Culv Exit Loss (m)	0.00
Delta EG (m)	0.00	Culv Entr Loss (m)	0.00
Delta WS (m)	0.00	Q Weir (m3/s)	121.43
E.G. IC (m)	201.17	Weir Sta Lft (m)	0.00
E.G. OC (m)	201.17	Weir Sta Rgt (m)	95.00
Culvert Control	Outlet	Weir Submerg	0.99
Culv WS Inlet (m)	197.40	Weir Max Depth (m)	2.18
Culv WS Outlet (m)	197.40	Weir Avg Depth (m)	1.71
Culv Nml Depth (m)		Weir Flow Area (m2)	162.42
Culv Crt Depth (m)	0.21	Min El Weir Flow (m)	199.00

Warning: The weir over culvert is submerged.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.191

INPUT
Description: Section 46.191 - Private Driveway - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	5	200	30	199	56	199	60	197
61.5	195.9	65.5	195.9	67	197	85	200	95	200
95	203	135	203						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	60	.035	67	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
60	67	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	61.5	198.5	F
65.5	135	198.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.81	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.81	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	197.29	Flow Area (m2)	36.37	25.70	23.64
E.G. Slope (m/m)	0.000054	Area (m2)	36.37	25.70	23.64
Q Total (m3/s)	20.59	Flow (m3/s)	4.28	12.01	4.31
Top Width (m)	74.03	Top Width (m)	50.18	7.00	16.84
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.12	0.47	0.18
Max Chl Dpth (m)	3.91	Hydr. Depth (m)	0.72	3.67	1.40
Conv. Total (m3/s)	2807.9	Conv. (m3/s)	583.1	1637.3	587.5
Length Wtd. (m)	50.00	Wetted Per. (m)	50.67	7.72	17.08
Min Ch El (m)	195.90	Shear (N/m2)	0.38	1.76	0.73
Alpha	2.38	Stream Power (N/m s)	0.04	0.82	0.13
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	47.36	77.39	39.41
C & E Loss (m)	0.00	Cum SA (1000 m2)	51.59	24.32	53.05

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.17	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.13	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	199.36	Flow Area (m2)	111.98	34.98	58.72
E.G. Slope (m/m)	0.000237	Area (m2)	111.98	34.98	58.72
Q Total (m3/s)	122.56	Flow (m3/s)	51.80	42.10	28.66
Top Width (m)	95.00	Top Width (m)	60.00	7.00	28.00
Vel Total (m/s)	0.60	Avg. Vel. (m/s)	0.46	1.20	0.49
Max Chl Dpth (m)	5.23	Hydr. Depth (m)	1.87	5.00	2.10
Conv. Total (m3/s)	7968.1	Conv. (m3/s)	3367.7	2736.8	1863.5
Length Wtd. (m)	50.00	Wetted Per. (m)	60.72	7.72	29.38
Min Ch El (m)	195.90	Shear (N/m2)	4.28	10.51	

4.64				
Alpha	1.81	Stream Power (N/m s)	1.98	12.65
2.26				
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	182.86	183.19
206.97				
C & E Loss (m)	0.01	Cum SA (1000 m2)	112.28	24.32
130.42				

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.19

INPUT
Description: Section 46.19 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	0	201	8	201	50	201	58	200
63	199	94	199	104	196.5	105	195.5	106	195.5
107	196.5	114	198	119	198.7	143	198.7	143	203
169	203								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	8	.025	50	.05	104	.035	107	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
104	107	45	45	45	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.81	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (m)	199.81	Reach Len. (m)	45.00	45.00
45.00				
Crit W.S. (m)		Flow Area (m2)	47.20	11.92
51.74				
E.G. Slope (m/m)	0.000048	Area (m2)	47.20	11.92
51.74				
Q Total (m3/s)	20.59	Flow (m3/s)	6.69	5.01
8.89				
Top Width (m)	84.03	Top Width (m)	45.03	3.00
36.00				
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.14	0.42
0.17				
Max Chl Dpth (m)	4.31	Hydr. Depth (m)	1.05	3.97
1.44				
Conv. Total (m3/s)	2981.7	Conv. (m3/s)	968.6	726.2
1286.8				
Length Wtd. (m)	45.00	Wetted Per. (m)	45.42	3.83
37.31				
Min Ch El (m)	195.50	Shear (N/m2)	0.49	1.46
0.65				
Alpha	1.81	Stream Power (N/m s)	0.07	0.61

0.11					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	45.27	76.45	
37.53					
C & E Loss (m)	0.00	Cum SA (1000 m2)	49.21	24.07	
51.73					

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.15	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	
0.050					
W.S. Elev (m)	201.13	Reach Len. (m)	45.00	45.00	
45.00					
Crit W.S. (m)		Flow Area (m2)	119.45	15.89	
99.36					
E.G. Slope (m/m)	0.000201	Area (m2)	119.45	15.89	
99.36					
Q Total (m3/s)	122.56	Flow (m3/s)	53.01	16.63	
52.92					
Top Width (m)	143.00	Top Width (m)	104.00	3.00	
36.00					
Vel Total (m/s)	0.52	Avg. Vel. (m/s)	0.44	1.05	
0.53					
Max Chl Dpth (m)	5.63	Hydr. Depth (m)	1.15	5.30	
2.76					
Conv. Total (m3/s)	8638.4	Conv. (m3/s)	3736.2	1172.4	
3729.8					
Length Wtd. (m)	45.00	Wetted Per. (m)	104.60	3.83	
38.64					
Min Ch El (m)	195.50	Shear (N/m2)	2.25	8.19	
5.08					
Alpha	1.31	Stream Power (N/m s)	1.00	8.58	
2.70					
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	177.07	181.92	
203.02					
C & E Loss (m)	0.00	Cum SA (1000 m2)	108.18	24.07	
128.82					

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.182

INPUT
Description: Section 46.182 - Private Driveway - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 47

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.972	.42	201.961	.55	201.96	1.85	201.935	8.17	201.804
21.62	201.526	31.13	201.301	35.82	201.196	38.11	201.147	43.98	201
47.21	201	54.76	201	59.23	201.022	59.93	201.025	61.24	201.019
63.83	201.008	65.54	201	67.48	200.312	68.6	200	69.51	199.67
71.2	199	80.47	198.706	97.37	198.231	101.25	198.152	103.18	198.11
108.63	198	109.89	197.509	111.25	197	113.61	196.424	114.44	196
115	195.5	117	195.5	119.57	196.761	120.39	197	120.93	197.262
122.38	198	123.56	198.575	124.53	199	125.86	199.005	126.15	199.005

126.32 199.005 128.81 199.016 129.09 199.016 133.53 199.074 152.28 199.311
155.51 199.353 179.8 199.659

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	43.98	.025	65.54	.05	111.25	.035	120.39	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
111.25	120.39	30	30	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	114	197.8	F
118	179.8	198.1	F

Left Levee Station= 59.93 Elevation= 201.025

Blocked Obstructions num= 1

Sta L	Sta R	Elev
143.39	178.45	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.81	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.80	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)	197.06	Flow Area (m2)	57.30	33.00	21.18
E.G. Slope (m/m)	0.000028	Area (m2)	57.30	33.00	21.18
Q Total (m3/s)	20.59	Flow (m3/s)	7.39	11.17	2.03
Top Width (m)	75.60	Top Width (m)	42.11	9.14	24.35
Vel Total (m/s)	0.18	Avg. Vel. (m/s)	0.13	0.34	0.10
Max Chl Dpth (m)	4.30	Hydr. Depth (m)	1.36	3.61	0.87
Conv. Total (m3/s)	3897.4	Conv. (m3/s)	1399.5	2114.3	383.6
Length Wtd. (m)	30.00	Wetted Per. (m)	42.46	9.83	25.73
Min Ch El (m)	195.50	Shear (N/m2)	0.37	0.92	0.23
Alpha	2.02	Stream Power (N/m s)	0.05	0.31	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	42.92	75.43	35.89
C & E Loss (m)		Cum SA (1000 m2)	47.24	23.79	50.38

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.14	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	

0.050					
W.S. Elev (m)	201.11	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)	198.95	Flow Area (m2)	117.48	44.95	53.01
E.G. Slope (m/m)	0.000169	Area (m2)	117.48	44.95	53.01
Q Total (m3/s)	122.56	Flow (m3/s)	55.11	46.00	21.45
Top Width (m)	105.23	Top Width (m)	71.74	9.14	24.35
Vel Total (m/s)	0.57	Avg. Vel. (m/s)	0.47	1.02	0.40
Max Chl Dpth (m)	5.61	Hydr. Depth (m)	1.64	4.92	2.18
Conv. Total (m3/s)	9427.7	Conv. (m3/s)	4239.3	3538.4	1650.0
Length Wtd. (m)	30.00	Wetted Per. (m)	72.29	9.83	29.65
Min Ch El (m)	195.50	Shear (N/m2)	2.69	7.58	2.96
Alpha	1.61	Stream Power (N/m s)	1.26	7.76	1.20
Frctn Loss (m)		Cum Volume (1000 m3)	171.74	180.55	199.59
C & E Loss (m)		Cum SA (1000 m2)	104.23	23.79	127.46

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1815

INPUT
Description: Hum-LL - Private Driveway Culvert - 3.23 m W x 2.1 m H x 20 m L Corrugated Metal Pipe Arch Culvert. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004
by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 20
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 68

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.814		8.43	201.594		9.83	201.579	
23.38	201.318		38.06	201.013		38.92	201.052	
39.19	201.044		39.55	201.046		40.67	201.053	
44.98	201.024		45.55	201		48.21	201	
51.41	201		53.82	201		57.05	201.013	
59.14	201.02		61.55	201.011		63.08	201.006	
64.24	201		66.61	200.06		66.78	200	
66.95	199.933		69.25	199		73.56	198.862	
78.46	198.707		78.57	198.703		91.01	198.328	
92.38	198.309		94.38	198.276		94.4	198.275	

94.48	198.274		104.2	198.082		107.92	198.006				
108.02	198.006		108.27	198.006		108.69	198.005				
109.45	198.005		110.23	198.004		110.59	198.004				
111.09	198.004		112.19	198.004		112.58	198.004				
113.44	198.003		114.64	198.003		115.23	198.003				
115.68	198.003		116.18	198.002		116.54	198.038				
119.63	198.468		121.93	198.762		122.56	198.775				
123.93	198.92		125.6	198.914		126.73	198.921				
128.12	198.95		128.92	198.942		130.41	198.978				
130.95	199		130.96	199		131.04	199				
131.13	199		131.47	199.005		131.56	199.007				
133.71	199.023		134.52	199.03		136.57	199.051				
136.8	199.053		177.16	199.555							

Upstream Bridge Cross Section Data
Station Elevation Data num= 47

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.972	.42	201.961	.55	201.96	1.85	201.935	8.17	201.804
21.62	201.526	31.13	201.301	35.82	201.196	38.11	201.147	43.98	201
47.21	201	54.76	201	59.23	201.022	59.93	201.025	61.24	201.019
63.83	201.008	65.54	201	67.48	200.312	68.6	200	69.51	199.67
71.2	199	80.47	198.706	97.37	198.231	101.25	198.152	103.18	198.11
108.63	198	109.89	197.509	111.25	197	113.61	196.424	114.44	196
115	195.5	117	195.5	119.57	196.761	120.39	197	120.93	197.262
122.38	198	123.56	198.575	124.53	199	125.86	199.005	126.15	199.005
126.32	199.005	128.81	199.016	129.09	199.016	133.53	199.074	152.28	199.311
155.51	199.353	179.8	199.659						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	43.98	.025	65.54	.05	111.25	.035	120.39	.05

Bank Sta: Left Right Coeff Contr. Expan.
111.25 120.39 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	114	197.8	F
118	179.8	198.1	F

Left Levee Station= 59.93 Elevation= 201.025
Blocked Obstructions num= 1

Sta L	Sta R	Elev
143.39	178.45	204

Downstream Deck/Roadway Coordinates
num= 68

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.814		8.43	201.594		9.83	201.579	
23.38	201.318		38.06	201.013		38.92	201.052	
39.19	201.044		39.55	201.046		40.67	201.053	
44.98	201.024		45.55	201		48.21	201	
51.41	201		53.82	201		57.05	201.013	
59.14	201.02		61.55	201.011		63.08	201.006	
64.24	201		66.61	200.06		66.78	200	
66.95	199.933		69.25	199		73.56	198.862	
78.46	198.707		78.57	198.703		91.01	198.328	
92.38	198.309		94.38	198.276		94.4	198.275	
94.48	198.274		104.2	198.082		107.92	198.006	
108.02	198.006		108.27	198.006		108.69	198.005	
109.45	198.005		110.23	198.004		110.59	198.004	
111.09	198.004		112.19	198.004		112.58	198.004	
113.44	198.003		114.64	198.003		115.23	198.003	
115.68	198.003		116.18	198.002		116.54	198.038	
119.63	198.468		121.93	198.762		122.56	198.775	

```
  123.93  198.92          125.6 198.914          126.73 198.921
  128.12  198.95         128.92 198.942          130.41 198.978
  130.95     199         130.96     199          131.04     199
  131.13     199         131.47 199.005          131.56 199.007
  133.71 199.023         134.52  199.03          136.57 199.051
   136.8 199.053         177.16 199.555

Downstream Bridge Cross Section Data
Station Elevation Data    num=      63
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 201.672   10.15 201.391   16.44 201.227   19.11 201.198   28.76 201.012
   29.08 201.003   29.75 201.003   30.18 201.003   33.16 201.006   34.09 201.007
   34.71 201.007   38.11 201.008   40.91 201.007   42.47 201.009   46.32  201.01
   49.08  201.01   50.09  201.01   52.79 201.011   53.95 201.011   55.33  201.01
   55.52  201.01   57.16 201.007    59.2 201.008   61.08 201.003   61.53 201.002
   62.11     201   63.74 200.449   63.89 200.402   64.96     200   67.14 199.213
   67.66     199   85.51 198.472   98.03 198.095  102.22 198.037  104.14 198.005
  104.83     198  107.05 197.336  108.45     197   109.6 196.471  110.03 196.349
   110.3 196.132  110.55   195.7  111.55  195.42  112.65  195.42  113.45   195.7
  113.65 196.153  114.19 196.347  114.96 196.478  115.28 196.495  115.54 196.648
  115.97     197  117.96 197.685   118.9     198  119.49 198.157  122.24     199
  123.93 199.013  125.15 199.031  128.94  199.07  130.34 199.094  131.13 199.106
  131.15 199.106  139.61 199.169  174.54 199.456

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   28.76    .025   62.11     .05  108.45    .035  115.97     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
        108.45  115.97             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     110   197.8       F
     114  174.54   197.8       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
  139.13  174.54     204

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     Pipe Arch     2.1    3.23
FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                 5      20     .024     .024        0                    .9
      1
Upstream   Elevation =  195.5
           Centerline Station =  116
Downstream Elevation =  195.42
           Centerline Station =  112

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1
```

Q Culv Group (m3/s)	1.13	Culv Full Len (m)	20.00
# Barrels	1	Culv Vel US (m/s)	0.22
Q Barrel (m3/s)	1.13	Culv Vel DS (m/s)	0.22
E.G. US. (m)	199.81	Culv Inv El Up (m)	195.50
W.S. US. (m)	199.80	Culv Inv El Dn (m)	195.42
E.G. DS (m)	199.81	Culv Frctn Ls (m)	0.00
W.S. DS (m)	199.80	Culv Exit Loss (m)	0.00
Delta EG (m)	0.00	Culv Entr Loss (m)	0.00
Delta WS (m)	0.00	Q Weir (m3/s)	19.46
E.G. IC (m)	199.19	Weir Sta Lft (m)	69.13
E.G. OC (m)	199.81	Weir Sta Rgt (m)	179.80
Culvert Control	Outlet	Weir Submerg	1.00
Culv WS Inlet (m)	197.60	Weir Max Depth (m)	1.81
Culv WS Outlet (m)	197.52	Weir Avg Depth (m)	1.18
Culv Nml Depth (m)		Weir Flow Area (m2)	89.52
Culv Crt Depth (m)	0.31	Min El Weir Flow (m)	198.01

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	3.10	Culv Full Len (m)	20.00
# Barrels	1	Culv Vel US (m/s)	0.59
Q Barrel (m3/s)	3.10	Culv Vel DS (m/s)	0.59
E.G. US. (m)	201.14	Culv Inv El Up (m)	195.50
W.S. US. (m)	201.11	Culv Inv El Dn (m)	195.42
E.G. DS (m)	201.11	Culv Frctn Ls (m)	0.01
W.S. DS (m)	201.09	Culv Exit Loss (m)	0.00
Delta EG (m)	0.02	Culv Entr Loss (m)	0.02
Delta WS (m)	0.03	Q Weir (m3/s)	119.46
E.G. IC (m)	201.12	Weir Sta Lft (m)	39.13
E.G. OC (m)	201.14	Weir Sta Rgt (m)	179.80
Culvert Control	Outlet	Weir Submerg	0.99
Culv WS Inlet (m)	197.60	Weir Max Depth (m)	3.12
Culv WS Outlet (m)	197.52	Weir Avg Depth (m)	1.84
Culv Nml Depth (m)		Weir Flow Area (m2)	194.21
Culv Crt Depth (m)	0.55	Min El Weir Flow (m)	198.01

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.181

INPUT
Description: Section 46.181 - Private Driveway - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 63

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.672	10.15	201.391	16.44	201.227	19.11	201.198	28.76	201.012
29.08	201.003	29.75	201.003	30.18	201.003	33.16	201.006	34.09	201.007
34.71	201.007	38.11	201.008	40.91	201.007	42.47	201.009	46.32	201.01

49.08	201.01	50.09	201.01	52.79	201.011	53.95	201.011	55.33	201.01
55.52	201.01	57.16	201.007	59.2	201.008	61.08	201.003	61.53	201.002
62.11	201	63.74	200.449	63.89	200.402	64.96	200	67.14	199.213
67.66	199	85.51	198.472	98.03	198.095	102.22	198.037	104.14	198.005
104.83	198	107.05	197.336	108.45	197	109.6	196.471	110.03	196.349
110.3	196.132	110.55	195.7	111.55	195.42	112.65	195.42	113.45	195.7
113.65	196.153	114.19	196.347	114.96	196.478	115.28	196.495	115.54	196.648
115.97	197	117.96	197.685	118.9	198	119.49	198.157	122.24	199
123.93	199.013	125.15	199.031	128.94	199.07	130.34	199.094	131.13	199.106
131.15	199.106	139.61	199.169	174.54	199.456				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	28.76	.025	62.11	.05	108.45	.035	115.97	.05

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

Left	Right	Left	Channel	Right	Coeff Contr.	Expan.
108.45	115.97	10	10	10	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	110	197.8	F
114	174.54	197.8	F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
139.13	174.54	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.81	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.80	Reach Len. (m)	10.00	10.00	10.00
Crit W.S. (m)	197.07	Flow Area (m2)	59.22	27.86	23.15
E.G. Slope (m/m)	0.000032	Area (m2)	59.22	27.86	23.15
Q Total (m3/s)	20.59	Flow (m3/s)	8.22	9.83	2.54
Top Width (m)	73.62	Top Width (m)	42.94	7.52	23.16
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.14	0.35	0.11
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.38	3.70	1.00
Conv. Total (m3/s)	3657.4	Conv. (m3/s)	1460.9	1746.0	450.5
Length Wtd. (m)	10.00	Wetted Per. (m)	43.24	8.57	24.11
Min Ch El (m)	195.42	Shear (N/m2)	0.43	1.01	0.30
Alpha	1.97	Stream Power (N/m s)	0.06	0.36	0.03
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	42.92	72.51	35.89
C & E Loss (m)	0.00	Cum SA (1000 m2)	45.97	23.54	49.66

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.11	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.09	Reach Len. (m)	10.00	10.00	10.00
Crit W.S. (m)	199.00	Flow Area (m2)	119.37	37.51	52.88
E.G. Slope (m/m)	0.000190	Area (m2)	119.37	37.51	52.88
Q Total (m3/s)	122.56	Flow (m3/s)	59.30	39.50	23.76
Top Width (m)	114.19	Top Width (m)	83.51	7.52	23.16
Vel Total (m/s)	0.58	Avg. Vel. (m/s)	0.50	1.05	0.45
Max Chl Dpth (m)	5.67	Hydr. Depth (m)	1.43	4.99	2.28
Conv. Total (m3/s)	8896.6	Conv. (m3/s)	4304.8	2867.1	1724.7
Length Wtd. (m)	10.00	Wetted Per. (m)	84.01	8.57	25.39
Min Ch El (m)	195.42	Shear (N/m2)	2.64	8.14	3.88
Alpha	1.51	Stream Power (N/m s)	1.31	8.58	1.74
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	171.74	174.48	199.59
C & E Loss (m)	0.00	Cum SA (1000 m2)	101.90	23.54	126.75

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.18

INPUT
Description: Section 46.18 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 36

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.977	11.8	201.517	19.72	201.217	24.63	201.027	25.49	201
25.73	200.891	27.72	200	72.09	200	72.38	200.049	72.68	200
73.08	199.878	75.33	199	90.41	198.582	110.99	198	113.81	197.148
114.16	197	114.84	196.777	115.23	196.607	117.24	196	118.92	195.419
119.01	195.418	119.32	195.43	120.38	195.971	120.82	196	123.44	196.968
123.53	197	123.87	197.147	125.89	198	126.38	198.193	128.56	199
130.21	199.025	143.32	199.109	146.37	199.102	152.23	199.148	160.44	199.206
181.15	199.373								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	117.24	.035	120.82	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
117.24	120.82	25	25	25	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
146.08	181.15	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.80	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)		Flow Area (m2)	64.59	14.65	30.67
E.G. Slope (m/m)	0.000038	Area (m2)	64.59	14.65	30.67
Q Total (m3/s)	20.59	Flow (m3/s)	10.15	6.30	4.14
Top Width (m)	72.80	Top Width (m)	43.96	3.58	25.26
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.16	0.43	0.14
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.47	4.09	1.21
Conv. Total (m3/s)	3360.8	Conv. (m3/s)	1657.3	1027.6	676.0
Length Wtd. (m)	25.00	Wetted Per. (m)	44.44	3.81	26.52
Min Ch El (m)	195.42	Shear (N/m2)	0.53	1.42	0.43
Alpha	2.06	Stream Power (N/m s)	0.08	0.61	0.06
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	42.30	72.30	35.62
C & E Loss (m)	0.00	Cum SA (1000 m2)	45.53	23.49	49.42

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.11	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.09	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)		Flow Area (m2)	172.08	19.25	63.15
E.G. Slope (m/m)	0.000189	Area (m2)	172.08	19.25	63.15
Q Total (m3/s)	122.56	Flow (m3/s)	70.32	22.26	29.98
Top Width (m)	122.99	Top Width (m)	94.15	3.58	25.26
Vel Total (m/s)	0.48	Avg. Vel. (m/s)	0.41	1.16	0.47
Max Chl Dpth (m)	5.67	Hydr. Depth (m)	1.83	5.38	2.50
Conv. Total (m3/s)	8920.1	Conv. (m3/s)	5117.8	1620.2	2182.2
Length Wtd. (m)	25.00	Wetted Per. (m)	94.89	3.81	

27.81					
Min Ch El (m)	195.42	Shear (N/m2)	3.36	9.36	4.20
Alpha	1.70	Stream Power (N/m s)	1.37	10.82	2.00
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	170.28	174.20	199.01
C & E Loss (m)	0.00	Cum SA (1000 m2)	101.01	23.49	126.51

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: RIVER-1
REACH: Reach-1 RS: 46.172

INPUT
Description: Section 46.172 - Doughton Road - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 112

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.734	12.56	201.239	18.71	201	19.16	200.796	20.83	200
22.76	199.053	22.87	199	62.25	199	63.17	199.011	64.63	199.022
66.94	199.001	66.98	199	67.01	199	68.2	198.967	103.48	198
104.09	197.739	105.82	197	106.27	196.833	107.29	196.474	107.64	196.354
108.58	196	109	195.6	109.6	195.423	111	195.423	111.7	195.6
112.13	196	114.2	196.671	115.34	197	118.55	197.877	118.99	198
121.05	198.574	123.33	199	123.42	199.001	123.5	199.001	123.54	199.001
123.9	199.003	124.23	199.004	124.61	199.005	126.14	199.011	127.45	199.01
127.51	199.01	130.18	199.02	131.13	199.023	131.75	199.022	131.93	199.022
136.67	199.034	138.19	199.034	142.37	199.028	144.48	199.031	146.18	199.033
147.98	199.03	151.4	199.025	152.23	199.024	153.19	199.023	162.26	199.102
168.85	199.106	176.2	199.054	176.37	199.053	179.61	199.282	179.92	199.303
181.07	199.326	182.68	199.444	185.09	199.554	185.23	199.561	190.14	200
190.33	200.08	192.14	200.106	194.32	200.348	197.51	200.575	198.87	200.608
201.34	200.55	205.59	200.325	205.97	200.323	207.47	200.186	208.18	200.159
208.63	200.138	208.84	200.128	209.03	200.12	209.29	200.117	209.54	200.119
210.38	200.139	210.98	200.174	211.81	200.246	213.46	200.375	218.29	200.752
218.48	200.763	218.67	200.765	219.17	200.789	219.59	200.805	220.25	200.786
223.9	200.72	227.49	200.773	227.81	200.78	230.24	200.911	230.52	200.931
231.19	201	231.74	201.005	232.08	201.007	242.92	201.282	250.3	201.41
251.76	201.387	251.9	201.386	253.2	201.371	255.13	201.441	255.57	201.457
256.04	201.474	256.2	201.479	256.73	201.495	258.39	201.529	263.36	201.693
264.27	201.707	264.32	201.707						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	108.58	.035	112.13	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
108.58	112.13	40	40	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	108.23	197.78	F
112.38	264.32	197.78	F

Right Levee Station= 198.87 Elevation= 200.608

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.80	Reach Len. (m)	40.00	40.00	40.00
Crit W.S. (m)	197.01	Flow Area (m2)	97.96	15.11	68.87
E.G. Slope (m/m)	0.000021	Area (m2)	97.96	15.11	68.87
Q Total (m3/s)	20.59	Flow (m3/s)	9.73	4.91	5.95
Top Width (m)	166.69	Top Width (m)	87.35	3.55	75.79
Vel Total (m/s)	0.11	Avg. Vel. (m/s)	0.10	0.32	0.09
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.12	4.26	0.91
Conv. Total (m3/s)	4455.0	Conv. (m3/s)	2105.7	1062.1	1287.3
Length Wtd. (m)	40.00	Wetted Per. (m)	87.93	3.92	76.22
Min Ch El (m)	195.42	Shear (N/m2)	0.23	0.81	0.19
Alpha	2.50	Stream Power (N/m s)	0.02	0.26	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	40.27	71.92	34.37
C & E Loss (m)		Cum SA (1000 m2)	43.89	23.40	48.16

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.10	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.09	Reach Len. (m)	40.00	40.00	40.00
Crit W.S. (m)	199.38	Flow Area (m2)	212.63	19.69	193.70
E.G. Slope (m/m)	0.000074	Area (m2)	212.63	19.69	193.70
Q Total (m3/s)	122.56	Flow (m3/s)	63.45	14.21	44.90
Top Width (m)	219.18	Top Width (m)	92.27	3.55	123.35
Vel Total (m/s)	0.29	Avg. Vel. (m/s)	0.30	0.72	0.23
Max Chl Dpth (m)	5.67	Hydr. Depth (m)	2.30	5.55	1.57
Conv. Total (m3/s)	14244.4	Conv. (m3/s)	7373.8	1652.0	5218.7
Length Wtd. (m)	40.00	Wetted Per. (m)	93.13	3.92	

123.88					
Min Ch El (m)	195.42	Shear (N/m2)	1.66	3.65	1.14
Alpha	1.52	Stream Power (N/m s)	0.49	2.64	0.26
Frctn Loss (m)		Cum Volume (1000 m3)	165.48	173.71	195.80
C & E Loss (m)		Cum SA (1000 m2)	98.68	23.40	124.65

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1715

INPUT
Description: Hum 13-4R. Doughton Road Culvert - 3.54 m W x 2.27 m H x 30 m L Corrugated Metal Pipe Arch Culvert. Drawing by Paul Theil (Dwg No. 8036P-A-17, February 1998) used to code culvert in HEC-RAS format..

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 30
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 146

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.659		17.1	201		18.56	200.215	
19.04	200		20.71	199.079		20.88	199	
58.5	199		58.75	199.001		59.61	199.002	
59.67	199.002		60.49	199.079		61.88	199.001	
62.77	199		62.78	198.999		62.87	198.999	
64.51	198.988		77.88	198.499		79.03	198.456	
80.45	198.394		80.53	198.393		80.55	198.393	
82.71	198.354		101.77	198.004		101.87	198.004	
102.35	198.004		102.49	198.003		103.08	198.003	
103.88	198.003		104.94	198.002		105.2	198.001	
105.36	198.001		105.37	198.001		105.48	198.001	
105.59	198.001		106.17	198		111.07	197.984	
112.06	197.981		112.22	197.981		112.33	197.981	
112.33	197.981		114.49	197.978		114.57	197.978	
114.65	197.978		115.8	197.978		118.45	197.973	
118.88	197.972		119.32	197.973		119.67	197.973	
120.76	197.97		121.29	197.971		125.31	197.974	
128.81	197.969		129.56	197.969		129.66	197.969	
131.93	197.969		135.28	197.977		135.33	197.977	
135.42	197.977		135.86	197.977		136.49	197.98	
136.85	197.98		138.97	197.983		140.58	197.983	
142.91	197.985		143.34	197.986		144	197.987	
148.3	197.988		148.81	197.988		150.8	197.989	
151.39	197.989		151.44	197.989		151.49	197.989	
152.06	197.99		152.7	197.99		156.88	197.993	

158.94	197.995	160.16	197.995	160.52	197.995
163.7	197.998	163.89	197.998	166.05	198
171.66	198.147	174	198.212	174.94	198.277
175.14	198.281	175.27	198.285	175.43	198.29
175.45	198.29	175.57	198.292	181.56	199
181.89	199	188.35	199	188.45	199
189.17	199	189.18	199	189.3	199
189.37	199	189.43	199	190.46	199
190.69	199	196.39	199	199.89	199
200.58	199	201.89	199	202.2	199
202.34	199	205.71	199	205.77	199
206.03	199	207.51	199	207.73	199
208.17	199	209.97	199	211.96	199.213
212.01	199.214	213.13	199.214	220.85	199.754
223.57	199.952	224.34	199.955	224.39	199.955
224.45	199.955	225.21	199.96	227.97	199.964
228.07	199.964	229.26	199.965	230.05	199.967
232.33	199.971	235.53	199.979	235.78	199.979
238.51	199.989	241.24	199.999	241.32	199.999
241.46	199.999	241.56	200	242.02	200.028
242.12	200.031	255.22	200.891	257.31	200.902
257.33	200.902	259.53	200.742	259.59	200.74
260.02	200.761	260.61	200.75	262.62	200.866
263.38	200.931	263.45	200.931		

Upstream Bridge Cross Section Data
Station Elevation Data num= 112

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.734	12.56	201.239	18.71	201	19.16	200.796	20.83	200
22.76	199.053	22.87	199	62.25	199	63.17	199.011	64.63	199.022
66.94	199.001	66.98	199	67.01	199	68.2	198.967	103.48	198
104.09	197.739	105.82	197	106.27	196.833	107.29	196.474	107.64	196.354
108.58	196	109	195.6	109.6	195.423	111	195.423	111.7	195.6
112.13	196	114.2	196.671	115.34	197	118.55	197.877	118.99	198
121.05	198.574	123.33	199	123.42	199.001	123.5	199.001	123.54	199.001
123.9	199.003	124.23	199.004	124.61	199.005	126.14	199.011	127.45	199.01
127.51	199.01	130.18	199.02	131.13	199.023	131.75	199.022	131.93	199.022
136.67	199.034	138.19	199.034	142.37	199.028	144.48	199.031	146.18	199.033
147.98	199.03	151.4	199.025	152.23	199.024	153.19	199.023	162.26	199.102
168.85	199.106	176.2	199.054	176.37	199.053	179.61	199.282	179.92	199.303
181.07	199.326	182.68	199.444	185.09	199.554	185.23	199.561	190.14	200
190.33	200.08	192.14	200.106	194.32	200.348	197.51	200.575	198.87	200.608
201.34	200.55	205.59	200.325	205.97	200.323	207.47	200.186	208.18	200.159
208.63	200.138	208.84	200.128	209.03	200.12	209.29	200.117	209.54	200.119
210.38	200.139	210.98	200.174	211.81	200.246	213.46	200.375	218.29	200.752
218.48	200.763	218.67	200.765	219.17	200.789	219.59	200.805	220.25	200.786
223.9	200.72	227.49	200.773	227.81	200.78	230.24	200.911	230.52	200.931
231.19	201	231.74	201.005	232.08	201.007	242.92	201.282	250.3	201.41
251.76	201.387	251.9	201.386	253.2	201.371	255.13	201.441	255.57	201.457
256.04	201.474	256.2	201.479	256.73	201.495	258.39	201.529	263.36	201.693
264.27	201.707	264.32	201.707						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	108.58	.035	112.13	.05

Bank Sta: Left Right Coeff Contr. Expan.
108.58 112.13 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	108.23	197.78	F
112.38	264.32	197.78	F

Right Levee Station= 198.87 Elevation= 200.608

Downstream Deck/Roadway Coordinates
num= 146

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.659		17.1	201		18.56	200.215	
19.04	200		20.71	199.079		20.88	199	
58.5	199		58.75	199.001		59.61	199.002	
59.67	199.002		60.49	199.079		61.88	199.001	
62.77	199		62.78	198.999		62.87	198.999	
64.51	198.988		77.88	198.499		79.03	198.456	
80.45	198.394		80.53	198.393		80.55	198.393	
82.71	198.354		101.77	198.004		101.87	198.004	
102.35	198.004		102.49	198.003		103.08	198.003	
103.88	198.003		104.94	198.002		105.2	198.001	
105.36	198.001		105.37	198.001		105.48	198.001	
105.59	198.001		106.17	198		111.07	197.984	
112.06	197.981		112.22	197.981		112.33	197.981	
112.33	197.981		114.49	197.978		114.57	197.978	
114.65	197.978		115.8	197.978		118.45	197.973	
118.88	197.972		119.32	197.973		119.67	197.973	
120.76	197.97		121.29	197.971		125.31	197.974	
128.81	197.969		129.56	197.969		129.66	197.969	
131.93	197.969		135.28	197.977		135.33	197.977	
135.42	197.977		135.86	197.977		136.49	197.98	
136.85	197.98		138.97	197.983		140.58	197.983	
142.91	197.985		143.34	197.986		144	197.987	
148.3	197.988		148.81	197.988		150.8	197.989	
151.39	197.989		151.44	197.989		151.49	197.989	
152.06	197.99		152.7	197.99		156.88	197.993	
158.94	197.995		160.16	197.995		160.52	197.995	
163.7	197.998		163.89	197.998		166.05	198	
171.66	198.147		174	198.212		174.94	198.277	
175.14	198.281		175.27	198.285		175.43	198.29	
175.45	198.29		175.57	198.292		181.56	199	
181.89	199		188.35	199		188.45	199	
189.17	199		189.18	199		189.3	199	
189.37	199		189.43	199		190.46	199	
190.69	199		196.39	199		199.89	199	
200.58	199		201.89	199		202.2	199	
202.34	199		205.71	199		205.77	199	
206.03	199		207.51	199		207.73	199	
208.17	199		209.97	199		211.96	199.213	
212.01	199.214		213.13	199.214		220.85	199.754	
223.57	199.952		224.34	199.955		224.39	199.955	
224.45	199.955		225.21	199.96		227.97	199.964	
228.07	199.964		229.26	199.965		230.05	199.967	
232.33	199.971		235.53	199.979		235.78	199.979	
238.51	199.989		241.24	199.999		241.32	199.999	
241.46	199.999		241.56	200		242.02	200.028	
242.12	200.031		255.22	200.891		257.31	200.902	
257.33	200.902		259.53	200.742		259.59	200.74	
260.02	200.761		260.61	200.75		262.62	200.866	
263.38	200.931		263.45	200.931				

Downstream Bridge Cross Section Data
Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.96	4.98	201.796	12.44	201.256	13.15	201.237	13.25	201.233
14.75	201.164	14.84	201.161	15.12	201.157	15.39	201.155	15.62	201.154
15.69	201.151	15.99	201	16.36	200.819	17.96	200	56.42	200
56.75	200.006	57.02	200.008	57.33	200.003	57.62	200	58.14	199.138
58.25	199.189	58.47	199	60.02	198.995	63.55	198.984	63.81	198.985
64	198.985	65.42	198.99	68.25	198.998	68.82	199	72	199.002

```
  72.03 199.002   72.61 199.001   73.78 199.001   75.32     199   75.36     199
  80.19 198.767   92.67 198.166    96.3     198   97.51 197.516   98.72     197
  99.68 196.606   99.91 196.501  100.61  196.23  100.78     196  101.09  195.65
    102   195.4     103   195.4  103.89  195.65   104.2     196  105.92 196.441
 106.96 196.581   107.6 196.655   107.9  196.67  111.41     197  111.54 197.014
 111.55 197.013  112.49 197.087  113.31  197.14  116.28 197.185  119.01 197.211
 119.24 197.207  121.22 197.229  124.15 197.307  124.51  197.35  124.99  197.41
 125.11 197.425  127.76  197.44  128.22 197.417  130.42     198  132.06 198.488
 133.88     199  134.14 199.003  134.41 199.003  134.45 199.003  137.25 199.032
 137.75 199.031  141.77 199.052  141.83 199.052  141.86 199.053  148.67 199.216
 150.74 199.224  152.75 199.228  159.58 199.291  160.35 199.297   162.8 199.347
 166.55 199.342   166.7 199.342  167.68 199.362  170.27 199.374  170.75 199.383
 172.18 199.397  173.54 199.408  175.72 199.407  176.75 199.414  180.91  199.49
 186.98 199.604   187.2 199.611  193.04 199.639     200     200  200.45 200.012
 202.09 200.042  206.82 200.085  218.03   200.5  221.19 200.617  221.21 200.618
 221.33 200.618  221.54 200.615  221.57 200.615   229.4 200.491  229.74  200.48
 236.66 200.579  244.75 200.914  250.98 200.952  251.55 200.969  251.75 200.978
 251.93 200.979   253.5     201  255.98 201.045  256.93 201.053  257.81 201.067
 258.72 201.075  258.93 201.079

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05  100.78    .035   104.2     .05  133.88    .025

Bank Sta: Left   Right    Coeff Contr.   Expan.
        100.78   104.2             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0  100.49   197.5       F
  104.45  258.93   197.5       F
Right Levee     Station=  221.19      Elevation=  200.62

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     Pipe Arch    2.27    3.54
FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                 5      30     .024     .024        0                    .9
      1
Upstream   Elevation =  195.423
           Centerline Station =  110.35
Downstream Elevation =  195.4
           Centerline Station =  102.49

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       0.95    Culv Full Len (m)        30.00
  # Barrels                    1    Culv Vel US (m/s)         0.15
  Q Barrel (m3/s)           0.95    Culv Vel DS (m/s)         0.15
  E.G. US. (m)            199.80    Culv Inv El Up (m)      195.42
  W.S. US. (m)            199.80    Culv Inv El Dn (m)      195.40
```

E.G. DS (m)	199.80	Culv Frctn Ls (m)	0.00
W.S. DS (m)	199.80	Culv Exit Loss (m)	0.00
Delta EG (m)	0.00	Culv Entr Loss (m)	0.00
Delta WS (m)	0.00	Q Weir (m3/s)	19.64
E.G. IC (m)	198.51	Weir Sta Lft (m)	21.23
E.G. OC (m)	199.80	Weir Sta Rgt (m)	187.93
Culvert Control	Outlet	Weir Submerg	1.00
Culv WS Inlet (m)	197.69	Weir Max Depth (m)	1.83
Culv WS Outlet (m)	197.67	Weir Avg Depth (m)	0.97
Culv Nml Depth (m)		Weir Flow Area (m2)	161.62
Culv Crt Depth (m)	0.28	Min El Weir Flow (m)	197.97

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	2.17	Culv Full Len (m)	30.00
# Barrels	1	Culv Vel US (m/s)	0.35
Q Barrel (m3/s)	2.17	Culv Vel DS (m/s)	0.35
E.G. US. (m)	201.10	Culv Inv El Up (m)	195.42
W.S. US. (m)	201.09	Culv Inv El Dn (m)	195.40
E.G. DS (m)	201.09	Culv Frctn Ls (m)	0.00
W.S. DS (m)	201.08	Culv Exit Loss (m)	0.00
Delta EG (m)	0.01	Culv Entr Loss (m)	0.01
Delta WS (m)	0.01	Q Weir (m3/s)	120.40
E.G. IC (m)	201.09	Weir Sta Lft (m)	16.33
E.G. OC (m)	201.10	Weir Sta Rgt (m)	235.46
Culvert Control	Outlet	Weir Submerg	1.00
Culv WS Inlet (m)	197.69	Weir Max Depth (m)	3.12
Culv WS Outlet (m)	197.67	Weir Avg Depth (m)	1.85
Culv Nml Depth (m)		Weir Flow Area (m2)	405.36
Culv Crt Depth (m)	0.43	Min El Weir Flow (m)	197.97

Warning: The weir over culvert is submerged.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.171

INPUT
Description: Section 46.171 - Doughton Road - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.96	4.98	201.796	12.44	201.256	13.15	201.237	13.25	201.233
14.75	201.164	14.84	201.161	15.12	201.157	15.39	201.155	15.62	201.154
15.69	201.151	15.99	201	16.36	200.819	17.96	200	56.42	200
56.75	200.006	57.02	200.008	57.33	200.003	57.62	200	58.14	199.138
58.25	199.189	58.47	199	60.02	198.995	63.55	198.984	63.81	198.985
64	198.985	65.42	198.99	68.25	198.998	68.82	199	72	199.002
72.03	199.002	72.61	199.001	73.78	199.001	75.32	199	75.36	199
80.19	198.767	92.67	198.166	96.3	198	97.51	197.516	98.72	197
99.68	196.606	99.91	196.501	100.61	196.23	100.78	196	101.09	195.65
102	195.4	103	195.4	103.89	195.65	104.2	196	105.92	196.441
106.96	196.581	107.6	196.655	107.9	196.67	111.41	197	111.54	197.014
111.55	197.013	112.49	197.087	113.31	197.14	116.28	197.185	119.01	197.211

119.24	197.207	121.22	197.229	124.15	197.307	124.51	197.35	124.99	197.41
125.11	197.425	127.76	197.44	128.22	197.417	130.42	198	132.06	198.488
133.88	199	134.14	199.003	134.41	199.003	134.45	199.003	137.25	199.032
137.75	199.031	141.77	199.052	141.83	199.052	141.86	199.053	148.67	199.216
150.74	199.224	152.75	199.228	159.58	199.291	160.35	199.297	162.8	199.347
166.55	199.342	166.7	199.342	167.68	199.362	170.27	199.374	170.75	199.383
172.18	199.397	173.54	199.408	175.72	199.407	176.75	199.414	180.91	199.49
186.98	199.604	187.2	199.611	193.04	199.639	200	200	200.45	200.012
202.09	200.042	206.82	200.085	218.03	200.5	221.19	200.617	221.21	200.618
221.33	200.618	221.54	200.615	221.57	200.615	229.4	200.491	229.74	200.48
236.66	200.579	244.75	200.914	250.98	200.952	251.55	200.969	251.75	200.978
251.93	200.979	253.5	201	255.98	201.045	256.93	201.053	257.81	201.067
258.72	201.075	258.93	201.079						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100.78	.035	104.2	.05	133.88	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
100.78	104.2	20	20	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	100.49	197.5	F
104.45	258.93	197.5	F

Right Levee Station= 221.19 Elevation= 200.62

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.045
W.S. Elev (m)	199.80	Reach Len. (m)	20.00	20.00	20.00
Crit W.S. (m)	197.05	Flow Area (m2)	53.47	14.56	103.52
E.G. Slope (m/m)	0.000013	Area (m2)	53.47	14.56	103.52
Q Total (m3/s)	20.59	Flow (m3/s)	4.42	3.69	12.48
Top Width (m)	138.41	Top Width (m)	43.04	3.42	91.95
Vel Total (m/s)	0.12	Avg. Vel. (m/s)	0.08	0.25	0.12
Max Chl Dpth (m)	4.40	Hydr. Depth (m)	1.24	4.26	1.13
Conv. Total (m3/s)	5677.0	Conv. (m3/s)	1218.0	1018.1	3441.0
Length Wtd. (m)	20.00	Wetted Per. (m)	43.98	3.80	92.28
Min Ch El (m)	195.40	Shear (N/m2)	0.16	0.49	0.14
Alpha	1.51	Stream Power (N/m s)	0.01	0.13	0.02
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	40.27	65.14	34.37
C & E Loss (m)	0.00	Cum SA (1000 m2)	41.29	23.26	44.80

Note: Multiple critical depths were found at this location. The critical depth

with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.09	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.037
W.S. Elev (m)	201.08	Reach Len. (m)	20.00	20.00	20.00
Crit W.S. (m)	198.40	Flow Area (m2)	152.90	18.95	256.04
E.G. Slope (m/m)	0.000047	Area (m2)	152.90	18.95	256.04
Q Total (m3/s)	122.56	Flow (m3/s)	30.86	10.88	80.82
Top Width (m)	243.10	Top Width (m)	84.95	3.42	154.73
Vel Total (m/s)	0.29	Avg. Vel. (m/s)	0.20	0.57	0.32
Max Chl Dpth (m)	5.68	Hydr. Depth (m)	1.80	5.54	1.65
Conv. Total (m3/s)	17786.0	Conv. (m3/s)	4478.4	1578.9	11728.6
Length Wtd. (m)	20.00	Wetted Per. (m)	86.27	3.80	155.09
Min Ch El (m)	195.40	Shear (N/m2)	0.83	2.32	0.77
Alpha	1.28	Stream Power (N/m s)	0.17	1.33	0.24
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	165.48	157.18	195.80
C & E Loss (m)	0.00	Cum SA (1000 m2)	95.14	23.26	119.09

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.17

INPUT
Description: Section 46.17 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 116

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.688	1.92	202.495	4.4	202.266	4.48	202.251	4.75	202.184
4.79	202.176	6.6	202	12.45	201.979	17.91	201.166	18.18	201.154
19.37	201.103	21.4	201	23.54	200.628	24.48	200.486	25.02	200.437
25.18	200.42	27.13	200.345	28.69	200.283	51.47	200.233	52.85	200.015
52.9	200.016	53.01	200.016	53.18	200.017	53.5	200.019	53.65	200.018
55.08	200	55.93	199.504	57.96	199	58.81	198.999	60.02	198.998
60.13	198.998	60.21	198.998	60.95	199	66.84	199.005	72.96	199.008
73.69	199.009	73.9	199.009	74.3	199.009	84.33	199.001	84.69	199
87.85	198.724	88.8	198.65	91.93	198.411	92.06	198.399	92.24	198.395
94.4	198.329	97.14	198.228	101.19	198	104.3	197.667	105.19	197.601
106.64	197.457	107.07	197.401	107.61	197.33	109.57	197.016	109.72	197
111.4	196.518	112.75	196.275	112.89	196.246	114	196	115.21	195.596

116.81	195.074	118.88	195.516	119.22	195.58	121	195.98	121.83	196
122.59	196.161	122.66	196.178	126.09	197	126.52	197.207	127.48	197.726
128.12	198	128.84	198.316	128.95	198.391	130.41	199	131.35	199.029
131.66	199.042	131.84	199.047	145.77	199.679	145.82	199.68	148.15	199.686
148.22	199.687	150.32	199.708	150.42	199.708	155.89	199.771	163.77	199.844
166.6	199.87	172.77	199.998	172.98	200	173.86	200	177.76	200.001
180.71	200.001	182.41	200.001	187.06	200	189.66	200	190.48	200
191.66	199.999	192.68	200	193.35	200	195.14	200.052	210.59	200.774
213.61	200.883	216.46	200.997	216.77	200.998	216.8	201	218.28	201.01
220.35	201.021	223.37	201.004	223.38	201.003	223.46	201.003	223.87	201.001
224	201.001	224.1	201.001	224.26	201.001	247.41	201.031	254.26	201.314
261.99	201.319								

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	114	.035	121.83	.05	130.41	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
114	121.83	25	25	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
224	254.26	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.046
W.S. Elev (m)	199.80	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)		Flow Area (m2)	78.43	33.06	29.72
E.G. Slope (m/m)	0.000016	Area (m2)	78.43	33.06	29.72
Q Total (m3/s)	20.59	Flow (m3/s)	7.48	9.53	3.58
Top Width (m)	103.45	Top Width (m)	58.57	7.83	37.04
Vel Total (m/s)	0.15	Avg. Vel. (m/s)	0.10	0.29	0.12
Max Chl Dpth (m)	4.72	Hydr. Depth (m)	1.34	4.22	0.80
Conv. Total (m3/s)	5225.2	Conv. (m3/s)	1897.9	2417.7	909.5
Length Wtd. (m)	25.00	Wetted Per. (m)	58.93	8.08	37.62
Min Ch El (m)	195.07	Shear (N/m2)	0.20	0.62	0.12
Alpha	2.08	Stream Power (N/m s)	0.02	0.18	0.01
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	38.95	64.66	33.04
C & E Loss (m)	0.00	Cum SA (1000 m2)	40.27	23.15	43.51

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.09	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.032
W.S. Elev (m)	201.08	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)		Flow Area (m2)	179.99	43.06	129.50
E.G. Slope (m/m)	0.000069	Area (m2)	179.99	43.06	129.50
Q Total (m3/s)	122.56	Flow (m3/s)	45.88	31.16	45.52
Top Width (m)	204.08	Top Width (m)	94.08	7.83	102.17
Vel Total (m/s)	0.35	Avg. Vel. (m/s)	0.25	0.72	0.35
Max Chl Dpth (m)	6.00	Hydr. Depth (m)	1.91	5.50	1.27
Conv. Total (m3/s)	14769.6	Conv. (m3/s)	5529.1	3754.9	5485.6
Length Wtd. (m)	25.00	Wetted Per. (m)	94.56	8.08	102.85
Min Ch El (m)	195.07	Shear (N/m2)	1.29	3.60	0.85
Alpha	1.68	Stream Power (N/m s)	0.33	2.61	0.30
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	162.15	156.56	191.95
C & E Loss (m)	0.00	Cum SA (1000 m2)	93.35	23.15	116.52

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: RIVER-1
REACH: Reach-1 RS: 46.162

INPUT
Description: Section 46.162 - Private Roadway - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 109

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.192	1.24	201.169	3.79	201.018	4.16	201	4.19	201
4.59	201	4.76	201	7.68	200.999	11.04	200.998	13.8	200.998
16.96	200.999	17.05	200.985	18.41	200.657	20.17	200.244	20.23	200.243
23.96	200	24.33	200	24.56	200	24.59	200	24.88	200
26.07	200.001	26.81	200.001	26.89	200.001	27.42	200.001	28.48	200.001
30.58	200.002	32.04	200.002	32.36	200.002	32.54	200.002	32.61	200.002
32.89	200.003	34.51	199.895	34.73	199.893	44.5	199.802	46.83	199.776
54.07	199.447	58.78	199.43	64.92	199.322	69.2	199.246	76.37	199.103
81.58	199.008	81.84	199	87.1	198.433	90.24	198	91.32	197.577
93.35	197	93.64	196.919	94.7	196.457	95.67	196.041	95.77	196
95.88	195.96	97	195.074	98.92	195.074	100.12	195.765	100.4	196
101.1	196.258	101.63	196.43	103.42	197	104.06	197.319	105.45	198

106.48	198.488	107.42	199	110.59	199.341	122.09	199.985	122.25	199.995
122.4	200	122.41	200	122.46	200	122.47	200	122.58	200
123.04	200	129.01	200	130.19	200	140.85	200	144.86	200
145.37	200	145.55	200	145.59	200	148.08	200	150.4	200
151.72	200.029	154.44	200.045	164.08	200.101	179.01	200.467	180.22	200.507
181.74	200.559	183.87	200.633	184.02	200.638	184.28	200.645	187.85	200.734
192.91	200.868	197.74	201	200.12	201.06	203.17	201.141	203.19	201.141
203.79	201.145	209.64	201.071	209.78	201.07	219.82	201.072	226.92	201.085
234.49	201.039	242.9	201.219	248.47	201.125	248.56	201.126	248.94	201.13
253.08	201.56	254.15	201.702	256.45	201.992	256.6	202		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	95.77	.035	100.4	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
95.77	100.4	30	30	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	96	198.8	F
100	256.6	198.8	F

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
154.44	183.87	204	209.64	248.47	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.79	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)	196.65	Flow Area (m2)	41.88	20.60	20.89
E.G. Slope (m/m)	0.000060	Area (m2)	41.88	20.60	20.89
Q Total (m3/s)	20.59	Flow (m3/s)	5.72	11.40	3.46
Top Width (m)	73.08	Top Width (m)	50.24	4.63	18.21
Vel Total (m/s)	0.25	Avg. Vel. (m/s)	0.14	0.55	0.17
Max Chl Dpth (m)	4.72	Hydr. Depth (m)	0.83	4.45	1.15
Conv. Total (m3/s)	2655.0	Conv. (m3/s)	737.6	1470.6	446.8
Length Wtd. (m)	30.00	Wetted Per. (m)	50.67	5.22	18.88
Min Ch El (m)	195.07	Shear (N/m2)	0.49	2.33	0.65
Alpha	2.94	Stream Power (N/m s)	0.07	1.29	0.11
Frctn Loss (m)		Cum Volume (1000 m3)	37.44	63.99	32.41
C & E Loss (m)		Cum SA (1000 m2)	38.91	22.99	42.82

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.05	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)	198.81	Flow Area (m2)	135.12	26.43	85.01
E.G. Slope (m/m)	0.000245	Area (m2)	135.12	26.43	85.01
Q Total (m3/s)	122.56	Flow (m3/s)	54.28	34.89	33.39
Top Width (m)	167.01	Top Width (m)	92.51	4.63	69.87
Vel Total (m/s)	0.50	Avg. Vel. (m/s)	0.40	1.32	0.39
Max Chl Dpth (m)	5.98	Hydr. Depth (m)	1.46	5.71	1.22
Conv. Total (m3/s)	7825.2	Conv. (m3/s)	3465.7	2227.8	2131.7
Length Wtd. (m)	30.00	Wetted Per. (m)	93.05	5.22	71.97
Min Ch El (m)	195.07	Shear (N/m2)	3.49	12.19	2.84
Alpha	2.47	Stream Power (N/m s)	1.40	16.10	1.12
Frctn Loss (m)		Cum Volume (1000 m3)	158.21	155.69	189.26
C & E Loss (m)		Cum SA (1000 m2)	91.01	22.99	114.37

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1615

INPUT
Description: Hum 13-KK. Paradise Convention Centre Culvert - 3.23 m W x 2.1 m H x 20 m L Corrugated Metal Pipe Arch Culvert. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 20
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 126

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.017		9.94	201		10.9	201	
11.2	200.998		11.24	200.998		11.49	200.997	
11.55	200.996		11.63	200.996		11.72	200.995	
11.81	200.995		12.69	200.991		13.63	200.995	

13.69	200.995	13.79	200.995	13.91	200.995				
14.12	200.995	14.43	200.995	15.32	200.994				
16.77	200.993	17.25	200.993	17.58	200.992				
17.88	200.988	18.13	200.991	18.74	201				
19.67	201	20.75	201	22.23	201				
22.68	201	23	201	25.78	200.523				
29.88	200	30.35	200	30.39	200				
30.42	200	30.46	200	30.91	200				
31.74	200	31.8	200	31.81	200				
32.21	199.978	32.38	199.976	37.76	199.901				
45.3	199.796	45.48	199.793	46.6	199.774				
47.47	199.76	48.2	199.747	48.73	199.737				
52.37	199.712	62.24	199.953	80.06	199.792				
80.14	199.784	82.52	199.86	83.52	199.767				
86.47	199.141	86.75	199.129	86.83	199.126				
86.88	199.126	87.13	199.124	87.38	199.123				
92.32	199.013	93.07	199.015	93.82	199.013				
94.29	199.014	95.15	199.016	97.02	199.018				
99.48	199.024	101.85	199.025	101.94	199.025				
102.27	199.026	102.57	199.026	108.65	199.546				
109.85	199.579	110.34	199.599	111.74	199.692				
113.68	199.827	113.8	199.834	114.21	199.865				
114.64	199.898	115.6	200	115.65	200				
115.87	200	115.88	200	116.22	200				
133.27	200.001	141.62	200.001	151.28	200				
152.5	200	152.57	200	152.67	200				
153.56	200.001	154.38	200	157.21	200.062				
161.12	200.085	198.43	201	198.44	201				
198.44	201	198.46	201	198.85	201.004				
198.89	201.004	199.24	201.005	201.34	201.009				
203.5	201.021	204.2	201.024	204.77	201.027				
206.84	201.024	207.23	201.023	207.31	201.023				
207.75	201.023	208.37	201.022	211.58	201.02				
227.39	201.113	228.72	201.124	234.54	201.088				
245.86	201	245.92	201	245.93	201				
245.97	201	247.18	201	247.71	201				
247.87	201	248.82	201.063	250.46	201.201				
257.76	202	258.46	202.763	258.74	203				

Upstream Bridge Cross Section Data
Station Elevation Data num= 109

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.192	1.24	201.169	3.79	201.018	4.16	201	4.19	201
4.59	201	4.76	201	7.68	200.999	11.04	200.998	13.8	200.998
16.96	200.999	17.05	200.985	18.41	200.657	20.17	200.244	20.23	200.243
23.96	200	24.33	200	24.56	200	24.59	200	24.88	200
26.07	200.001	26.81	200.001	26.89	200.001	27.42	200.001	28.48	200.001
30.58	200.002	32.04	200.002	32.36	200.002	32.54	200.002	32.61	200.002
32.89	200.003	34.51	199.895	34.73	199.893	44.5	199.802	46.83	199.776
54.07	199.447	58.78	199.43	64.92	199.322	69.2	199.246	76.37	199.103
81.58	199.008	81.84	199	87.1	198.433	90.24	198	91.32	197.577
93.35	197	93.64	196.919	94.7	196.457	95.67	196.041	95.77	196
95.88	195.96	97	195.074	98.92	195.074	100.12	195.765	100.4	196
101.1	196.258	101.63	196.43	103.42	197	104.06	197.319	105.45	198
106.48	198.488	107.42	199	110.59	199.341	122.09	199.985	122.25	199.995
122.4	200	122.41	200	122.46	200	122.47	200	122.58	200
123.04	200	129.01	200	130.19	200	140.85	200	144.86	200
145.37	200	145.55	200	145.59	200	148.08	200	150.4	200
151.72	200.029	154.44	200.045	164.08	200.101	179.01	200.467	180.22	200.507
181.74	200.559	183.87	200.633	184.02	200.638	184.28	200.645	187.85	200.734
192.91	200.868	197.74	201	200.12	201.06	203.17	201.141	203.19	201.141
203.79	201.145	209.64	201.071	209.78	201.07	219.82	201.072	226.92	201.085
234.49	201.039	242.9	201.219	248.47	201.125	248.56	201.126	248.94	201.13

253.08	201.56	254.15	201.702	256.45	201.992	256.6	202

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	95.77	.035	100.4	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
95.77	100.4	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	96	198.8	F
100	256.6	198.8	F

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
154.44	183.87	204	209.64	248.47	204

Downstream Deck/Roadway Coordinates

num= 126

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.017		9.94	201		10.9	201	
11.2	200.998		11.24	200.998		11.49	200.997	
11.55	200.996		11.63	200.996		11.72	200.995	
11.81	200.995		12.69	200.991		13.63	200.995	
13.69	200.995		13.79	200.995		13.91	200.995	
14.12	200.995		14.43	200.995		15.32	200.994	
16.77	200.993		17.25	200.993		17.58	200.992	
17.88	200.988		18.13	200.991		18.74	201	
19.67	201		20.75	201		22.23	201	
22.68	201		23	201		25.78	200.523	
29.88	200		30.35	200		30.39	200	
30.42	200		30.46	200		30.91	200	
31.74	200		31.8	200		31.81	200	
32.21	199.978		32.38	199.976		37.76	199.901	
45.3	199.796		45.48	199.793		46.6	199.774	
47.47	199.76		48.2	199.747		48.73	199.737	
52.37	199.712		62.24	199.953		80.06	199.792	
80.14	199.784		82.52	199.86		83.52	199.767	
86.47	199.141		86.75	199.129		86.83	199.126	
86.88	199.126		87.13	199.124		87.38	199.123	
92.32	199.013		93.07	199.015		93.82	199.013	
94.29	199.014		95.15	199.016		97.02	199.018	
99.48	199.024		101.85	199.025		101.94	199.025	
102.27	199.026		102.57	199.026		108.65	199.546	
109.85	199.579		110.34	199.599		111.74	199.692	
113.68	199.827		113.8	199.834		114.21	199.865	
114.64	199.898		115.6	200		115.65	200	
115.87	200		115.88	200		116.22	200	
133.27	200.001		141.62	200.001		151.28	200	
152.5	200		152.57	200		152.67	200	
153.56	200.001		154.38	200		157.21	200.062	
161.12	200.085		198.43	201		198.44	201	
198.44	201		198.46	201		198.85	201.004	
198.89	201.004		199.24	201.005		201.34	201.009	
203.5	201.021		204.2	201.024		204.77	201.027	
206.84	201.024		207.23	201.023		207.31	201.023	
207.75	201.023		208.37	201.022		211.58	201.02	
227.39	201.113		228.72	201.124		234.54	201.088	
245.86	201		245.92	201		245.93	201	
245.97	201		247.18	201		247.71	201	
247.87	201		248.82	201.063		250.46	201.201	
257.76	202		258.46	202.763		258.74	203	

Downstream Bridge Cross Section Data

Station Elevation Data num= 97

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.234	6.98	201.333	9.75	201.336	9.77	201.336	17.8	201.001
17.86	201.001	18.1	201.001	19.36	201.001	20.8	201.001	25.37	201
25.69	201	26.12	201	29.2	201	35.72	200.103	36.41	200
36.94	199.99	50.43	199.898	66.47	200.295	73.43	200.347	83.13	199.309
84.14	199	88.09	198.41	90.41	198	91.93	197.362	92.38	197.153
92.68	197	92.7	196.996	92.92	196.907	94.09	196.435	94.82	196.155
94.98	196.097	95.34	196	95.45	195.993	95.5	195.993	95.57	195.99
95.6	195.99	95.68	195.987	95.95	195.983	96.08	195.977	96.09	195.977
96.4	195.5	97.3	195.055	98.25	195.055	98.61	195.055	99.49	195.4
100.35	196	100.36	196.016	100.39	196.018	100.4	196.019	101.12	196.161
101.26	196.181	101.4	196.224	101.65	196.305	102.38	196.618	102.6	196.702
103.35	197	103.53	197.076	104.33	197.5	105.15	198	105.7	198.366
106.74	199	112.96	199.847	113.59	200.124	114.14	200	115.59	200
121.06	200	128.26	200.001	134.61	200.001	134.71	200.001	134.82	200.001
140.07	200.001	142.39	200.001	148.34	200.001	158.18	200.001	158.9	200.001
160.19	200	160.29	200	163.09	200.057	163.77	200.072	188.65	200.623
188.78	200.626	191.1	200.678	193.84	200.742	203.22	200.935	204.53	200.978
204.69	200.98	205.35	201	205.36	201	205.87	201	205.94	201
205.95	201	210.51	200.999	213.45	201	228.33	201.138	239.76	201.423
255.77	201.644	259.74	202						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	95.34	.035	100.35	.05

Bank Sta: Left Right Coeff Contr. Expan.
95.34 100.35 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	96	198.8	F
100	259.74	198.8	F

Left Levee Station= 73.43 Elevation= 200.35

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
112.96	193.84	204	213.45	255.77	204

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 = 199
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	Pipe Arch	2.1	3.23

FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG

Culvert Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
5	20	.024	.024	0	.9	1

Upstream Elevation = 195.074
Centerline Station = 98
Downstream Elevation = 195.055
Centerline Station = 98

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	3.51	Culv Full Len (m)	20.00
# Barrels	1	Culv Vel US (m/s)	0.67
Q Barrel (m3/s)	3.51	Culv Vel DS (m/s)	0.67
E.G. US. (m)	199.80	Culv Inv El Up (m)	195.07
W.S. US. (m)	199.79	Culv Inv El Dn (m)	195.05
E.G. DS (m)	199.76	Culv Frctn Ls (m)	0.01
W.S. DS (m)	199.75	Culv Exit Loss (m)	0.01
Delta EG (m)	0.04	Culv Entr Loss (m)	0.02
Delta WS (m)	0.04	Q Weir (m3/s)	17.08
E.G. IC (m)	198.77	Weir Sta Lft (m)	45.02
E.G. OC (m)	199.80	Weir Sta Rgt (m)	113.29
Culvert Control	Outlet	Weir Submerg	0.91
Culv WS Inlet (m)	197.17	Weir Max Depth (m)	0.79
Culv WS Outlet (m)	197.16	Weir Avg Depth (m)	0.41
Culv Nml Depth (m)		Weir Flow Area (m2)	17.62
Culv Crt Depth (m)	0.59	Min El Weir Flow (m)	199.02

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	1.98	Culv Full Len (m)	20.00
# Barrels	1	Culv Vel US (m/s)	0.38
Q Barrel (m3/s)	1.98	Culv Vel DS (m/s)	0.38
E.G. US. (m)	201.08	Culv Inv El Up (m)	195.07
W.S. US. (m)	201.05	Culv Inv El Dn (m)	195.05
E.G. DS (m)	201.07	Culv Frctn Ls (m)	0.00
W.S. DS (m)	200.99	Culv Exit Loss (m)	0.00
Delta EG (m)	0.01	Culv Entr Loss (m)	0.01
Delta WS (m)	0.06	Q Weir (m3/s)	118.27
E.G. IC (m)	201.07	Weir Sta Lft (m)	2.73
E.G. OC (m)	201.08	Weir Sta Rgt (m)	209.64
Culvert Control	Outlet	Weir Submerg	0.98
Culv WS Inlet (m)	197.17	Weir Max Depth (m)	2.07
Culv WS Outlet (m)	197.16	Weir Avg Depth (m)	1.03
Culv Nml Depth (m)		Weir Flow Area (m2)	175.13
Culv Crt Depth (m)	0.43	Min El Weir Flow (m)	199.02

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.161

INPUT
Description: Section 46.161 - Private Roadway - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 97

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.234	6.98	201.333	9.75	201.336	9.77	201.336	17.8	201.001
17.86	201.001	18.1	201.001	19.36	201.001	20.8	201.001	25.37	201
25.69	201	26.12	201	29.2	201	35.72	200.103	36.41	200
36.94	199.99	50.43	199.898	66.47	200.295	73.43	200.347	83.13	199.309

84.14	199	88.09	198.41	90.41	198	91.93	197.362	92.38	197.153
92.68	197	92.7	196.996	92.92	196.907	94.09	196.435	94.82	196.155
94.98	196.097	95.34	196	95.45	195.993	95.5	195.993	95.57	195.99
95.6	195.99	95.68	195.987	95.95	195.983	96.08	195.977	96.09	195.977
96.4	195.5	97.3	195.055	98.25	195.055	98.61	195.055	99.49	195.4
100.35	196	100.36	196.016	100.39	196.018	100.4	196.019	101.12	196.161
101.26	196.181	101.4	196.224	101.65	196.305	102.38	196.618	102.6	196.702
103.35	197	103.53	197.076	104.33	197.5	105.15	198	105.7	198.366
106.74	199	112.96	199.847	113.59	200.124	114.14	200	115.59	200
121.06	200	128.26	200.001	134.61	200.001	134.71	200.001	134.82	200.001
140.07	200.001	142.39	200.001	148.34	200.001	158.18	200.001	158.9	200.001
160.19	200	160.29	200	163.09	200.057	163.77	200.072	188.65	200.623
188.78	200.626	191.1	200.678	193.84	200.742	203.22	200.935	204.53	200.978
204.69	200.98	205.35	201	205.36	201	205.87	201	205.94	201
205.95	201	210.51	200.999	213.45	201	228.33	201.138	239.76	201.423
255.77	201.644	259.74	202						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	95.34	.035	100.35	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
95.34	100.35	115	115	110	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	96	198.8	F
100	259.74	198.8	F

Left Levee Station= 73.43 Elevation= 200.35

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
112.96	193.84	204	213.45	255.77	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.76	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.75	Reach Len. (m)	115.00	115.00	110.00
Crit W.S. (m)	196.68	Flow Area (m2)	22.94	21.69	18.04
E.G. Slope (m/m)	0.000066	Area (m2)	22.94	21.69	18.04
Q Total (m3/s)	20.59	Flow (m3/s)	4.56	12.33	3.70
Top Width (m)	33.18	Top Width (m)	16.30	5.01	11.87
Vel Total (m/s)	0.33	Avg. Vel. (m/s)	0.20	0.57	0.21
Max Chl Dpth (m)	4.69	Hydr. Depth (m)	1.41	4.33	1.52
Conv. Total (m3/s)	2543.9	Conv. (m3/s)	563.8	1523.0	457.0
Length Wtd. (m)	114.24	Wetted Per. (m)	16.84	5.63	12.65
Min Ch El (m)	195.05	Shear (N/m2)	0.87	2.48	0.92
Alpha	1.94	Stream Power (N/m s)	0.17	1.41	0.19
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	37.44	63.00	32.41

C & E Loss (m)	0.00	Cum SA (1000 m2)	37.91	22.85	42.37

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.07	Element	Left OB	Channel	Right OB
Vel Head (m)	0.08	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	200.99	Reach Len. (m)	115.00	115.00	110.00
Crit W.S. (m)	198.80	Flow Area (m2)	85.42	27.90	35.07
E.G. Slope (m/m)	0.000494	Area (m2)	85.42	27.90	35.07
Q Total (m3/s)	122.56	Flow (m3/s)	44.76	51.49	26.31
Top Width (m)	94.74	Top Width (m)	66.04	5.01	23.68
Vel Total (m/s)	0.83	Avg. Vel. (m/s)	0.52	1.85	0.75
Max Chl Dpth (m)	5.93	Hydr. Depth (m)	1.29	5.57	1.48
Conv. Total (m3/s)	5517.0	Conv. (m3/s)	2014.8	2317.8	1184.4
Length Wtd. (m)	113.39	Wetted Per. (m)	66.70	5.63	25.86
Min Ch El (m)	195.05	Shear (N/m2)	6.20	24.00	6.56
Alpha	2.42	Stream Power (N/m s)	3.25	44.28	4.92
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	158.21	149.95	189.26
C & E Loss (m)	0.03	Cum SA (1000 m2)	88.64	22.85	112.97

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.15

INPUT
Description: Section 46.15 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 127

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.186	1.5	202.211	3.88	202.172	12.6	202	18.62	201.651
19.7	201.593	24.97	201.562	31.47	201.499	34.76	201.41	37.06	201.349
38.71	201.307	40.01	201.275	46.43	201.234	53.66	201.182	63.04	201.024
64.83	201	71.77	201	81.8	201.001	98.39	201	98.42	201

98.43	201	98.62	201	99	201	99.33	201	102.54	201		
105.72	201	107.82	201	116.56	201	116.8	201	116.89	201		
117.43	201	120.19	201	129	201.384	129.41	201.366	129.47	201.361		
130.32	201.338	132.46	201.25	145.66	201.39	149.94	201.365	150.29	201.371		
150.32	201.371	150.34	201.37	165.5	201.241	174.71	201.093	174.73	201.093		
178.62	201.002	178.71	201	179.11	200.997	180.09	200.997	180.29	200.997		
182.91	200.994	183.59	200.992	187.46	200.99	189.73	200.989	193.41	200.986		
196.61	200.981	201.38	200.993	202.28	200.998	202.8	201	202.82	201.001		
204.7	201.012	204.87	201.012	207.02	201	215.88	200.597	217.98	200.503		
229.1	200	239.57	200	240.14	200	240.35	200	240.69	200		
241.46	200.001	244.02	200.003	244.52	200.003	247.88	200	252.68	199.697		
253.79	199.631	254.22	199.606	254.25	199.604	254.45	199.589	254.57	199.581		
254.58	199.58	257.09	199.519	293.77	199	311.44	198.052	312.46	198		
313.91	197.526	315.84	197	316.71	196.647	317.76	196	318.28	195.859		
320.41	195.022	323.03	195.56	324.63	196	325.3	196.405	326.37	197		
327.54	197.629	328.2	198	330.14	198.631	330.95	199	332.88	199.124		
334.89	199.177	336.12	199.217	343.97	199.5	348.81	199.629	349.11	199.635		
350.43	199.664	351.55	199.685	352.86	199.711	358.34	199.849	358.57	199.852		
363.52	199.98	371.23	199.957	379.73	199.99	380.54	199.992	381.05	199.993		
381.68	199.994	381.77	199.994	381.97	199.994	381.98	199.994	382.55	199.994		
383.23	199.994	383.28	199.994	383.63	199.994	388.93	199.98	393.62	199.989		
395.11	199.992	396.07	199.992								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	293.77	.08	317.76	.035	324.63	.08	330.95	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
317.76	324.63	50	50	.1	.3

Left Levee Station= 145.66 Elevation= 201.39

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
38.64	61.59	204	257.09	293.77	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.75	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035
0.061				
W.S. Elev (m)	199.74	Reach Len. (m)	50.00	50.00
50.00				
Crit W.S. (m)	196.48	Flow Area (m2)	37.70	29.14
20.59				
E.G. Slope (m/m)	0.000044	Area (m2)	37.70	29.14
20.59				
Q Total (m3/s)	20.59	Flow (m3/s)	3.98	14.03
2.58				
Top Width (m)	65.42	Top Width (m)	29.11	6.87
29.44				
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.11	0.48
0.13				
Max Chl Dpth (m)	4.72	Hydr. Depth (m)	1.30	4.24
0.70				
Conv. Total (m3/s)	3113.9	Conv. (m3/s)	602.0	2122.3
389.5				
Length Wtd. (m)	50.00	Wetted Per. (m)	30.50	7.16
30.16				
Min Ch El (m)	195.02	Shear (N/m2)	0.53	1.74
0.29				
Alpha	2.92	Stream Power (N/m s)	0.06	0.84
0.04				

Frctn Loss (m)	0.00	Cum Volume (1000 m3)	33.96	60.08	30.28
C & E Loss (m)	0.00	Cum SA (1000 m2)	35.30	22.16	40.10

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.01	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.071	0.035	0.032
W.S. Elev (m)	200.99	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	198.74	Flow Area (m2)	107.71	37.69	100.58
E.G. Slope (m/m)	0.000161	Area (m2)	107.71	37.69	100.58
Q Total (m3/s)	122.56	Flow (m3/s)	28.62	41.35	52.59
Top Width (m)	156.70	Top Width (m)	78.39	6.87	71.44
Vel Total (m/s)	0.50	Avg. Vel. (m/s)	0.27	1.10	0.52
Max Chl Dpth (m)	5.96	Hydr. Depth (m)	1.37	5.49	1.41
Conv. Total (m3/s)	9655.4	Conv. (m3/s)	2254.7	3257.8	4142.8
Length Wtd. (m)	50.00	Wetted Per. (m)	82.30	7.16	73.15
Min Ch El (m)	195.02	Shear (N/m2)	2.07	8.32	2.17
Alpha	2.18	Stream Power (N/m s)	0.55	9.12	1.14
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	147.10	146.18	181.80
C & E Loss (m)	0.01	Cum SA (1000 m2)	80.33	22.16	107.73

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.142

INPUT

Description: Section 46.142 - Private Roadway - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 54

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.236	12.59	201	21	200.671	22.43	200.623	37.81	200
39.38	200	40.23	200	42.31	200.027	44.55	200.047	44.93	200.051
45.27	200.048	49.43	200	56.95	199.696	56.96	199.695	56.98	199.695
85.47	199.453	94.46	199	96.11	198.897	108.79	198	110.82	197.095
111.08	197	111.27	196.916	113.02	196	115.02	195.28	116.06	195
116.72	194.83	117.13	194.83	117.19	194.83	117.27	194.83	118.2	195
120.05	195.7	120.42	195.827	121	196	123.66	196.903	123.94	197
124.59	197.177	124.93	197.245	126.67	198	128.21	198.693	128.78	199
131.04	199.231	132.73	199.5	140.22	199.865	142.99	200	146.99	200.195
153.53	200.5	153.55	200.5	156.96	200.577	157.48	200.588	173.76	200.995
173.97	201	179.85	201.266	181.95	201.351	185.83	201.5		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	94.46	.08	113.02	.035	121	.08	142.99	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
113.02	121	60	60	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	115.11	199.5	F
119.14	185.83	199.5	F

Left Levee Station= 44.93 Elevation= 200.051

Blocked Obstructions num= 1

Sta L	Sta R	Elev
56.98	96.11	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.75	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	199.74	Reach Len. (m)	60.00	60.00	60.00
Crit W.S. (m)	196.40	Flow Area (m2)	27.82	35.17	21.08
E.G. Slope (m/m)	0.000037	Area (m2)	27.82	35.17	21.08
Q Total (m3/s)	20.59	Flow (m3/s)	2.80	15.95	1.83
Top Width (m)	42.64	Top Width (m)	18.02	7.98	16.65
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.10	0.45	0.09
Max Chl Dpth (m)	4.91	Hydr. Depth (m)	1.54	4.41	1.27
Conv. Total (m3/s)	3380.5	Conv. (m3/s)	460.2	2619.3	301.0
Length Wtd. (m)	60.00	Wetted Per. (m)	19.39	8.35	17.26
Min Ch El (m)	194.83	Shear (N/m2)	0.52	1.53	0.44
Alpha	2.69	Stream Power (N/m s)	0.05	0.69	0.04
Frctn Loss (m)		Cum Volume (1000 m3)	32.32	58.47	29.24
C & E Loss (m)		Cum SA (1000 m2)	34.12	21.79	

38.95

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.00	Element	Left OB	Channel	Right OB
Vel Head (m)	0.08	Wt. n-Val.	0.071	0.035	0.069
W.S. Elev (m)	200.91	Reach Len. (m)	60.00	60.00	60.00
Crit W.S. (m)	199.50	Flow Area (m2)	76.41	44.53	56.71
E.G. Slope (m/m)	0.000350	Area (m2)	76.41	44.53	56.71
Q Total (m3/s)	122.56	Flow (m3/s)	28.44	72.59	21.53
Top Width (m)	116.53	Top Width (m)	59.07	7.98	49.48
Vel Total (m/s)	0.69	Avg. Vel. (m/s)	0.37	1.63	0.38
Max Chl Dpth (m)	6.08	Hydr. Depth (m)	1.29	5.58	1.15
Conv. Total (m3/s)	6554.2	Conv. (m3/s)	1521.0	3881.9	1151.2
Length Wtd. (m)	60.00	Wetted Per. (m)	62.81	8.35	50.12
Min Ch El (m)	194.83	Shear (N/m2)	4.17	18.28	3.88
Alpha	3.43	Stream Power (N/m s)	1.55	29.80	1.47
Frctn Loss (m)		Cum Volume (1000 m3)	142.50	144.12	177.87
C & E Loss (m)		Cum SA (1000 m2)	76.89	21.79	104.71

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1415

INPUT
Description: Hum 13-JJ. Private Driveway Culvert - 3.23 m W x 2.1 m H x 52 m L Corrugated Metal Pipe Arch Culvert. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004
by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.
Distance from Upstream XS = 5
Deck/Roadway Width = 52
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 76

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.501		9.03	201.276		10.69	201.235	
11.93	201.205		15.26	201.124		15.65	201.116	
17.33	201.085		18.3	201.067		21.82	201	
22.59	200.991		22.61	200.991		24.72	200.975	
26.52	200.961		27.55	200.966		33.24	200.845	
34.76	200.824		37.08	200.776		39.72	200.726	
44.95	200.557		45.1	200.554		54.53	200.18	
61.95	200		72.68	199.814		72.97	199.813	
73.26	199.813		73.34	199.813		76.99	199.789	
82.12	199.738		84.44	199.737		86.82	199.742	
87.45	199.733		88.14	199.722		88.29	199.72	
94.48	199.736		95.23	199.732		95.99	199.728	
96.52	199.728		97.04	199.728		97.15	199.728	
97.87	199.727		98.58	199.727		100.35	199.739	
106	199.685		107.51	199.675		109.42	199.671	
109.55	199.67		110.18	199.672		116.42	199.732	
116.58	199.736		116.81	199.741		117.04	199.746	
117.21	199.75		120.07	199.82		125.43	199.969	
126.11	199.987		126.2	199.988		126.71	200	
126.77	200.001		127.26	200.002		127.65	200.002	
133.77	200.118		138.89	200.206		139.11	200.209	
140.01	200.216		140.99	200.224		148.28	200.355	
148.4	200.357		153.83	200.495		154.42	200.496	
154.61	200.497		155.83	200.5		162.15	200.643	
176.54	201		177.09	201.017		191.23	201.5	
191.27	201.5							

Upstream Bridge Cross Section Data
Station Elevation Data num= 54

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.236	12.59	201	21	200.671	22.43	200.623	37.81	200
39.38	200	40.23	200	42.31	200.027	44.55	200.047	44.93	200.051
45.27	200.048	49.43	200	56.95	199.696	56.96	199.695	56.98	199.695
85.47	199.453	94.46	199	96.11	198.897	108.79	198	110.82	197.095
111.08	197	111.27	196.916	113.02	196	115.02	195.28	116.06	195
116.72	194.83	117.13	194.83	117.19	194.83	117.27	194.83	118.2	195
120.05	195.7	120.42	195.827	121	196	123.66	196.903	123.94	197
124.59	197.177	124.93	197.245	126.67	198	128.21	198.693	128.78	199
131.04	199.231	132.73	199.5	140.22	199.865	142.99	200	146.99	200.195
153.53	200.5	153.55	200.5	156.96	200.577	157.48	200.588	173.76	200.995
173.97	201	179.85	201.266	181.95	201.351	185.83	201.5		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	94.46	.08	113.02	.035	121	.08	142.99	.025

Bank Sta: Left Right Coeff Contr. Expan.
113.02 121 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	115.11	199.5	F
119.14	185.83	199.5	F

Left Levee Station= 44.93 Elevation= 200.051
Blocked Obstructions num= 1

Sta L	Sta R	Elev
56.98	96.11	204

Downstream Deck/Roadway Coordinates
num= 76

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord

0	201.501	9.03	201.276	10.69	201.235
11.93	201.205	15.26	201.124	15.65	201.116
17.33	201.085	18.3	201.067	21.82	201
22.59	200.991	22.61	200.991	24.72	200.975
26.52	200.961	27.55	200.966	33.24	200.845
34.76	200.824	37.08	200.776	39.72	200.726
44.95	200.557	45.1	200.554	54.53	200.18
61.95	200	72.68	199.814	72.97	199.813
73.26	199.813	73.34	199.813	76.99	199.789
82.12	199.738	84.44	199.737	86.82	199.742
87.45	199.733	88.14	199.722	88.29	199.72
94.48	199.736	95.23	199.732	95.99	199.728
96.52	199.728	97.04	199.728	97.15	199.728
97.87	199.727	98.58	199.727	100.35	199.739
106	199.685	107.51	199.675	109.42	199.671
109.55	199.67	110.18	199.672	116.42	199.732
116.58	199.736	116.81	199.741	117.04	199.746
117.21	199.75	120.07	199.82	125.43	199.969
126.11	199.987	126.2	199.988	126.71	200
126.77	200.001	127.26	200.002	127.65	200.002
133.77	200.118	138.89	200.206	139.11	200.209
140.01	200.216	140.99	200.224	148.28	200.355
148.4	200.357	153.83	200.495	154.42	200.496
154.61	200.497	155.83	200.5	162.15	200.643
176.54	201	177.09	201.017	191.23	201.5
191.27	201.5				

Downstream Bridge Cross Section Data
Station Elevation Data num= 102

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.964	2.43	201.92	2.94	201.91	3.53	201.894	4.38	201.869
5.84	201.802	10.38	201.593	13.97	201.399	14.53	201.37	16.68	201.262
16.97	201.25	18.86	201.161	21.88	201.012	22.13	201.011	23.05	201.004
26.53	201	27.47	200.995	28.29	200.997	28.76	200.997	28.82	200.997
29.15	200.996	33.62	200.993	33.7	200.993	37.58	200.533	37.75	200.516
37.79	200.514	38.56	200.515	42.31	200.545	48.93	200.615	49.07	200.618
50.33	200.646	50.39	200.649	61.33	200.328	70.12	200.012	72.92	200.006
73.26	200.005	73.27	200.005	73.46	200.005	73.47	200.004	78.8	200.01
78.81	200.01	80.68	200	84.14	199.945	85.98	199.929	88.28	199.936
92.02	199.995	93.24	199.991	94.47	199.996	95.37	200	97.6	200.002
98.34	200.002	99.45	200.003	100.7	200.002	101.57	200.001	102.44	200
103.62	199.631	105.8	199	106.7	198.73	108.53	198.229	108.84	198.134
109.24	198	109.55	197.899	109.76	197.822	111.11	197	111.52	196.37
111.75	196	111.95	195.708	112.46	195	117.89	194.823	120.59	194.823
122.27	194.884	125.1	195	126.97	195.253	128.35	195.435	132.42	195.983
132.63	195.986	132.82	196	134.16	196.531	134.6	196.682	135.45	197
135.58	197.071	137.13	198	137.6	198.204	137.71	198.254	139.23	199
140.32	199.45	141.61	200	146.06	200.194	161.96	200.967	165.01	200.972
168.03	200.99	169.39	200.999	169.49	201	169.5	201.001	169.55	201.001
170.18	201.005	170.26	201.005	170.49	201.006	172.16	201.006	179.97	201.133
180.44	201.14	194	201.345						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	105.8	.08	112.46	.035	125.1	.08	139.23	.025

Bank Sta: Left Right Coeff Contr. Expan.

Left	Right	Coeff Contr.	Expan.
112.46	125.1	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116.68	197	F
120.7	194	197	F

Left Levee Station= 50.33 Elevation= 200.65

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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     Pipe Arch     2.1    3.23
FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                 5      52     .024     .024        0                    .9
      1
Upstream   Elevation =  194.88
           Centerline Station =  117.13
Downstream Elevation =  194.82
           Centerline Station =  118.7

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      20.31    Culv Full Len (m)        52.00
  # Barrels                   1    Culv Vel US (m/s)         3.87
  Q Barrel (m3/s)          20.31    Culv Vel DS (m/s)         3.87
  E.G. US. (m)            199.75    Culv Inv El Up (m)      194.88
  W.S. US. (m)            199.74    Culv Inv El Dn (m)      194.82
  E.G. DS (m)             197.45    Culv Frctn Ls (m)         0.87
  W.S. DS (m)             197.43    Culv Exit Loss (m)        0.75
  Delta EG (m)              2.30    Culv Entr Loss (m)        0.69
  Delta WS (m)              2.31    Q Weir (m3/s)             0.28
  E.G. IC (m)             198.58    Weir Sta Lft (m)         96.11
  E.G. OC (m)             199.75    Weir Sta Rgt (m)        117.14
  Culvert Control         Outlet    Weir Submerg              0.00
  Culv WS Inlet (m)       196.98    Weir Max Depth (m)        0.08
  Culv WS Outlet (m)      196.92    Weir Avg Depth (m)        0.04
  Culv Nml Depth (m)                Weir Flow Area (m2)       0.88
  Culv Crt Depth (m)        1.65    Min El Weir Flow (m)    199.67


Warning: During the culvert inlet control computations, the program could not
balance the culvert/weir flow.  The reported
         inlet energy grade answer may not be valid.

CULVERT OUTPUT  Profile #Regional w red'n  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      19.10    Culv Full Len (m)        52.00
  # Barrels                   1    Culv Vel US (m/s)         3.64
  Q Barrel (m3/s)          19.10    Culv Vel DS (m/s)         3.64
  E.G. US. (m)            200.99    Culv Inv El Up (m)      194.88
  W.S. US. (m)            200.91    Culv Inv El Dn (m)      194.82
  E.G. DS (m)             199.10    Culv Frctn Ls (m)         0.77
  W.S. DS (m)             198.95    Culv Exit Loss (m)        0.52
  Delta EG (m)              1.89    Culv Entr Loss (m)        0.61
  Delta WS (m)              1.97    Q Weir (m3/s)           103.46
  E.G. IC (m)             200.94    Weir Sta Lft (m)         22.23
  E.G. OC (m)             200.99    Weir Sta Rgt (m)        173.77
  Culvert Control         Outlet    Weir Submerg              0.00
```

Culv WS Inlet (m)	196.98	Weir Max Depth (m)	1.33
Culv WS Outlet (m)	196.92	Weir Avg Depth (m)	0.67
Culv Nml Depth (m)		Weir Flow Area (m2)	75.53
Culv Crt Depth (m)	1.57	Min El Weir Flow (m)	199.67

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.141

INPUT
Description: Section 46.141 - Private Roadway - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 102

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.964	2.43	201.92	2.94	201.91	3.53	201.894	4.38	201.869
5.84	201.802	10.38	201.593	13.97	201.399	14.53	201.37	16.68	201.262
16.97	201.25	18.86	201.161	21.88	201.012	22.13	201.011	23.05	201.004
26.53	201	27.47	200.995	28.29	200.997	28.76	200.997	28.82	200.997
29.15	200.996	33.62	200.993	33.7	200.993	37.58	200.533	37.75	200.516
37.79	200.514	38.56	200.515	42.31	200.545	48.93	200.615	49.07	200.618
50.33	200.646	50.39	200.649	61.33	200.328	70.12	200.012	72.92	200.006
73.26	200.005	73.27	200.005	73.46	200.005	73.47	200.004	78.8	200.01
78.81	200.01	80.68	200	84.14	199.945	85.98	199.929	88.28	199.936
92.02	199.995	93.24	199.991	94.47	199.996	95.37	200	97.6	200.002
98.34	200.002	99.45	200.003	100.7	200.002	101.57	200.001	102.44	200
103.62	199.631	105.8	199	106.7	198.73	108.53	198.229	108.84	198.134
109.24	198	109.55	197.899	109.76	197.822	111.11	197	111.52	196.37
111.75	196	111.95	195.708	112.46	195	117.89	194.823	120.59	194.823
122.27	194.884	125.1	195	126.97	195.253	128.35	195.435	132.42	195.983
132.63	195.986	132.82	196	134.16	196.531	134.6	196.682	135.45	197
135.58	197.071	137.13	198	137.6	198.204	137.71	198.254	139.23	199
140.32	199.45	141.61	200	146.06	200.194	161.96	200.967	165.01	200.972
168.03	200.99	169.39	200.999	169.49	201	169.5	201.001	169.55	201.001
170.18	201.005	170.26	201.005	170.49	201.006	172.16	201.006	179.97	201.133
180.44	201.14	194	201.345						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	105.8	.08	112.46	.035	125.1	.08	139.23	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
112.46	125.1	30	25	20	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116.68	197	F
120.7	194	197	F

Left Levee Station= 50.33 Elevation= 200.65

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	197.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	197.43	Reach Len. (m)	30.00	25.00	20.00
Crit W.S. (m)	196.22	Flow Area (m2)	2.13	32.14	17.40
E.G. Slope (m/m)	0.000104	Area (m2)	2.13	32.14	

17.40					
Q Total (m3/s)	20.59	Flow (m3/s)	0.20	17.45	
2.93					
Top Width (m)	25.79	Top Width (m)	2.06	12.64	
11.09					
Vel Total (m/s)	0.40	Avg. Vel. (m/s)	0.10	0.54	
0.17					
Max Chl Dpth (m)	2.61	Hydr. Depth (m)	1.03	2.54	
1.57					
Conv. Total (m3/s)	2017.4	Conv. (m3/s)	20.0	1710.0	
287.3					
Length Wtd. (m)	24.73	Wetted Per. (m)	3.25	12.65	
11.46					
Min Ch El (m)	194.82	Shear (N/m2)	0.67	2.60	
1.55					
Alpha	1.60	Stream Power (N/m s)	0.06	1.41	
0.26					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	32.32	57.70	
29.24					
C & E Loss (m)	0.00	Cum SA (1000 m2)	33.52	21.17	
38.11					

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	199.10	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.15	Wt. n-Val.	0.080	0.035	
0.080					
W.S. Elev (m)	198.95	Reach Len. (m)	30.00	25.00	
20.00					
Crit W.S. (m)	197.00	Flow Area (m2)	8.15	51.27	
36.30					
E.G. Slope (m/m)	0.000693	Area (m2)	8.15	51.27	
36.30					
Q Total (m3/s)	122.56	Flow (m3/s)	2.73	98.06	
21.77					
Top Width (m)	33.15	Top Width (m)	6.49	12.64	
14.02					
Vel Total (m/s)	1.28	Avg. Vel. (m/s)	0.33	1.91	
0.60					
Max Chl Dpth (m)	4.12	Hydr. Depth (m)	1.26	4.06	
2.59					
Conv. Total (m3/s)	4654.5	Conv. (m3/s)	103.7	3724.1	
826.7					
Length Wtd. (m)	24.71	Wetted Per. (m)	7.94	12.65	
14.76					
Min Ch El (m)	194.82	Shear (N/m2)	6.98	27.57	
16.72					
Alpha	1.83	Stream Power (N/m s)	2.34	52.73	
10.03					
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	142.50	138.63	
177.87					
C & E Loss (m)	0.03	Cum SA (1000 m2)	74.93	21.17	
102.81					

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.14

INPUT
Description: Section 46.14 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 77

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.098	2.06	202	3.77	201.783	3.8	201.785	6.14	201.803
8.42	201.79	12.49	201.689	12.69	201.684	17.83	201.529	20.79	201.459
33.23	201.049	35.11	201.034	39.84	201.001	39.85	201.001	39.89	201.001
39.92	201.001	39.96	201.001	40.1	201	53.76	200.745	58.1	200.647
58.57	200.638	64.09	200.501	64.12	200.501	64.22	200.5	71.26	200.142
74.41	200	75.87	199.864	77.75	199.81	88.67	199.239	90.92	199.19
94.02	199.106	98.67	199.004	98.73	199.004	98.82	199.004	98.97	199.004
104.41	199	106.38	198.532	109.25	198	111.6	197.01	111.62	197
111.64	196.992	113.27	196.326	114.07	196	114.61	195.85	116.18	195.444
117.28	195	120.38	194.954	124.47	194.898	126.14	194.877	129.68	194.823
133.94	194.919	135.82	194.961	137.74	195	138.12	195.172	139.11	196
139.82	196.864	139.93	197	140.61	197.763	140.81	197.95	140.88	198
141	198.098	142.31	199	145.61	199.973	145.72	200	159.64	200.564
168.75	200.894	180.93	200.961	188.25	200.988	188.75	200.981	190	200.965
190.01	200.965	192.12	200.994	192.14	200.994	192.16	200.994	192.55	201
208.35	201.2341	216.71	201.358						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	104.41	.08	117.28	.035	137.74	.08	142.31	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
117.28	137.74	37.5	37.5	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
145.61	208.35	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	197.44	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	197.44	Reach Len. (m)	37.50	37.50	37.50
Crit W.S. (m)		Flow Area (m2)	8.58	51.63	3.58
E.G. Slope (m/m)	0.000050	Area (m2)	8.58	51.63	3.58
Q Total (m3/s)	20.59	Flow (m3/s)	0.86	19.41	0.32
Top Width (m)	29.73	Top Width (m)	6.69	20.46	2.58
Vel Total (m/s)	0.32	Avg. Vel. (m/s)	0.10	0.38	0.09
Max Chl Dpth (m)	2.61	Hydr. Depth (m)	1.28	2.52	1.39
Conv. Total (m3/s)	2899.4	Conv. (m3/s)	121.2	2733.6	44.6

Length Wtd. (m)	37.50	Wetted Per. (m)	7.13	20.46	3.58
Min Ch El (m)	194.82	Shear (N/m2)	0.59	1.25	0.49
Alpha	1.28	Stream Power (N/m s)	0.06	0.47	0.04
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	32.16	56.66	29.03
C & E Loss (m)	0.05	Cum SA (1000 m2)	33.39	20.76	37.98

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	199.06	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	198.97	Reach Len. (m)	37.50	37.50	37.50
Crit W.S. (m)		Flow Area (m2)	22.93	83.00	8.88
E.G. Slope (m/m)	0.000346	Area (m2)	22.93	83.00	8.88
Q Total (m3/s)	122.56	Flow (m3/s)	7.63	112.26	2.66
Top Width (m)	37.73	Top Width (m)	12.74	20.46	4.53
Vel Total (m/s)	1.07	Avg. Vel. (m/s)	0.33	1.35	0.30
Max Chl Dpth (m)	4.15	Hydr. Depth (m)	1.80	4.06	1.96
Conv. Total (m3/s)	6585.2	Conv. (m3/s)	410.2	6031.9	143.1
Length Wtd. (m)	37.50	Wetted Per. (m)	13.40	20.46	6.07
Min Ch El (m)	194.82	Shear (N/m2)	5.81	13.78	4.97
Alpha	1.48	Stream Power (N/m s)	1.94	18.64	1.49
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	142.03	136.95	177.42
C & E Loss (m)	0.05	Cum SA (1000 m2)	74.64	20.76	102.62

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: RIVER-1
REACH: Reach-1 RS: 46.132

INPUT
Description: Section 46.132 - Private Driveway - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 158

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203.031	4.21	203	6.29	202.04	6.39	202	6.47	201.973
9.02	201	11.19	200.218	11.79	200	11.95	199.995	12.11	199.991
13.73	199.942	14.44	199.957	15.58	200	22.02	200.459	23.3	200.5
23.73	200.501	23.84	200.501	23.88	200.501	24.1	200.505	27.21	200.56
39.78	200.546	43.86	200.559	45.36	200.616	45.59	200.618	46.09	200.615
60.3	200.512	60.52	200.5	67.58	200.314	71.78	200.282	75.54	200.281
75.73	200.287	78.77	200	79.96	199.843	80.54	199.765	86.79	199
91.14	198.248	92.76	198	92.82	197.999	92.88	197.999	93.81	197.998
94.59	197.998	95.38	197.998	96.45	197.998	97.49	197.997	103.13	197.995
104.78	197.997	105.78	197.996	106.85	197.997	107.61	198	112.33	198.851
112.89	199	113.63	199	115.71	199.001	116.33	199.001	118.64	199
119.62	198.642	121.42	198	123.03	197.538	125.2	197.319	125.59	197.265
126.04	197.198	126.29	197.179	126.45	197.149	126.85	197.083	127.29	197.085
127.33	197.08	127.37	197.076	127.89	197.013	129.85	197.011	129.95	197.01
130.35	197.01	132.11	197.014	132.3	197.012	133.91	197.011	134.07	197.009
134.24	197.009	134.44	197.009	134.47	197.009	135.58	197.018	136.75	197.007
136.96	197.005	136.98	197.005	137.16	197.005	137.18	197.005	138.6	197.011
138.83	197.009	139.36	197.005	139.64	197.003	139.73	197	140.03	196.913
140.21	196.887	140.28	196.867	140.33	196.854	140.58	196.76	141.61	196.467
141.72	196.455	143.1	196	143.4	195.948	145.84	195	146.14	194.87
146.23	194.823	146.44	194.865	147.11	195	147.76	195.231	149.57	196
150.75	196.979	150.78	197	150.81	197.022	151.68	198	152.7	198.573
153.48	199	153.61	199.01	158.04	199.446	163.24	199.854	164.21	199.935
164.49	199.957	164.51	199.958	165.41	199.996	165.46	199.999	165.53	200
165.55	200.004	165.69	200.013	165.92	200.013	166.1	200.023	167.24	200.039
167.72	200.033	168.11	200.078	168.16	200.077	168.21	200.076	168.33	200.077
170.66	200.113	172.93	200.103	175.92	200.024	175.95	200.023	177.95	200.045
177.96	200.044	177.97	200.043	177.97	200.042	188.98	200.112	192.6	200.049
195.25	200	195.28	200	196.41	200	197.16	200	197.45	200
197.5	200	200.28	200	201.07	200	201.93	200	202.05	200
213.45	200.076	216.09	200.093	218.17	200.105	219.59	200.114	220.81	200.121
221.65	200.128	222.07	200.132	227.76	200.187				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	139.73	.08	145.84	.035	147.11	.08	151.68	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
145.84	147.11	27.5	27.5	.3	.5

Left Levee Station= 118.64 Elevation= 199

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	197.38	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.54	Wt. n-Val.	0.080	0.035
0.080				
W.S. Elev (m)	196.84	Reach Len. (m)	27.50	27.50
27.50				
Crit W.S. (m)	196.84	Flow Area (m2)	4.72	2.45
3.76				

E.G. Slope (m/m)	0.010373	Area (m2)	4.72	2.45	3.76
Q Total (m3/s)	20.59	Flow (m3/s)	5.25	10.72	4.62
Top Width (m)	10.22	Top Width (m)	5.47	1.27	3.47
Vel Total (m/s)	1.88	Avg. Vel. (m/s)	1.11	4.38	1.23
Max Chl Dpth (m)	2.02	Hydr. Depth (m)	0.86	1.93	1.08
Conv. Total (m3/s)	202.2	Conv. (m3/s)	51.6	105.2	45.4
Length Wtd. (m)	27.50	Wetted Per. (m)	5.78	1.33	3.97
Min Ch El (m)	194.82	Shear (N/m2)	83.04	187.78	96.36
Alpha	3.00	Stream Power (N/m s)	92.33	822.29	118.32
Frctn Loss (m)	0.06	Cum Volume (1000 m3)	31.91	55.64	28.89
C & E Loss (m)	0.24	Cum SA (1000 m2)	33.16	20.35	37.86

Warning: The energy equation could not be 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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.97	Element	Left OB	Channel	Right OB
Vel Head (m)	0.61	Wt. n-Val.	0.061	0.035	0.080
W.S. Elev (m)	198.35	Reach Len. (m)	27.50	27.50	27.50
Crit W.S. (m)	198.35	Flow Area (m2)	36.11	4.37	10.17
E.G. Slope (m/m)	0.009790	Area (m2)	36.11	4.37	10.17
Q Total (m3/s)	122.56	Flow (m3/s)	76.73	27.32	18.52
Top Width (m)	31.87	Top Width (m)	25.40	1.27	5.19
Vel Total (m/s)	2.42	Avg. Vel. (m/s)	2.12	6.26	

1.82					
Max Chl Dpth (m)	3.53	Hydr. Depth (m)	1.42	3.44	
1.96					
Conv. Total (m3/s)	1238.7	Conv. (m3/s)	775.5	276.1	
187.1					
Length Wtd. (m)	27.50	Wetted Per. (m)	25.90	1.33	
6.29					
Min Ch El (m)	194.82	Shear (N/m2)	133.89	316.13	
155.28					
Alpha	2.06	Stream Power (N/m s)	284.46	1978.05	
282.66					
Frctn Loss (m)	0.07	Cum Volume (1000 m3)	140.93	135.31	
177.06					
C & E Loss (m)	0.25	Cum SA (1000 m2)	73.92	20.35	
102.44					

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 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: RIVER-1
REACH: Reach-1 RS: 46.13

INPUT
Description: Section 46.13 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 127

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203.03	.53	203	.96	202.775	2.6	202	4.3	201.009
4.31	201	4.46	200.95	7.15	200	9.26	199.922	13.37	199.838
14.21	199.82	16.49	199.886	21.16	199.987	21.18	200	21.39	200.001
21.4	200.001	21.83	200.002	29.6	200.151	34.56	200.228	35.93	200.238
37.21	200.246	37.34	200.247	39.62	200.26	42.15	200.288	44.35	200.296
46.4	200.303	51.59	200.321	52.9	200.324	54.35	200.328	55.76	200.33
57.13	200.323	58.65	200.312	59.48	200.303	60.41	200.293	60.51	200.291
60.64	200.291	60.78	200.29	60.92	200.29	61.05	200.289	62.88	200.27
65.13	200.241	68.92	200.17	71.75	200.101	75.66	200	75.68	200
76.81	199.771	77.55	199.623	80.95	199	83.24	198.448	85.09	198
86.6	197.995	87.61	197.991	98.22	197.954	101.88	197.965	111.06	198
112.99	198.592	115.45	198.783	118.53	198.292	118.71	198.22	118.81	198.215
119.38	198	122.2	197.044	122.33	197	122.49	196.957	126.05	196
126.98	195.7	127.15	195.657	128.79	195.261	129.74	195.021	129.84	195.018
129.93	195.011	129.96	195.01	130.02	195	131.97	194.859	144.15	194

145.77	193.62	148.15	193	148.36	192.929	148.69	192.82	149.6	192.963
149.87	193	150.14	193.206	150.99	194	151.39	194.702	151.52	195
151.69	195.371	152.08	196	152.24	196.027	152.47	196.039	152.56	196.043
152.62	196.045	152.67	196.044	152.68	196.044	152.79	196.042	152.82	196.041
152.98	196.035	154.35	196.467	155.01	196.685	155.45	196.85	155.58	196.893
155.62	196.908	155.76	196.973	155.82	197	155.89	197.042	157.56	198
161.85	198.688	163.59	199	164.11	199.021	168.85	199.177	171.26	199.182
173.88	199.243	176.15	199.295	177.78	199.33	179.26	199.361	183.65	199.389
188.79	199.423	194.86	199.511	194.9	199.511	201.21	199.575	206.07	199.623
222.21	200	223.15	200.01	223.53	200.01	223.62	200.01	223.66	200.01
224.17	200.01	236.77	200.272						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	119.38	.08	148.15	.035	149.87	.08	157.56	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
148.15	149.87	25	25	.1	.3

Left Levee Station= 115.45 Elevation= 198.783

Blocked Obstructions num= 1

Sta L	Sta R	Elev
171	229	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	195.74	Element	Left OB	Channel Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.080	0.035 0.080
W.S. Elev (m)	195.67	Reach Len. (m)	25.00	25.00 25.00
Crit W.S. (m)	194.77	Flow Area (m2)	26.30	4.75 3.20
E.G. Slope (m/m)	0.000918	Area (m2)	26.30	4.75 3.20
Q Total (m3/s)	20.59	Flow (m3/s)	11.46	7.97 1.17
Top Width (m)	24.79	Top Width (m)	21.07	1.72 2.01
Vel Total (m/s)	0.60	Avg. Vel. (m/s)	0.44	1.68 0.36
Max Chl Dpth (m)	2.85	Hydr. Depth (m)	1.25	2.76 1.59
Conv. Total (m3/s)	679.6	Conv. (m3/s)	378.2	262.9 38.5
Length Wtd. (m)	25.00	Wetted Per. (m)	21.31	1.76 3.40
Min Ch El (m)	192.82	Shear (N/m2)	11.11	24.26 8.48
Alpha	3.32	Stream Power (N/m s)	4.84	40.67 3.08
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	31.48	55.54 28.80
C & E Loss (m)	0.01	Cum SA (1000 m2)	32.80	20.31 37.79

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.50	Element	Left OB	Channel	Right OB
Vel Head (m)	0.12	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	198.38	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)	196.37	Flow Area (m2)	95.68	9.40	18.58
E.G. Slope (m/m)	0.001047	Area (m2)	95.68	9.40	18.58
Q Total (m3/s)	122.56	Flow (m3/s)	84.80	26.54	11.23
Top Width (m)	41.93	Top Width (m)	30.16	1.72	10.05
Vel Total (m/s)	0.99	Avg. Vel. (m/s)	0.89	2.82	0.60
Max Chl Dpth (m)	5.56	Hydr. Depth (m)	3.17	5.47	1.85
Conv. Total (m3/s)	3787.8	Conv. (m3/s)	2620.7	820.1	347.0
Length Wtd. (m)	25.00	Wetted Per. (m)	30.81	1.76	12.08
Min Ch El (m)	192.82	Shear (N/m2)	31.89	54.76	15.79
Alpha	2.34	Stream Power (N/m s)	28.26	154.56	9.54
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	139.11	135.12	176.67
C & E Loss (m)	0.00	Cum SA (1000 m2)	73.16	20.31	102.23

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.122

INPUT
Description: Section 46.122 - Peelar Road - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 153

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203.853	.23	203.855	.93	203.865	1.01	203.866	2.78	203.939
3.03	203.939	3.37	203.951	3.73	203.964	5.01	203.946	5.31	203.936
5.61	203.945	6.98	204	8.21	203.442	9.46	203	9.88	202.784
11.44	202	13.15	201.154	13.44	201	14.01	200.722	15.52	200
17.01	199.481	18.02	199	20.35	198.365	21.48	198.229	22.2	198.229
22.48	198.242	22.55	198.253	23.36	198.361	25.19	198.587	26.16	198.662
26.31	198.67	26.95	198.656	27.03	198.655	28	198.645	29.49	198.666
32.66	198.758	32.85	198.766	33.38	198.788	36.68	199	43.6	199.165
43.64	199.166	44.06	199.173	44.1	199.174	45.22	199.23	45.29	199.233
49.48	199.327	54.88	199.38	58.89	199.448	59.82	199.441	62.67	199.521
66.36	199.453	67.01	199.441	68.92	199.378	69.47	199.357	72.61	199.214
73.37	199.196	73.56	199.181	74.94	199	75.77	198.822	76.04	198.77
77.37	198.575	78.16	198.426	78.34	198.376	78.46	198.351	79.57	198
79.94	197.998	80.59	197.996	83.89	197.984	85.16	197.985	85.23	197.984

85.29	197.984	86.24	197.981	86.6	197.98	86.93	197.981	86.99	197.981
92.12	197.978	92.67	197.975	93.8	197.973	96.51	197.968	109.87	197.327
112.55	197.295	123.04	197.978	123.43	197.979	124.91	197.982	126.71	197.996
126.79	197.996	127.47	198	130.8	198	132.4	198	133.05	198
133.1	198	133.26	198	134.36	198	135.44	198	135.67	198
136.01	198	136.06	198	136.92	198	136.94	198	138.2	197.725
141.43	197	143.11	196.356	143.45	196.246	143.63	196.196	144.35	196
145.45	195.701	148.42	195	151.6	194.377	153.04	194	154.48	193.345
154.54	193.311	155.34	193	155.73	192.919	157.65	192.63	159.49	192.987
159.52	193	159.55	193.013	161.56	194	162.02	194.215	163.58	195
164.59	195.492	165.53	196	165.88	196.23	167.15	197	169.04	197.525
170.01	198	170.48	198.005	171.29	198.01	171.61	198.012	176.33	198.211
181.2	198.381	185.45	198.603	188.51	198.84	190.44	198.995	190.51	199
192.15	199.001	192.24	199.001	192.28	199.001	192.41	199.001	192.81	199.001
194.2	199.001	195.83	199.001	195.94	199.001	196.05	199.001	200.13	199.042
211.06	199.149	222.84	199.423	229.22	199.464	230.38	199.482	231.47	199.497
235.25	199.523	240.57	199.568	242.89	199.629				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	155.34	.035	159.52	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
155.34	159.52	38	38	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	155.42	196.7	F
159.34	242.89	196.7	F

Left Levee Station= 136.92 Elevation= 198

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	195.70	Element	Left OB	Channel	Right OB
Vel Head (m)	0.19	Wt. n-Val.		0.035	
W.S. Elev (m)	195.50	Reach Len. (m)	38.00	38.00	38.00
Crit W.S. (m)	194.21	Flow Area (m2)		10.61	
E.G. Slope (m/m)	0.001248	Area (m2)	9.67	11.27	6.39
Q Total (m3/s)	20.59	Flow (m3/s)		20.59	
Top Width (m)	18.32	Top Width (m)	9.05	4.18	5.09
Vel Total (m/s)	1.94	Avg. Vel. (m/s)		1.94	
Max Chl Dpth (m)	2.87	Hydr. Depth (m)		2.71	
Conv. Total (m3/s)	582.8	Conv. (m3/s)		582.8	
Length Wtd. (m)	38.00	Wetted Per. (m)		3.98	
Min Ch El (m)	192.63	Shear (N/m2)		32.62	
Alpha	1.00	Stream Power (N/m s)		63.31	
Frctn Loss (m)		Cum Volume (1000 m3)	31.03	55.34	28.68
C & E Loss (m)		Cum SA (1000 m2)	32.42	20.24	37.70

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.47	Element	Left OB	Channel	Right OB
Vel Head (m)	0.16	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	198.31	Reach Len. (m)	38.00	38.00	38.00
Crit W.S. (m)	196.70	Flow Area (m2)	78.09	23.01	30.08
E.G. Slope (m/m)	0.000790	Area (m2)	78.09	23.01	30.08
Q Total (m3/s)	122.56	Flow (m3/s)	44.00	57.01	21.55
Top Width (m)	102.88	Top Width (m)	78.97	4.18	19.73
Vel Total (m/s)	0.93	Avg. Vel. (m/s)	0.56	2.48	0.72
Max Chl Dpth (m)	5.68	Hydr. Depth (m)	0.99	5.50	1.52
Conv. Total (m3/s)	4359.4	Conv. (m3/s)	1564.9	2027.9	766.6
Length Wtd. (m)	38.00	Wetted Per. (m)	79.79	4.25	20.90
Min Ch El (m)	192.63	Shear (N/m2)	7.59	42.00	11.15
Alpha	3.51	Stream Power (N/m s)	4.27	104.06	7.99
Frctn Loss (m)		Cum Volume (1000 m3)	136.94	134.72	176.06
C & E Loss (m)		Cum SA (1000 m2)	71.80	20.24	101.86

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1215

INPUT
Description: Hum 13-3R. Peelar Road Culvert - 3.72 m W x 2.35 m H x 30 m L Corrugated Metal Pipe Arch Culvert. No drawings available. Size estimated from HEC-2 coding.

HEC-2 to HEC-RAS conversion
January 2004 by Acres included recoding of culvert to HEC-RAS format, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 3
Deck/Roadway Width = 30

Weir Coefficient = 1.4

Upstream Deck/Roadway Coordinates

num= 157

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	198.649		1.52	198.401		2.47	198	
2.8	198		2.85	198		3.5	198	
3.74	198		4.59	198		13.86	198	
15.45	198		15.74	198		17.17	198	
18.02	197.999		19.18	197.875		22.99	197.861	
24.53	197.999		28.09	197.999		28.15	197.999	
28.28	197.999		28.43	197.999		28.64	197.999	
29.19	197.999		31.03	197.999		31.34	197.999	
32.15	197.999		32.89	197.999		34.84	197.999	
34.92	197.999		37.18	197.998		37.71	197.998	
38.66	197.998		41.94	197.997		43.56	197.997	
44.75	197.997		45.96	197.997		46.74	197.997	
49.78	197.996		50.07	197.995		52.53	197.995	
54.64	197.995		55.11	197.995		55.42	197.995	
55.76	197.995		57.94	197.995		59.43	197.994	
60.73	197.994		61.45	197.993		62	197.993	
64.12	197.992		64.22	197.992		64.28	197.992	
65.61	197.989		67.27	197.991		68.33	197.991	
71.97	197.999		72.26	198		73.27	198.017	
76.65	198.059		77.23	198.092		78.18	198.119	
80.03	198.063		81.1	198		81.68	197.998	
81.8	197.997		82.79	197.994		83.16	197.992	
83.96	197.989		86.33	197.985		91.22	197.968	
99.31	197.849		99.61	197.847		100.72	197.846	
105.6	197.845		107.24	197.851		115.83	197.928	
117.78	197.909		118.71	197.903		119.04	197.903	
119.4	197.899		121.59	197.885		122.03	197.885	
124.28	197.863		124.74	197.388		125.47	197.26	
125.59	197.264		125.6	197.264		127.02	197.214	
127.16	197.211		127.78	197.201		139.62	197	
140.18	196.992		140.89	196.988		141.46	196.989	
142	196.987		142.75	196.987		143.84	196.986	
143.94	196.986		150.74	196.962		158.29	196.957	
158.39	196.957		160.98	196.955		164.67	196.924	
165.88	196.912		167.31	196.935		168.65	196.948	
168.79	196.948		168.84	196.949		169.49	196.951	
170.16	196.951		171.53	196.952		172.2	196.956	
172.58	196.955		172.76	196.956		172.87	196.955	
172.93	196.955		174	196.962		174.57	196.956	
175.1	196.959		175.75	196.962		178.58	196.956	
180.14	196.971		182.32	196.983		182.65	196.984	
182.82	196.987		183.42	196.997		183.61	197	
186.18	197.165		192.25	197.667		192.7	197.681	
193.37	197.689		193.89	197.919		194.46	197.92	
195.12	197.925		196.24	197.935		198.9	197.945	
202.32	197.938		208.58	197.985		210.37	197.994	
210.52	198		211.83	198.115		211.87	198.116	
222.47	198.877		223.67	198.88		226.51	198.911	
228.79	198.924		230.7	198.93		232.45	198.935	
237.16	198.966		237.24	198.966		237.7	198.968	
238.12	198.971		239.89	198.978		239.96	198.978	
240.04	198.979		240.24	198.978		240.47	198.98	
240.87	199							

Upstream Bridge Cross Section Data

Station Elevation Data num= 153

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203.853	.23	203.855	.93	203.865	1.01	203.866	2.78	203.939
3.03	203.939	3.37	203.951	3.73	203.964	5.01	203.946	5.31	203.936

5.61	203.945	6.98	204	8.21	203.442	9.46	203	9.88	202.784
11.44	202	13.15	201.154	13.44	201	14.01	200.722	15.52	200
17.01	199.481	18.02	199	20.35	198.365	21.48	198.229	22.2	198.229
22.48	198.242	22.55	198.253	23.36	198.361	25.19	198.587	26.16	198.662
26.31	198.67	26.95	198.656	27.03	198.655	28	198.645	29.49	198.666
32.66	198.758	32.85	198.766	33.38	198.788	36.68	199	43.6	199.165
43.64	199.166	44.06	199.173	44.1	199.174	45.22	199.23	45.29	199.233
49.48	199.327	54.88	199.38	58.89	199.448	59.82	199.441	62.67	199.521
66.36	199.453	67.01	199.441	68.92	199.378	69.47	199.357	72.61	199.214
73.37	199.196	73.56	199.181	74.94	199	75.77	198.822	76.04	198.77
77.37	198.575	78.16	198.426	78.34	198.376	78.46	198.351	79.57	198
79.94	197.998	80.59	197.996	83.89	197.984	85.16	197.985	85.23	197.984
85.29	197.984	86.24	197.981	86.6	197.98	86.93	197.981	86.99	197.981
92.12	197.978	92.67	197.975	93.8	197.973	96.51	197.968	109.87	197.327
112.55	197.295	123.04	197.978	123.43	197.979	124.91	197.982	126.71	197.996
126.79	197.996	127.47	198	130.8	198	132.4	198	133.05	198
133.1	198	133.26	198	134.36	198	135.44	198	135.67	198
136.01	198	136.06	198	136.92	198	136.94	198	138.2	197.725
141.43	197	143.11	196.356	143.45	196.246	143.63	196.196	144.35	196
145.45	195.701	148.42	195	151.6	194.377	153.04	194	154.48	193.345
154.54	193.311	155.34	193	155.73	192.919	157.65	192.63	159.49	192.987
159.52	193	159.55	193.013	161.56	194	162.02	194.215	163.58	195
164.59	195.492	165.53	196	165.88	196.23	167.15	197	169.04	197.525
170.01	198	170.48	198.005	171.29	198.01	171.61	198.012	176.33	198.211
181.2	198.381	185.45	198.603	188.51	198.84	190.44	198.995	190.51	199
192.15	199.001	192.24	199.001	192.28	199.001	192.41	199.001	192.81	199.001
194.2	199.001	195.83	199.001	195.94	199.001	196.05	199.001	200.13	199.042
211.06	199.149	222.84	199.423	229.22	199.464	230.38	199.482	231.47	199.497
235.25	199.523	240.57	199.568	242.89	199.629				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	155.34	.035	159.52	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
155.34	159.52	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	155.42	196.7	F
159.34	242.89	196.7	F

Left Levee Station= 136.92 Elevation= 198

Downstream Deck/Roadway Coordinates

num= 157

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	198.649		1.52	198.401		2.47	198	
2.8	198		2.85	198		3.5	198	
3.74	198		4.59	198		13.86	198	
15.45	198		15.74	198		17.17	198	
18.02	197.999		19.18	197.875		22.99	197.861	
24.53	197.999		28.09	197.999		28.15	197.999	
28.28	197.999		28.43	197.999		28.64	197.999	
29.19	197.999		31.03	197.999		31.34	197.999	
32.15	197.999		32.89	197.999		34.84	197.999	
34.92	197.999		37.18	197.998		37.71	197.998	
38.66	197.998		41.94	197.997		43.56	197.997	
44.75	197.997		45.96	197.997		46.74	197.997	
49.78	197.996		50.07	197.995		52.53	197.995	
54.64	197.995		55.11	197.995		55.42	197.995	
55.76	197.995		57.94	197.995		59.43	197.994	
60.73	197.994		61.45	197.993		62	197.993	
64.12	197.992		64.22	197.992		64.28	197.992	
65.61	197.989		67.27	197.991		68.33	197.991	

71.97	197.999	72.26	198	73.27	198.017
76.65	198.059	77.23	198.092	78.18	198.119
80.03	198.063	81.1	198	81.68	197.998
81.8	197.997	82.79	197.994	83.16	197.992
83.96	197.989	86.33	197.985	91.22	197.968
99.31	197.849	99.61	197.847	100.72	197.846
105.6	197.845	107.24	197.851	115.83	197.928
117.78	197.909	118.71	197.903	119.04	197.903
119.4	197.899	121.59	197.885	122.03	197.885
124.28	197.863	124.74	197.388	125.47	197.26
125.59	197.264	125.6	197.264	127.02	197.214
127.16	197.211	127.78	197.201	139.62	197
140.18	196.992	140.89	196.988	141.46	196.989
142	196.987	142.75	196.987	143.84	196.986
143.94	196.986	150.74	196.962	158.29	196.957
158.39	196.957	160.98	196.955	164.67	196.924
165.88	196.912	167.31	196.935	168.65	196.948
168.79	196.948	168.84	196.949	169.49	196.951
170.16	196.951	171.53	196.952	172.2	196.956
172.58	196.955	172.76	196.956	172.87	196.955
172.93	196.955	174	196.962	174.57	196.956
175.1	196.959	175.75	196.962	178.58	196.956
180.14	196.971	182.32	196.983	182.65	196.984
182.82	196.987	183.42	196.997	183.61	197
186.18	197.165	192.25	197.667	192.7	197.681
193.37	197.689	193.89	197.919	194.46	197.92
195.12	197.925	196.24	197.935	198.9	197.945
202.32	197.938	208.58	197.985	210.37	197.994
210.52	198	211.83	198.115	211.87	198.116
222.47	198.877	223.67	198.88	226.51	198.911
228.79	198.924	230.7	198.93	232.45	198.935
237.16	198.966	237.24	198.966	237.7	198.968
238.12	198.971	239.89	198.978	239.96	198.978
240.04	198.979	240.24	198.978	240.47	198.98
240.87	199				

Downstream Bridge Cross Section Data
Station Elevation Data num= 193

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.116	.09	201.103	.16	201.086	2.46	201.134	2.97	201
4.37	200.471	4.61	200.366	5.6	200.081	5.84	200	5.96	199.911
5.99	199.908	6.02	199.896	6.07	199.878	6.15	199.835	7.19	199.231
7.68	199	8.13	198.755	8.5	198.631	8.62	198.603	9.26	198.509
9.72	198.47	10.14	198.456	10.23	198.452	10.32	198.448	11.96	198.458
17.93	198.627	18.79	198.683	20.17	198.853	21.45	198.905	21.67	198.908
22.9	198.868	23.49	198.882	23.72	198.871	24.78	198.788	24.93	198.787
28.22	198.487	32.27	198.564	32.41	198.559	32.55	198.553	32.7	198.554
34.55	198.443	36.02	198.405	47.41	198.657	48.15	198.664	48.64	198.668
48.8	198.663	49	198.655	56.83	198.515	56.94	198.515	57.21	198.506
57.47	198.5	59.64	198.564	60.7	198.535	64.04	198.604	69.34	198.85
70.1	198.861	70.3	198.882	70.32	198.882	71.57	199	74.15	199
75.35	199	76.07	199	76.75	199	77.12	199	78.35	199
79.35	199	79.82	199	81.11	199	81.15	199	81.23	199
81.33	199	81.52	199	84.17	199	85.18	199	86.83	199
86.9	199	86.98	199	91.42	199	92.96	199	96.93	199
97.22	199	97.61	199	98.45	199	98.47	199	98.92	199
99.22	199	101.39	199	102.08	199	102.12	199	102.14	199
103.01	199	103.02	199	106.1	198.877	110.03	198.634	110.07	198.631
110.12	198.629	110.16	198.627	112.11	198.13	112.47	198.125	114.53	198.075
115.89	198.061	116.61	198.058	116.85	198.054	117.55	198.032	119.12	198
121.6	197.696	125.61	197.384	130.31	197	130.42	196.977	131.19	196.835
134.73	196.198	135.06	196.126	135.92	196	136.57	195.912	137.53	195.823
137.73	195.805	139.61	195.582	141.72	195.474	142.72	195.431	142.83	195.423

```
  146.3     195  146.85 194.937  146.93 194.922   147.7 194.851  147.91 194.818
 150.84 194.094  151.01  194.05  151.08 194.036  151.14 194.027  151.23     194
 151.49  193.87  152.54 193.041   152.6     193  152.61 192.999  152.94 192.956
 153.08 192.961  153.39 192.841  153.59 192.827  154.01     192  154.29 191.839
 154.31 191.823  154.36 191.841   154.5 191.889  154.85     192  155.27 192.599
 155.43 192.632  156.55 192.853   157.2 192.963  157.33     193  157.71   193.1
 157.92 193.149  158.07 193.188  158.44 193.273   159.2  193.41  159.73 193.495
 161.66     194  161.73 194.024   162.6 194.305  162.76 194.371   163.8     195
  164.8 195.636  165.37     196  166.09 196.414     167     197  168.71  197.76
 169.29     198   170.4 198.016  170.43 198.017  170.57 198.018  172.02 198.031
 174.94 198.052  176.13  198.07  176.47 198.141  179.95 198.291  191.32 198.853
 196.68     199  198.11 199.013  201.12 199.029  202.88 199.024  217.21 199.414
 218.54 199.448  219.63 199.477  219.66 199.478  219.79 199.484  219.93 199.488
 227.87 199.454  235.99 199.769  237.56 199.797   238.2   199.8  238.42 199.808
 238.61 199.813  239.21 199.826  239.73 199.834

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   152.6    .035  157.33     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
         152.6  157.33            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   152.9  196.51       F
  156.88  239.73  196.51       F
Left Levee      Station=  103.02      Elevation=     199

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     Pipe Arch    2.35    3.72
FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                 3      30     .024     .024        0                   .9
      1
Upstream   Elevation =  192.63
           Centerline Station =  157.4
Downstream Elevation =  192.37
           Centerline Station =  154.9

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      20.59    Culv Full Len (m)
  # Barrels                   1    Culv Vel US (m/s)        3.64
  Q Barrel (m3/s)          20.59    Culv Vel DS (m/s)        4.09
  E.G. US. (m)            195.70    Culv Inv El Up (m)      192.63
  W.S. US. (m)            195.50    Culv Inv El Dn (m)      192.37
  E.G. DS (m)             194.62    Culv Frctn Ls (m)         0.00
  W.S. DS (m)             193.92    Culv Exit Loss (m)        0.16
  Delta EG (m)              1.08    Culv Entr Loss (m)        0.61
  Delta WS (m)              1.58    Q Weir (m3/s)
```

E.G. IC (m)	195.55	Weir Sta Lft (m)	
E.G. OC (m)	195.70	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	194.41	Weir Max Depth (m)	
Culv WS Outlet (m)	193.92	Weir Avg Depth (m)	
Culv Nml Depth (m)	1.90	Weir Flow Area (m2)	
Culv Crt Depth (m)	1.53	Min El Weir Flow (m)	196.92

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	10.85	Culv Full Len (m)	30.00
# Barrels	1	Culv Vel US (m/s)	1.62
Q Barrel (m3/s)	10.85	Culv Vel DS (m/s)	1.62
E.G. US. (m)	198.47	Culv Inv El Up (m)	192.63
W.S. US. (m)	198.31	Culv Inv El Dn (m)	192.37
E.G. DS (m)	198.23	Culv Frctn Ls (m)	0.07
W.S. DS (m)	198.14	Culv Exit Loss (m)	0.04
Delta EG (m)	0.24	Culv Entr Loss (m)	0.12
Delta WS (m)	0.17	Q Weir (m3/s)	111.71
E.G. IC (m)	198.34	Weir Sta Lft (m)	19.96
E.G. OC (m)	198.47	Weir Sta Rgt (m)	182.92
Culvert Control	Outlet	Weir Submerg	0.64
Culv WS Inlet (m)	194.98	Weir Max Depth (m)	1.56
Culv WS Outlet (m)	194.72	Weir Avg Depth (m)	0.74
Culv Nml Depth (m)		Weir Flow Area (m2)	80.97
Culv Crt Depth (m)	1.08	Min El Weir Flow (m)	196.92

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.121

INPUT
Description: Section 46.121 - Peelar Road - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 193

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.116	.09	201.103	.16	201.086	2.46	201.134	2.97	201
4.37	200.471	4.61	200.366	5.6	200.081	5.84	200	5.96	199.911
5.99	199.908	6.02	199.896	6.07	199.878	6.15	199.835	7.19	199.231
7.68	199	8.13	198.755	8.5	198.631	8.62	198.603	9.26	198.509
9.72	198.47	10.14	198.456	10.23	198.452	10.32	198.448	11.96	198.458
17.93	198.627	18.79	198.683	20.17	198.853	21.45	198.905	21.67	198.908
22.9	198.868	23.49	198.882	23.72	198.871	24.78	198.788	24.93	198.787
28.22	198.487	32.27	198.564	32.41	198.559	32.55	198.553	32.7	198.554
34.55	198.443	36.02	198.405	47.41	198.657	48.15	198.664	48.64	198.668
48.8	198.663	49	198.655	56.83	198.515	56.94	198.515	57.21	198.506
57.47	198.5	59.64	198.564	60.7	198.535	64.04	198.604	69.34	198.85
70.1	198.861	70.3	198.882	70.32	198.882	71.57	199	74.15	199
75.35	199	76.07	199	76.75	199	77.12	199	78.35	199
79.35	199	79.82	199	81.11	199	81.15	199	81.23	199
81.33	199	81.52	199	84.17	199	85.18	199	86.83	199
86.9	199	86.98	199	91.42	199	92.96	199	96.93	199
97.22	199	97.61	199	98.45	199	98.47	199	98.92	199
99.22	199	101.39	199	102.08	199	102.12	199	102.14	199
103.01	199	103.02	199	106.1	198.877	110.03	198.634	110.07	198.631
110.12	198.629	110.16	198.627	112.11	198.13	112.47	198.125	114.53	198.075
115.89	198.061	116.61	198.058	116.85	198.054	117.55	198.032	119.12	198
121.6	197.696	125.61	197.384	130.31	197	130.42	196.977	131.19	196.835
134.73	196.198	135.06	196.126	135.92	196	136.57	195.912	137.53	195.823

```
  137.73 195.805  139.61 195.582  141.72 195.474  142.72 195.431  142.83 195.423
   146.3     195  146.85 194.937  146.93 194.922   147.7 194.851  147.91 194.818
  150.84 194.094  151.01  194.05  151.08 194.036  151.14 194.027  151.23     194
  151.49  193.87  152.54 193.041   152.6     193  152.61 192.999  152.94 192.956
  153.08 192.961  153.39 192.841  153.59 192.827  154.01     192  154.29 191.839
  154.31 191.823  154.36 191.841   154.5 191.889  154.85     192  155.27 192.599
  155.43 192.632  156.55 192.853   157.2 192.963  157.33     193  157.71   193.1
  157.92 193.149  158.07 193.188  158.44 193.273   159.2  193.41  159.73 193.495
  161.66     194  161.73 194.024   162.6 194.305  162.76 194.371   163.8     195
   164.8 195.636  165.37     196  166.09 196.414     167     197  168.71  197.76
  169.29     198   170.4 198.016  170.43 198.017  170.57 198.018  172.02 198.031
  174.94 198.052  176.13  198.07  176.47 198.141  179.95 198.291  191.32 198.853
  196.68     199  198.11 199.013  201.12 199.029  202.88 199.024  217.21 199.414
  218.54 199.448  219.63 199.477  219.66 199.478  219.79 199.484  219.93 199.488
  227.87 199.454  235.99 199.769  237.56 199.797   238.2   199.8  238.42 199.808
  238.61 199.813  239.21 199.826  239.73 199.834

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   152.6    .035  157.33     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         152.6  157.33                20      20      20             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   152.9  196.51       F
  156.88  239.73  196.51       F
Left Levee      Station=  103.02      Elevation=     199

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           194.62    Element                 Left OB    Channel
Right OB
  Vel Head (m)              0.69    Wt. n-Val.                          0.035

  W.S. Elev (m)           193.92    Reach Len. (m)           20.00      20.00
20.00
  Crit W.S. (m)           193.92    Flow Area (m2)                       5.58

  E.G. Slope (m/m)      0.014163    Area (m2)                 0.54       6.30
1.90
  Q Total (m3/s)            20.59   Flow (m3/s)                         20.59

  Top Width (m)             9.97    Top Width (m)             1.21       4.73
4.03
  Vel Total (m/s)           3.69    Avg. Vel. (m/s)                      3.69

  Max Chl Dpth (m)          2.10    Hydr. Depth (m)                      1.40

  Conv. Total (m3/s)       173.0    Conv. (m3/s)                        173.0

  Length Wtd. (m)           20.00   Wetted Per. (m)                      4.93

  Min Ch El (m)           191.82    Shear (N/m2)                        157.14

  Alpha                     1.00    Stream Power (N/m s)                580.15

  Frctn Loss (m)            0.24    Cum Volume (1000 m3)     31.03      55.08
28.68
  C & E Loss (m)            0.15    Cum SA (1000 m2)         32.22      20.07
37.53
```

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 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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.23	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	198.14	Reach Len. (m)	20.00	20.00	20.00
Crit W.S. (m)	196.51	Flow Area (m2)	68.57	26.25	37.11
E.G. Slope (m/m)	0.000574	Area (m2)	68.57	26.25	37.11
Q Total (m3/s)	122.56	Flow (m3/s)	46.17	49.79	26.60
Top Width (m)	64.38	Top Width (m)	40.52	4.73	19.13
Vel Total (m/s)	0.93	Avg. Vel. (m/s)	0.67	1.90	0.72
Max Chl Dpth (m)	6.32	Hydr. Depth (m)	1.69	5.55	1.94
Conv. Total (m3/s)	5115.7	Conv. (m3/s)	1927.2	2078.2	1110.4
Length Wtd. (m)	20.00	Wetted Per. (m)	41.16	5.69	20.27
Min Ch El (m)	191.82	Shear (N/m2)	9.38	25.96	10.30
Alpha	2.02	Stream Power (N/m s)	6.31	49.24	7.39
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	136.94	131.43	176.06
C & E Loss (m)	0.03	Cum SA (1000 m2)	69.53	20.07	101.12

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: RIVER-1
REACH: Reach-1 RS: 46.12

INPUT
Description: Section 46.12 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 121

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204.017	.64	204	1.57	203.584	2.88	203	4.16	202.234
4.52	202	5.56	201.407	6.37	201	10.22	201	14.03	201
15.11	201.341	17.03	201.774	17.39	201.08	19.08	201.047	20.72	201
24.05	200.087	24.34	200	25.06	199.958	40.15	199.007	40.26	199.007
42.43	199.003	42.76	199.003	45.21	199.27	45.36	199.272	47	199.255
47.99	199.251	57.78	199.012	58.42	199.012	60	199.011	66.24	199
66.68	199	66.83	199	67.45	199	68.32	199	70.6	199
78.32	199	82.38	198.38	85.31	198	86.68	197.459	88	197
88.9	197	89.01	197	89.06	197	89.47	197	90.05	197
90.13	197	90.19	197	92.58	197	93.92	197	95.28	197
98.06	197	98.16	197	98.96	197	104.19	196.364	106.24	196.391
109.27	196	109.29	195.994	109.82	195.992	109.83	195.992	110.07	195.99
110.19	195.988	111.79	195.978	112.9	195.816	112.97	195.809	116.66	195.626
117.36	195.562	117.5	195.552	118.97	195.46	120.07	195.413	121.94	195.336
125.09	195	127.14	194.798	128.66	194.593	128.86	194.565	129.9	194.436
130.12	194.409	133.39	194	134.46	193.993	134.62	193.992	134.65	193.992
134.67	193.992	136.01	193.914	142.87	193.531	143.04	193.525	143.27	193.512
144.35	193.401	148.02	193	149.07	192.548	150.54	192	150.66	191.955
150.99	191.823	151.13	191.883	151.39	192	153.89	192.96	154.01	193
154.32	193.077	156.61	193.626	157.62	193.852	158.11	194	159.55	194.326
162.27	195	164.16	195.858	164.18	195.863	164.2	195.868	164.23	195.877
164.52	196	165.52	196.466	165.69	196.535	166.77	196.945	166.9	197
167	197.043	168.84	198	179.75	198.43	194.54	199	199.89	199.172
218.12	199.701	222.85	199.836	227.56	199.963	228.52	200	228.56	200
228.84	200								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	148.02	.035	154.01	.05

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
148.02 154.01 35 38 40 .1 .3
Left Levee Station= 45.21 Elevation= 199.27

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	193.92	Element	Left OB	Channel	Right OB
Vel Head (m)	0.40	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	193.51	Reach Len. (m)	35.00	38.00	40.00
Crit W.S. (m)	193.51	Flow Area (m2)	1.22	6.62	0.55
E.G. Slope (m/m)	0.009935	Area (m2)	1.22	6.62	0.55
Q Total (m3/s)	20.59	Flow (m3/s)	0.97	19.19	0.43
Top Width (m)	12.93	Top Width (m)	4.80	5.99	2.14
Vel Total (m/s)	2.46	Avg. Vel. (m/s)	0.80	2.90	0.79
Max Chl Dpth (m)	1.69	Hydr. Depth (m)	0.25	1.10	0.26

Conv. Total (m3/s)	206.6	Conv. (m3/s)	9.7	192.5	4.3
Length Wtd. (m)	37.95	Wetted Per. (m)	4.83	6.44	2.20
Min Ch El (m)	191.82	Shear (N/m2)	24.55	100.14	24.27
Alpha	1.31	Stream Power (N/m s)	19.52	290.43	19.16
Frctn Loss (m)	0.15	Cum Volume (1000 m3)	31.02	54.95	28.65
C & E Loss (m)	0.07	Cum SA (1000 m2)	32.16	19.96	37.46

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 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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.19	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	198.17	Reach Len. (m)	35.00	38.00	40.00
Crit W.S. (m)	194.95	Flow Area (m2)	170.19	34.50	46.06
E.G. Slope (m/m)	0.000121	Area (m2)	170.19	34.50	46.06
Q Total (m3/s)	122.56	Flow (m3/s)	71.65	33.24	17.68
Top Width (m)	89.13	Top Width (m)	64.02	5.99	19.13
Vel Total (m/s)	0.49	Avg. Vel. (m/s)	0.42	0.96	0.38
Max Chl Dpth (m)	6.35	Hydr. Depth (m)	2.66	5.76	2.41
Conv. Total (m3/s)	11128.4	Conv. (m3/s)	6505.3	3018.1	1605.0
Length Wtd. (m)	37.26	Wetted Per. (m)	64.42	6.44	20.03
Min Ch El (m)	191.82	Shear (N/m2)	3.14	6.37	2.74
Alpha	1.58	Stream Power (N/m s)	1.32	6.14	1.05
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	134.55	130.82	175.23

C & E Loss (m)	0.05	Cum SA (1000 m2)	68.48	19.96	100.74

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.

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.11

INPUT
Description: Station 46.11 - Highway 407 - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 157

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204.194	7.42	204	8.35	203.615	9.72	203	10.51	202.654
11.9	202	13.52	201.278	13.79	201.12	14.04	201	14.65	200.732
16.39	200	19.18	199.003	19.19	199	19.21	199	19.73	199
20.17	199	20.27	199	21.54	199.137	21.57	199.136	22.93	199.296
27.45	199.348	31.63	199.351	31.74	199.347	35.8	199.168	40.37	199.056
40.58	199.048	41.65	199	41.8	199	43.05	199	44.74	199
45.85	199	51.4	198.797	51.94	198.785	52.27	198.776	52.69	198.777
53.03	198.784	53.16	198.787	53.2	198.788	53.37	198.79	53.4	198.791
61.25	199	65.25	199	67.89	199	69.57	199	71.3	199
72.99	198.774	81.96	199	82.48	199	82.91	199	87.13	199
87.27	199	89.8	199.348	92.33	199.42	92.43	199.422	92.63	199.428
92.82	199.435	93.33	199.424	96.19	199	96.38	199	96.8	199
96.94	199	97.06	198.997	97.07	198.997	97.08	198.997	97.09	198.997
97.3	198.997	98.11	198.973	108.25	198.335	110.22	198.302	111.36	198.277
114.19	198.195	116.72	198.145	119.02	198.024	119.8	198.022	120.85	198.023
124.59	198.036	124.96	198.033	126.47	198.02	128.17	198.004	128.71	198.001
128.74	198	129.24	197.91	129.28	197.902	129.33	197.895	131.38	197.515
132.26	197.384	132.42	197.378	134.55	197.078	134.78	197.085	136.08	197.005
136.09	197.005	136.2	197	137.94	196.567	140.2	196	140.31	195.965
140.65	195.808	142.27	195.002	142.28	195	142.86	194.747	143.59	194.559
143.95	194.432	145.52	194	147.05	193.476	147.49	193.353	148.41	193
149.22	192.702	149.63	192.585	149.8	192	150	191.725	153.14	191.725
153.57	191.725	156	191.725	156.2	192	156.84	193	157.12	193.11
157.35	193.215	158.69	194	160.15	194.705	160.84	195	161.92	195.417
163.52	196	165.53	196.656	166.54	197	169.15	197.405	171.98	197.769
172.73	197.841	173.74	198	174.74	198.01	174.77	198.01	175.33	198.016
176.17	198.026	176.63	198.028	178.63	198.05	178.89	198.05	193.15	198.522
195.72	198.556	198.31	198.69	202.36	198.883	204.46	199	222.27	199.574
235.58	200	245.55	200.352	249	200.514	250.09	200.573	255.18	200.87
257.13	200.961	257.34	200.963	257.9	200.992	261.45	200.989	261.74	200.99
264.23	200.975	264.53	200.978	266.78	200.994	266.87	201	268.79	201.048
272.01	201.138	283.95	201.338						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	149.8	.035	156.2	.05

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

```
        149.8   156.2             235     235     235            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   149.5  200.65       F
   156.5  283.95   200.5       F
Left Levee      Station=   92.82      Elevation= 199.435

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           193.64    Element                Left OB    Channel
Right OB
  Vel Head (m)              0.16    Wt. n-Val.              0.050      0.035
0.050
  W.S. Elev (m)           193.48    Reach Len. (m)         235.00     235.00
235.00
  Crit W.S. (m)           192.75    Flow Area (m2)           0.32      11.17
0.37
  E.G. Slope (m/m)      0.002016    Area (m2)                1.36      11.17
0.88
  Q Total (m3/s)            20.59   Flow (m3/s)              0.16      20.17
0.26
  Top Width (m)             10.76   Top Width (m)            2.76       6.40
1.60
  Vel Total (m/s)           1.74    Avg. Vel. (m/s)          0.51       1.81
0.69
  Max Chl Dpth (m)          1.75    Hydr. Depth (m)          1.05       1.74
1.24
  Conv. Total (m3/s)       458.6    Conv. (m3/s)              3.6      449.3
5.7
  Length Wtd. (m)         235.00    Wetted Per. (m)          0.74       6.68
0.56
  Min Ch El (m)           191.73    Shear (N/m2)             8.37      33.04
13.26
  Alpha                     1.06    Stream Power (N/m s)     4.24      59.70
9.12
  Frctn Loss (m)                    Cum Volume (1000 m3)    30.97      54.61
28.63
  C & E Loss (m)                    Cum SA (1000 m2)        32.03      19.73
37.39


Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #Regional w red'n


  E.G. Elev (m)           198.13    Element                Left OB    Channel
Right OB
  Vel Head (m)              0.49    Wt. n-Val.              0.050      0.035
0.050
  W.S. Elev (m)           197.64    Reach Len. (m)         235.00     235.00
235.00
  Crit W.S. (m)           195.01    Flow Area (m2)           1.56      37.83
1.62
  E.G. Slope (m/m)      0.001191    Area (m2)               40.24      37.83
28.33
  Q Total (m3/s)           122.56   Flow (m3/s)              1.77     118.50
2.29
  Top Width (m)             40.33   Top Width (m)           19.12       6.40
14.81
```

Vel Total (m/s)	2.99	Avg. Vel. (m/s)	1.13	3.13	1.41
Max Chl Dpth (m)	5.92	Hydr. Depth (m)	5.22	5.91	5.41
Conv. Total (m3/s)	3551.8	Conv. (m3/s)	51.4	3434.2	66.3
Length Wtd. (m)	235.00	Wetted Per. (m)	0.74	6.68	0.56
Min Ch El (m)	191.73	Shear (N/m2)	24.55	66.13	34.06
Alpha	1.07	Stream Power (N/m s)	27.80	207.16	47.99
Frctn Loss (m)		Cum Volume (1000 m3)	130.87	129.45	173.74
C & E Loss (m)		Cum SA (1000 m2)	67.03	19.73	100.06

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1015

INPUT
Description: Hum 13-2R. Highway 407 Culvert - 6.0 m W x 4.3 m H x 215 m L Concrete Box Culvert. Drawings by MTO (WP 140-87-08, Sheet 76, 1993) used to code in new culvert not previously coded in HEC-2.

HEC-2 to HEC-RAS conversion January 2004 by Acres
included coding of culvert to HEC-RAS format, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 12
Deck/Roadway Width = 215
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 146

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	204.208		4.75	204.007		4.97	204.007	
5.27	204.006		5.82	204.006		6.46	204.006	
7.86	204.005		8.62	204.005		8.71	204.005	
8.78	204.005		15.85	204.005		16.29	204.005	
17.76	204.004		17.9	204.004		18.19	204.004	
18.94	204.004		19.1	204.004		19.28	204.004	
20.12	204.004		21.34	204.004		21.76	204.004	
23.12	204.003		23.2	204.003		23.24	204.003	
23.33	204.003		23.38	204.003		23.44	204.003	
23.71	204.003		26.02	204.003		26.83	204.003	
28.53	204.003		34.85	204.001		37.83	204	
37.89	204		37.96	204		37.98	204	
38.02	204		43.02	203.56		47.14	203.538	
50.92	203.25		56.58	203.216		56.61	203.216	
56.64	203.216		56.83	203.213		57.93	203.201	
60.55	203.159		62.45	203.15		64.39	203.13	
64.6	203.129		64.76	203.127		69.02	203.102	
72.02	203.093		74.17	203.074		74.23	203.074	
75.29	203.068		75.83	203.062		76.16	203.061	
76.51	203.057		76.78	203.053		83.95	203	

84.95	202.936	85.88	202.932	86.17	202.919
91.34	202.663	92.19	202.66	93.67	202.607
93.81	202.601	95.31	202.52	102.69	202.429
106.82	202.107	109.74	202.092	114.1	202.071
117.19	202.043	117.24	202.043	117.39	202.042
117.45	202.041	118.91	202.033	121.76	202
126.9	201.626	135.34	201.601	138.96	201.498
146.46	201.017	146.74	201.017	147.02	201.017
147.32	201.017	148.59	201.016	150.04	201.016
150.78	201.016	152	201.015	152.08	201.014
152.54	201.014	153.09	201.014	153.16	201.014
157.65	201.014	158.63	201.014	159.79	201.014
159.86	201.014	159.95	201.014	163.62	201.013
167.46	201.011	171.93	201.294	176.54	201.237
179.73	201.007	180.03	201.007	180.13	201.007
182.08	201.007	183.45	201.007	196.02	201.006
199.93	201.005	200.98	201.005	201.21	201.005
203.84	201.005	219.13	201.005	223.98	201.005
224.97	201.005	225.02	201.005	225.67	201.005
226.17	201.005	226.62	201.005	226.68	201.005
228.24	201.005	228.93	201.005	238.94	201.006
244.81	201.005	246.52	201.005	249.44	201.005
251.75	201.154	255.03	201.173	256.62	201.006
259.78	201.005	260.65	201.005	262.23	201.005
262.29	201.005	262.38	201.005	265.7	201.004
265.92	201.004	266.14	201.004	266.66	201.004
268.21	201.004	270.47	201.004	270.83	201.004
271.72	201.005	271.99	201.005	272.99	201.005
279.13	201.004	279.54	201.004		

Upstream Bridge Cross Section Data
Station Elevation Data num= 157

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204.194	7.42	204	8.35	203.615	9.72	203	10.51	202.654
11.9	202	13.52	201.278	13.79	201.12	14.04	201	14.65	200.732
16.39	200	19.18	199.003	19.19	199	19.21	199	19.73	199
20.17	199	20.27	199	21.54	199.137	21.57	199.136	22.93	199.296
27.45	199.348	31.63	199.351	31.74	199.347	35.8	199.168	40.37	199.056
40.58	199.048	41.65	199	41.8	199	43.05	199	44.74	199
45.85	199	51.4	198.797	51.94	198.785	52.27	198.776	52.69	198.777
53.03	198.784	53.16	198.787	53.2	198.788	53.37	198.79	53.4	198.791
61.25	199	65.25	199	67.89	199	69.57	199	71.3	199
72.99	198.774	81.96	199	82.48	199	82.91	199	87.13	199
87.27	199	89.8	199.348	92.33	199.42	92.43	199.422	92.63	199.428
92.82	199.435	93.33	199.424	96.19	199	96.38	199	96.8	199
96.94	199	97.06	198.997	97.07	198.997	97.08	198.997	97.09	198.997
97.3	198.997	98.11	198.973	108.25	198.335	110.22	198.302	111.36	198.277
114.19	198.195	116.72	198.145	119.02	198.024	119.8	198.022	120.85	198.023
124.59	198.036	124.96	198.033	126.47	198.02	128.17	198.004	128.71	198.001
128.74	198	129.24	197.91	129.28	197.902	129.33	197.895	131.38	197.515
132.26	197.384	132.42	197.378	134.55	197.078	134.78	197.085	136.08	197.005
136.09	197.005	136.2	197	137.94	196.567	140.2	196	140.31	195.965
140.65	195.808	142.27	195.002	142.28	195	142.86	194.747	143.59	194.559
143.95	194.432	145.52	194	147.05	193.476	147.49	193.353	148.41	193
149.22	192.702	149.63	192.585	149.8	192	150	191.725	153.14	191.725
153.57	191.725	156	191.725	156.2	192	156.84	193	157.12	193.11
157.35	193.215	158.69	194	160.15	194.705	160.84	195	161.92	195.417
163.52	196	165.53	196.656	166.54	197	169.15	197.405	171.98	197.769
172.73	197.841	173.74	198	174.74	198.01	174.77	198.01	175.33	198.016
176.17	198.026	176.63	198.028	178.63	198.05	178.89	198.05	193.15	198.522
195.72	198.556	198.31	198.69	202.36	198.883	204.46	199	222.27	199.574
235.58	200	245.55	200.352	249	200.514	250.09	200.573	255.18	200.87
257.13	200.961	257.34	200.963	257.9	200.992	261.45	200.989	261.74	200.99

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  264.23 200.975  264.53 200.978  266.78 200.994  266.87     201  268.79 201.048
  272.01 201.138  283.95 201.338

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   149.8    .035   156.2     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
         149.8   156.2             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   149.5  200.65       F
   156.5  283.95   200.5       F
Left Levee      Station=   92.82      Elevation= 199.435

Downstream  Deck/Roadway Coordinates
    num=     146
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0 204.208            4.75 204.007            4.97 204.007
    5.27 204.006            5.82 204.006            6.46 204.006
    7.86 204.005            8.62 204.005            8.71 204.005
    8.78 204.005           15.85 204.005           16.29 204.005
   17.76 204.004            17.9 204.004           18.19 204.004
   18.94 204.004            19.1 204.004           19.28 204.004
   20.12 204.004           21.34 204.004           21.76 204.004
   23.12 204.003            23.2 204.003           23.24 204.003
   23.33 204.003           23.38 204.003           23.44 204.003
   23.71 204.003           26.02 204.003           26.83 204.003
   28.53 204.003           34.85 204.001           37.83     204
   37.89     204           37.96     204           37.98     204
   38.02     204           43.02  203.56           47.14 203.538
   50.92  203.25           56.58 203.216           56.61 203.216
   56.64 203.216           56.83 203.213           57.93 203.201
   60.55 203.159           62.45  203.15           64.39  203.13
    64.6 203.129           64.76 203.127           69.02 203.102
   72.02 203.093           74.17 203.074           74.23 203.074
   75.29 203.068           75.83 203.062           76.16 203.061
   76.51 203.057           76.78 203.053           83.95     203
   84.95 202.936           85.88 202.932           86.17 202.919
   91.34 202.663           92.19  202.66           93.67 202.607
   93.81 202.601           95.31  202.52          102.69 202.429
  106.82 202.107          109.74 202.092           114.1 202.071
  117.19 202.043          117.24 202.043          117.39 202.042
  117.45 202.041          118.91 202.033          121.76     202
   126.9 201.626          135.34 201.601          138.96 201.498
  146.46 201.017          146.74 201.017          147.02 201.017
  147.32 201.017          148.59 201.016          150.04 201.016
  150.78 201.016             152 201.015          152.08 201.014
  152.54 201.014          153.09 201.014          153.16 201.014
  157.65 201.014          158.63 201.014          159.79 201.014
  159.86 201.014          159.95 201.014          163.62 201.013
  167.46 201.011          171.93 201.294          176.54 201.237
  179.73 201.007          180.03 201.007          180.13 201.007
  182.08 201.007          183.45 201.007          196.02 201.006
  199.93 201.005          200.98 201.005          201.21 201.005
  203.84 201.005          219.13 201.005          223.98 201.005
  224.97 201.005          225.02 201.005          225.67 201.005
  226.17 201.005          226.62 201.005          226.68 201.005
  228.24 201.005          228.93 201.005          238.94 201.006
  244.81 201.005          246.52 201.005          249.44 201.005
  251.75 201.154          255.03 201.173          256.62 201.006
  259.78 201.005          260.65 201.005          262.23 201.005
  262.29 201.005          262.38 201.005           265.7 201.004
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265.92	201.004	266.14	201.004	266.66	201.004				
268.21	201.004	270.47	201.004	270.83	201.004				
271.72	201.005	271.99	201.005	272.99	201.005				
279.13	201.004	279.54	201.004						

Downstream Bridge Cross Section Data
Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.016	1.7	202.008	3.31	202	6.36	201.056	6.55	201
9.56	200.072	9.81	200	10.8	199.702	11.4	199.711	13.91	199.257
20.78	199.071	21.41	199.041	21.73	199.035	22.13	199.012	28.32	199.055
30.43	199.043	30.53	199.043	30.61	199	34.33	198.39	36.83	198
38.26	197.761	38.91	197.735	42.59	197.626	45.28	197.715	49.27	197.928
49.51	197.912	49.64	197.913	50.24	198	54.26	198.904	54.69	199
55.54	199.006	55.6	199.007	56.47	199.015	56.56	199.016	58.01	199.028
58.36	199.031	64.08	199.075	66.11	199.058	71.53	199.016	73.74	199
78.09	198.205	79.43	198	80.3	197.717	82.64	197	84.16	196.504
85.78	196	87.38	195.494	88.82	195	90.55	194.411	91.82	194
93.73	193.361	95.06	193	96.61	192.832	96.99	192.821	97.75	192.766
99.02	192.647	104.34	192.001	104.36	192.001	104.39	192	107.5	192
108	191.6	114	191.6	114.5	192	116.67	192	119.53	192.809
120.23	193	120.93	193.226	123.26	194	125.52	194.789	126.17	195
129.05	195.811	130	196	130.82	196.156	134.81	197	136.27	197.006
139.91	197.009	140.26	197.01	149.58	197.28	159.19	197.543	159.78	197.568
160.61	197.581	161.67	197.609	161.81	197.612	162.94	197.638	163.7	197.652
169.85	197.681	172.35	197.776	174.11	197.816	175.39	197.838	176.32	197.837
176.8	197.835	177.83	197.831	178.38	197.827	178.95	197.822	180.79	197.795
184.91	197.765	186.04	197.738	186.65	197.724	187.33	197.708	192.06	197.647
192.56	197.637	195.08	197.575	199.98	197.49	201.37	197.459	203.14	197.409
207.72	197.255	214.28	197.01	214.52	197	219.09	196.443	220.61	196.279
221.92	196.225	229.69	196.45	231.97	196.372	232.71	196.357	233.41	196.345
235.42	196.321	237.27	196.318	238.24	196.334	239.43	196.362	242.98	196.554
248.74	196.965	250.8	197						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	107.5	.035	114.5	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
107.5	114.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	107.5	200	F
114.5	250.8	200	F

Left Levee Station= 64.08 Elevation= 199.075
Right Levee Station= 175.39 Elevation= 197.838

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	4.3	6

FHWA Chart # 58- Rectangular concrete
FHWA Scale # 2 - Side tapered; More favorable edges
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef

```
Exit Loss Coef
                12     215     .015     .015        0                    .5
      1
Upstream   Elevation =  191.725
           Centerline Station =  153
Downstream Elevation =  191.6
           Centerline Station =  111
```

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	20.59	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	2.24
Q Barrel (m3/s)	20.59	Culv Vel DS (m/s)	3.23
E.G. US. (m)	193.64	Culv Inv El Up (m)	191.73
W.S. US. (m)	193.48	Culv Inv El Dn (m)	191.60
E.G. DS (m)	193.07	Culv Frctn Ls (m)	0.00
W.S. DS (m)	192.59	Culv Exit Loss (m)	0.13
Delta EG (m)	0.57	Culv Entr Loss (m)	0.13
Delta WS (m)	0.89	Q Weir (m3/s)	
E.G. IC (m)	193.62	Weir Sta Lft (m)	
E.G. OC (m)	193.64	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	193.26	Weir Max Depth (m)	
Culv WS Outlet (m)	192.66	Weir Avg Depth (m)	
Culv Nml Depth (m)	1.92	Weir Flow Area (m2)	
Culv Crt Depth (m)	1.06	Min El Weir Flow (m)	201.01

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	122.56	Culv Full Len (m)	119.53
# Barrels	1	Culv Vel US (m/s)	4.75
Q Barrel (m3/s)	122.56	Culv Vel DS (m/s)	5.85
E.G. US. (m)	198.13	Culv Inv El Up (m)	191.73
W.S. US. (m)	197.64	Culv Inv El Dn (m)	191.60
E.G. DS (m)	196.35	Culv Frctn Ls (m)	0.45
W.S. DS (m)	194.78	Culv Exit Loss (m)	0.48
Delta EG (m)	1.78	Culv Entr Loss (m)	0.58
Delta WS (m)	2.86	Q Weir (m3/s)	
E.G. IC (m)	198.26	Weir Sta Lft (m)	
E.G. OC (m)	198.13	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	196.03	Weir Max Depth (m)	
Culv WS Outlet (m)	195.09	Weir Avg Depth (m)	
Culv Nml Depth (m)	4.30	Weir Flow Area (m2)	
Culv Crt Depth (m)	3.49	Min El Weir Flow (m)	201.01

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.
Note: During supercritical analysis, the culvert direct step method went to critical depth. The program then assumed
       critical depth at the outlet.
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: 46.10

INPUT
Description: Station 46.10 - Highway 407 - D/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.016	1.7	202.008	3.31	202	6.36	201.056	6.55	201
9.56	200.072	9.81	200	10.8	199.702	11.4	199.711	13.91	199.257
20.78	199.071	21.41	199.041	21.73	199.035	22.13	199.012	28.32	199.055
30.43	199.043	30.53	199.043	30.61	199	34.33	198.39	36.83	198
38.26	197.761	38.91	197.735	42.59	197.626	45.28	197.715	49.27	197.928
49.51	197.912	49.64	197.913	50.24	198	54.26	198.904	54.69	199
55.54	199.006	55.6	199.007	56.47	199.015	56.56	199.016	58.01	199.028
58.36	199.031	64.08	199.075	66.11	199.058	71.53	199.016	73.74	199
78.09	198.205	79.43	198	80.3	197.717	82.64	197	84.16	196.504
85.78	196	87.38	195.494	88.82	195	90.55	194.411	91.82	194
93.73	193.361	95.06	193	96.61	192.832	96.99	192.821	97.75	192.766
99.02	192.647	104.34	192.001	104.36	192.001	104.39	192	107.5	192
108	191.6	114	191.6	114.5	192	116.67	192	119.53	192.809
120.23	193	120.93	193.226	123.26	194	125.52	194.789	126.17	195
129.05	195.811	130	196	130.82	196.156	134.81	197	136.27	197.006
139.91	197.009	140.26	197.01	149.58	197.28	159.19	197.543	159.78	197.568
160.61	197.581	161.67	197.609	161.81	197.612	162.94	197.638	163.7	197.652
169.85	197.681	172.35	197.776	174.11	197.816	175.39	197.838	176.32	197.837
176.8	197.835	177.83	197.831	178.38	197.827	178.95	197.822	180.79	197.795
184.91	197.765	186.04	197.738	186.65	197.724	187.33	197.708	192.06	197.647
192.56	197.637	195.08	197.575	199.98	197.49	201.37	197.459	203.14	197.409
207.72	197.255	214.28	197.01	214.52	197	219.09	196.443	220.61	196.279
221.92	196.225	229.69	196.45	231.97	196.372	232.71	196.357	233.41	196.345
235.42	196.321	237.27	196.318	238.24	196.334	239.43	196.362	242.98	196.554
248.74	196.965	250.8	197						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	107.5	.035	114.5	.05

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
107.5 114.5 130 200 160 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	107.5	200	F
114.5	250.8	200	F

Left Levee Station= 64.08 Elevation= 199.075
Right Levee Station= 175.39 Elevation= 197.838

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	193.07	Element	Left OB	Channel	Right OB
Vel Head (m)	0.48	Wt. n-Val.		0.035	
W.S. Elev (m)	192.59	Reach Len. (m)	130.00	200.00	160.00
Crit W.S. (m)	192.59	Flow Area (m2)		6.72	
E.G. Slope (m/m)	0.012821	Area (m2)	3.28	6.72	1.89
Q Total (m3/s)	20.59	Flow (m3/s)		20.59	

Top Width (m)	19.24	Top Width (m)	7.99	7.00	4.25
Vel Total (m/s)	3.07	Avg. Vel. (m/s)		3.07	
Max Chl Dpth (m)	0.99	Hydr. Depth (m)		0.96	
Conv. Total (m3/s)	181.8	Conv. (m3/s)		181.8	
Length Wtd. (m)	199.34	Wetted Per. (m)		7.28	
Min Ch El (m)	191.60	Shear (N/m2)		115.98	
Alpha	1.00	Stream Power (N/m s)		355.55	
Frctn Loss (m)	1.06	Cum Volume (1000 m3)	30.97	52.54	28.63
C & E Loss (m)	0.13	Cum SA (1000 m2)	30.77	18.15	36.70

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 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, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	196.35	Element	Left OB	Channel	Right OB
Vel Head (m)	1.57	Wt. n-Val.		0.035	
W.S. Elev (m)	194.78	Reach Len. (m)	130.00	200.00	160.00
Crit W.S. (m)	194.78	Flow Area (m2)		22.09	
E.G. Slope (m/m)	0.008591	Area (m2)	34.85	22.09	18.94
Q Total (m3/s)	122.56	Flow (m3/s)		122.56	
Top Width (m)	36.05	Top Width (m)	18.04	7.00	11.00
Vel Total (m/s)	5.55	Avg. Vel. (m/s)		5.55	
Max Chl Dpth (m)	3.18	Hydr. Depth (m)		3.16	
Conv. Total (m3/s)	1322.3	Conv. (m3/s)		1322.3	

Length Wtd. (m)	184.22	Wetted Per. (m)				7.28
Min Ch El (m)	191.60	Shear (N/m2)				255.57
Alpha	1.00	Stream Power (N/m s)				1418.26
Frctn Loss (m)	0.11	Cum Volume (1000 m3)	130.87	122.47	173.74	
C & E Loss (m)	0.77	Cum SA (1000 m2)	62.66	18.15	97.02	

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, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.09

INPUT
Description: Section 46.09 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	199.5	20	198	60	198	92	191	93	190
95	189	99	189	100	190	102	191	146	192
173	194	210	196	255	197				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	93	.035	100	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
93	100	80	95	125	.1 .3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	191.07	Element	Left OB	Channel	Right OB	
Vel Head (m)	0.22	Wt. n-Val.	0.050	0.035	0.050	
W.S. Elev (m)	190.85	Reach Len. (m)	80.00	95.00		

125.00					
Crit W.S. (m)		Flow Area (m2)	0.36	11.45	
0.72					
E.G. Slope (m/m)	0.003188	Area (m2)	0.36	11.45	
0.72					
Q Total (m3/s)	24.80	Flow (m3/s)	0.18	24.18	
0.43					
Top Width (m)	9.55	Top Width (m)	0.85	7.00	
1.70					
Vel Total (m/s)	1.98	Avg. Vel. (m/s)	0.51	2.11	
0.59					
Max Chl Dpth (m)	1.85	Hydr. Depth (m)	0.43	1.64	
0.43					
Conv. Total (m3/s)	439.2	Conv. (m3/s)	3.2	428.3	
7.6					
Length Wtd. (m)	95.20	Wetted Per. (m)	1.20	7.65	
1.90					
Min Ch El (m)	189.00	Shear (N/m2)	9.40	46.80	
11.89					
Alpha	1.11	Stream Power (N/m s)	4.77	98.81	
7.05					
Frctn Loss (m)	0.21	Cum Volume (1000 m3)	30.73	50.72	
28.42					
C & E Loss (m)	0.02	Cum SA (1000 m2)	30.19	16.75	
36.23					

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	194.31	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	
0.050					
W.S. Elev (m)	194.28	Reach Len. (m)	80.00	95.00	
125.00					
Crit W.S. (m)		Flow Area (m2)	28.44	35.49	
165.48					
E.G. Slope (m/m)	0.000218	Area (m2)	28.44	35.49	
165.48					
Q Total (m3/s)	133.76	Flow (m3/s)	11.93	41.61	
80.23					
Top Width (m)	101.27	Top Width (m)	16.01	7.00	
78.25					
Vel Total (m/s)	0.58	Avg. Vel. (m/s)	0.42	1.17	
0.48					
Max Chl Dpth (m)	5.28	Hydr. Depth (m)	1.78	5.07	
2.11					
Conv. Total (m3/s)	9065.7	Conv. (m3/s)	808.3	2820.1	
5437.3					
Length Wtd. (m)	115.54	Wetted Per. (m)	16.78	7.65	
78.58					
Min Ch El (m)	189.00	Shear (N/m2)	3.62	9.90	
4.50					
Alpha	1.72	Stream Power (N/m s)	1.52	11.61	
2.18					
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	126.76	116.71	
158.99					
C & E Loss (m)	0.01	Cum SA (1000 m2)	60.44	16.75	
89.88					

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: RIVER-1
REACH: Reach-1 RS: 46.082

INPUT
Description: Section 46.082 - Jane Steet - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	196	50	195	94	194	116	192	122	189
123	188.7	129	188.7	129.5	189	132	189.5	175	190
192	191	220	192	225	193	267	194	300	195

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	122	.035	129.5	.05

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
122 129.5 75 75 75 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	122.5	196.5	F
129.5	300	193.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	190.84	Element	Left OB	Channel	Right OB
Vel Head (m)	0.17	Wt. n-Val.		0.035	
W.S. Elev (m)	190.68	Reach Len. (m)	75.00	75.00	75.00
Crit W.S. (m)	189.80	Flow Area (m2)		13.72	
E.G. Slope (m/m)	0.001663	Area (m2)	2.81	14.60	47.27
Q Total (m3/s)	24.80	Flow (m3/s)		24.80	
Top Width (m)	67.85	Top Width (m)	3.35	7.50	56.99
Vel Total (m/s)	1.81	Avg. Vel. (m/s)		1.81	
Max Chl Dpth (m)	1.98	Hydr. Depth (m)		1.96	
Conv. Total (m3/s)	607.9	Conv. (m3/s)		607.9	
Length Wtd. (m)	75.00	Wetted Per. (m)		7.11	
Min Ch El (m)	188.70	Shear (N/m2)		31.50	
Alpha	1.00	Stream Power (N/m s)		56.93	
Frctn Loss (m)		Cum Volume (1000 m3)	30.61	49.48	25.42
C & E Loss (m)		Cum SA (1000 m2)	30.03	16.06	

32.56

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	194.30	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.035	0.050
W.S. Elev (m)	194.29	Reach Len. (m)	75.00	75.00	75.00
Crit W.S. (m)	192.06	Flow Area (m2)		39.01	393.75
E.G. Slope (m/m)	0.000051	Area (m2)	52.93	41.70	393.75
Q Total (m3/s)	133.76	Flow (m3/s)		24.89	108.87
Top Width (m)	195.26	Top Width (m)	40.72	7.50	147.04
Vel Total (m/s)	0.31	Avg. Vel. (m/s)		0.64	0.28
Max Chl Dpth (m)	5.59	Hydr. Depth (m)		5.57	2.68
Conv. Total (m3/s)	18640.6	Conv. (m3/s)		3469.1	15171.5
Length Wtd. (m)	75.00	Wetted Per. (m)		7.11	147.25
Min Ch El (m)	188.70	Shear (N/m2)		2.77	1.35
Alpha	1.44	Stream Power (N/m s)		1.77	0.37
Frctn Loss (m)		Cum Volume (1000 m3)	123.50	113.05	124.03
C & E Loss (m)		Cum SA (1000 m2)	58.18	16.06	75.80

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.0815

INPUT
Description: Hum 13-1R. Jane Street. 6.0 m W x 4.3 m H x 65 m L Concrete Box Culvert. Previous drawings by Ducan Hopper (1964) are out of date. Culvert modified as part of Highway 407, but no drawings available. Field observations used to update previous HEC-2 coding.

HEC-2 to HEC-RAS conversion January 2004 by Acres
included recoding of culvert to HEC-RAS format, including adjustments to roadway coding and hydraulic loss coefficients.
Distance from Upstream XS = 5

Deck/Roadway Width = 65
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 5

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	200		126	196.5		235	193.5	
267	194		300	195				

Upstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	196	50	195	94	194	116	192	122	189
123	188.7	129	188.7	129.5	189	132	189.5	175	190
192	191	220	192	225	193	267	194	300	195

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	122	.035	129.5	.05

Bank Sta: Left Right Coeff Contr. Expan.
122 129.5 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	122.5	196.5	F
129.5	300	193.5	F

Downstream Deck/Roadway Coordinates
num= 5

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	200		126	196.5		235	193.5	
267	194		300	195				

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	196	50	195	94	194	116	192	122	189
123	188.7	129	188.7	129.5	189	132	189.5	175	190
192	191	220	192	225	193	267	194	300	195

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	122	.035	129.5	.08	225	.05

Bank Sta: Left Right Coeff Contr. Expan.
122 129.5 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	122.5	196.5	F
129.5	300	191.8	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 = 193.5
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	4.3	6

FHWA Chart # 58- Rectangular concrete

FHWA Scale # 2 - Side tapered; More favorable edges
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	5	65	.015	.015	0	.5	1

Upstream Elevation = 188.7
Centerline Station = 126
Downstream Elevation = 188.7
Centerline Station = 126

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	24.80	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	2.57
Q Barrel (m3/s)	24.80	Culv Vel DS (m/s)	3.02
E.G. US. (m)	190.84	Culv Inv El Up (m)	188.70
W.S. US. (m)	190.68	Culv Inv El Dn (m)	188.70
E.G. DS (m)	190.42	Culv Frctn Ls (m)	0.00
W.S. DS (m)	190.07	Culv Exit Loss (m)	0.12
Delta EG (m)	0.43	Culv Entr Loss (m)	0.20
Delta WS (m)	0.61	Q Weir (m3/s)	
E.G. IC (m)	190.84	Weir Sta Lft (m)	
E.G. OC (m)	190.81	Weir Sta Rgt (m)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (m)	190.31	Weir Max Depth (m)	
Culv WS Outlet (m)	190.07	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	1.20	Min El Weir Flow (m)	193.50

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	104.27	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	4.54
Q Barrel (m3/s)	104.27	Culv Vel DS (m/s)	5.54
E.G. US. (m)	194.30	Culv Inv El Up (m)	188.70
W.S. US. (m)	194.29	Culv Inv El Dn (m)	188.70
E.G. DS (m)	191.93	Culv Frctn Ls (m)	0.06
W.S. DS (m)	191.80	Culv Exit Loss (m)	1.47
Delta EG (m)	2.37	Culv Entr Loss (m)	0.72
Delta WS (m)	2.49	Q Weir (m3/s)	29.50
E.G. IC (m)	194.30	Weir Sta Lft (m)	205.90
E.G. OC (m)	194.25	Weir Sta Rgt (m)	276.93
Culvert Control	Inlet	Weir Submerg	0.00
Culv WS Inlet (m)	192.53	Weir Max Depth (m)	0.80
Culv WS Outlet (m)	191.83	Weir Avg Depth (m)	0.43
Culv Nml Depth (m)		Weir Flow Area (m2)	30.77
Culv Crt Depth (m)	3.13	Min El Weir Flow (m)	193.50

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.081

INPUT
Description: Section 46.081 - Jane Steet - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	196	50	195	94	194	116	192	122	189

123	188.7	129	188.7	129.5	189	132	189.5	175	190
192	191	220	192	225	193	267	194	300	195

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	122	.035	129.5	.08	225	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
122	129.5	185	175	145	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	122.5	196.5	F
129.5	300	191.8	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	190.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.		0.035	
W.S. Elev (m)	190.07	Reach Len. (m)	185.00	175.00	145.00
Crit W.S. (m)	189.80	Flow Area (m2)		9.46	
E.G. Slope (m/m)	0.005752	Area (m2)	1.14	10.03	15.71
Q Total (m3/s)	24.80	Flow (m3/s)		24.80	
Top Width (m)	56.27	Top Width (m)	2.13	7.50	46.64
Vel Total (m/s)	2.62	Avg. Vel. (m/s)		2.62	
Max Chl Dpth (m)	1.37	Hydr. Depth (m)		1.35	
Conv. Total (m3/s)	326.9	Conv. (m3/s)		326.9	
Length Wtd. (m)	166.20	Wetted Per. (m)		7.11	
Min Ch El (m)	188.70	Shear (N/m2)		75.07	
Alpha	1.00	Stream Power (N/m s)		196.84	
Frctn Loss (m)	1.19	Cum Volume (1000 m3)	30.61	48.52	25.42
C & E Loss (m)	0.11	Cum SA (1000 m2)	29.82	15.50	28.67

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.93	Element	Left OB	Channel	

Right OB					
Vel Head (m)	0.13	Wt. n-Val.		0.035	0.080
W.S. Elev (m)	191.80	Reach Len. (m)	185.00	175.00	145.00
Crit W.S. (m)	191.80	Flow Area (m2)		21.59	125.59
E.G. Slope (m/m)	0.001613	Area (m2)	7.84	23.03	125.59
Q Total (m3/s)	133.76	Flow (m3/s)		51.97	81.79
Top Width (m)	98.00	Top Width (m)	5.60	7.50	84.90
Vel Total (m/s)	0.91	Avg. Vel. (m/s)		2.41	0.65
Max Chl Dpth (m)	3.10	Hydr. Depth (m)		3.08	1.48
Conv. Total (m3/s)	3330.5	Conv. (m3/s)		1294.0	2036.5
Length Wtd. (m)	155.29	Wetted Per. (m)		7.11	85.00
Min Ch El (m)	188.70	Shear (N/m2)		48.07	23.37
Alpha	3.04	Stream Power (N/m s)		115.71	15.22
Frctn Loss (m)	0.24	Cum Volume (1000 m3)	123.50	106.93	124.03
C & E Loss (m)	0.04	Cum SA (1000 m2)	56.44	15.50	67.10

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.07

INPUT
Description: Section 46.07 - J.D. Barnes 2003 topo mapping
Section 46.06
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	193	15	190	20	189	24	188	25	188
25	187.7	27	187.7	27	188	30	188	64	189
70	190	102	193	146	193	157	194		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val

0 .08 25 .035 27 .08

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
25 27 95 165 125 .1 .3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	189.12	Element	Left OB	Channel	Right OB
Vel Head (m)	0.13	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	188.99	Reach Len. (m)	95.00	165.00	125.00
Crit W.S. (m)		Flow Area (m2)	2.93	2.57	19.49
E.G. Slope (m/m)	0.009195	Area (m2)	2.93	2.57	19.49
Q Total (m3/s)	24.80	Flow (m3/s)	2.44	7.00	15.36
Top Width (m)	43.47	Top Width (m)	4.94	2.00	36.52
Vel Total (m/s)	0.99	Avg. Vel. (m/s)	0.83	2.72	0.79
Max Chl Dpth (m)	1.29	Hydr. Depth (m)	0.59	1.29	0.53
Conv. Total (m3/s)	258.6	Conv. (m3/s)	25.4	73.0	160.2
Length Wtd. (m)	133.79	Wetted Per. (m)	5.07	2.60	36.54
Min Ch El (m)	187.70	Shear (N/m2)	52.17	89.20	48.09
Alpha	2.58	Stream Power (N/m s)	43.42	242.64	37.91
Frctn Loss (m)	1.22	Cum Volume (1000 m3)	30.23	47.42	22.87
C & E Loss (m)	0.01	Cum SA (1000 m2)	29.16	14.67	22.64

Warning: The energy loss was 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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.31	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	191.26	Reach Len. (m)	95.00	165.00	125.00
Crit W.S. (m)		Flow Area (m2)	27.00	7.11	122.40
E.G. Slope (m/m)	0.001526	Area (m2)	27.00	7.11	122.40
Q Total (m3/s)	133.76	Flow (m3/s)	18.22	15.53	100.02
Top Width (m)	74.67	Top Width (m)	16.28	2.00	56.39
Vel Total (m/s)	0.85	Avg. Vel. (m/s)	0.67	2.18	

0.82					
Max Chl Dpth (m)	3.56	Hydr. Depth (m)	1.66	3.56	
2.17					
Conv. Total (m3/s)	3423.9	Conv. (m3/s)	466.3	397.4	
2560.2					
Length Wtd. (m)	117.48	Wetted Per. (m)	16.62	2.60	
56.55					
Min Ch El (m)	187.70	Shear (N/m2)	24.31	40.94	
32.40					
Alpha	1.53	Stream Power (N/m s)	16.40	89.38	
26.47					
Frctn Loss (m)	0.05	Cum Volume (1000 m3)	120.28	104.29	
106.05					
C & E Loss (m)	0.01	Cum SA (1000 m2)	54.41	14.67	
56.86					

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: RIVER-1
REACH: Reach-1 RS: 46.06

INPUT
Description: Section 46.06 - J.D. Barnes 2003 topo mapping
Section 46.06
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	192	25	191	47	190	55	188	114	187
118	186.9	119	186.4	121	186.4	122	186.9	125	187
142	192	187	192	217	192	222	191	255	191
257	192	275	193						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	118	.035	122	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
118	122	130	165	145	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
142	275	192.1	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	187.89	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.23	Wt. n-Val.	0.080	0.035	
0.080					
W.S. Elev (m)	187.66	Reach Len. (m)	130.00	165.00	
145.00					
Crit W.S. (m)	187.66	Flow Area (m2)	15.80	4.55	
2.88					
E.G. Slope (m/m)	0.008997	Area (m2)	15.80	4.55	
2.88					
Q Total (m3/s)	24.80	Flow (m3/s)	9.60	12.93	
2.27					

Top Width (m)	52.35	Top Width (m)	43.09	4.00	5.25
Vel Total (m/s)	1.07	Avg. Vel. (m/s)	0.61	2.84	0.79
Max Chl Dpth (m)	1.26	Hydr. Depth (m)	0.37	1.14	0.55
Conv. Total (m3/s)	261.4	Conv. (m3/s)	101.2	136.3	23.9
Length Wtd. (m)	156.17	Wetted Per. (m)	43.10	4.24	5.35
Min Ch El (m)	186.40	Shear (N/m2)	32.35	94.77	47.56
Alpha	3.88	Stream Power (N/m s)	19.65	269.37	37.36
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	29.34	46.83	21.47
C & E Loss (m)	0.07	Cum SA (1000 m2)	26.88	14.17	20.03

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 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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.25	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	191.23	Reach Len. (m)	130.00	165.00	145.00
Crit W.S. (m)		Flow Area (m2)	271.80	18.82	43.27
E.G. Slope (m/m)	0.000217	Area (m2)	271.80	18.82	51.07
Q Total (m3/s)	133.76	Flow (m3/s)	98.07	21.40	14.29
Top Width (m)	154.77	Top Width (m)	98.77	4.00	52.00
Vel Total (m/s)	0.40	Avg. Vel. (m/s)	0.36	1.14	0.33
Max Chl Dpth (m)	4.83	Hydr. Depth (m)	2.75	4.71	2.49
Conv. Total (m3/s)	9083.5	Conv. (m3/s)	6659.4	1453.4	970.7
Length Wtd. (m)	148.83	Wetted Per. (m)	99.05	4.24	

18.00					
Min Ch El (m)	186.40	Shear (N/m2)	5.84	9.45	5.11
Alpha	1.96	Stream Power (N/m s)	2.11	10.75	1.69
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	106.09	102.15	95.21
C & E Loss (m)	0.00	Cum SA (1000 m2)	48.95	14.17	50.09

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.05

INPUT
Description: Section 46.05 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	193	30	192	72	191	90	186	93	185
95	184.8	100	184.5	123	184.5	128	184.8	150	189
170	190	190	191	210	192	217	191	260	190
280	190	292	193						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	95	.035	128	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
95	128	70	70	65	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
210	292	192.1	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	187.52	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	187.52	Reach Len. (m)	70.00	70.00	65.00
Crit W.S. (m)	184.93	Flow Area (m2)	15.47	98.20	19.40
E.G. Slope (m/m)	0.000015	Area (m2)	15.47	98.20	19.40
Q Total (m3/s)	24.80	Flow (m3/s)	0.96	22.69	1.15
Top Width (m)	57.73	Top Width (m)	10.48	33.00	14.25
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.06	0.23	0.06
Max Chl Dpth (m)	3.02	Hydr. Depth (m)	1.48	2.98	1.36

Conv. Total (m3/s)	6342.1	Conv. (m3/s)	245.0	5802.9	294.2
Length Wtd. (m)	69.23	Wetted Per. (m)	10.86	33.02	14.51
Min Ch El (m)	184.50	Shear (N/m2)	0.21	0.45	0.20
Alpha	1.42	Stream Power (N/m s)	0.01	0.10	0.01
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	27.31	38.36	19.85
C & E Loss (m)	0.00	Cum SA (1000 m2)	23.40	11.12	18.62

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.24	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	191.23	Reach Len. (m)	70.00	70.00	65.00
Crit W.S. (m)	185.72	Flow Area (m2)	79.98	220.47	144.74
E.G. Slope (m/m)	0.000024	Area (m2)	79.98	220.47	203.68
Q Total (m3/s)	133.76	Flow (m3/s)	8.82	110.04	14.90
Top Width (m)	201.52	Top Width (m)	32.51	33.00	136.02
Vel Total (m/s)	0.30	Avg. Vel. (m/s)	0.11	0.50	0.10
Max Chl Dpth (m)	6.73	Hydr. Depth (m)	2.46	6.68	2.18
Conv. Total (m3/s)	27150.8	Conv. (m3/s)	1790.8	22336.0	3024.0
Length Wtd. (m)	68.38	Wetted Per. (m)	33.36	33.02	66.98
Min Ch El (m)	184.50	Shear (N/m2)	0.57	1.59	0.51
Alpha	2.29	Stream Power (N/m s)	0.06	0.79	0.05
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	83.22	82.41	76.74
C & E Loss (m)	0.00	Cum SA (1000 m2)	40.42	11.12	36.45

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.04

INPUT
Description: Section 46.04 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	192	38	192	65	191	107	190	120	189
126	185	127	184	130	184	131	184.5	135	185
148	189	190	189.5	205	189	220	189	232	192

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	126	.035	131	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
126	131	115	100	70	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
190	232	190	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	187.52	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	187.48	Reach Len. (m)	115.00	100.00	70.00
Crit W.S. (m)	185.46	Flow Area (m2)	4.60	16.64	20.88
E.G. Slope (m/m)	0.000306	Area (m2)	4.60	16.64	20.88
Q Total (m3/s)	24.80	Flow (m3/s)	1.03	17.32	6.44
Top Width (m)	20.77	Top Width (m)	3.72	5.00	12.05
Vel Total (m/s)	0.59	Avg. Vel. (m/s)	0.22	1.04	0.31
Max Chl Dpth (m)	3.48	Hydr. Depth (m)	1.24	3.33	1.73
Conv. Total (m3/s)	1417.3	Conv. (m3/s)	58.7	990.2	368.4
Length Wtd. (m)	98.06	Wetted Per. (m)	4.47	5.53	12.45
Min Ch El (m)	184.00	Shear (N/m2)	3.09	9.03	5.03
Alpha	2.26	Stream Power (N/m s)	0.69	9.40	1.55
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	26.61	34.34	18.54
C & E Loss (m)	0.00	Cum SA (1000 m2)	22.90	9.79	17.76

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.23	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	191.19	Reach Len. (m)	115.00	100.00	70.00
Crit W.S. (m)	187.49	Flow Area (m2)	76.88	35.22	233.69
E.G. Slope (m/m)	0.000190	Area (m2)	76.88	35.22	233.69
Q Total (m3/s)	133.76	Flow (m3/s)	14.46	47.70	71.61
Top Width (m)	169.03	Top Width (m)	66.26	5.00	97.78
Vel Total (m/s)	0.39	Avg. Vel. (m/s)	0.19	1.35	0.31
Max Chl Dpth (m)	7.19	Hydr. Depth (m)	1.16	7.04	2.39
Conv. Total (m3/s)	9694.4	Conv. (m3/s)	1047.8	3457.0	5189.6
Length Wtd. (m)	95.43	Wetted Per. (m)	67.52	5.53	98.69
Min Ch El (m)	184.00	Shear (N/m2)	2.13	11.89	4.42
Alpha	4.73	Stream Power (N/m s)	0.40	16.10	1.35
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	77.73	73.46	62.53
C & E Loss (m)	0.01	Cum SA (1000 m2)	36.96	9.79	28.86

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: RIVER-1
REACH: Reach-1 RS: 46.032

INPUT
Description: Section 46.032 - CNR - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	191.25	6	191	9.7	190	13.7	189.8	58	189
88.3	188	109.3	185	121.7	184.2	125	184	181.4	182.6
195.4	182.6	209	184	287.6	185	289.7	187	297.1	188
316	189	328	189	334	185.4	350	192		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	125	.035	209	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
125	209	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	182.9	189.8	F
193.9	350	191.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	187.49	Element	Left OB	Channel	Right OB
Vel Head (m)	0.08	Wt. n-Val.		0.035	
W.S. Elev (m)	187.41	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	184.15	Flow Area (m2)		52.87	
E.G. Slope (m/m)	0.000242	Area (m2)	65.97	354.71	240.20
Q Total (m3/s)	66.97	Flow (m3/s)		66.97	
Top Width (m)	208.45	Top Width (m)	32.54	84.00	91.91
Vel Total (m/s)	1.27	Avg. Vel. (m/s)		1.27	
Max Chl Dpth (m)	4.81	Hydr. Depth (m)		4.81	
Conv. Total (m3/s)	4301.8	Conv. (m3/s)		4301.8	
Length Wtd. (m)	50.00	Wetted Per. (m)		11.00	
Min Ch El (m)	182.60	Shear (N/m2)		11.42	
Alpha	1.00	Stream Power (N/m s)		14.47	
Frctn Loss (m)		Cum Volume (1000 m3)	22.55	15.77	9.41
C & E Loss (m)		Cum SA (1000 m2)	20.82	5.34	14.12

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.22	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035	
W.S. Elev (m)	191.22	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	185.84	Flow Area (m2)	375.67	554.11	
E.G. Slope (m/m)	0.000007	Area (m2)	375.67	674.68	709.24
Q Total (m3/s)	200.64	Flow (m3/s)	26.82	173.83	

Top Width (m)	347.26	Top Width (m)	124.16	84.00 139.10
Vel Total (m/s)	0.22	Avg. Vel. (m/s)	0.07	0.31
Max Chl Dpth (m)	8.62	Hydr. Depth (m)	3.03	8.04
Conv. Total (m3/s)	73340.5	Conv. (m3/s)	9801.9	63538.5
Length Wtd. (m)	50.00	Wetted Per. (m)	124.57	68.92
Min Ch El (m)	182.60	Shear (N/m2)	0.22	0.59
Alpha	1.85	Stream Power (N/m s)	0.02	0.19
Frctn Loss (m)		Cum Volume (1000 m3)	51.71	37.97 29.53
C & E Loss (m)		Cum SA (1000 m2)	26.01	5.34 20.57

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.0315

INPUT
Description: Hum 13-1RR. CNR Culvert. Twin 3.0 m W x 3.5 m H x 32 m L Structural Steel Plate Arch Culverts. No drawings available. Size estimated from HEC-2 coding.

HEC-2 to HEC-RAS conversion
January 2004 by Acres included recoding of culvert to HEC-RAS format, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 13
Deck/Roadway Width = 32
Weir Coefficient = 1.4

Upstream Deck/Roadway Coordinates
num= 10

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	191.2		5	191		8.7	190	
12.7	189.8		16.6	190		25	190.3	
115.5	191		274.1	192		335	192.5	
350	192.65							

Upstream Bridge Cross Section Data
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	191.25	6	191	9.7	190	13.7	189.8	58	189
88.3	188	109.3	185	121.7	184.2	125	184	181.4	182.6
195.4	182.6	209	184	287.6	185	289.7	187	297.1	188
316	189	328	189	334	185.4	350	192		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	125	.035	209	.08

```
Bank Sta: Left   Right    Coeff Contr.   Expan.
          125     209           .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   182.9   189.8       F
   193.9     350   191.5       F

Downstream  Deck/Roadway Coordinates
    num=      10
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0   191.2               5     191             8.7     190
    12.7   189.8            16.6     190              25   190.3
   115.5     191           274.1     192             335   192.5
     350  192.65

Downstream Bridge Cross Section Data
Station Elevation Data    num=      15
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   191.2       6     191     9.7     190    13.7   189.8      58     189
    88.3     188   109.3     185   121.7   184.2     125     184     170   183.2
     171   182.6     180   182.6     181   183.2     195     184     310     190

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .08     170    .035     181     .08

Bank Sta: Left   Right    Coeff Contr.   Expan.
          170     181           .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     170     187       F
     181     310     187       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         =   190.5
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       Ellipse     3.5       3
FHWA Chart # 30- Vertical Ellipse; Concrete
FHWA Scale # 1 - Square edge with headwall
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                13      32     .024     .024        0                   .7
      1
Number of Barrels =  2
Upstream   Elevation =  182.6
Centerline Stations
    Sta.    Sta.
   185.4   191.4
Downstream Elevation =  182.6
Centerline Stations
    Sta.    Sta.
     172     178

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1
```

Q Culv Group (m3/s)	66.97	Culv Full Len (m)	
# Barrels	2	Culv Vel US (m/s)	4.07
Q Barrel (m3/s)	33.49	Culv Vel DS (m/s)	5.02
E.G. US. (m)	187.49	Culv Inv El Up (m)	182.60
W.S. US. (m)	187.41	Culv Inv El Dn (m)	182.60
E.G. DS (m)	184.99	Culv Frctn Ls (m)	0.00
W.S. DS (m)	184.22	Culv Exit Loss (m)	1.53
Delta EG (m)	2.50	Culv Entr Loss (m)	0.59
Delta WS (m)	3.19	Q Weir (m3/s)	
E.G. IC (m)	187.09	Weir Sta Lft (m)	
E.G. OC (m)	187.49	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	186.05	Weir Max Depth (m)	
Culv WS Outlet (m)	185.24	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	2.64	Min El Weir Flow (m)	190.50

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	112.90	Culv Full Len (m)	29.43
# Barrels	2	Culv Vel US (m/s)	6.84
Q Barrel (m3/s)	56.45	Culv Vel DS (m/s)	7.01
E.G. US. (m)	191.22	Culv Inv El Up (m)	182.60
W.S. US. (m)	191.22	Culv Inv El Dn (m)	182.60
E.G. DS (m)	187.51	Culv Frctn Ls (m)	1.06
W.S. DS (m)	185.89	Culv Exit Loss (m)	0.89
Delta EG (m)	3.71	Culv Entr Loss (m)	1.67
Delta WS (m)	5.32	Q Weir (m3/s)	87.74
E.G. IC (m)	191.21	Weir Sta Lft (m)	0.68
E.G. OC (m)	191.22	Weir Sta Rgt (m)	150.71
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	186.10	Weir Max Depth (m)	1.40
Culv WS Outlet (m)	185.89	Weir Avg Depth (m)	0.51
Culv Nml Depth (m)		Weir Flow Area (m2)	76.97
Culv Crt Depth (m)	3.25	Min El Weir Flow (m)	190.50

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.031

INPUT
Description: Section 46.031 - CNR - D/S Bounding Section - J.D. Barnes 2003
topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	191.2	6	191	9.7	190	13.7	189.8	58	189
88.3	188	109.3	185	121.7	184.2	125	184	170	183.2
171	182.6	180	182.6	181	183.2	195	184	310	190

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	170	.035	181	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
170	181	90	110	75	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	170	187	F

181 310 187 F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	184.99	Element	Left OB	Channel	Right OB
Vel Head (m)	0.77	Wt. n-Val.		0.035	
W.S. Elev (m)	184.22	Reach Len. (m)	90.00	110.00	75.00
Crit W.S. (m)	184.22	Flow Area (m2)		17.18	
E.G. Slope (m/m)	0.010691	Area (m2)	28.11	17.18	9.07
Q Total (m3/s)	66.97	Flow (m3/s)		66.97	
Top Width (m)	77.69	Top Width (m)	48.55	11.00	18.14
Vel Total (m/s)	3.90	Avg. Vel. (m/s)		3.90	
Max Chl Dpth (m)	1.62	Hydr. Depth (m)		1.56	
Conv. Total (m3/s)	647.7	Conv. (m3/s)		647.7	
Length Wtd. (m)	102.88	Wetted Per. (m)		11.33	
Min Ch El (m)	182.60	Shear (N/m2)		158.94	
Alpha	1.00	Stream Power (N/m s)		619.61	
Frctn Loss (m)	0.24	Cum Volume (1000 m3)	22.55	6.82	9.41
C & E Loss (m)	0.37	Cum SA (1000 m2)	18.79	2.97	11.37

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 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, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	187.51	Element	Left OB	Channel	Right OB

Vel Head (m)	1.62	Wt. n-Val.			0.035
W.S. Elev (m)	185.89	Reach Len. (m)	90.00	110.00	75.00
Crit W.S. (m)	185.89	Flow Area (m2)			35.64
E.G. Slope (m/m)	0.008428	Area (m2)	128.00	35.64	66.50
Q Total (m3/s)	200.64	Flow (m3/s)			200.64
Top Width (m)	128.26	Top Width (m)	66.96	11.00	50.30
Vel Total (m/s)	5.63	Avg. Vel. (m/s)			5.63
Max Chl Dpth (m)	3.29	Hydr. Depth (m)			3.24
Conv. Total (m3/s)	2185.5	Conv. (m3/s)			2185.5
Length Wtd. (m)	101.96	Wetted Per. (m)			11.33
Min Ch El (m)	182.60	Shear (N/m2)			259.91
Alpha	1.00	Stream Power (N/m s)			1463.36
Frctn Loss (m)	0.23	Cum Volume (1000 m3)	51.71	11.26	29.53
C & E Loss (m)	0.78	Cum SA (1000 m2)	21.23	2.97	15.83

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 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, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.03

INPUT
Description: Section 46.03 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	189	17	183	34	182.3	35	182	39	182
40	182.3	43	183	88	182.5	89	181.5	93	181.5

```
      94   182.5      96     183     100     184     103     185     138     187
     187     188

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .08      88    .035      94     .08

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            88      94             185     205     150             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
       0      43   183.1       F

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           184.04    Element                Left OB    Channel
Right OB
  Vel Head (m)              0.04    Wt. n-Val.              0.080      0.035
0.080
  W.S. Elev (m)           184.00    Reach Len. (m)         185.00     205.00
150.00
  Crit W.S. (m)           183.28    Flow Area (m2)          96.30      14.00
4.49
  E.G. Slope (m/m)      0.000995    Area (m2)               96.30      14.00
4.49
  Q Total (m3/s)            66.97   Flow (m3/s)             45.19      20.35
1.43
  Top Width (m)             85.83   Top Width (m)           73.83       6.00
6.00
  Vel Total (m/s)           0.58    Avg. Vel. (m/s)          0.47       1.45
0.32
  Max Chl Dpth (m)          2.50    Hydr. Depth (m)          1.30       2.33
0.75
  Conv. Total (m3/s)      2122.9    Conv. (m3/s)           1432.3      645.2
45.4
  Length Wtd. (m)         184.84    Wetted Per. (m)         74.19       6.83
6.18
  Min Ch El (m)           181.50    Shear (N/m2)            12.67      20.00
7.10
  Alpha                     2.33    Stream Power (N/m s)     5.94      29.09
2.26
  Frctn Loss (m)            0.32    Cum Volume (1000 m3)    16.95       5.11
8.90
  C & E Loss (m)            0.01    Cum SA (1000 m2)        13.29       2.03
10.47



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 OUTPUT  Profile #Regional w red'n


  E.G. Elev (m)           185.45    Element                Left OB    Channel
Right OB
  Vel Head (m)              0.07    Wt. n-Val.              0.080      0.035
0.080
```

W.S. Elev (m)	185.39	Reach Len. (m)	185.00	205.00	150.00
Crit W.S. (m)	183.85	Flow Area (m2)	201.48	22.32	16.79
E.G. Slope (m/m)	0.000999	Area (m2)	201.48	22.32	16.79
Q Total (m3/s)	200.64	Flow (m3/s)	149.42	44.40	6.81
Top Width (m)	99.53	Top Width (m)	77.76	6.00	15.77
Vel Total (m/s)	0.83	Avg. Vel. (m/s)	0.74	1.99	0.41
Max Chl Dpth (m)	3.89	Hydr. Depth (m)	2.59	3.72	1.06
Conv. Total (m3/s)	6347.1	Conv. (m3/s)	4726.9	1404.7	215.6
Length Wtd. (m)	181.78	Wetted Per. (m)	78.36	6.83	16.13
Min Ch El (m)	181.50	Shear (N/m2)	25.20	32.03	10.20
Alpha	1.86	Stream Power (N/m s)	18.69	63.72	4.14
Frctn Loss (m)	0.29	Cum Volume (1000 m3)	36.88	8.07	26.40
C & E Loss (m)	0.01	Cum SA (1000 m2)	14.72	2.03	13.35

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: RIVER-1
REACH: Reach-1 RS: 46.02

INPUT
Description: Section 46.02 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	189	18	183	41	182	44	181.7	44	181
46	181	47	181.7	50	182	70	183	78	185
90	186	120	187	150	188				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	44	.035	47	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
44	47	110	120	110	.1 .3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	183.71	Element	Left OB	Channel	Right OB
Vel Head (m)	0.13	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	183.57	Reach Len. (m)	110.00	120.00	110.00

Crit W.S. (m)		Flow Area (m2)	30.30	7.36	27.25
E.G. Slope (m/m)	0.003860	Area (m2)	30.30	7.36	27.25
Q Total (m3/s)	66.97	Flow (m3/s)	24.89	19.90	22.18
Top Width (m)	56.00	Top Width (m)	27.71	3.00	25.29
Vel Total (m/s)	1.03	Avg. Vel. (m/s)	0.82	2.70	0.81
Max Chl Dpth (m)	2.57	Hydr. Depth (m)	1.09	2.45	1.08
Conv. Total (m3/s)	1077.9	Conv. (m3/s)	400.7	320.3	356.9
Length Wtd. (m)	113.76	Wetted Per. (m)	27.84	3.92	25.40
Min Ch El (m)	181.00	Shear (N/m2)	41.19	71.11	40.62
Alpha	2.48	Stream Power (N/m s)	33.85	192.16	33.06
Frctn Loss (m)	0.34	Cum Volume (1000 m3)	5.24	2.92	6.52
C & E Loss (m)	0.00	Cum SA (1000 m2)	3.89	1.11	8.12

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	185.15	Element	Left OB	Channel	Right OB
Vel Head (m)	0.16	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	184.99	Reach Len. (m)	110.00	120.00	110.00
Crit W.S. (m)		Flow Area (m2)	72.73	11.63	67.24
E.G. Slope (m/m)	0.003026	Area (m2)	72.73	11.63	67.24
Q Total (m3/s)	200.64	Flow (m3/s)	85.86	37.73	77.05
Top Width (m)	65.95	Top Width (m)	31.98	3.00	30.97
Vel Total (m/s)	1.32	Avg. Vel. (m/s)	1.18	3.24	1.15
Max Chl Dpth (m)	3.99	Hydr. Depth (m)	2.27	3.88	2.17
Conv. Total (m3/s)	3647.3	Conv. (m3/s)	1560.7	685.9	1400.7
Length Wtd. (m)	112.32	Wetted Per. (m)	32.34	3.92	31.26
Min Ch El (m)	181.00	Shear (N/m2)	66.75	88.03	63.84
Alpha	1.76	Stream Power (N/m s)	78.79	285.62	73.15
Frctn Loss (m)	0.25	Cum Volume (1000 m3)	11.52	4.59	20.10
C & E Loss (m)	0.01	Cum SA (1000 m2)	4.57	1.11	

9.85

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.01

INPUT
Description: Section 46.01 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	189	14	188	20	182	33	181	34	180.4
37	180.4	38	182	87	183	98	185	106	186
126	187	180	188						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	33	.035	38	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
33	38	95	105	95	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	183.36	Element	Left OB	Channel	Right OB
Vel Head (m)	0.14	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	183.22	Reach Len. (m)	95.00	105.00	95.00
Crit W.S. (m)		Flow Area (m2)	23.16	13.02	35.59
E.G. Slope (m/m)	0.002412	Area (m2)	23.16	13.02	35.59
Q Total (m3/s)	66.97	Flow (m3/s)	19.18	30.43	17.36
Top Width (m)	69.45	Top Width (m)	14.22	5.00	50.23
Vel Total (m/s)	0.93	Avg. Vel. (m/s)	0.83	2.34	0.49
Max Chl Dpth (m)	2.82	Hydr. Depth (m)	1.63	2.60	0.71
Conv. Total (m3/s)	1363.7	Conv. (m3/s)	390.6	619.7	353.4
Length Wtd. (m)	100.25	Wetted Per. (m)	14.77	6.05	50.26
Min Ch El (m)	180.40	Shear (N/m2)	37.08	50.86	16.75
Alpha	3.15	Stream Power (N/m s)	30.72	118.91	8.17
Frctn Loss (m)	0.19	Cum Volume (1000 m3)	2.30	1.70	3.06
C & E Loss (m)	0.00	Cum SA (1000 m2)	1.59	0.63	3.97

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	184.89	Element	Left OB	Channel	Right OB
Vel Head (m)	0.13	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	184.76	Reach Len. (m)	95.00	105.00	95.00
Crit W.S. (m)		Flow Area (m2)	46.23	20.71	119.40
E.G. Slope (m/m)	0.001702	Area (m2)	46.23	20.71	119.40
Q Total (m3/s)	200.64	Flow (m3/s)	46.54	55.43	98.67
Top Width (m)	79.46	Top Width (m)	15.76	5.00	58.69
Vel Total (m/s)	1.08	Avg. Vel. (m/s)	1.01	2.68	0.83
Max Chl Dpth (m)	4.36	Hydr. Depth (m)	2.93	4.14	2.03
Conv. Total (m3/s)	4863.7	Conv. (m3/s)	1128.2	1343.8	2391.7
Length Wtd. (m)	98.47	Wetted Per. (m)	16.95	6.05	58.86
Min Ch El (m)	180.40	Shear (N/m2)	45.53	57.11	33.85
Alpha	2.20	Stream Power (N/m s)	45.84	152.85	27.97
Frctn Loss (m)	0.16	Cum Volume (1000 m3)	4.97	2.65	9.84
C & E Loss (m)	0.01	Cum SA (1000 m2)	1.94	0.63	4.92

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.00

INPUT
Description: Section 46.00 - J.D. Barnes 2003 topo mapping (This section location corresponds to D/S HEC-RAS model section 475.53)
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	188	20	187	40	182	55	181	57	180
60	180	62	181	73	182	95	183	103	184
110	185	123	187	180	187				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	55	.035	62	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
55	62	0	0	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	183.18	Element	Left OB	Channel	Right OB
Vel Head (m)	0.14	Wt. n-Val.	0.080	0.035	0.080

W.S. Elev (m)	183.04	Reach Len. (m)			
Crit W.S. (m)	182.26	Flow Area (m2)	25.26	19.28	28.83
E.G. Slope (m/m)	0.001480	Area (m2)	25.26	19.28	28.83
Q Total (m3/s)	66.97	Flow (m3/s)	14.53	39.87	12.57
Top Width (m)	59.48	Top Width (m)	19.16	7.00	33.32
Vel Total (m/s)	0.91	Avg. Vel. (m/s)	0.58	2.07	0.44
Max Chl Dpth (m)	3.04	Hydr. Depth (m)	1.32	2.75	0.87
Conv. Total (m3/s)	1740.6	Conv. (m3/s)	377.6	1036.3	326.7
Length Wtd. (m)		Wetted Per. (m)	19.32	7.47	33.39
Min Ch El (m)	180.00	Shear (N/m2)	18.98	37.46	12.53
Alpha	3.19	Stream Power (N/m s)	10.92	77.47	5.47
Frctn Loss (m)		Cum Volume (1000 m3)			
C & E Loss (m)		Cum SA (1000 m2)			

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	184.73	Element	Left OB	Channel	Right OB
Vel Head (m)	0.19	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	184.54	Reach Len. (m)			
Crit W.S. (m)	183.38	Flow Area (m2)	58.50	29.78	87.66
E.G. Slope (m/m)	0.001535	Area (m2)	58.50	29.78	87.66
Q Total (m3/s)	200.64	Flow (m3/s)	49.83	83.80	67.01
Top Width (m)	76.94	Top Width (m)	25.16	7.00	44.78
Vel Total (m/s)	1.14	Avg. Vel. (m/s)	0.85	2.81	0.76
Max Chl Dpth (m)	4.54	Hydr. Depth (m)	2.33	4.25	1.96
Conv. Total (m3/s)	5120.9	Conv. (m3/s)	1271.8	2138.8	1710.3
Length Wtd. (m)		Wetted Per. (m)	25.51	7.47	44.95
Min Ch El (m)	180.00	Shear (N/m2)	34.53	60.00	29.36
Alpha	2.83	Stream Power (N/m s)	29.41	168.84	22.44
Frctn Loss (m)		Cum Volume (1000 m3)			
C & E Loss (m)		Cum SA (1000 m2)			

SUMMARY OF MANNING'S N VALUES

River:RIVER-1

Reach	River Sta.	n1	n2	n3	n4	n5	n6	n7
Reach-1	46.45	.05	.035	.08				
Reach-1	46.44	.05	.035	.05				
Reach-1	46.43	.05	.08	.035	.08	.05		
Reach-1	46.42	.05	.08	.035	.08	.05		
Reach-1	46.413	.05	.08	.035	.08	.05		
Reach-1	46.4125	Inl Struct						
Reach-1	46.412	.05	.08	.035	.08	.05		
Reach-1	46.4115	Culvert						
Reach-1	46.411	.05	.08	.035	.08	.05		
Reach-1	46.41	.05	.08	.035	.08	.035	.08	.05
Reach-1	46.402	.05	.08	.035	.08	.05		
Reach-1	46.4015	Culvert						
Reach-1	46.401	.05	.08	.035	.08	.05		
Reach-1	46.392	.05	.025	.05	.08	.035	.08	.05
Reach-1	46.3915	Mult Open						
Reach-1	46.391	.05	.025	.05	.08	.05		
Reach-1	46.39	.05	.025	.05	.08	.035	.08	.05
Reach-1	46.382	.025	.08	.035	.08	.05		
Reach-1	46.3815	Culvert						
Reach-1	46.381	.025	.05	.08	.035	.08	.05	
Reach-1	46.36	.025	.05	.08	.035	.08	.05	
Reach-1	46.35	.025	.05	.08	.035	.08	.05	
Reach-1	46.34	.025	.05	.08	.035	.08	.05	
Reach-1	46.33	.05	.08	.035	.08	.05		
Reach-1	46.322	.05	.08	.035	.08	.05		

Reach-1 46.3215 Culvert

Reach-1 46.321 .05 .08 .035 .08 .05

Reach-1 46.32 .05 .08 .035 .08 .05

Reach-1 46.312 .05 .08 .035 .08 .05

Reach-1 46.3115 Culvert

Reach-1 46.311 .05 .08 .035 .08 .05

Reach-1 46.31 .05 .08 .035 .08 .05

Reach-1 46.30 .05 .08 .035 .08 .025
.05

Reach-1 46.292 .05 .08 .035 .08 .05

Reach-1 46.2915 Culvert

Reach-1 46.291 .05 .08 .035 .08 .05

Reach-1 46.29 .05 .08 .035 .08 .05

Reach-1 46.282 .05 .08 .035 .08 .05
.025 .05

Reach-1 46.2815 Culvert

Reach-1 46.281 .05 .08 .035 .08 .05
.025 .05

Reach-1 46.28 .05 .08 .035 .08 .05
.025 .05

Reach-1 46.274 .05 .08 .035 .08 .05

Reach-1 46.2735 Bridge

Reach-1 46.273 .05 .08 .035 .08 .05

Reach-1 46.272 .05 .08 .035 .08 .05

Reach-1 46.2715 Culvert

Reach-1 46.271 .05 .05 .08 .035 .08
.05

Reach-1 46.27 .08 .035 .08

Reach-1 46.26 .05 .08 .035 .08 .05

Reach-1 46.25 .05 .08 .035 .08 .05

Reach-1 46.24 .05 .08 .035 .08 .05

Reach-1 46.2375 .05 .08 .035 .08 .05

Reach-1 46.235 Bridge

Reach-1 46.2325 .05 .08 .035 .08 .05

Reach-1 46.23 .05 .08 .035 .08 .05

Reach-1 46.22 .08 .035 .08 .035 .05

Reach-1 46.214 .05 .035 .08

Reach-1	46.2135	Inl Struct					
Reach-1	46.213		.05	.035	.08		
Reach-1	46.212		.05	.035	.08		
Reach-1	46.2115	Culvert					
Reach-1	46.211		.05	.035	.08		
Reach-1	46.21		.05	.035	.05		
Reach-1	46.202		.05	.035	.05		
Reach-1	46.2015	Culvert					
Reach-1	46.201		.05	.035	.05		
Reach-1	46.192		.05	.035	.05		
Reach-1	46.1915	Culvert					
Reach-1	46.191		.05	.035	.05		
Reach-1	46.19		.05	.025	.05	.035	.05
Reach-1	46.182		.05	.025	.05	.035	.05
Reach-1	46.1815	Culvert					
Reach-1	46.181		.05	.025	.05	.035	.05
Reach-1	46.18		.05	.035	.05		
Reach-1	46.172		.05	.035	.05		
Reach-1	46.1715	Culvert					
Reach-1	46.171		.05	.035	.05	.025	
Reach-1	46.17		.05	.035	.05	.025	
Reach-1	46.162		.05	.035	.05		
Reach-1	46.1615	Culvert					
Reach-1	46.161		.05	.035	.05		
Reach-1	46.15		.05	.08	.035	.08	.025
Reach-1	46.142		.05	.08	.035	.08	.025
Reach-1	46.1415	Culvert					
Reach-1	46.141		.05	.08	.035	.08	.025
Reach-1	46.14		.05	.08	.035	.08	.025
Reach-1	46.132		.05	.08	.035	.08	.05
Reach-1	46.13		.05	.08	.035	.08	.05

Reach-1	46.122	.05	.035	.05	
Reach-1	46.1215	Culvert			
Reach-1	46.121	.05	.035	.05	
Reach-1	46.12	.05	.035	.05	
Reach-1	46.11	.05	.035	.05	
Reach-1	46.1015	Culvert			
Reach-1	46.10	.05	.035	.05	
Reach-1	46.09	.05	.035	.05	
Reach-1	46.082	.05	.035	.05	
Reach-1	46.0815	Culvert			
Reach-1	46.081	.08	.035	.08	.05
Reach-1	46.07	.08	.035	.08	
Reach-1	46.06	.08	.035	.08	
Reach-1	46.05	.08	.035	.08	
Reach-1	46.04	.08	.035	.08	
Reach-1	46.032	.08	.035	.08	
Reach-1	46.0315	Culvert			
Reach-1	46.031	.08	.035	.08	
Reach-1	46.03	.08	.035	.08	
Reach-1	46.02	.08	.035	.08	
Reach-1	46.01	.08	.035	.08	
Reach-1	46.00	.08	.035	.08	

SUMMARY OF REACH LENGTHS

River: RIVER-1

Reach	River Sta.	Left	Channel	Right
Reach-1	46.45	180	180	170
Reach-1	46.44	130	130	125
Reach-1	46.43	100	100	95
Reach-1	46.42	295	240	190
Reach-1	46.413	5	5	5
Reach-1	46.4125	Inl Struct		
Reach-1	46.412	45	45	45
Reach-1	46.4115	Culvert		

Reach-1	46.411		80	80	90
Reach-1	46.41		140	140	120
Reach-1	46.402		100	100	100
Reach-1	46.4015	Culvert			
Reach-1	46.401		80	95	100
Reach-1	46.392		70	70	70
Reach-1	46.3915	Mult Open			
Reach-1	46.391		45	35	25
Reach-1	46.39		50	35	25
Reach-1	46.382		45	45	45
Reach-1	46.3815	Culvert			
Reach-1	46.381		260	275	290
Reach-1	46.36		150	150	150
Reach-1	46.35		120	120	120
Reach-1	46.34		225	205	190
Reach-1	46.33		130	130	130
Reach-1	46.322		50	50	50
Reach-1	46.3215	Culvert			
Reach-1	46.321		50	50	50
Reach-1	46.32		110	110	110
Reach-1	46.312		60	60	60
Reach-1	46.3115	Culvert			
Reach-1	46.311		150	150	150
Reach-1	46.31		150	150	150
Reach-1	46.30		110	110	110
Reach-1	46.292		55	55	55
Reach-1	46.2915	Culvert			
Reach-1	46.291		145	150	155
Reach-1	46.29		135	145	150
Reach-1	46.282		50	50	50
Reach-1	46.2815	Culvert			
Reach-1	46.281		40	40	40
Reach-1	46.28		50	50	50
Reach-1	46.274		1	1	1
Reach-1	46.2735	Bridge			
Reach-1	46.273		4	4	4
Reach-1	46.272		100	80	60
Reach-1	46.2715	Culvert			
Reach-1	46.271		55	60	70
Reach-1	46.27		100	110	120
Reach-1	46.26		115	120	120
Reach-1	46.25		140	130	125
Reach-1	46.24		54	51	45
Reach-1	46.2375		30	30	30
Reach-1	46.235	Bridge			
Reach-1	46.2325		94	94	94
Reach-1	46.23		101	95	89
Reach-1	46.22		125	140	115
Reach-1	46.214		1	1	1
Reach-1	46.2135	Inl Struct			
Reach-1	46.213		15	15	15
Reach-1	46.212		55	45	10
Reach-1	46.2115	Culvert			
Reach-1	46.211		10	10	10
Reach-1	46.21		30	30	30
Reach-1	46.202		70	70	70
Reach-1	46.2015	Culvert			
Reach-1	46.201		20	25	30
Reach-1	46.192		25	25	25
Reach-1	46.1915	Culvert			
Reach-1	46.191		50	50	50
Reach-1	46.19		45	45	45
Reach-1	46.182		30	30	30

Reach-1	46.1815	Culvert		
Reach-1	46.181	10	10	10
Reach-1	46.18	25	25	25
Reach-1	46.172	40	40	40
Reach-1	46.1715	Culvert		
Reach-1	46.171	20	20	20
Reach-1	46.17	25	25	25
Reach-1	46.162	30	30	30
Reach-1	46.1615	Culvert		
Reach-1	46.161	115	115	110
Reach-1	46.15	50	50	50
Reach-1	46.142	60	60	60
Reach-1	46.1415	Culvert		
Reach-1	46.141	30	25	20
Reach-1	46.14	37.5	37.5	37.5
Reach-1	46.132	27.5	27.5	27.5
Reach-1	46.13	25	25	25
Reach-1	46.122	38	38	38
Reach-1	46.1215	Culvert		
Reach-1	46.121	20	20	20
Reach-1	46.12	35	38	40
Reach-1	46.11	235	235	235
Reach-1	46.1015	Culvert		
Reach-1	46.10	130	200	160
Reach-1	46.09	80	95	125
Reach-1	46.082	75	75	75
Reach-1	46.0815	Culvert		
Reach-1	46.081	185	175	145
Reach-1	46.07	95	165	125
Reach-1	46.06	130	165	145
Reach-1	46.05	70	70	65
Reach-1	46.04	115	100	70
Reach-1	46.032	50	50	50
Reach-1	46.0315	Culvert		
Reach-1	46.031	90	110	75
Reach-1	46.03	185	205	150
Reach-1	46.02	110	120	110
Reach-1	46.01	95	105	95
Reach-1	46.00	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: RIVER-1

Reach	River Sta.	Contr.	Expan.
Reach-1	46.45	.1	.3
Reach-1	46.44	.1	.3
Reach-1	46.43	.1	.3
Reach-1	46.42	.1	.3
Reach-1	46.413	.3	.5
Reach-1	46.4125	Inl Struct	
Reach-1	46.412	.3	.5
Reach-1	46.4115	Culvert	
Reach-1	46.411	.3	.5
Reach-1	46.41	.1	.3
Reach-1	46.402	.3	.5
Reach-1	46.4015	Culvert	
Reach-1	46.401	.3	.5
Reach-1	46.392	.3	.5

Reach-1	46.3915	Mult Open		
Reach-1	46.391		.3	.5
Reach-1	46.39		.1	.3
Reach-1	46.382		.3	.5
Reach-1	46.3815	Culvert		
Reach-1	46.381		.3	.5
Reach-1	46.36		.1	.3
Reach-1	46.35		.1	.3
Reach-1	46.34		.1	.3
Reach-1	46.33		.1	.3
Reach-1	46.322		.3	.5
Reach-1	46.3215	Culvert		
Reach-1	46.321		.3	.5
Reach-1	46.32		.1	.3
Reach-1	46.312		.3	.5
Reach-1	46.3115	Culvert		
Reach-1	46.311		.3	.5
Reach-1	46.31		.1	.3
Reach-1	46.30		.1	.3
Reach-1	46.292		.3	.5
Reach-1	46.2915	Culvert		
Reach-1	46.291		.3	.5
Reach-1	46.29		.1	.3
Reach-1	46.282		.3	.5
Reach-1	46.2815	Culvert		
Reach-1	46.281		.3	.5
Reach-1	46.28		.1	.3
Reach-1	46.274		.3	.5
Reach-1	46.2735	Bridge		
Reach-1	46.273		.3	.5
Reach-1	46.272		.3	.5
Reach-1	46.2715	Culvert		
Reach-1	46.271		.3	.5
Reach-1	46.27		.1	.3
Reach-1	46.26		.1	.3
Reach-1	46.25		.1	.3
Reach-1	46.24		.1	.3
Reach-1	46.2375		.3	.5
Reach-1	46.235	Bridge		
Reach-1	46.2325		.3	.5
Reach-1	46.23		.1	.3
Reach-1	46.22		.1	.3
Reach-1	46.214		.3	.5
Reach-1	46.2135	Inl Struct		
Reach-1	46.213		.3	.5
Reach-1	46.212		.3	.5
Reach-1	46.2115	Culvert		
Reach-1	46.211		.3	.5
Reach-1	46.21		.1	.3
Reach-1	46.202		.3	.5
Reach-1	46.2015	Culvert		
Reach-1	46.201		.3	.5
Reach-1	46.192		.3	.5
Reach-1	46.1915	Culvert		
Reach-1	46.191		.3	.5
Reach-1	46.19		.1	.3
Reach-1	46.182		.3	.5
Reach-1	46.1815	Culvert		
Reach-1	46.181		.3	.5
Reach-1	46.18		.1	.3
Reach-1	46.172		.3	.5
Reach-1	46.1715	Culvert		
Reach-1	46.171		.3	.5

Reach-1	46.17		.1	.3
Reach-1	46.162		.3	.5
Reach-1	46.1615	Culvert		
Reach-1	46.161		.3	.5
Reach-1	46.15		.1	.3
Reach-1	46.142		.3	.5
Reach-1	46.1415	Culvert		
Reach-1	46.141		.3	.5
Reach-1	46.14		.1	.3
Reach-1	46.132		.3	.5
Reach-1	46.13		.1	.3
Reach-1	46.122		.3	.5
Reach-1	46.1215	Culvert		
Reach-1	46.121		.3	.5
Reach-1	46.12		.1	.3
Reach-1	46.11		.3	.5
Reach-1	46.1015	Culvert		
Reach-1	46.10		.3	.5
Reach-1	46.09		.1	.3
Reach-1	46.082		.3	.5
Reach-1	46.0815	Culvert		
Reach-1	46.081		.3	.5
Reach-1	46.07		.1	.3
Reach-1	46.06		.1	.3
Reach-1	46.05		.1	.3
Reach-1	46.04		.1	.3
Reach-1	46.032		.3	.5
Reach-1	46.0315	Culvert		
Reach-1	46.031		.3	.5
Reach-1	46.03		.1	.3
Reach-1	46.02		.1	.3
Reach-1	46.01		.1	.3
Reach-1	46.00		.1	.3

HEC-RAS HEC-RAS 5.0.0 February 2016
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

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

PROJECT DATA
Project Title: Black Creek Update (2016-02-26)
Project File : BlackCreekUpdate.prj
Run Date and Time: 6/30/2016 3:32:00 PM

Project in SI units

Project Description:
Main Humber River and Tributaries Digital Flood Plain Mapping
Hec-Ras File:
Black Creek Geometry.gxx covers Sheets HUM 13 (Converted Hec-2 file 46f1tbc.dat using new mapping), HUM 13A, HUM 13B & HUM 13C (New HEC-RAS based on new mapping)

PLAN DATA

Plan Title: Portage Parkway (Feb 2016 Alternative#4)
Plan File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.p08

Geometry Title: BlackCreek-PortageAlternative#4-Feb2016
Geometry File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.g06

Flow Title : Black Creek EXISTING Flows - April '10
Flow File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.f04

Plan Summary Information:

Number of: Cross Sections	=	86	Multiple Openings	=	1
Culverts	=	19	Inline Structures	=	2
Bridges	=	2	Lateral Structures	=	0

Computational Information
Water surface calculation tolerance = 0.003
Critical depth calculation tolerance = 0.003
Maximum number of iterations = 20

Maximum difference tolerance = 0.1
Flow tolerance factor = 0.001

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

FLOW DATA

Flow Title: Black Creek EXISTING Flows - April '10
Flow File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.f04

Flow Data (m3/s)

River	Reach	RS	2-year	5-year	10-year	25-year	50-year	100-year	Aug. 19th	Regional	10-year red'n
RIVER-1	Reach-1	46.45	3.729	4.826	5.609	6.57	7.342	7.79	16.701		42.698
RIVER-1	Reach-1	46.413	1.611	2.011	2.244	2.66	3.591	4.753	10.797		42.698
RIVER-1	Reach-1	46.41	3.066	4.074	4.85	5.926	6.831	7.624	17.745		47.801
RIVER-1	Reach-1	46.36	6.209	8.542	10.169	12.321	14.297	16.307	41.071		66.485
RIVER-1	Reach-1	46.33	8.661	12.09	14.453	17.546	20.243	22.971	57.024		74.783
RIVER-1	Reach-1	46.30	10.769	15.139	18.134	22.036	25.353	28.697	70.731		81.913
RIVER-1	Reach-1	46.274	8.055	11.399	13.737	17.024	19.57	22.105	52.858		81.913
RIVER-1	Reach-1	46.25	15.029	21.487	25.936	31.807	36.287	40.806	96.524		108.096
RIVER-1	Reach-1	46.214	3.775	6.823	9.185	12.675	15.796	19.055	49.3		108.096
RIVER-1	Reach-1	46.21	7.789	11.08	13.186	15.823	17.823	20.589	50.389		122.563
RIVER-1	Reach-1	46.09	8.997	12.899	15.58	19.072	21.783	24.795	62.776		133.764
RIVER-1	Reach-1	46.032	19.481	29.214	36.46	51.57	58.851	66.972	191.204		200.643

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
RIVER-1	Reach-1	2-year		
Known WS = 181.99				
RIVER-1	Reach-1	5-year		
Known WS = 182.42				
RIVER-1	Reach-1	10-year		
Known WS = 182.66				
RIVER-1	Reach-1	25-year		
Known WS = 182.73				
RIVER-1	Reach-1	50-year		
Known WS = 182.89				
RIVER-1	Reach-1	100-year		
Known WS = 183.04				
RIVER-1	Reach-1	Aug. 19th		
Known WS = 184.54				
RIVER-1	Reach-1	Regional w red'n		
Known WS = 184.54				

GEOMETRY DATA

Geometry Title: BlackCreek-PortageAlternative#4-Feb2016
Geometry File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.g06

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.45

INPUT
Description: Section 46.45 - J.D. Barnes 2003 topo mapping - U/S Study Limit
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	209	30	208	75	207.5	84	206.5	85	206.5
90	207.5	130	208	136	209				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	75	.035	90	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
75	90	180	180	170	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	207.38	Element	Left OB	Channel	Right OB
Vel Head (m)	0.19	Wt. n-Val.		0.035	

W.S. Elev (m)	207.19	Reach Len. (m)	180.00	180.00
170.00				
Crit W.S. (m)	207.19	Flow Area (m2)		4.02
E.G. Slope (m/m)	0.017095	Area (m2)		4.02
Q Total (m3/s)	7.79	Flow (m3/s)		7.79
Top Width (m)	10.66	Top Width (m)		10.66
Vel Total (m/s)	1.94	Avg. Vel. (m/s)		1.94
Max Chl Dpth (m)	0.69	Hydr. Depth (m)		0.38
Conv. Total (m3/s)	59.6	Conv. (m3/s)		59.6
Length Wtd. (m)	179.49	Wetted Per. (m)		10.76
Min Ch El (m)	206.50	Shear (N/m2)		62.62
Alpha	1.00	Stream Power (N/m s)		121.33
Frctn Loss (m)	0.16	Cum Volume (1000 m3)	119.99	215.30
77.72				
C & E Loss (m)	0.05	Cum SA (1000 m2)	121.50	84.02
93.41				

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 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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	208.17	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.22	Wt. n-Val.	0.050	0.035
0.080				
W.S. Elev (m)	207.95	Reach Len. (m)	180.00	180.00
170.00				
Crit W.S. (m)	207.95	Flow Area (m2)	8.94	14.69
7.94				
E.G. Slope (m/m)	0.006925	Area (m2)	8.94	14.69
7.94				
Q Total (m3/s)	42.70	Flow (m3/s)	5.47	34.19
3.04				
Top Width (m)	90.74	Top Width (m)	40.10	15.00

35.64					
Vel Total (m/s)	1.35	Avg. Vel. (m/s)	0.61	2.33	
0.38					
Max Chl Dpth (m)	1.45	Hydr. Depth (m)	0.22	0.98	
0.22					
Conv. Total (m3/s)	513.1	Conv. (m3/s)	65.7	410.9	
36.5					
Length Wtd. (m)	177.73	Wetted Per. (m)	40.10	15.15	
35.65					
Min Ch El (m)	206.50	Shear (N/m2)	15.13	65.81	
15.13					
Alpha	2.40	Stream Power (N/m s)	9.26	153.23	
5.79					
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	450.78	442.19	
387.72					
C & E Loss (m)	0.07	Cum SA (1000 m2)	335.17	84.42	
330.64					

Warning: The energy equation could not be 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: RIVER-1
REACH: Reach-1 RS: 46.44

INPUT
Description: Section 46.44 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	209	84	208	118	205	126	204	129	203.7
131	203.7	132	204	136	205	139	206	216	207
224	208	300	209						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	126	.035	132	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
126	132	130	130	125	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	205.29	Element	Left OB	Channel

Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	205.28	Reach Len. (m)	130.00	130.00	125.00
Crit W.S. (m)		Flow Area (m2)	6.69	8.88	3.24
E.G. Slope (m/m)	0.000274	Area (m2)	6.69	8.88	3.24
Q Total (m3/s)	7.79	Flow (m3/s)	1.57	5.42	0.80
Top Width (m)	22.02	Top Width (m)	11.18	6.00	4.84
Vel Total (m/s)	0.41	Avg. Vel. (m/s)	0.23	0.61	0.25
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.60	1.48	0.67
Conv. Total (m3/s)	470.5	Conv. (m3/s)	94.6	327.5	48.4
Length Wtd. (m)	129.13	Wetted Per. (m)	11.25	6.06	5.01
Min Ch El (m)	203.70	Shear (N/m2)	1.60	3.94	1.74
Alpha	1.61	Stream Power (N/m s)	0.37	2.41	0.43
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	119.39	214.14	77.44
C & E Loss (m)	0.00	Cum SA (1000 m2)	120.50	82.52	92.99

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.46	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	207.46	Reach Len. (m)	130.00	130.00	125.00
Crit W.S. (m)		Flow Area (m2)	57.86	21.94	92.20
E.G. Slope (m/m)	0.000074	Area (m2)	57.86	21.94	92.20
Q Total (m3/s)	42.70	Flow (m3/s)	13.64	12.70	16.35
Top Width (m)	129.50	Top Width (m)	35.84	6.00	87.65
Vel Total (m/s)	0.25	Avg. Vel. (m/s)	0.24	0.58	0.18
Max Chl Dpth (m)	3.76	Hydr. Depth (m)	1.61	3.66	1.05
Conv. Total (m3/s)	4968.4	Conv. (m3/s)	1587.3	1478.3	1902.8
Length Wtd. (m)	128.13	Wetted Per. (m)	36.01	6.06	87.97
Min Ch El (m)	203.70	Shear (N/m2)	1.16	2.62	0.76

Alpha	2.10	Stream Power (N/m s)	0.27	1.52
0.13				
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	444.77	438.90
379.20				
C & E Loss (m)	0.00	Cum SA (1000 m2)	328.34	82.53
320.16				

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.43

INPUT
Description: Section 46.43 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	95	210	95	208.3	105	208	116	205
143	204	145	203.5	149	203.5	150	204	177	205
180	206	187	207	231	208	310	208.6		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	105	.08	143	.035	150	.08	177	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
143	150	100	100	95	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	205.27	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035
0.080				
W.S. Elev (m)	205.27	Reach Len. (m)	100.00	100.00
95.00				
Crit W.S. (m)		Flow Area (m2)	20.95	11.65
20.93				
E.G. Slope (m/m)	0.000076	Area (m2)	20.95	11.65
20.93				
Q Total (m3/s)	7.79	Flow (m3/s)	1.88	4.00
1.91				
Top Width (m)	62.81	Top Width (m)	27.99	7.00
27.81				
Vel Total (m/s)	0.15	Avg. Vel. (m/s)	0.09	0.34
0.09				
Max Chl Dpth (m)	1.77	Hydr. Depth (m)	0.75	1.66
0.75				
Conv. Total (m3/s)	894.4	Conv. (m3/s)	215.7	459.5
219.3				
Length Wtd. (m)	99.26	Wetted Per. (m)	28.05	7.18
27.88				
Min Ch El (m)	203.50	Shear (N/m2)	0.56	1.21
0.56				
Alpha	3.05	Stream Power (N/m s)	0.05	0.41
0.05				
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	117.59	212.81
75.93				
C & E Loss (m)	0.00	Cum SA (1000 m2)	117.95	81.68
90.95				

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.46	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035	0.077
W.S. Elev (m)	207.45	Reach Len. (m)	100.00	100.00	95.00
Crit W.S. (m)		Flow Area (m2)	90.69	26.91	96.66
E.G. Slope (m/m)	0.000047	Area (m2)	90.69	26.91	96.66
Q Total (m3/s)	42.70	Flow (m3/s)	14.32	12.73	15.65
Top Width (m)	99.83	Top Width (m)	35.99	7.00	56.84
Vel Total (m/s)	0.20	Avg. Vel. (m/s)	0.16	0.47	0.16
Max Chl Dpth (m)	3.95	Hydr. Depth (m)	2.52	3.84	1.70
Conv. Total (m3/s)	6221.0	Conv. (m3/s)	2086.0	1854.8	2280.2
Length Wtd. (m)	98.70	Wetted Per. (m)	36.33	7.18	57.10
Min Ch El (m)	203.50	Shear (N/m2)	1.15	1.73	0.78
Alpha	2.13	Stream Power (N/m s)	0.18	0.82	0.13
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	435.12	435.72	367.40
C & E Loss (m)	0.00	Cum SA (1000 m2)	323.67	81.69	311.13

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.42

INPUT
Description: Section 46.42 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208.5	13	208	29	207	31	206	52	205
64	204	66	203.3	70	203.3	74	204	80	205
84	206	105	207	215	208	231	208.3		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	29	.08	64	.035	74	.08	105	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
64	74	295	240	190	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	205.27	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	205.26	Reach Len. (m)	295.00	240.00	190.00
Crit W.S. (m)		Flow Area (m2)	9.83	17.50	4.69
E.G. Slope (m/m)	0.000085	Area (m2)	9.83	17.50	4.69
Q Total (m3/s)	7.79	Flow (m3/s)	0.77	6.61	0.41
Top Width (m)	34.50	Top Width (m)	17.46	10.00	7.04
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.08	0.38	0.09
Max Chl Dpth (m)	1.96	Hydr. Depth (m)	0.56	1.75	0.67
Conv. Total (m3/s)	845.3	Conv. (m3/s)	83.6	717.4	44.3
Length Wtd. (m)	241.75	Wetted Per. (m)	17.51	10.18	7.15
Min Ch El (m)	203.30	Shear (N/m2)	0.47	1.43	0.55
Alpha	2.06	Stream Power (N/m s)	0.04	0.54	0.05
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	116.05	211.35	74.71
C & E Loss (m)	0.00	Cum SA (1000 m2)	115.68	80.83	89.30

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.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.077
W.S. Elev (m)	207.44	Reach Len. (m)	295.00	240.00	190.00
Crit W.S. (m)		Flow Area (m2)	79.44	39.30	55.77
E.G. Slope (m/m)	0.000067	Area (m2)	79.44	39.30	55.77
Q Total (m3/s)	42.70	Flow (m3/s)	13.58	22.59	6.53
Top Width (m)	131.40	Top Width (m)	42.04	10.00	79.37
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.17	0.57	0.12
Max Chl Dpth (m)	4.14	Hydr. Depth (m)	1.89	3.93	0.70
Conv. Total (m3/s)	5223.1	Conv. (m3/s)	1661.5	2763.0	798.6
Length Wtd. (m)	248.69	Wetted Per. (m)	42.35	10.18	79.60
Min Ch El (m)	203.30	Shear (N/m2)	1.23	2.53	

0.46					
Alpha	3.11	Stream Power (N/m s)	0.21	1.45	
0.05					
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	426.61	432.41	
360.16					
C & E Loss (m)	0.00	Cum SA (1000 m2)	319.77	80.84	
304.66					

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: RIVER-1
REACH: Reach-1 RS: 46.413

INPUT
Description: Section 46.413 - Creditview Road - Inline Weir Section
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	203.05	144.7	203.05	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
128	146	5	5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	129.7	207.11	F
144.7	352	207.4	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	205.26	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.00	Wt. n-Val.		0.035	
W.S. Elev (m)	205.26	Reach Len. (m)	5.00	5.00	
5.00					
Crit W.S. (m)	203.27	Flow Area (m2)		33.11	
E.G. Slope (m/m)	0.000009	Area (m2)	29.76	39.05	
14.63					
Q Total (m3/s)	4.75	Flow (m3/s)		4.75	
Top Width (m)	52.28	Top Width (m)	22.19	18.00	
12.09					
Vel Total (m/s)	0.14	Avg. Vel. (m/s)		0.14	
Max Chl Dpth (m)	2.21	Hydr. Depth (m)		2.21	
Conv. Total (m3/s)	1603.4	Conv. (m3/s)		1603.4	
Length Wtd. (m)	5.00	Wetted Per. (m)		15.00	

Min Ch El (m)	203.05	Shear (N/m2)			0.19
Alpha	1.00	Stream Power (N/m s)			0.03
Frctn Loss (m)		Cum Volume (1000 m3)	110.21	204.56	72.88
C & E Loss (m)		Cum SA (1000 m2)	109.83	77.47	87.48

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.44	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.079	0.035	0.080
W.S. Elev (m)	207.44	Reach Len. (m)	5.00	5.00	5.00
Crit W.S. (m)	203.99	Flow Area (m2)	93.25	78.25	48.65
E.G. Slope (m/m)	0.000021	Area (m2)	93.25	78.25	48.65
Q Total (m3/s)	42.70	Flow (m3/s)	10.48	27.13	5.09
Top Width (m)	99.97	Top Width (m)	62.80	18.00	19.16
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.11	0.35	0.10
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.48	4.35	2.54
Conv. Total (m3/s)	9325.7	Conv. (m3/s)	2288.4	5926.0	1111.3
Length Wtd. (m)	5.00	Wetted Per. (m)	63.25	18.13	19.70
Min Ch El (m)	203.05	Shear (N/m2)	0.30	0.89	0.51
Alpha	2.15	Stream Power (N/m s)	0.03	0.31	0.05
Frctn Loss (m)		Cum Volume (1000 m3)	401.14	418.31	350.24
C & E Loss (m)		Cum SA (1000 m2)	304.30	77.48	295.30

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

INLINE STRUCTURE

RIVER: RIVER-1
REACH: Reach-1 RS: 46.4125

INPUT
Description: Hum 13B-4R. Creditview Road - 4 Cell - 3.0 m W x 1.5 m H x 41 m L Concrete Box Culverts and 6.5 m W Weir with Drop Inlet Structure.

Drawings by Urban Ecosystems Ltd. (DT-2 & G-4), 1999.

New
HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 1
Deck/Roadway Width = .5
Weir Coefficient = 1.75
Weir Embankment Coordinates num = 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	129.75	207.11	129.75	207	133.95	207
133.95	204.7	137.2	204.7	140.45	204.7	140.45	207	144.65	207
144.65	207.4	205	207.79	305	208.3	352	208.6		

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 =
Weir crest shape = Broad Crested

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.412

INPUT
Description: Section 46.412 - Creditview Road - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	203.05	144.7	203.05	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
128	146	45	45	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	129.7	207.11	F
144.7	352	207.4	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.91	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.035	
W.S. Elev (m)	203.91	Reach Len. (m)	45.00	45.00	45.00
Crit W.S. (m)	203.27	Flow Area (m2)		12.86	
E.G. Slope (m/m)	0.000206	Area (m2)	2.99	14.75	1.33
Q Total (m3/s)	4.75	Flow (m3/s)		4.75	

Top Width (m)	39.18	Top Width (m)	14.66	18.00	6.52
Vel Total (m/s)	0.37	Avg. Vel. (m/s)		0.37	
Max Chl Dpth (m)	0.86	Hydr. Depth (m)		0.86	
Conv. Total (m3/s)	331.4	Conv. (m3/s)		331.4	
Length Wtd. (m)	45.00	Wetted Per. (m)		15.00	
Min Ch El (m)	203.05	Shear (N/m2)		1.73	
Alpha	1.00	Stream Power (N/m s)		0.64	
Frctn Loss (m)		Cum Volume (1000 m3)	110.21	204.37	72.88
C & E Loss (m)		Cum SA (1000 m2)	109.74	77.38	87.43

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.37	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	
W.S. Elev (m)	207.37	Reach Len. (m)	45.00	45.00	45.00
Crit W.S. (m)	203.99	Flow Area (m2)	89.20	71.72	
E.G. Slope (m/m)	0.000032	Area (m2)	89.20	77.04	47.37
Q Total (m3/s)	42.70	Flow (m3/s)	12.31	30.39	
Top Width (m)	94.35	Top Width (m)	57.41	18.00	18.94
Vel Total (m/s)	0.27	Avg. Vel. (m/s)	0.14	0.42	
Max Chl Dpth (m)	4.32	Hydr. Depth (m)	1.55	4.29	
Conv. Total (m3/s)	7588.4	Conv. (m3/s)	2187.2	5401.2	
Length Wtd. (m)	45.00	Wetted Per. (m)	57.86	16.76	
Min Ch El (m)	203.05	Shear (N/m2)	0.48	1.33	
Alpha	1.89	Stream Power (N/m s)	0.07	0.56	
Frctn Loss (m)		Cum Volume (1000 m3)	401.14	417.72	350.24
C & E Loss (m)		Cum SA (1000 m2)	304.00	77.39	295.21

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.4115

INPUT
Description: Hum 13B-4R. Creditview Road - 4 Cell - 3.0 m W x 1.5 m H x 45 m L
Concrete Box Culverts and 6.5 m W Weir with Drop Inlet Structure.
Drawings by Urban Ecosystems Ltd. (DT-2 & G-4), 1999.

New
HEC-RAS coding January 2004 by Acres included coding of culvert
in HEC-RAS, including adjustments to roadway coding and hydraulic
loss coefficients.

Distance from Upstream XS = 10
Deck/Roadway Width = 25
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 11

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	208		60	207.5		129.7	207.11	
129.7	208.5		137.2	208.5		144.7	208.5	
144.7	207.4		205	207.79		265	208	
305	208.3		352	208.6				

Upstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	203.05	144.7	203.05	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
128	146	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	129.7	207.11	F
144.7	352	207.4	F

Downstream Deck/Roadway Coordinates
num= 11

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	208		60	207.5		129.7	207.11	
129.7	208.5		137.2	208.5		144.7	208.5	
144.7	207.4		205	207.79		265	208	
305	208.3		352	208.6				

Downstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	202.96	144.7	202.96	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

```
Bank Sta: Left   Right    Coeff Contr.   Expan.
          128     146            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   129.7   206.8       F
   144.7     352   206.8       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           Box     1.5       3
FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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      41     .015     .015        0                   .5
      1
Number of Barrels =  4
Upstream   Elevation =  203.05
Centerline Stations
    Sta.    Sta.    Sta.    Sta.
   132.1   135.5   138.9   142.3
Downstream Elevation =  202.96
Centerline Stations
    Sta.    Sta.    Sta.    Sta.
   132.1   135.5   138.9   142.3

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       4.75    Culv Full Len (m)
  # Barrels                    4    Culv Vel US (m/s)         0.47
  Q Barrel (m3/s)           1.19    Culv Vel DS (m/s)         0.42
  E.G. US. (m)            203.91    Culv Inv El Up (m)      203.05
  W.S. US. (m)            203.91    Culv Inv El Dn (m)      202.96
  E.G. DS (m)             203.90    Culv Frctn Ls (m)         0.01
  W.S. DS (m)             203.90    Culv Exit Loss (m)        0.00
  Delta EG (m)              0.01    Culv Entr Loss (m)        0.01
  Delta WS (m)              0.01    Q Weir (m3/s)
  E.G. IC (m)             203.46    Weir Sta Lft (m)
  E.G. OC (m)             203.91    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
  Culv WS Inlet (m)       203.90    Weir Max Depth (m)
  Culv WS Outlet (m)      203.90    Weir Avg Depth (m)
  Culv Nml Depth (m)        0.31    Weir Flow Area (m2)
  Culv Crt Depth (m)        0.25    Min El Weir Flow (m)    207.11


CULVERT OUTPUT  Profile #Regional w red'n  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      39.14    Culv Full Len (m)        41.00
  # Barrels                   4     Culv Vel US (m/s)         2.17
  Q Barrel (m3/s)           9.79    Culv Vel DS (m/s)         2.17
  E.G. US. (m)            207.37    Culv Inv El Up (m)      203.05
  W.S. US. (m)            207.37    Culv Inv El Dn (m)      202.96
```

E.G. DS (m)	206.91	Culv Frctn Ls (m)	0.11
W.S. DS (m)	206.90	Culv Exit Loss (m)	0.24
Delta EG (m)	0.47	Culv Entr Loss (m)	0.12
Delta WS (m)	0.46	Q Weir (m3/s)	3.55
E.G. IC (m)	204.84	Weir Sta Lft (m)	82.57
E.G. OC (m)	207.37	Weir Sta Rgt (m)	129.70
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	204.55	Weir Max Depth (m)	0.26
Culv WS Outlet (m)	204.46	Weir Avg Depth (m)	0.13
Culv Nml Depth (m)		Weir Flow Area (m2)	6.21
Culv Crt Depth (m)	1.03	Min El Weir Flow (m)	207.11

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.411

INPUT
Description: Section 46.411 - Creditview Road - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	202.96	144.7	202.96	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
128	146	80	80	90	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	129.7	206.8	F
144.7	352	206.8	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.90	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.035	
W.S. Elev (m)	203.90	Reach Len. (m)	80.00	80.00	90.00
Crit W.S. (m)	203.18	Flow Area (m2)		14.03	
E.G. Slope (m/m)	0.000154	Area (m2)	2.82	16.03	1.25
Q Total (m3/s)	4.75	Flow (m3/s)		4.75	
Top Width (m)	38.57	Top Width (m)	14.24	18.00	6.33
Vel Total (m/s)	0.34	Avg. Vel. (m/s)		0.34	
Max Chl Dpth (m)	0.94	Hydr. Depth (m)		0.94	

Conv. Total (m3/s)	383.6	Conv. (m3/s)		383.6
Length Wtd. (m)	80.76	Wetted Per. (m)		15.00
Min Ch El (m)	202.96	Shear (N/m2)		1.41
Alpha	1.00	Stream Power (N/m s)		0.48
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	110.21	204.19
72.88				
C & E Loss (m)	0.00	Cum SA (1000 m2)	109.09	76.57
87.15				

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.91	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	
0.080					
W.S. Elev (m)	206.90	Reach Len. (m)	80.00	80.00	
90.00					
Crit W.S. (m)	203.90	Flow Area (m2)	70.79	70.16	
38.91					
E.G. Slope (m/m)	0.000033	Area (m2)	70.79	70.16	
38.91					
Q Total (m3/s)	42.70	Flow (m3/s)	9.47	28.50	
4.72					
Top Width (m)	63.11	Top Width (m)	27.68	18.00	
17.43					
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.13	0.41	
0.12					
Max Chl Dpth (m)	3.94	Hydr. Depth (m)	2.56	3.90	
2.23					
Conv. Total (m3/s)	7384.3	Conv. (m3/s)	1638.0	4929.7	
816.7					
Length Wtd. (m)	81.46	Wetted Per. (m)	28.11	18.19	
17.89					
Min Ch El (m)	202.96	Shear (N/m2)	0.83	1.26	
0.71					
Alpha	2.05	Stream Power (N/m s)	0.11	0.51	
0.09					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	401.14	416.61	
350.24					
C & E Loss (m)	0.00	Cum SA (1000 m2)	302.09	76.58	
294.39					

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: RIVER-1
REACH: Reach-1 RS: 46.41

INPUT
Description: Section 46.41 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207.5	71	207	83	204	84	203.56	123	203.56
126	205	136	205	140	204	156	203.1	161	202.5
164	202.5	166	203	195	204	206	208	234	208.2

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	71	.08	83	.035	126	.08	156	.035
166	.08	195	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
156	166	140	140	120	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.89	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.043	0.035	0.080
W.S. Elev (m)	203.89	Reach Len. (m)	140.00	140.00	120.00
Crit W.S. (m)		Flow Area (m2)	18.39	11.85	11.37
E.G. Slope (m/m)	0.000130	Area (m2)	18.39	11.85	11.37
Q Total (m3/s)	7.62	Flow (m3/s)	2.38	4.30	0.94
Top Width (m)	90.05	Top Width (m)	54.38	10.00	25.67
Vel Total (m/s)	0.18	Avg. Vel. (m/s)	0.13	0.36	0.08
Max Chl Dpth (m)	1.39	Hydr. Depth (m)	0.34	1.19	0.44
Conv. Total (m3/s)	667.9	Conv. (m3/s)	208.6	376.8	82.5
Length Wtd. (m)	138.77	Wetted Per. (m)	54.54	10.10	25.69
Min Ch El (m)	202.50	Shear (N/m2)	0.43	1.50	0.57
Alpha	2.39	Stream Power (N/m s)	0.06	0.54	0.05
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	109.36	203.08	72.31
C & E Loss (m)	0.00	Cum SA (1000 m2)	106.34	75.45	85.71

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.91	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.044	0.035	0.077
W.S. Elev (m)	206.90	Reach Len. (m)	140.00	140.00	120.00
Crit W.S. (m)		Flow Area (m2)	240.59	42.04	110.32
E.G. Slope (m/m)	0.000008	Area (m2)	240.59	42.04	110.32
Q Total (m3/s)	47.80	Flow (m3/s)	30.75	8.57	8.48
Top Width (m)	131.60	Top Width (m)	84.62	10.00	36.99
Vel Total (m/s)	0.12	Avg. Vel. (m/s)	0.13	0.20	0.08
Max Chl Dpth (m)	4.40	Hydr. Depth (m)	2.84	4.20	2.98
Conv. Total (m3/s)	17337.3	Conv. (m3/s)	11152.1	3108.5	3076.7
Length Wtd. (m)	135.44	Wetted Per. (m)	85.54	10.10	37.51
Min Ch El (m)	202.50	Shear (N/m2)	0.21	0.31	0.22
Alpha	1.28	Stream Power (N/m s)	0.03	0.06	0.02
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	388.68	412.12	343.52
C & E Loss (m)	0.00	Cum SA (1000 m2)	297.60	75.46	291.94

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: RIVER-1
REACH: Reach-1 RS: 46.402

INPUT
Description: Section 46.402 - Highway 400 - U/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	212	21	206	97	205	104	203	105	202.4
115	202.4	116	203	125	205	136	206	187	206
250	206	270	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	97	.08	104	.035	116	.08	136	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
104	116	100	100	100	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	106	206.7	F
114.5	270	206.7	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.86	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.84	Reach Len. (m)	100.00	100.00	100.00
Crit W.S. (m)	202.83	Flow Area (m2)		12.26	
E.G. Slope (m/m)	0.000291	Area (m2)	1.24	16.70	1.60
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	18.74	Top Width (m)	2.95	12.00	3.79
Vel Total (m/s)	0.62	Avg. Vel. (m/s)		0.62	
Max Chl Dpth (m)	1.44	Hydr. Depth (m)		1.44	
Conv. Total (m3/s)	447.0	Conv. (m3/s)		447.0	
Length Wtd. (m)	100.00	Wetted Per. (m)		8.50	
Min Ch El (m)	202.40	Shear (N/m2)		4.11	
Alpha	1.00	Stream Power (N/m s)		2.56	
Frctn Loss (m)		Cum Volume (1000 m3)	107.99	201.08	71.53
C & E Loss (m)		Cum SA (1000 m2)	102.33	73.91	83.94

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.90	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.055	0.035	0.059
W.S. Elev (m)	206.90	Reach Len. (m)	100.00	100.00	100.00
Crit W.S. (m)	203.88	Flow Area (m2)	128.12	53.40	148.15
E.G. Slope (m/m)	0.000023	Area (m2)	128.12	53.40	148.15
Q Total (m3/s)	47.80	Flow (m3/s)	15.09	19.42	13.30
Top Width (m)	241.15	Top Width (m)	86.15	12.00	143.00
Vel Total (m/s)	0.14	Avg. Vel. (m/s)	0.12	0.36	0.09
Max Chl Dpth (m)	4.50	Hydr. Depth (m)	1.49	4.45	

1.04					
Conv. Total (m3/s)	9978.6	Conv. (m3/s)	3149.6	4053.3	2775.7
Length Wtd. (m)	100.00	Wetted Per. (m)	86.56	12.33	143.31
Min Ch El (m)	202.40	Shear (N/m2)	0.33	0.97	0.23
Alpha	2.87	Stream Power (N/m s)	0.04	0.35	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	362.87	405.44	328.02
C & E Loss (m)		Cum SA (1000 m2)	285.64	73.92	281.14

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.4015

INPUT
Description: Hum 13B-3R. Highway 400 - 3 Cell - 2.4 m W x 2.4 m H x 80 m L Concrete Box Culverts. Drawings by McCormick Rankin (Sheet 40 & 47, no date) used to code culvert in HEC-RAS format.

New
HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 14
Deck/Roadway Width = 80
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	206.5		189	207		270	207.8	

Upstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	212	21	206	97	205	104	203	105	202.4
115	202.4	116	203	125	205	136	206	187	206
250	206	270	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	97	.08	104	.035	116	.08	136	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
104	116	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	106	206.7	F
114.5	270	206.7	F

Downstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord

```
       0   206.5             189     207             270   207.8

Downstream Bridge Cross Section Data
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0     212      21     206      97     205     104     203     105   202.4
     115   202.4     116     203     125     205     136     206     187     206
     270   206.5

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05      21     .08     104    .035     116     .08     136     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
           104     116            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     106     206       F
   114.5     270     206       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           Box     2.4     2.4
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
                14      80     .015     .015        0                    .4
      1
Number of Barrels =  3
Upstream   Elevation =  202.4
Centerline Stations
    Sta.    Sta.    Sta.
   107.5   110.2   112.9
Downstream Elevation =  202.4
Centerline Stations
    Sta.    Sta.    Sta.
   107.5   110.2   112.9

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       7.62    Culv Full Len (m)
  # Barrels                    3    Culv Vel US (m/s)         0.74
  Q Barrel (m3/s)           2.54    Culv Vel DS (m/s)         0.75
  E.G. US. (m)            203.86    Culv Inv El Up (m)      202.40
  W.S. US. (m)            203.84    Culv Inv El Dn (m)      202.40
  E.G. DS (m)             203.82    Culv Frctn Ls (m)         0.01
  W.S. DS (m)             203.80    Culv Exit Loss (m)        0.01
  Delta EG (m)              0.04    Culv Entr Loss (m)        0.01
  Delta WS (m)              0.04    Q Weir (m3/s)
  E.G. IC (m)             203.16    Weir Sta Lft (m)
  E.G. OC (m)             203.86    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
```

Culv WS Inlet (m)	203.82	Weir Max Depth (m)	
Culv WS Outlet (m)	203.80	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.49	Min El Weir Flow (m)	206.70

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	31.75	Culv Full Len (m)	80.00
# Barrels	3	Culv Vel US (m/s)	1.84
Q Barrel (m3/s)	10.58	Culv Vel DS (m/s)	1.84
E.G. US. (m)	206.90	Culv Inv El Up (m)	202.40
W.S. US. (m)	206.90	Culv Inv El Dn (m)	202.40
E.G. DS (m)	206.55	Culv Frctn Ls (m)	0.12
W.S. DS (m)	206.54	Culv Exit Loss (m)	0.16
Delta EG (m)	0.35	Culv Entr Loss (m)	0.07
Delta WS (m)	0.36	Q Weir (m3/s)	16.05
E.G. IC (m)	205.08	Weir Sta Lft (m)	17.83
E.G. OC (m)	206.90	Weir Sta Rgt (m)	153.02
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	204.80	Weir Max Depth (m)	0.35
Culv WS Outlet (m)	204.80	Weir Avg Depth (m)	0.18
Culv Nml Depth (m)		Weir Flow Area (m2)	23.96
Culv Crt Depth (m)	1.26	Min El Weir Flow (m)	206.70

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.401

INPUT
Description: Section 46.401 - Highway 400 - D/S Bounding Section - J.D. Barnes
2003 topo mapping

Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	212	21	206	97	205	104	203	105	202.4
115	202.4	116	203	125	205	136	206	187	206
270	206.5								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	21	.08	104	.035	116	.08	136	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
104	116	80	95	100	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	106	206	F
114.5	270	206	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.82	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	

W.S. Elev (m)	203.80	Reach Len. (m)	80.00	95.00	100.00
Crit W.S. (m)	202.83	Flow Area (m2)		11.93	
E.G. Slope (m/m)	0.000318	Area (m2)	1.13	16.24	1.45
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	18.43	Top Width (m)	2.81	12.00	3.62
Vel Total (m/s)	0.64	Avg. Vel. (m/s)		0.64	
Max Chl Dpth (m)	1.40	Hydr. Depth (m)		1.40	
Conv. Total (m3/s)	427.3	Conv. (m3/s)		427.3	
Length Wtd. (m)	95.00	Wetted Per. (m)		8.50	
Min Ch El (m)	202.40	Shear (N/m2)		4.38	
Alpha	1.00	Stream Power (N/m s)		2.80	
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	107.99	200.48	71.53
C & E Loss (m)	0.00	Cum SA (1000 m2)	102.04	72.71	83.57

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.55	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.066
W.S. Elev (m)	206.54	Reach Len. (m)	80.00	95.00	100.00
Crit W.S. (m)	203.88	Flow Area (m2)	97.50	49.10	86.23
E.G. Slope (m/m)	0.000063	Area (m2)	97.50	49.10	86.23
Q Total (m3/s)	47.80	Flow (m3/s)	10.67	27.93	9.20
Top Width (m)	250.90	Top Width (m)	84.90	12.00	154.00
Vel Total (m/s)	0.21	Avg. Vel. (m/s)	0.11	0.57	0.11
Max Chl Dpth (m)	4.14	Hydr. Depth (m)	1.15	4.09	0.56
Conv. Total (m3/s)	6032.0	Conv. (m3/s)	1346.1	3524.6	1161.3
Length Wtd. (m)	90.36	Wetted Per. (m)	85.26	12.33	154.31
Min Ch El (m)	202.40	Shear (N/m2)	0.70	2.45	0.34
Alpha	4.60	Stream Power (N/m s)	0.08	1.39	0.04
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	362.87	398.03	328.02

C & E Loss (m)	0.00	Cum SA (1000 m2)	277.09	72.72
266.29				

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: RIVER-1
REACH: Reach-1 RS: 46.392

INPUT
Description: Section 46.392 - Langstaff Road - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	15	206	30	206	103	206	106	205
130	205	135	203	136	202.5	145	202.5	147	203
153	205	175	205	191	210	203	210		

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.025	103	.05	130	.08	135	.035
147	.08	153	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
135	147	70	70	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	136.4	206.2	F
145	203	212.9	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.79	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.03	Wt. n-Val.		0.035
W.S. Elev (m)	203.76	Reach Len. (m)	70.00	70.00
70.00				
Crit W.S. (m)	202.93	Flow Area (m2)		10.86
E.G. Slope (m/m)	0.000443	Area (m2)	0.73	14.40
0.87				
Q Total (m3/s)	7.62	Flow (m3/s)		7.62
Top Width (m)	16.19	Top Width (m)	1.91	12.00
2.29				
Vel Total (m/s)	0.70	Avg. Vel. (m/s)		0.70
Max Chl Dpth (m)	1.26	Hydr. Depth (m)		1.26
Conv. Total (m3/s)	362.4	Conv. (m3/s)		362.4
Length Wtd. (m)	70.00	Wetted Per. (m)		8.60
Min Ch El (m)	202.50	Shear (N/m2)		5.48

Alpha	1.00	Stream Power (N/m s)		3.85
Frctn Loss (m)		Cum Volume (1000 m3)	107.91	199.03
71.42				
C & E Loss (m)		Cum SA (1000 m2)	101.85	71.57
83.27				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.54	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.01	Wt. n-Val.	0.043	0.035
W.S. Elev (m)	206.53	Reach Len. (m)	70.00	70.00
70.00				
Crit W.S. (m)	203.97	Flow Area (m2)	99.88	40.07
E.G. Slope (m/m)	0.000081	Area (m2)	99.88	47.64
52.66				
Q Total (m3/s)	47.80	Flow (m3/s)	21.97	25.83
Top Width (m)	166.90	Top Width (m)	122.00	12.00
32.90				
Vel Total (m/s)	0.34	Avg. Vel. (m/s)	0.22	0.64
Max Chl Dpth (m)	4.03	Hydr. Depth (m)	0.82	4.01
Conv. Total (m3/s)	5302.7	Conv. (m3/s)	2436.8	2865.9
Length Wtd. (m)	70.00	Wetted Per. (m)	122.61	10.12
Min Ch El (m)	202.50	Shear (N/m2)	0.65	3.16
Alpha	2.12	Stream Power (N/m s)	0.14	2.03
Frctn Loss (m)		Cum Volume (1000 m3)	354.98	393.44
321.07				
C & E Loss (m)		Cum SA (1000 m2)	268.81	71.58
256.95				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

MULTIPLE OPENING

RIVER: RIVER-1
REACH: Reach-1 RS: 46.3915

INPUT
Description: Hum 13B-2R. Langstaff Road - 3 Cell - 2.4 m W x 2.4 m H x 60 m L Concrete Box Culverts. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004 by Acres
included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 60
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 9

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	212.8		8	213	212	28	213.2	212.3
73	213.82	212.82	103	213.4	212.4	103	213.4	206
142	213		182	212		203	211.5	

Upstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	15	206	30	206	103	206	106	205
130	205	135	203	136	202.5	145	202.5	147	203
153	205	175	205	191	210	203	210		

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.025	103	.05	130	.08	135	.035
147	.08	153	.05						

Bank Sta: Left	Right	Coeff Contr.	Expan.
135	147	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	136.4	206.2	F
145	203	212.9	F

Downstream Deck/Roadway Coordinates
num= 9

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	212.8		8	213	212	28	213.2	212.3
73	213.82	212.82	103	213.4	212.4	103	213.4	206
142	213		182	212		203	211.5	

Downstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	15	206	30	206	103	206	106	205
130	205	135	203	136	202.4	145	202.4	147	203
153	205	175	205	191	210	203	210		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.025	103	.05	130	.08	153	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
135	147	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	136.4	206	F
145	203	211	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 Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Box	2.4	2.4

FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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
	5	60	.015	.015	0	.5	1

Number of Barrels = 3
Upstream Elevation = 202.5
Centerline Stations

Sta.	Sta.	Sta.
138	140.7	143.4

Downstream Elevation = 202.4
Centerline Stations

Sta.	Sta.	Sta.
138	140.7	143.4

Multiple Opening Stagnation Limits

	Upstream		Downstream	
Opening Type	Sta. Left	Sta. Right	Sta. Left	Sta. Right
Bridge	0	120	0	120
Culvert Group	120	203	120	203

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.391

INPUT
Description: Section 46.391 - Langstaff Road - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	15	206	30	206	103	206	106	205
130	205	135	203	136	202.4	145	202.4	147	203
153	205	175	205	191	210	203	210		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.025	103	.05	130	.08	153	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
135	147	45	35	25	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	136.4	206	F
145	203	211	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.74	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.080	
W.S. Elev (m)	203.72	Reach Len. (m)	45.00	35.00	25.00
Crit W.S. (m)	202.83	Flow Area (m2)		11.34	
E.G. Slope (m/m)	0.002002	Area (m2)	0.65	14.92	0.77
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	15.95	Top Width (m)	1.80	12.00	2.16
Vel Total (m/s)	0.67	Avg. Vel. (m/s)		0.67	
Max Chl Dpth (m)	1.32	Hydr. Depth (m)		1.32	
Conv. Total (m3/s)	170.4	Conv. (m3/s)		170.4	
Length Wtd. (m)	35.03	Wetted Per. (m)		8.60	
Min Ch El (m)	202.40	Shear (N/m2)		25.88	
Alpha	1.00	Stream Power (N/m s)		17.40	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	107.91	199.03	71.42
C & E Loss (m)	0.01	Cum SA (1000 m2)	101.72	70.73	83.12

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.045	0.080	
W.S. Elev (m)	206.45	Reach Len. (m)	45.00	35.00	25.00

Crit W.S. (m)	203.87	Flow Area (m2)	89.27	40.15
E.G. Slope (m/m)	0.000212	Area (m2)	89.27	47.64
49.80				
Q Total (m3/s)	47.80	Flow (m3/s)	29.55	18.25
Top Width (m)	166.29	Top Width (m)	121.67	12.00
32.62				
Vel Total (m/s)	0.37	Avg. Vel. (m/s)	0.33	0.45
Max Chl Dpth (m)	4.05	Hydr. Depth (m)	0.73	4.02
Conv. Total (m3/s)	3285.2	Conv. (m3/s)	2031.2	1254.0
Length Wtd. (m)	38.91	Wetted Per. (m)	122.27	10.17
Min Ch El (m)	202.40	Shear (N/m2)	1.52	8.20
Alpha	1.07	Stream Power (N/m s)	0.50	3.73
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	354.98	393.44
321.07				
C & E Loss (m)	0.00	Cum SA (1000 m2)	260.29	70.74
254.65				

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: RIVER-1
REACH: Reach-1 RS: 46.39

INPUT
Description: Section 46.39 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	20	205	45	205	51	206.5	133	206.3
142	206	152	205	161	204	185	204	193	203
195	202.4	204	202.4	206	203	212	204	236	205
268	210								

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	51	.025	142	.05	185	.08	193	.035
206	.08	212	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
193	206	50	35	25	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	51	206.6	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.72	Element	Left OB	Channel

Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.71	Reach Len. (m)	50.00	35.00	25.00
Crit W.S. (m)	202.80	Flow Area (m2)	2.01	15.81	1.51
E.G. Slope (m/m)	0.000206	Area (m2)	2.01	15.81	1.51
Q Total (m3/s)	7.62	Flow (m3/s)	0.18	7.31	0.13
Top Width (m)	22.92	Top Width (m)	5.67	13.00	4.25
Vel Total (m/s)	0.39	Avg. Vel. (m/s)	0.09	0.46	0.09
Max Chl Dpth (m)	1.31	Hydr. Depth (m)	0.35	1.22	0.35
Conv. Total (m3/s)	531.7	Conv. (m3/s)	12.5	509.9	9.3
Length Wtd. (m)	35.09	Wetted Per. (m)	5.71	13.18	4.31
Min Ch El (m)	202.40	Shear (N/m2)	0.71	2.42	0.70
Alpha	1.32	Stream Power (N/m s)	0.06	1.12	0.06
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	107.85	198.49	71.39
C & E Loss (m)	0.00	Cum SA (1000 m2)	101.56	70.29	83.04

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.055	0.035	0.057
W.S. Elev (m)	206.44	Reach Len. (m)	50.00	35.00	25.00
Crit W.S. (m)	203.62	Flow Area (m2)	116.11	51.38	71.02
E.G. Slope (m/m)	0.000029	Area (m2)	166.83	51.38	71.02
Q Total (m3/s)	47.80	Flow (m3/s)	18.06	19.50	10.23
Top Width (m)	216.77	Top Width (m)	164.53	13.00	39.25
Vel Total (m/s)	0.20	Avg. Vel. (m/s)	0.16	0.38	0.14
Max Chl Dpth (m)	4.04	Hydr. Depth (m)	0.97	3.95	1.81
Conv. Total (m3/s)	8912.9	Conv. (m3/s)	3368.0	3636.8	1908.1
Length Wtd. (m)	40.73	Wetted Per. (m)	119.48	13.18	39.46

Min Ch El (m)	202.40	Shear (N/m2)	0.27	1.10	0.51
Alpha	1.80	Stream Power (N/m s)	0.04	0.42	0.07
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	349.22	391.71	319.56
C & E Loss (m)	0.00	Cum SA (1000 m2)	253.85	70.30	253.75

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: RIVER-1
REACH: Reach-1 RS: 46.382

INPUT
Description: Section 46.382 - Hwy 400 / Langstaff Rd Ramp - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	50	206.5	95	205	220	204	227	203
235	202.4	244	202.4	247	203	252	204	257	205
269	206	300	206	300	209.5				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	50	.08	227	.035	247	.08	257	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
227	247	45	45	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235.2	206.38	F
243.8	300	207.55	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.71	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.68	Reach Len. (m)	45.00	45.00	45.00
Crit W.S. (m)	202.83	Flow Area (m2)		11.03	
E.G. Slope (m/m)	0.000420	Area (m2)	1.63	22.36	1.17
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	28.20	Top Width (m)	4.78	20.00	3.42
Vel Total (m/s)	0.69	Avg. Vel. (m/s)		0.69	
Max Chl Dpth (m)	1.28	Hydr. Depth (m)		1.28	
Conv. Total (m3/s)	372.2	Conv. (m3/s)		372.2	

Length Wtd. (m)	45.00	Wetted Per. (m)			8.60
Min Ch El (m)	202.40	Shear (N/m2)			5.28
Alpha	1.00	Stream Power (N/m s)			3.65
Frctn Loss (m)		Cum Volume (1000 m3)	107.76	197.82	71.35
C & E Loss (m)		Cum SA (1000 m2)	101.29	69.71	82.94

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035	45.00
W.S. Elev (m)	206.44	Reach Len. (m)	45.00	45.00	45.00
Crit W.S. (m)	203.86	Flow Area (m2)	294.89	65.54	
E.G. Slope (m/m)	0.000024	Area (m2)	294.89	77.58	49.53
Q Total (m3/s)	47.80	Flow (m3/s)	25.30	22.50	
Top Width (m)	248.32	Top Width (m)	175.32	20.00	53.00
Vel Total (m/s)	0.13	Avg. Vel. (m/s)	0.09	0.34	
Max Chl Dpth (m)	4.04	Hydr. Depth (m)	1.68	3.90	
Conv. Total (m3/s)	9847.5	Conv. (m3/s)	5211.3	4636.2	
Length Wtd. (m)	45.00	Wetted Per. (m)	175.42	16.82	
Min Ch El (m)	202.40	Shear (N/m2)	0.39	0.90	
Alpha	3.38	Stream Power (N/m s)	0.03	0.31	
Frctn Loss (m)		Cum Volume (1000 m3)	337.67	389.45	318.06
C & E Loss (m)		Cum SA (1000 m2)	245.35	69.72	252.60

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.3815

INPUT

Description: Hum 13B-1R. Hwy 400 / Langstaff Rd Ramp - 3 Cell - 2.4 m W x 2.4 m H x 38 m L Concrete Box Culverts. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004
by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 2
Deck/Roadway Width = 38
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	207		130	206.38		200	206	
230	207		260	208		285	209	
300	209.5							

Upstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	50	206.5	95	205	220	204	227	203
235	202.4	244	202.4	247	203	252	204	257	205
269	206	300	206	300	209.5				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	50	.08	227	.035	247	.08	257	.05

Bank Sta: Left Right Coeff Contr. Expan.
227 247 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235.2	206.38	F
243.8	300	207.55	F

Downstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	207		130	206.38		200	206	
230	207		260	208		285	209	
300	209.5							

Downstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	50	206.5	95	205	220	204	227	203
235	202.3	244	202.3	247	203	252	204	257	205
269	206	300	206	300	209.5				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	50	.05	220	.08	227	.035	247	.08
257	.05								

Bank Sta: Left Right Coeff Contr. Expan.
227 247 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235.2	205.5	F
243.8	300	205.5	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           Box     2.4     2.4
FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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
                 2      38     .015     .015        0                    .7
      1
Number of Barrels =  3
Upstream   Elevation =  202.4
Centerline Stations
    Sta.    Sta.    Sta.
   236.9   239.5   242.1
Downstream Elevation =  202.3
Centerline Stations
    Sta.    Sta.    Sta.
   236.9   239.5   242.1

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       7.62    Culv Full Len (m)
  # Barrels                    3    Culv Vel US (m/s)         0.85
  Q Barrel (m3/s)           2.54    Culv Vel DS (m/s)         0.79
  E.G. US. (m)            203.71    Culv Inv El Up (m)      202.40
  W.S. US. (m)            203.68    Culv Inv El Dn (m)      202.30
  E.G. DS (m)             203.66    Culv Frctn Ls (m)         0.01
  W.S. DS (m)             203.64    Culv Exit Loss (m)        0.01
  Delta EG (m)              0.05    Culv Entr Loss (m)        0.03
  Delta WS (m)              0.04    Q Weir (m3/s)
  E.G. IC (m)             203.19    Weir Sta Lft (m)
  E.G. OC (m)             203.71    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
  Culv WS Inlet (m)       203.64    Weir Max Depth (m)
  Culv WS Outlet (m)      203.64    Weir Avg Depth (m)
  Culv Nml Depth (m)        0.58    Weir Flow Area (m2)
  Culv Crt Depth (m)        0.49    Min El Weir Flow (m)    206.38


CULVERT OUTPUT  Profile #Regional w red'n  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      32.68    Culv Full Len (m)        38.00
  # Barrels                   3     Culv Vel US (m/s)         1.89
  Q Barrel (m3/s)          10.89    Culv Vel DS (m/s)         1.89
  E.G. US. (m)            206.45    Culv Inv El Up (m)      202.40
  W.S. US. (m)            206.44    Culv Inv El Dn (m)      202.30
  E.G. DS (m)             206.08    Culv Frctn Ls (m)         0.06
  W.S. DS (m)             206.08    Culv Exit Loss (m)        0.18
  Delta EG (m)              0.37    Culv Entr Loss (m)        0.13
  Delta WS (m)              0.37    Q Weir (m3/s)            15.12
  E.G. IC (m)             205.10    Weir Sta Lft (m)        116.39
  E.G. OC (m)             206.45    Weir Sta Rgt (m)        213.35
  Culvert Control         Outlet    Weir Submerg              0.00
  Culv WS Inlet (m)       204.80    Weir Max Depth (m)        0.44
  Culv WS Outlet (m)      204.70    Weir Avg Depth (m)        0.22
```

Culv Nml Depth (m)		Weir Flow Area (m2)	21.26
Culv Crt Depth (m)	1.28	Min El Weir Flow (m)	206.38

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.381

INPUT
Description: Section 46.381 - Hwy 400 / Langstaff Rd Ramp - D/S Bounding
Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	50	206.5	95	205	220	204	227	203
235	202.3	244	202.3	247	203	252	204	257	205
269	206	300	206	300	209.5				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	50	.05	220	.08	227	.035	247	.08
257	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
227	247	260	275	290	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235.2	205.5	F
243.8	300	205.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.66	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.64	Reach Len. (m)	260.00	275.00	290.00
Crit W.S. (m)	202.73	Flow Area (m2)		11.51	
E.G. Slope (m/m)	0.000364	Area (m2)	1.43	22.93	1.02
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	27.67	Top Width (m)	4.47	20.00	3.20
Vel Total (m/s)	0.66	Avg. Vel. (m/s)		0.66	
Max Chl Dpth (m)	1.34	Hydr. Depth (m)		1.34	
Conv. Total (m3/s)	399.7	Conv. (m3/s)		399.7	
Length Wtd. (m)	275.05	Wetted Per. (m)		8.60	
Min Ch El (m)	202.30	Shear (N/m2)		4.78	
Alpha	1.00	Stream Power (N/m s)		3.16	

Frctn Loss (m)	0.11	Cum Volume (1000 m3)	107.76	197.65	71.35
C & E Loss (m)	0.00	Cum SA (1000 m2)	101.09	68.81	82.79

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.052	0.035	0.076
W.S. Elev (m)	206.08	Reach Len. (m)	260.00	275.00	290.00
Crit W.S. (m)	203.77	Flow Area (m2)	232.29	71.65	29.99
E.G. Slope (m/m)	0.000019	Area (m2)	232.29	71.65	29.99
Q Total (m3/s)	47.80	Flow (m3/s)	24.83	20.86	2.11
Top Width (m)	237.26	Top Width (m)	164.26	20.00	53.00
Vel Total (m/s)	0.14	Avg. Vel. (m/s)	0.11	0.29	0.07
Max Chl Dpth (m)	3.78	Hydr. Depth (m)	1.41	3.58	0.57
Conv. Total (m3/s)	10945.2	Conv. (m3/s)	5686.6	4775.9	482.7
Length Wtd. (m)	272.95	Wetted Per. (m)	164.35	20.11	53.32
Min Ch El (m)	202.30	Shear (N/m2)	0.26	0.67	0.11
Alpha	2.10	Stream Power (N/m s)	0.03	0.19	0.01
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	337.67	387.53	318.06
C & E Loss (m)	0.01	Cum SA (1000 m2)	237.71	68.82	250.22

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: RIVER-1
REACH: Reach-1 RS: 46.36

INPUT

Description: Section 46.36 - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207.4	29	207	39	205	50	202	52	201.6
57	201.6	59	202	71	205	130	205.8		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	29	.05	39	.08	50	.035	59	.08
71	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
50	59	150	150	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
110	130	208	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.54	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.51	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)		Flow Area (m2)	4.17	16.38	4.55
E.G. Slope (m/m)	0.000435	Area (m2)	4.17	16.38	4.55
Q Total (m3/s)	16.31	Flow (m3/s)	0.88	14.46	0.96
Top Width (m)	20.57	Top Width (m)	5.53	9.00	6.04
Vel Total (m/s)	0.65	Avg. Vel. (m/s)	0.21	0.88	0.21
Max Chl Dpth (m)	1.91	Hydr. Depth (m)	0.75	1.82	0.75
Conv. Total (m3/s)	782.1	Conv. (m3/s)	42.2	693.7	46.2
Length Wtd. (m)	150.00	Wetted Per. (m)	5.73	9.08	6.22
Min Ch El (m)	201.60	Shear (N/m2)	3.10	7.69	3.12
Alpha	1.65	Stream Power (N/m s)	0.65	6.79	0.66
Frctn Loss (m)	0.06	Cum Volume (1000 m3)	107.03	192.24	70.55
C & E Loss (m)	0.00	Cum SA (1000 m2)	99.79	64.83	81.45

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.05	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.079	0.035	0.068
W.S. Elev (m)	206.02	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)		Flow Area (m2)	30.26	38.95	

59.52					
E.G. Slope (m/m)	0.000195	Area (m2)	30.26	38.95	
66.56					
Q Total (m3/s)	66.49	Flow (m3/s)	9.17	41.00	
16.32					
Top Width (m)	96.08	Top Width (m)	16.08	9.00	
71.00					
Vel Total (m/s)	0.52	Avg. Vel. (m/s)	0.30	1.05	
0.27					
Max Chl Dpth (m)	4.42	Hydr. Depth (m)	1.88	4.33	
1.17					
Conv. Total (m3/s)	4764.5	Conv. (m3/s)	657.4	2937.9	
1169.2					
Length Wtd. (m)	150.00	Wetted Per. (m)	16.58	9.08	
51.37					
Min Ch El (m)	201.60	Shear (N/m2)	3.48	8.19	
2.21					
Alpha	2.68	Stream Power (N/m s)	1.06	8.62	
0.61					
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	303.54	372.32	
304.06					
C & E Loss (m)	0.00	Cum SA (1000 m2)	214.27	64.83	
232.24					

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.35

INPUT
Description: Section 46.35 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	206.8	29	206.5	35	206	49	202	52	201.4
56	201.4	59	202	79	205	100	205.5	100	208
139	208								

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	29	.05	35	.08	49	.035	59	.08
79	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
49	59	120	120	120	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.49	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	
0.080					
W.S. Elev (m)	203.46	Reach Len. (m)	120.00	120.00	
120.00					
Crit W.S. (m)		Flow Area (m2)	3.73	18.80	
7.11					
E.G. Slope (m/m)	0.000314	Area (m2)	3.73	18.80	

7.11					
Q Total (m3/s)	16.31	Flow (m3/s)	0.65	14.39	
1.27					
Top Width (m)	24.84	Top Width (m)	5.11	10.00	
9.73					
Vel Total (m/s)	0.55	Avg. Vel. (m/s)	0.17	0.77	
0.18					
Max Chl Dpth (m)	2.06	Hydr. Depth (m)	0.73	1.88	
0.73					
Conv. Total (m3/s)	920.2	Conv. (m3/s)	36.8	811.9	
71.5					
Length Wtd. (m)	120.00	Wetted Per. (m)	5.31	10.12	
9.84					
Min Ch El (m)	201.40	Shear (N/m2)	2.16	5.72	
2.22					
Alpha	1.72	Stream Power (N/m s)	0.38	4.38	
0.40					
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	106.44	189.60	
69.67					
C & E Loss (m)	0.00	Cum SA (1000 m2)	98.99	63.40	
80.27					

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.02	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	
0.075					
W.S. Elev (m)	205.99	Reach Len. (m)	120.00	120.00	
120.00					
Crit W.S. (m)		Flow Area (m2)	27.91	44.14	
65.50					
E.G. Slope (m/m)	0.000158	Area (m2)	27.91	44.14	
65.50					
Q Total (m3/s)	66.49	Flow (m3/s)	6.77	42.26	
17.46					
Top Width (m)	64.98	Top Width (m)	13.98	10.00	
41.00					
Vel Total (m/s)	0.48	Avg. Vel. (m/s)	0.24	0.96	
0.27					
Max Chl Dpth (m)	4.59	Hydr. Depth (m)	2.00	4.41	
1.60					
Conv. Total (m3/s)	5296.5	Conv. (m3/s)	539.0	3366.8	
1390.6					
Length Wtd. (m)	120.00	Wetted Per. (m)	14.54	10.12	
41.72					
Min Ch El (m)	201.40	Shear (N/m2)	2.97	6.74	
2.43					
Alpha	2.60	Stream Power (N/m s)	0.72	6.45	
0.65					
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	299.18	366.09	
294.15					
C & E Loss (m)	0.00	Cum SA (1000 m2)	212.01	63.41	
223.84					

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.34

INPUT
Description: Section 46.34 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	206.4	30	206.4	36	206	46	202	51	201.2
53	201.2	58	202	68	205	144	205.4		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	30	.05	36	.08	46	.035	58	.08
68	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
46	58	225	205	190	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
100	144	208	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.43	Reach Len. (m)	225.00	205.00	190.00
Crit W.S. (m)		Flow Area (m2)	2.56	22.76	3.41
E.G. Slope (m/m)	0.000243	Area (m2)	2.56	22.76	3.41
Q Total (m3/s)	16.31	Flow (m3/s)	0.38	15.41	0.52
Top Width (m)	20.34	Top Width (m)	3.58	12.00	4.77
Vel Total (m/s)	0.57	Avg. Vel. (m/s)	0.15	0.68	0.15
Max Chl Dpth (m)	2.23	Hydr. Depth (m)	0.72	1.90	0.72
Conv. Total (m3/s)	1047.0	Conv. (m3/s)	24.3	989.6	33.1
Length Wtd. (m)	204.98	Wetted Per. (m)	3.85	12.13	4.98
Min Ch El (m)	201.20	Shear (N/m2)	1.58	4.46	1.63
Alpha	1.35	Stream Power (N/m s)	0.23	3.02	0.25
Frctn Loss (m)	0.07	Cum Volume (1000 m3)	106.06	187.11	69.04
C & E Loss (m)	0.00	Cum SA (1000 m2)	98.47	62.08	79.40

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.01	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	

0.065					
W.S. Elev (m)	205.97	Reach Len. (m)	225.00	205.00	190.00
Crit W.S. (m)		Flow Area (m2)	19.74	53.29	53.21
E.G. Slope (m/m)	0.000144	Area (m2)	19.74	53.29	83.55
Q Total (m3/s)	66.49	Flow (m3/s)	4.46	49.09	12.94
Top Width (m)	107.93	Top Width (m)	9.93	12.00	86.00
Vel Total (m/s)	0.53	Avg. Vel. (m/s)	0.23	0.92	0.24
Max Chl Dpth (m)	4.77	Hydr. Depth (m)	1.99	4.44	1.27
Conv. Total (m3/s)	5531.7	Conv. (m3/s)	371.1	4084.3	1076.3
Length Wtd. (m)	205.80	Wetted Per. (m)	10.70	12.13	42.44
Min Ch El (m)	201.20	Shear (N/m2)	2.61	6.22	1.78
Alpha	2.31	Stream Power (N/m s)	0.59	5.73	0.43
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	296.32	360.24	285.21
C & E Loss (m)	0.00	Cum SA (1000 m2)	210.58	62.09	216.22

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.33

INPUT
Description: Section 46.33 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	67	205	75	202	78	201	83	201
86	202	97	205	115	205	115	208	180	208

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	67	.08	75	.035	86	.08	97	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
75	86	130	130	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.38	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.34	Reach Len. (m)	130.00	130.00	130.00
Crit W.S. (m)		Flow Area (m2)	2.38	22.69	

3.27				
E.G. Slope (m/m)	0.000451	Area (m2)	2.38	22.69
3.27				
Q Total (m3/s)	22.97	Flow (m3/s)	0.46	21.86
0.65				
Top Width (m)	19.46	Top Width (m)	3.56	11.00
4.90				
Vel Total (m/s)	0.81	Avg. Vel. (m/s)	0.19	0.96
0.20				
Max Chl Dpth (m)	2.34	Hydr. Depth (m)	0.67	2.06
0.67				
Conv. Total (m3/s)	1082.2	Conv. (m3/s)	21.7	1030.0
30.5				
Length Wtd. (m)	130.00	Wetted Per. (m)	3.80	11.32
5.07				
Min Ch El (m)	201.00	Shear (N/m2)	2.76	8.85
2.85				
Alpha	1.35	Stream Power (N/m s)	0.54	8.53
0.56				
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	105.51	182.45
68.41				
C & E Loss (m)	0.00	Cum SA (1000 m2)	97.66	59.72
78.48				

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.98	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.03	Wt. n-Val.	0.058	0.035
0.070				
W.S. Elev (m)	205.95	Reach Len. (m)	130.00	130.00
130.00				
Crit W.S. (m)		Flow Area (m2)	83.32	51.46
44.08				
E.G. Slope (m/m)	0.000128	Area (m2)	83.32	51.46
44.08				
Q Total (m3/s)	74.78	Flow (m3/s)	18.67	45.71
10.40				
Top Width (m)	115.00	Top Width (m)	75.00	11.00
29.00				
Vel Total (m/s)	0.42	Avg. Vel. (m/s)	0.22	0.89
0.24				
Max Chl Dpth (m)	4.95	Hydr. Depth (m)	1.11	4.68
1.52				
Conv. Total (m3/s)	6598.8	Conv. (m3/s)	1647.2	4033.6
918.0				
Length Wtd. (m)	130.00	Wetted Per. (m)	76.49	11.32
30.35				
Min Ch El (m)	201.00	Shear (N/m2)	1.37	5.72
1.83				
Alpha	2.88	Stream Power (N/m s)	0.31	5.08
0.43				
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	284.72	349.50
273.08				
C & E Loss (m)	0.00	Cum SA (1000 m2)	201.02	59.73
205.29				

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

water surface.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.322

INPUT
Description: Section 46.322 - Applewod Crescent - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	58	208	58	205.5	66	205.5	78.5	201.8
79.15	201	91	201	91.5	201.8	100.5	205.7	115	205.7
115	208	175	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	66	.08	78.5	.035	91.5	.08	100.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
78.5	91.5	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	78.5	205.6	F
91.5	175	205.6	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.035	
W.S. Elev (m)	203.30	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	201.71	Flow Area (m2)		29.44	
E.G. Slope (m/m)	0.000272	Area (m2)	3.80	29.44	2.60
Q Total (m3/s)	22.97	Flow (m3/s)		22.97	
Top Width (m)	21.53	Top Width (m)	5.07	13.00	3.46
Vel Total (m/s)	0.78	Avg. Vel. (m/s)		0.78	
Max Chl Dpth (m)	2.30	Hydr. Depth (m)		2.26	
Conv. Total (m3/s)	1392.6	Conv. (m3/s)		1392.6	
Length Wtd. (m)	50.00	Wetted Per. (m)		13.82	
Min Ch El (m)	201.00	Shear (N/m2)		5.68	
Alpha	1.00	Stream Power (N/m s)		4.43	
Frctn Loss (m)		Cum Volume (1000 m3)	105.11	179.06	68.03
C & E Loss (m)		Cum SA (1000 m2)	97.10	58.16	77.94

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.96	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.078	0.035	0.078
W.S. Elev (m)	205.92	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	202.54	Flow Area (m2)	31.65	63.45	22.63
E.G. Slope (m/m)	0.000153	Area (m2)	31.65	63.45	22.63
Q Total (m3/s)	74.78	Flow (m3/s)	7.79	61.95	5.04
Top Width (m)	57.00	Top Width (m)	20.50	13.00	23.50
Vel Total (m/s)	0.64	Avg. Vel. (m/s)	0.25	0.98	0.22
Max Chl Dpth (m)	4.92	Hydr. Depth (m)	1.54	4.88	0.96
Conv. Total (m3/s)	6044.1	Conv. (m3/s)	629.9	5006.7	407.6
Length Wtd. (m)	50.00	Wetted Per. (m)	21.45	13.82	24.52
Min Ch El (m)	201.00	Shear (N/m2)	2.22	6.89	1.39
Alpha	1.98	Stream Power (N/m s)	0.55	6.73	0.31
Frctn Loss (m)		Cum Volume (1000 m3)	277.25	342.03	268.75
C & E Loss (m)		Cum SA (1000 m2)	194.81	58.17	201.88

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.3215

INPUT
Description: Hum 13A-4R. Applewood Crescent - Twin Cell - 4.3 m W x 2.4 m H x 30 m L Concrete Box Culverts. Based on Drawings - July 2010

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.
Distance from Upstream XS = 10
Deck/Roadway Width = 30
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 2
Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord

58	205.6	115	205.6

Upstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	58	208	58	205.5	66	205.5	78.5	201.8
79.15	201	91	201	91.5	201.8	100.5	205.7	115	205.7
115	208	175	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	66	.08	78.5	.035	91.5	.08	100.5	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
78.5	91.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	78.5	205.6	F
91.5	175	205.6	F

Downstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
58	205.6	115	205.6

Downstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	58	208	58	205.5	66	205.5	78.5	201.8
79.15	200.6	91	200.6	91.5	201.8	100.5	205.7	115	205.7
115	208	175	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	66	.08	78.5	.035	91.5	.08	100.5	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
78.5	91.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	78.5	205	F
91.5	175	205	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	Box	2.44	4.27

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
10	30	.015	.015	0	.4	1

Number of Barrels = 2

Upstream Elevation = 201
Centerline Stations
Sta. Sta.
82.5 87.5
Downstream Elevation = 200.6
Centerline Stations
Sta. Sta.
82.5 87.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	22.97	Culv Full Len (m)	14.69
# Barrels	2	Culv Vel US (m/s)	1.21
Q Barrel (m3/s)	11.49	Culv Vel DS (m/s)	1.10
E.G. US. (m)	203.33	Culv Inv El Up (m)	201.00
W.S. US. (m)	203.30	Culv Inv El Dn (m)	200.60
E.G. DS (m)	203.25	Culv Frctn Ls (m)	0.01
W.S. DS (m)	203.23	Culv Exit Loss (m)	0.04
Delta EG (m)	0.08	Culv Entr Loss (m)	0.03
Delta WS (m)	0.07	Q Weir (m3/s)	
E.G. IC (m)	202.42	Weir Sta Lft (m)	
E.G. OC (m)	203.33	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	203.23	Weir Max Depth (m)	
Culv WS Outlet (m)	203.04	Weir Avg Depth (m)	
Culv Nml Depth (m)	0.59	Weir Flow Area (m2)	
Culv Crt Depth (m)	0.90	Min El Weir Flow (m)	205.60

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	58.92	Culv Full Len (m)	30.00
# Barrels	2	Culv Vel US (m/s)	2.83
Q Barrel (m3/s)	29.46	Culv Vel DS (m/s)	2.83
E.G. US. (m)	205.96	Culv Inv El Up (m)	201.00
W.S. US. (m)	205.92	Culv Inv El Dn (m)	200.60
E.G. DS (m)	205.36	Culv Frctn Ls (m)	0.08
W.S. DS (m)	205.31	Culv Exit Loss (m)	0.35
Delta EG (m)	0.59	Culv Entr Loss (m)	0.16
Delta WS (m)	0.61	Q Weir (m3/s)	15.87
E.G. IC (m)	204.55	Weir Sta Lft (m)	58.00
E.G. OC (m)	205.96	Weir Sta Rgt (m)	115.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	203.44	Weir Max Depth (m)	0.36
Culv WS Outlet (m)	203.04	Weir Avg Depth (m)	0.33
Culv Nml Depth (m)		Weir Flow Area (m2)	18.96
Culv Crt Depth (m)	1.69	Min El Weir Flow (m)	205.60

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.321

INPUT
Description: Section 46.322 - Applewod Crescent - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	58	208	58	205.5	66	205.5	78.5	201.8
79.15	200.6	91	200.6	91.5	201.8	100.5	205.7	115	205.7
115	208	175	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	66	.08	78.5	.035	91.5	.08	100.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
78.5	91.5	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	78.5	205	F
91.5	175	205	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.25	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.23	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	201.32	Flow Area (m2)		33.50	
E.G. Slope (m/m)	0.000189	Area (m2)	3.46	33.50	2.36
Q Total (m3/s)	22.97	Flow (m3/s)		22.97	
Top Width (m)	21.13	Top Width (m)	4.83	13.00	3.30
Vel Total (m/s)	0.69	Avg. Vel. (m/s)		0.69	
Max Chl Dpth (m)	2.63	Hydr. Depth (m)		2.58	
Conv. Total (m3/s)	1672.0	Conv. (m3/s)		1672.0	
Length Wtd. (m)	50.00	Wetted Per. (m)		14.51	
Min Ch El (m)	200.60	Shear (N/m2)		4.27	
Alpha	1.00	Stream Power (N/m s)		2.93	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	105.11	178.30	68.03
C & E Loss (m)	0.02	Cum SA (1000 m2)	96.85	57.51	77.77

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.36	Element	Left OB	Channel	Right OB

Vel Head (m)	0.05	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	205.31	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	202.15	Flow Area (m2)	20.82	60.55	14.22
E.G. Slope (m/m)	0.000215	Area (m2)	20.82	60.55	14.22
Q Total (m3/s)	74.78	Flow (m3/s)	5.40	65.79	3.58
Top Width (m)	32.96	Top Width (m)	11.86	13.00	8.10
Vel Total (m/s)	0.78	Avg. Vel. (m/s)	0.26	1.09	0.25
Max Chl Dpth (m)	4.71	Hydr. Depth (m)	1.76	4.66	1.76
Conv. Total (m3/s)	5095.9	Conv. (m3/s)	368.3	4483.3	244.3
Length Wtd. (m)	50.00	Wetted Per. (m)	12.37	14.51	8.83
Min Ch El (m)	200.60	Shear (N/m2)	3.55	8.81	3.40
Alpha	1.71	Stream Power (N/m s)	0.92	9.57	0.86
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	277.25	339.68	268.75
C & E Loss (m)	0.02	Cum SA (1000 m2)	194.00	57.52	201.09

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: RIVER-1
REACH: Reach-1 RS: 46.32

INPUT
Description: Section 46.32 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	45	208	45	205.5	52	205	66	201
68	200.6	69	200.6	71	201	84	205	102	206
102	208	152	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	52	.08	66	.035	71	.08	84	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
66	71	110	110	110	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.22	Element	Left OB	Channel	Right OB

Vel Head (m)	0.08	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.14	Reach Len. (m)	110.00	110.00	110.00
Crit W.S. (m)		Flow Area (m2)	7.98	11.88	7.41
E.G. Slope (m/m)	0.000838	Area (m2)	7.98	11.88	7.41
Q Total (m3/s)	22.97	Flow (m3/s)	2.94	17.31	2.72
Top Width (m)	19.42	Top Width (m)	7.47	5.00	6.94
Vel Total (m/s)	0.84	Avg. Vel. (m/s)	0.37	1.46	0.37
Max Chl Dpth (m)	2.54	Hydr. Depth (m)	1.07	2.38	1.07
Conv. Total (m3/s)	793.4	Conv. (m3/s)	101.5	598.0	93.9
Length Wtd. (m)	110.00	Wetted Per. (m)	7.77	5.08	7.26
Min Ch El (m)	200.60	Shear (N/m2)	8.44	19.22	8.39
Alpha	2.30	Stream Power (N/m s)	3.11	28.01	3.08
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	104.82	177.17	67.78
C & E Loss (m)	0.02	Cum SA (1000 m2)	96.55	57.06	77.51

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.12	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	205.21	Reach Len. (m)	110.00	110.00	110.00
Crit W.S. (m)		Flow Area (m2)	31.23	22.25	29.11
E.G. Slope (m/m)	0.000650	Area (m2)	31.23	22.25	29.11
Q Total (m3/s)	74.78	Flow (m3/s)	16.32	43.36	15.10
Top Width (m)	38.69	Top Width (m)	16.93	5.00	16.77
Vel Total (m/s)	0.91	Avg. Vel. (m/s)	0.52	1.95	0.52
Max Chl Dpth (m)	4.61	Hydr. Depth (m)	1.85	4.45	1.74
Conv. Total (m3/s)	2934.3	Conv. (m3/s)	640.2	1701.6	592.6
Length Wtd. (m)	110.00	Wetted Per. (m)	17.50	5.08	17.37
Min Ch El (m)	200.60	Shear (N/m2)	11.37	27.90	10.67
Alpha	2.83	Stream Power (N/m s)	5.94	54.38	

5.54					
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	275.95	337.61	267.67
C & E Loss (m)	0.02	Cum SA (1000 m2)	193.28	57.07	200.47

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: RIVER-1
REACH: Reach-1 RS: 46.312

INPUT
Description: Section 46.312 - Edgeley Blvd - U/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	43	207	43	204.6	49	204.6	52	204.1
60.5	201.1	61.15	200.6	72.85	200.6	73.5	201.1	82	204.1
84	204.7	90	204.7	90	207	150	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	49	.08	60.5	.035	73.5	.08	84	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
60.5	73.5	60	60	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	60.5	204.7	F
73.5	150	204.7	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.16	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.035	
W.S. Elev (m)	203.14	Reach Len. (m)	60.00	60.00	60.00
Crit W.S. (m)	201.31	Flow Area (m2)		32.68	
E.G. Slope (m/m)	0.000183	Area (m2)	5.89	32.68	5.89
Q Total (m3/s)	22.97	Flow (m3/s)		22.97	
Top Width (m)	24.55	Top Width (m)	5.78	13.00	5.78
Vel Total (m/s)	0.70	Avg. Vel. (m/s)		0.70	
Max Chl Dpth (m)	2.54	Hydr. Depth (m)		2.51	
Conv. Total (m3/s)	1697.0	Conv. (m3/s)		1697.0	
Length Wtd. (m)	60.00	Wetted Per. (m)		13.34	

Min Ch El (m)	200.60	Shear (N/m2)			4.40
Alpha	1.00	Stream Power (N/m s)			3.09
Frctn Loss (m)		Cum Volume (1000 m3)	104.06	174.72	67.05
C & E Loss (m)		Cum SA (1000 m2)	95.82	56.07	76.81

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.27	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.077	0.035	0.078
W.S. Elev (m)	205.23	Reach Len. (m)	60.00	60.00	60.00
Crit W.S. (m)	202.13	Flow Area (m2)	28.76	59.86	27.18
E.G. Slope (m/m)	0.000169	Area (m2)	28.76	59.86	27.18
Q Total (m3/s)	74.78	Flow (m3/s)	7.27	60.47	7.03
Top Width (m)	47.00	Top Width (m)	17.50	13.00	16.50
Vel Total (m/s)	0.65	Avg. Vel. (m/s)	0.25	1.01	0.26
Max Chl Dpth (m)	4.63	Hydr. Depth (m)	1.64	4.60	1.65
Conv. Total (m3/s)	5753.4	Conv. (m3/s)	559.7	4652.6	541.2
Length Wtd. (m)	60.00	Wetted Per. (m)	18.68	13.34	17.63
Min Ch El (m)	200.60	Shear (N/m2)	2.55	7.43	2.55
Alpha	2.01	Stream Power (N/m s)	0.65	7.51	0.66
Frctn Loss (m)		Cum Volume (1000 m3)	272.65	333.10	264.57
C & E Loss (m)		Cum SA (1000 m2)	191.39	56.08	198.64

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.3115

INPUT
Description: Hum 13A-3R. Edgeley Blvd - Twin Cell - 4.3 m W x 2.4 m H x 35 m L Concrete Box Culverts. July 2010

Drawing by Ander Engineering Ltd. (Dwg No. 88-150-7, October 1989) used to recode culvert in HEC-RAS format.

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 10
Deck/Roadway Width = 35
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates

num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
43	204.7	90	204.7

Upstream Bridge Cross Section Data

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	43	207	43	204.6	49	204.6	52	204.1
60.5	201.1	61.15	200.6	72.85	200.6	73.5	201.1	82	204.1
84	204.7	90	204.7	90	207	150	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	49	.08	60.5	.035	73.5	.08	84	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
60.5	73.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	60.5	204.7	F
73.5	150	204.7	F

Downstream Deck/Roadway Coordinates

num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
43	204.7	90	204.7

Downstream Bridge Cross Section Data

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	43	207	43	204.6	49	204.6	52	204.1
60.5	201.1	61.15	200.5	72.85	200.5	73.5	201.1	82	204.1
84	204.7	90	204.7	90	207	150	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	49	.08	60.5	.035	73.5	.08	84	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
60.5	73.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	60.5	203.5	F
73.5	150	203.5	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	Box	2.44	4.27

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
10	35	.015	.015	0	.4	1

Number of Barrels = 2
Upstream Elevation = 200.6
Centerline Stations

Sta.	Sta.
64.5	69.5

Downstream Elevation = 200.5
Centerline Stations

Sta.	Sta.
64.5	69.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	22.97	Culv Full Len (m)	35.00
# Barrels	2	Culv Vel US (m/s)	1.10
Q Barrel (m3/s)	11.49	Culv Vel DS (m/s)	1.10
E.G. US. (m)	203.16	Culv Inv El Up (m)	200.60
W.S. US. (m)	203.14	Culv Inv El Dn (m)	200.50
E.G. DS (m)	203.09	Culv Frctn Ls (m)	0.01
W.S. DS (m)	203.06	Culv Exit Loss (m)	0.04
Delta EG (m)	0.08	Culv Entr Loss (m)	0.02
Delta WS (m)	0.07	Q Weir (m3/s)	
E.G. IC (m)	202.03	Weir Sta Lft (m)	
E.G. OC (m)	203.16	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	203.04	Weir Max Depth (m)	
Culv WS Outlet (m)	202.94	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.90	Min El Weir Flow (m)	204.70

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	45.55	Culv Full Len (m)	35.00
# Barrels	2	Culv Vel US (m/s)	2.19
Q Barrel (m3/s)	22.77	Culv Vel DS (m/s)	2.19
E.G. US. (m)	205.27	Culv Inv El Up (m)	200.60
W.S. US. (m)	205.23	Culv Inv El Dn (m)	200.50
E.G. DS (m)	204.93	Culv Frctn Ls (m)	0.05
W.S. DS (m)	204.88	Culv Exit Loss (m)	0.19
Delta EG (m)	0.34	Culv Entr Loss (m)	0.10
Delta WS (m)	0.35	Q Weir (m3/s)	29.24
E.G. IC (m)	204.16	Weir Sta Lft (m)	43.00
E.G. OC (m)	205.27	Weir Sta Rgt (m)	90.00
Culvert Control	Outlet	Weir Submerg	0.31
Culv WS Inlet (m)	203.04	Weir Max Depth (m)	0.57
Culv WS Outlet (m)	202.94	Weir Avg Depth (m)	0.57
Culv Nml Depth (m)		Weir Flow Area (m2)	26.85
Culv Crt Depth (m)	1.43	Min El Weir Flow (m)	204.70

Warning: During the culvert inlet control computations, the program could not

balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.311

INPUT
Description: Section 46.311 - Edgeley Blvd - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	43	207	43	204.6	49	204.6	52	204.1
60.5	201.1	61.15	200.5	72.85	200.5	73.5	201.1	82	204.1
84	204.7	90	204.7	90	207	150	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	49	.08	60.5	.035	73.5	.08	84	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
60.5	73.5	150	150	150	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	60.5	203.5	F
73.5	150	203.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.09	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.06	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)	201.21	Flow Area (m2)		32.94	
E.G. Slope (m/m)	0.000181	Area (m2)	5.46	32.94	5.46
Q Total (m3/s)	22.97	Flow (m3/s)		22.97	
Top Width (m)	24.13	Top Width (m)	5.56	13.00	5.56
Vel Total (m/s)	0.70	Avg. Vel. (m/s)		0.70	
Max Chl Dpth (m)	2.56	Hydr. Depth (m)		2.53	
Conv. Total (m3/s)	1708.6	Conv. (m3/s)		1708.6	
Length Wtd. (m)	150.00	Wetted Per. (m)		13.47	
Min Ch El (m)	200.50	Shear (N/m2)		4.34	
Alpha	1.00	Stream Power (N/m s)		3.02	
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	104.06	173.81	67.05
C & E Loss (m)	0.00	Cum SA (1000 m2)	95.48	55.29	76.47

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.93	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.079	0.035	0.079
W.S. Elev (m)	204.88	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)	202.03	Flow Area (m2)	22.63	56.53	21.40
E.G. Slope (m/m)	0.000225	Area (m2)	22.63	56.53	21.40
Q Total (m3/s)	74.78	Flow (m3/s)	5.89	63.08	5.81
Top Width (m)	47.00	Top Width (m)	17.50	13.00	16.50
Vel Total (m/s)	0.74	Avg. Vel. (m/s)	0.26	1.12	0.27
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.29	4.35	1.30
Conv. Total (m3/s)	4982.1	Conv. (m3/s)	392.5	4202.8	386.9
Length Wtd. (m)	150.00	Wetted Per. (m)	18.33	13.47	17.28
Min Ch El (m)	200.50	Shear (N/m2)	2.73	9.27	2.74
Alpha	1.92	Stream Power (N/m s)	0.71	10.35	0.74
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	272.65	330.26	264.57
C & E Loss (m)	0.00	Cum SA (1000 m2)	190.34	55.30	197.65

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.31

INPUT
Description: Section 46.31 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	40	207	40	204.5	46	204.5	49	204
58	201	61	200.4	67	200.4	70	201	81	204
85	204.6	107	204.6	107	207	148	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	46	.08	58	.035	70	.08	85	.05

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

58 70 150 150 150 .1 .3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.06	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.04	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)		Flow Area (m2)	6.23	29.86	7.62
E.G. Slope (m/m)	0.000177	Area (m2)	6.23	29.86	7.62
Q Total (m3/s)	22.97	Flow (m3/s)	1.01	20.71	1.25
Top Width (m)	25.59	Top Width (m)	6.12	12.00	7.47
Vel Total (m/s)	0.53	Avg. Vel. (m/s)	0.16	0.69	0.16
Max Chl Dpth (m)	2.64	Hydr. Depth (m)	1.02	2.49	1.02
Conv. Total (m3/s)	1726.9	Conv. (m3/s)	76.2	1556.5	94.2
Length Wtd. (m)	150.00	Wetted Per. (m)	6.45	12.12	7.75
Min Ch El (m)	200.40	Shear (N/m2)	1.68	4.28	1.71
Alpha	1.58	Stream Power (N/m s)	0.27	2.96	0.28
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	103.18	169.10	66.07
C & E Loss (m)	0.00	Cum SA (1000 m2)	94.60	53.42	75.50

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.90	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.079	0.035	0.078
W.S. Elev (m)	204.84	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)		Flow Area (m2)	24.94	51.52	33.32
E.G. Slope (m/m)	0.000236	Area (m2)	24.94	51.52	33.32
Q Total (m3/s)	74.78	Flow (m3/s)	6.86	59.32	8.61
Top Width (m)	67.00	Top Width (m)	18.00	12.00	37.00
Vel Total (m/s)	0.68	Avg. Vel. (m/s)	0.28	1.15	0.26
Max Chl Dpth (m)	4.44	Hydr. Depth (m)	1.39	4.29	0.90
Conv. Total (m3/s)	4870.7	Conv. (m3/s)	446.6	3863.5	560.5
Length Wtd. (m)	150.00	Wetted Per. (m)	18.87	12.12	37.69

Min Ch El (m)	200.40	Shear (N/m2)	3.05	9.83	2.04
Alpha	2.30	Stream Power (N/m s)	0.84	11.32	0.53
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	269.08	322.16	260.47
C & E Loss (m)	0.00	Cum SA (1000 m2)	187.68	53.43	193.63

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.30

INPUT
Description: Section 46.30 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	20	207	20	205	46	205	56	201
59	200.3	65	200.3	68	201	80	204	83	204.7
119	205	119	207	146	207				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	46	.08	56	.035	68	.08	83	.025
119	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
56	68	110	110	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.03	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.99	Reach Len. (m)	110.00	110.00	110.00
Crit W.S. (m)		Flow Area (m2)	4.96	30.19	7.93
E.G. Slope (m/m)	0.000273	Area (m2)	4.96	30.19	7.93
Q Total (m3/s)	28.70	Flow (m3/s)	0.97	26.13	1.60
Top Width (m)	24.94	Top Width (m)	4.98	12.00	7.96
Vel Total (m/s)	0.67	Avg. Vel. (m/s)	0.20	0.87	0.20
Max Chl Dpth (m)	2.69	Hydr. Depth (m)	1.00	2.52	1.00
Conv. Total (m3/s)	1737.4	Conv. (m3/s)	58.8	1581.8	96.8
Length Wtd. (m)	110.00	Wetted Per. (m)	5.36	12.16	8.21
Min Ch El (m)	200.30	Shear (N/m2)	2.47	6.64	2.58
Alpha	1.54	Stream Power (N/m s)	0.48	5.75	0.52
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	102.34	164.59	

64.90
  C & E Loss (m) 0.00 Cum SA (1000 m2) 93.77 51.62
74.34

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.86	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	204.79	Reach Len. (m)	110.00	110.00	110.00
Crit W.S. (m)		Flow Area (m2)	17.92	51.73	29.19
E.G. Slope (m/m)	0.000297	Area (m2)	17.92	51.73	29.19
Q Total (m3/s)	81.91	Flow (m3/s)	5.62	66.89	9.40
Top Width (m)	46.80	Top Width (m)	9.47	12.00	25.33
Vel Total (m/s)	0.83	Avg. Vel. (m/s)	0.31	1.29	0.32
Max Chl Dpth (m)	4.49	Hydr. Depth (m)	1.89	4.31	1.15
Conv. Total (m3/s)	4752.5	Conv. (m3/s)	326.2	3880.6	545.6
Length Wtd. (m)	110.00	Wetted Per. (m)	10.19	12.16	25.78
Min Ch El (m)	200.30	Shear (N/m2)	5.12	12.39	3.30
Alpha	2.01	Stream Power (N/m s)	1.61	16.02	1.06
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	265.87	314.41	255.78
C & E Loss (m)	0.01	Cum SA (1000 m2)	185.62	51.63	188.96

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.292

INPUT
Description: Section 46.292 - Millway Avenue - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	25	207	25	204	40	204	50	201
50.5	200.3	63	200.3	64	201	72	204	75	204.5
85	204.7	85	207	142	207				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	40	.08	50	.035	64	.08	72	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
50	64	55	55	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	50.5	204.1	F
63	142	204.1	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.00	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.		0.035	
W.S. Elev (m)	202.96	Reach Len. (m)	55.00	55.00	55.00
Crit W.S. (m)	201.11	Flow Area (m2)		33.24	
E.G. Slope (m/m)	0.000248	Area (m2)	6.40	36.70	5.12
Q Total (m3/s)	28.70	Flow (m3/s)		28.70	
Top Width (m)	25.75	Top Width (m)	6.53	14.00	5.22
Vel Total (m/s)	0.86	Avg. Vel. (m/s)		0.86	
Max Chl Dpth (m)	2.66	Hydr. Depth (m)		2.66	
Conv. Total (m3/s)	1822.9	Conv. (m3/s)		1822.9	
Length Wtd. (m)	55.00	Wetted Per. (m)		12.50	
Min Ch El (m)	200.30	Shear (N/m2)		6.46	
Alpha	1.00	Stream Power (N/m s)		5.58	
Frctn Loss (m)		Cum Volume (1000 m3)	101.72	160.91	64.18
C & E Loss (m)		Cum SA (1000 m2)	93.14	50.19	73.61

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.82	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.071	0.035	0.078
W.S. Elev (m)	204.77	Reach Len. (m)	55.00	55.00	55.00
Crit W.S. (m)	201.94	Flow Area (m2)	34.37	62.12	21.52
E.G. Slope (m/m)	0.000204	Area (m2)	34.37	62.12	21.52
Q Total (m3/s)	81.91	Flow (m3/s)	9.53	66.62	5.76
Top Width (m)	60.00	Top Width (m)	25.00	14.00	21.00
Vel Total (m/s)	0.69	Avg. Vel. (m/s)	0.28	1.07	0.27

Max Chl Dpth (m)	4.47	Hydr. Depth (m)	1.37	4.44	1.02
Conv. Total (m3/s)	5735.4	Conv. (m3/s)	667.5	4664.7	403.2
Length Wtd. (m)	55.00	Wetted Per. (m)	26.22	14.58	21.66
Min Ch El (m)	200.30	Shear (N/m2)	2.62	8.52	1.99
Alpha	1.97	Stream Power (N/m s)	0.73	9.14	0.53
Frctn Loss (m)		Cum Volume (1000 m3)	262.99	308.15	252.99
C & E Loss (m)		Cum SA (1000 m2)	183.72	50.20	186.41

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2915

INPUT
Description: Hum 13A-2RR. Millway Avenue Culvert - Twin Cell - 4.3 m W x 2.4 m H x 30 m L Concrete Box Culverts. Based on drawings - July 2010

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 15
Deck/Roadway Width = 30
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
25	204.1		75	204.1		85	204.7	

Upstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	25	207	25	204	40	204	50	201
50.5	200.3	63	200.3	64	201	72	204	75	204.5
85	204.7	85	207	142	207				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	40	.08	50	.035	64	.08	72	.05

Bank Sta: Left Right Coeff Contr. Expan.
50 64 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	50.5	204.1	F
63	142	204.1	F

Downstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord

25	204.1	75	204.1	85	204.7

Downstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	25	207	25	204	40	204	50	201
50.5	200.2	63	200.2	64	201	72	204	75	204.5
85	204.7	85	207	142	207				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	40	.08	50	.035	64	.08	72	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
50	64	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	50.5	203.4	F
63	142	203.4	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	Box	2.44	4.27

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
	15	30	.015	.015	0	.4	1

Number of Barrels = 2
Upstream Elevation = 200.3
Centerline Stations

Sta.	Sta.
54.3	59.3

Downstream Elevation = 200.2
Centerline Stations

Sta.	Sta.
54.3	59.3

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	28.70	Culv Full Len (m)	30.00
# Barrels	2	Culv Vel US (m/s)	1.38
Q Barrel (m3/s)	14.35	Culv Vel DS (m/s)	1.38
E.G. US. (m)	203.00	Culv Inv El Up (m)	200.30
W.S. US. (m)	202.96	Culv Inv El Dn (m)	200.20
E.G. DS (m)	202.88	Culv Frctn Ls (m)	0.02
W.S. DS (m)	202.84	Culv Exit Loss (m)	0.06
Delta EG (m)	0.11	Culv Entr Loss (m)	0.04
Delta WS (m)	0.12	Q Weir (m3/s)	
E.G. IC (m)	201.97	Weir Sta Lft (m)	
E.G. OC (m)	203.00	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	

Culv WS Inlet (m)	202.74	Weir Max Depth (m)	
Culv WS Outlet (m)	202.64	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	1.05	Min El Weir Flow (m)	204.10

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	36.81	Culv Full Len (m)	30.00
# Barrels	2	Culv Vel US (m/s)	1.77
Q Barrel (m3/s)	18.40	Culv Vel DS (m/s)	1.77
E.G. US. (m)	204.82	Culv Inv El Up (m)	200.30
W.S. US. (m)	204.77	Culv Inv El Dn (m)	200.20
E.G. DS (m)	204.63	Culv Frctn Ls (m)	0.03
W.S. DS (m)	204.57	Culv Exit Loss (m)	0.10
Delta EG (m)	0.20	Culv Entr Loss (m)	0.06
Delta WS (m)	0.20	Q Weir (m3/s)	45.11
E.G. IC (m)	204.15	Weir Sta Lft (m)	25.00
E.G. OC (m)	204.82	Weir Sta Rgt (m)	85.00
Culvert Control	Outlet	Weir Submerg	0.63
Culv WS Inlet (m)	202.74	Weir Max Depth (m)	0.72
Culv WS Outlet (m)	202.64	Weir Avg Depth (m)	0.63
Culv Nml Depth (m)		Weir Flow Area (m2)	37.97
Culv Crt Depth (m)	1.24	Min El Weir Flow (m)	204.10

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.291

INPUT
Description: Section 46.291 - Millway Avenue - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	25	207	25	204	40	204	50	201
50.5	200.2	63	200.2	64	201	72	204	75	204.5
85	204.7	85	207	142	207				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	40	.08	50	.035	64	.08	72	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
50	64	145	150	155	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	50.5	203.4	F
63	142	203.4	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.88	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.		0.035	

W.S. Elev (m)	202.84	Reach Len. (m)	145.00	150.00	155.00
Crit W.S. (m)	201.01	Flow Area (m2)		33.05	
E.G. Slope (m/m)	0.000253	Area (m2)	5.67	36.42	4.53
Q Total (m3/s)	28.70	Flow (m3/s)		28.70	
Top Width (m)	25.06	Top Width (m)	6.15	14.00	4.92
Vel Total (m/s)	0.87	Avg. Vel. (m/s)		0.87	
Max Chl Dpth (m)	2.64	Hydr. Depth (m)		2.64	
Conv. Total (m3/s)	1805.7	Conv. (m3/s)		1805.7	
Length Wtd. (m)	149.98	Wetted Per. (m)		12.50	
Min Ch El (m)	200.20	Shear (N/m2)		6.55	
Alpha	1.00	Stream Power (N/m s)		5.69	
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	101.72	159.72	64.18
C & E Loss (m)	0.00	Cum SA (1000 m2)	92.79	49.42	73.33

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.63	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.073	0.035	0.079
W.S. Elev (m)	204.57	Reach Len. (m)	145.00	150.00	155.00
Crit W.S. (m)	201.84	Flow Area (m2)	29.29	60.60	17.66
E.G. Slope (m/m)	0.000239	Area (m2)	29.29	60.60	17.66
Q Total (m3/s)	81.91	Flow (m3/s)	8.10	68.73	5.08
Top Width (m)	53.57	Top Width (m)	25.00	14.00	14.57
Vel Total (m/s)	0.76	Avg. Vel. (m/s)	0.28	1.13	0.29
Max Chl Dpth (m)	4.37	Hydr. Depth (m)	1.17	4.33	1.21
Conv. Total (m3/s)	5299.6	Conv. (m3/s)	524.0	4446.8	328.7
Length Wtd. (m)	149.85	Wetted Per. (m)	26.01	14.72	15.16
Min Ch El (m)	200.20	Shear (N/m2)	2.64	9.64	2.73
Alpha	1.88	Stream Power (N/m s)	0.73	10.94	0.79
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	262.99	304.20	252.99

C & E Loss (m)	0.00	Cum SA (1000 m2)	182.35	49.43	185.43

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.29

INPUT
Description: Section 46.29 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	30	207	30	204.5	54	204	64	201
71	200.2	78	201	86	204	110	205	156	205

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	54	.08	64	.035	78	.08	86	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
64	78	135	145	150	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.84	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.80	Reach Len. (m)	135.00	145.00	150.00
Crit W.S. (m)		Flow Area (m2)	5.42	30.84	4.33
E.G. Slope (m/m)	0.000324	Area (m2)	5.42	30.84	4.33
Q Total (m3/s)	28.70	Flow (m3/s)	1.10	26.72	0.87
Top Width (m)	24.82	Top Width (m)	6.01	14.00	4.81
Vel Total (m/s)	0.71	Avg. Vel. (m/s)	0.20	0.87	0.20
Max Chl Dpth (m)	2.60	Hydr. Depth (m)	0.90	2.20	0.90
Conv. Total (m3/s)	1594.8	Conv. (m3/s)	61.4	1485.1	48.4
Length Wtd. (m)	144.88	Wetted Per. (m)	6.27	14.09	5.13
Min Ch El (m)	200.20	Shear (N/m2)	2.74	6.95	2.68
Alpha	1.40	Stream Power (N/m s)	0.56	6.02	0.54
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	100.91	154.68	63.50
C & E Loss (m)	0.00	Cum SA (1000 m2)	91.91	47.32	72.58

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.58	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.076	0.035	0.078
W.S. Elev (m)	204.52	Reach Len. (m)	135.00	145.00	150.00
Crit W.S. (m)		Flow Area (m2)	26.57	54.84	19.34
E.G. Slope (m/m)	0.000310	Area (m2)	26.57	54.84	19.34
Q Total (m3/s)	81.91	Flow (m3/s)	7.82	68.22	5.88
Top Width (m)	68.41	Top Width (m)	34.00	14.00	20.41
Vel Total (m/s)	0.81	Avg. Vel. (m/s)	0.29	1.24	0.30
Max Chl Dpth (m)	4.32	Hydr. Depth (m)	0.78	3.92	0.95
Conv. Total (m3/s)	4654.5	Conv. (m3/s)	444.1	3876.2	334.1
Length Wtd. (m)	144.53	Wetted Per. (m)	34.46	14.09	20.96
Min Ch El (m)	200.20	Shear (N/m2)	2.34	11.82	2.80
Alpha	1.97	Stream Power (N/m s)	0.69	14.70	0.85
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	258.94	295.55	250.12
C & E Loss (m)	0.01	Cum SA (1000 m2)	178.07	47.33	182.72

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.282

INPUT
Description: Section 46.282 - Pennsylvania Avenue - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	60	207	60	204	73	204	81	201
83	200.4	84	199.9	96	199.9	97	200.4	99	202
101	203	103	204	118	204	145	204	180	204.64
225	204.64								

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	83	.035	97	.08	103	.05
118	.025	145	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
83	97	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	83.5	204.1	F

96.5 225 204.05 F
Right Levee Station= 180 Elevation= 207

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.035	
W.S. Elev (m)	202.77	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	200.70	Flow Area (m2)		37.21	
E.G. Slope (m/m)	0.000181	Area (m2)	8.33	39.71	3.74
Q Total (m3/s)	28.70	Flow (m3/s)		28.70	
Top Width (m)	24.27	Top Width (m)	6.73	14.00	3.54
Vel Total (m/s)	0.77	Avg. Vel. (m/s)		0.77	
Max Chl Dpth (m)	2.87	Hydr. Depth (m)		2.86	
Conv. Total (m3/s)	2130.5	Conv. (m3/s)		2130.5	
Length Wtd. (m)	50.00	Wetted Per. (m)		13.12	
Min Ch El (m)	199.90	Shear (N/m2)		5.05	
Alpha	1.00	Stream Power (N/m s)		3.89	
Frctn Loss (m)		Cum Volume (1000 m3)	99.99	149.56	62.89
C & E Loss (m)		Cum SA (1000 m2)	91.05	45.29	71.95

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.54	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.076	0.035	0.048
W.S. Elev (m)	204.50	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	201.50	Flow Area (m2)	30.13	63.92	40.55
E.G. Slope (m/m)	0.000170	Area (m2)	30.13	63.92	40.55
Q Total (m3/s)	81.91	Flow (m3/s)	7.60	64.86	9.45
Top Width (m)	112.42	Top Width (m)	23.00	14.00	75.42
Vel Total (m/s)	0.61	Avg. Vel. (m/s)	0.25	1.01	0.23
Max Chl Dpth (m)	4.60	Hydr. Depth (m)	1.31	4.57	0.54

Conv. Total (m3/s)	6277.0	Conv. (m3/s)	582.7	4970.3	724.0
Length Wtd. (m)	50.00	Wetted Per. (m)	24.13	14.24	76.46
Min Ch El (m)	199.90	Shear (N/m2)	2.09	7.50	0.89
Alpha	2.23	Stream Power (N/m s)	0.53	7.61	0.21
Frctn Loss (m)		Cum Volume (1000 m3)	255.12	286.94	245.63
C & E Loss (m)		Cum SA (1000 m2)	174.22	45.30	175.54

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2815

INPUT
Description: Hum 13A-2R. Pennsylvania Avenue Culvert - Twin Cell - 5.7 m W x 2.4 m H x 40 m L Concrete Box Culverts. Drawing by Ander Engineering Ltd. (Dwg No. 85-102-9, December 1989) shows 4 Cell Culvert, but only two cells observed in field.

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 40
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 6

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	205	103	204	133	203.53
145	204	180	204	225	204

Upstream Bridge Cross Section Data
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	60	207	60	204	73	204	81	201
83	200.4	84	199.9	96	199.9	97	200.4	99	202
101	203	103	204	118	204	145	204	180	204.64
225	204.64								

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	83	.035	97	.08	103	.05
118	.025	145	.05						

Bank Sta: Left	Right	Coeff Contr.	Expan.
83	97	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	83.5	204.1	F
96.5	225	204.05	F

Right Levee Station= 180 Elevation= 207

```
Downstream  Deck/Roadway Coordinates
    num=       5
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0     205             103     204             133  203.53
     160     204             200     204

Downstream Bridge Cross Section Data
Station Elevation Data    num=      15
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0     205      73     204      81     201      83   200.4      84   199.8
      96   199.8      97   200.4      99     202     101     203     103     204
     118     204     145     204     160     204     200     204     200     206

Manning's n Values        num=       7
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05      73     .08      83    .035      97     .08     103     .05
     118    .025     145     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
            83      97             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    83.5   203.4       F
    96.5     200   203.4       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           Box    3.05    4.57
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      40     .015     .015        0                  .4
     1
Number of Barrels =  2
Upstream   Elevation =  199.3
Centerline Stations
    Sta.    Sta.
    87.5    92.5
Downstream Elevation =  199.2
Centerline Stations
    Sta.    Sta.
    87.5    92.5

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      28.70    Culv Full Len (m)        40.00
  # Barrels                   2     Culv Vel US (m/s)         1.03
  Q Barrel (m3/s)          14.35    Culv Vel DS (m/s)         1.03
  E.G. US. (m)            202.80    Culv Inv El Up (m)      199.30
  W.S. US. (m)            202.77    Culv Inv El Dn (m)      199.20
  E.G. DS (m)             202.75    Culv Frctn Ls (m)         0.01
```

W.S. DS (m)	202.72	Culv Exit Loss (m)	0.02
Delta EG (m)	0.06	Culv Entr Loss (m)	0.02
Delta WS (m)	0.06	Q Weir (m3/s)	
E.G. IC (m)	200.88	Weir Sta Lft (m)	
E.G. OC (m)	202.80	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	202.35	Weir Max Depth (m)	
Culv WS Outlet (m)	202.25	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	1.00	Min El Weir Flow (m)	204.05

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	39.48	Culv Full Len (m)	40.00
# Barrels	2	Culv Vel US (m/s)	1.42
Q Barrel (m3/s)	19.74	Culv Vel DS (m/s)	1.42
E.G. US. (m)	204.54	Culv Inv El Up (m)	199.30
W.S. US. (m)	204.50	Culv Inv El Dn (m)	199.20
E.G. DS (m)	204.42	Culv Frctn Ls (m)	0.02
W.S. DS (m)	204.38	Culv Exit Loss (m)	0.06
Delta EG (m)	0.12	Culv Entr Loss (m)	0.04
Delta WS (m)	0.12	Q Weir (m3/s)	42.44
E.G. IC (m)	202.56	Weir Sta Lft (m)	60.00
E.G. OC (m)	204.54	Weir Sta Rgt (m)	174.62
Culvert Control	Outlet	Weir Submerg	0.61
Culv WS Inlet (m)	202.35	Weir Max Depth (m)	0.54
Culv WS Outlet (m)	202.25	Weir Avg Depth (m)	0.39
Culv Nml Depth (m)		Weir Flow Area (m2)	45.09
Culv Crt Depth (m)	1.24	Min El Weir Flow (m)	204.05

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.281

INPUT
Description: Section 46.281 - Pennsylvania Avenue - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	73	204	81	201	83	200.4	84	199.8
96	199.8	97	200.4	99	202	101	203	103	204
118	204	145	204	160	204	200	204	200	206

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	83	.035	97	.08	103	.05
118	.025	145	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
83	97	40	40	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	83.5	203.4	F
96.5	200	203.4	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.75	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.035	
W.S. Elev (m)	202.72	Reach Len. (m)	40.00	40.00	40.00
Crit W.S. (m)	200.60	Flow Area (m2)		37.76	
E.G. Slope (m/m)	0.000174	Area (m2)	7.96	40.22	3.55
Q Total (m3/s)	28.70	Flow (m3/s)		28.70	
Top Width (m)	24.01	Top Width (m)	6.58	14.00	3.43
Vel Total (m/s)	0.76	Avg. Vel. (m/s)		0.76	
Max Chl Dpth (m)	2.92	Hydr. Depth (m)		2.90	
Conv. Total (m3/s)	2177.6	Conv. (m3/s)		2177.6	
Length Wtd. (m)	40.00	Wetted Per. (m)		13.17	
Min Ch El (m)	199.80	Shear (N/m2)		4.88	
Alpha	1.00	Stream Power (N/m s)		3.71	
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	99.99	148.68	62.89
C & E Loss (m)	0.01	Cum SA (1000 m2)	90.72	44.59	71.78

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.078	0.035	0.051
W.S. Elev (m)	204.38	Reach Len. (m)	40.00	40.00	40.00
Crit W.S. (m)	201.40	Flow Area (m2)	27.60	63.49	48.56
E.G. Slope (m/m)	0.000181	Area (m2)	27.60	63.49	48.56
Q Total (m3/s)	81.91	Flow (m3/s)	6.65	65.85	9.42
Top Width (m)	154.61	Top Width (m)	37.61	14.00	103.00
Vel Total (m/s)	0.59	Avg. Vel. (m/s)	0.24	1.04	0.19
Max Chl Dpth (m)	4.58	Hydr. Depth (m)	0.73	4.54	0.47

Conv. Total (m3/s)	6087.2	Conv. (m3/s)	494.0	4893.3	700.0
Length Wtd. (m)	40.00	Wetted Per. (m)	38.25	14.33	104.41
Min Ch El (m)	199.80	Shear (N/m2)	1.28	7.87	0.83
Alpha	2.54	Stream Power (N/m s)	0.31	8.16	0.16
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	255.12	283.61	245.63
C & E Loss (m)	0.02	Cum SA (1000 m2)	172.71	44.60	171.08

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.28

INPUT
Description: Section 46.28 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	73	204	83	201	87	200	89	199.8
91	199.8	93	200	95	201	98	202	101	203
103	204	117	204	142	204	173	204	173	206

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	87	.035	93	.08	103	.05
117	.025	142	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
87	93	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.72	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.66	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)		Flow Area (m2)	13.23	16.76	8.45
E.G. Slope (m/m)	0.000517	Area (m2)	13.23	16.76	8.45
Q Total (m3/s)	28.70	Flow (m3/s)	4.56	21.53	2.60
Top Width (m)	22.51	Top Width (m)	9.53	6.00	6.98
Vel Total (m/s)	0.75	Avg. Vel. (m/s)	0.34	1.29	0.31
Max Chl Dpth (m)	2.86	Hydr. Depth (m)	1.39	2.79	

1.21					
Conv. Total (m3/s)	1262.3	Conv. (m3/s)	200.6	947.2	114.5
Length Wtd. (m)	50.00	Wetted Per. (m)	9.90	6.02	7.48
Min Ch El (m)	199.80	Shear (N/m2)	6.77	14.11	5.72
Alpha	2.27	Stream Power (N/m s)	2.33	18.13	1.76
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	99.56	147.54	62.65
C & E Loss (m)	0.02	Cum SA (1000 m2)	90.39	44.19	71.57

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.39	Element	Left OB	Channel	Right OB
Vel Head (m)	0.10	Wt. n-Val.	0.079	0.035	0.065
W.S. Elev (m)	204.29	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)		Flow Area (m2)	36.25	26.56	43.48
E.G. Slope (m/m)	0.000550	Area (m2)	36.25	26.56	43.48
Q Total (m3/s)	81.91	Flow (m3/s)	17.19	47.86	16.87
Top Width (m)	121.43	Top Width (m)	35.43	6.00	80.00
Vel Total (m/s)	0.77	Avg. Vel. (m/s)	0.47	1.80	0.39
Max Chl Dpth (m)	4.49	Hydr. Depth (m)	1.02	4.43	0.54
Conv. Total (m3/s)	3494.1	Conv. (m3/s)	733.0	2041.4	719.6
Length Wtd. (m)	50.00	Wetted Per. (m)	35.99	6.02	81.09
Min Ch El (m)	199.80	Shear (N/m2)	5.43	23.78	2.89
Alpha	3.33	Stream Power (N/m s)	2.57	42.85	1.12
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	253.84	281.81	243.79
C & E Loss (m)	0.02	Cum SA (1000 m2)	171.25	44.20	167.42

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.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.274

INPUT
Description: Section 46.274 - Jane Street - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	76	204	83	201	90	200
94	199.34	98	199.34	102	200	106	201	116	204
130	204	205	204	205	206				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	76	.08	90	.035	106	.08	116	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	102	1	1	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	89	203.21	F
103	205	203.21	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.70	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.035
W.S. Elev (m)	202.69	Reach Len. (m)	0.50	0.50	0.50
Crit W.S. (m)	200.27	Flow Area (m2)	2.61	37.50	2.56
E.G. Slope (m/m)	0.000080	Area (m2)	18.61	37.50	13.47
Q Total (m3/s)	22.11	Flow (m3/s)	0.55	20.35	1.20
Top Width (m)	32.55	Top Width (m)	10.93	12.00	9.62
Vel Total (m/s)	0.52	Avg. Vel. (m/s)	0.21	0.54	0.47
Max Chl Dpth (m)	3.34	Hydr. Depth (m)	2.61	3.12	2.56
Conv. Total (m3/s)	2472.1	Conv. (m3/s)	61.6	2276.4	134.1
Length Wtd. (m)	0.50	Wetted Per. (m)	1.01	12.11	1.03
Min Ch El (m)	199.34	Shear (N/m2)	2.03	2.43	1.95
Alpha	1.06	Stream Power (N/m s)	0.43	1.32	0.91
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	98.77	146.18	62.10
C & E Loss (m)	0.04	Cum SA (1000 m2)	89.88	43.74	71.16

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.36	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.076	0.035	0.047
W.S. Elev (m)	204.33	Reach Len. (m)	0.50	0.50	0.50
Crit W.S. (m)	201.18	Flow Area (m2)	55.32	57.29	63.40
E.G. Slope (m/m)	0.000123	Area (m2)	55.32	57.29	63.40
Q Total (m3/s)	81.91	Flow (m3/s)	12.21	51.16	18.53
Top Width (m)	181.69	Top Width (m)	66.69	12.00	103.00
Vel Total (m/s)	0.47	Avg. Vel. (m/s)	0.22	0.89	0.29
Max Chl Dpth (m)	4.99	Hydr. Depth (m)	0.83	4.77	0.62
Conv. Total (m3/s)	7384.7	Conv. (m3/s)	1101.2	4612.7	1670.9
Length Wtd. (m)	0.50	Wetted Per. (m)	67.38	12.11	103.90
Min Ch El (m)	199.34	Shear (N/m2)	0.99	5.71	0.74
Alpha	2.42	Stream Power (N/m s)	0.22	5.10	0.22
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	251.55	279.71	241.12
C & E Loss (m)	0.03	Cum SA (1000 m2)	168.69	43.75	162.84

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.

BRIDGE

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2735

INPUT
Description: Hum 13A-1R. Jane Street Culverts - Upstream In-Line Weir Coded as Bridge. Weir is 25 m L. Drawings by Ander Engineering Ltd. (85-101-7 & 85-101-1) 1985.

New HEC-RAS coding January 2004 by
Acres included coding of in-line weir (as a bridge) and culverts in HEC-RAS.
Distance from Upstream XS = .5
Deck/Roadway Width = .25
Weir Coefficient = 1.72
Upstream Deck/Roadway Coordinates
num= 8

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
76	204	204	83.5	204		83.5	203.21	
90	203.21	200.7	102	203.21	200.7	108.5	203.21	
108.5	204		116	204				

Upstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	76	204	83	201	90	200
94	199.34	98	199.34	102	200	106	201	116	204
130	204	205	204	205	206				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	76	.08	90	.035	106	.08	116	.05

Bank Sta: Left Right Coeff Contr. Expan.
90 102 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	89	203.21	F
103	205	203.21	F

Downstream Deck/Roadway Coordinates
num= 8

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
76	204	204	83.5	204		83.5	203.21	
90	203.21	200.7	102	203.21	200.7	108.5	203.21	
108.5	204		116	204				

Downstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	76	204	83	201	90	200
94	199.34	98	199.34	102	200	106	201	116	204
130	204	205	204	205	206				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	76	.08	90	.035	106	.08	116	.05

Bank Sta: Left Right Coeff Contr. Expan.
90 102 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	89	203.2	F
103	205	203.2	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 Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method

Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT Profile #100-year

E.G. US. (m)	202.70	Element	Inside BR US	Inside BR DS
W.S. US. (m)	202.69	E.G. Elev (m)	202.66	202.66
Q Total (m3/s)	22.11	W.S. Elev (m)	202.53	202.53
Q Bridge (m3/s)	22.11	Crit W.S. (m)	200.26	200.26
Q Weir (m3/s)		Max Chl Dpth (m)	3.19	3.19
Weir Sta Lft (m)		Vel Total (m/s)	1.62	1.62
Weir Sta Rgt (m)		Flow Area (m2)	13.69	13.69
Weir Submerg		Froude # Chl	0.29	0.29
Weir Max Depth (m)		Specif Force (m3)	36.79	36.76
Min El Weir Flow (m)	203.21	Hydr Depth (m)		
Min El Prs (m)	200.70	W.P. Total (m)	25.52	25.52
Delta EG (m)	0.10	Conv. Total (m3/s)	267.9	267.9
Delta WS (m)	0.10	Top Width (m)		
BR Open Area (m2)	13.69	Frctn Loss (m)	0.00	0.00
BR Open Vel (m/s)	1.62	C & E Loss (m)	0.00	0.06
BR Sluice Coef		Shear Total (N/m2)	35.80	35.80
BR Sel Method	Energy only	Power Total (N/m s)	57.81	57.81

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
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.

BRIDGE OUTPUT Profile #Regional w red'n

E.G. US. (m)	204.36	Element	Inside BR US	Inside BR DS
W.S. US. (m)	204.33	E.G. Elev (m)	204.33	

Q Total (m3/s)	81.91	W.S. Elev (m)	204.22
Q Bridge (m3/s)	20.94	Crit W.S. (m)	203.76
Q Weir (m3/s)		Max Chl Dpth (m)	4.88
Weir Sta Lft (m)		Vel Total (m/s)	1.13
Weir Sta Rgt (m)		Flow Area (m2)	72.20
Weir Submerg		Froude # Chl	0.21
Weir Max Depth (m)		Specif Force (m3)	84.34
Min El Weir Flow (m)	203.21	Hydr Depth (m)	0.41
Min El Prs (m)	200.70	W.P. Total (m)	205.13
Delta EG (m)	0.07	Conv. Total (m3/s)	1020.1
Delta WS (m)	0.07	Top Width (m)	177.80
BR Open Area (m2)	13.69	Frctn Loss (m)	0.00
BR Open Vel (m/s)	1.53	C & E Loss (m)	0.00
BR Sluice Coef		Shear Total (N/m2)	22.26
BR Sel Method	Energy only	Power Total (N/m s)	25.25

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
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: RIVER-1
REACH: Reach-1 RS: 46.273

INPUT
Description: Section 46.273 - Jane Street - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	76	204	83	201	90	200
94	199.34	98	199.34	102	200	106	201	116	204
130	204	205	204	205	206				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	76	.08	90	.035	106	.08	116	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	102	4	4	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	89	203.2	F
103	205	203.2	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.60	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.035
W.S. Elev (m)	202.59	Reach Len. (m)	4.00	4.00	4.00
Crit W.S. (m)	200.27	Flow Area (m2)	2.52	36.33	2.46
E.G. Slope (m/m)	0.000089	Area (m2)	17.55	36.33	12.55
Q Total (m3/s)	22.11	Flow (m3/s)	0.55	20.37	1.19
Top Width (m)	32.00	Top Width (m)	10.70	12.00	9.29
Vel Total (m/s)	0.54	Avg. Vel. (m/s)	0.22	0.56	0.48
Max Chl Dpth (m)	3.25	Hydr. Depth (m)	2.52	3.03	2.46
Conv. Total (m3/s)	2343.1	Conv. (m3/s)	57.8	2159.5	125.8
Length Wtd. (m)	4.00	Wetted Per. (m)	1.01	12.11	1.03
Min Ch El (m)	199.34	Shear (N/m2)	2.17	2.62	2.09
Alpha	1.06	Stream Power (N/m s)	0.47	1.47	1.00
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	98.76	146.16	62.10
C & E Loss (m)	0.01	Cum SA (1000 m2)	89.88	43.73	71.15

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.29	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.077	0.035	0.046
W.S. Elev (m)	204.26	Reach Len. (m)	4.00	4.00	4.00
Crit W.S. (m)	201.19	Flow Area (m2)	50.65	56.43	56.05
E.G. Slope (m/m)	0.000136	Area (m2)	50.65	56.43	56.05
Q Total (m3/s)	81.91	Flow (m3/s)	11.81	52.37	17.73
Top Width (m)	179.19	Top Width (m)	64.19	12.00	

103.00					
Vel Total (m/s)	0.50	Avg. Vel. (m/s)	0.23	0.93	
0.32					
Max Chl Dpth (m)	4.92	Hydr. Depth (m)	0.79	4.70	
0.54					
Conv. Total (m3/s)	7035.6	Conv. (m3/s)	1014.1	4498.4	
1523.1					
Length Wtd. (m)	4.00	Wetted Per. (m)	64.88	12.11	
103.83					
Min Ch El (m)	199.34	Shear (N/m2)	1.04	6.20	
0.72					
Alpha	2.30	Stream Power (N/m s)	0.24	5.75	
0.23					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	251.52	279.67	
241.08					
C & E Loss (m)	0.01	Cum SA (1000 m2)	168.63	43.73	
162.74					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.272

INPUT
Description: Section 46.272 - Jane Street - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	80	204	90	201	91	200
92	199.34	100	199.34	101	200	102	201	105	202
115	203	120	204	130	204	205	204	205	206

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	80	.08	91	.035	102	.08	120	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
91	101	100	80	60	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	92	204	F
100	205	204	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.60	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.04	Wt. n-Val.		0.035	
W.S. Elev (m)	202.56	Reach Len. (m)	100.00	80.00	
60.00					
Crit W.S. (m)	200.26	Flow Area (m2)		25.75	
E.G. Slope (m/m)	0.000190	Area (m2)	6.11	31.52	
6.79					
Q Total (m3/s)	22.11	Flow (m3/s)		22.11	

Top Width (m)	25.78	Top Width (m)	6.19	10.00
9.59				
Vel Total (m/s)	0.86	Avg. Vel. (m/s)		0.86
Max Chl Dpth (m)	3.22	Hydr. Depth (m)		3.22
Conv. Total (m3/s)	1603.6	Conv. (m3/s)		1603.6
Length Wtd. (m)	80.00	Wetted Per. (m)		8.00
Min Ch El (m)	199.34	Shear (N/m2)		6.00
Alpha	1.00	Stream Power (N/m s)		5.15
Frctn Loss (m)		Cum Volume (1000 m3)	98.71	146.02
62.06				
C & E Loss (m)		Cum SA (1000 m2)	89.84	43.69
71.12				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.28	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.06	Wt. n-Val.	0.075	0.035	
0.064					
W.S. Elev (m)	204.22	Reach Len. (m)	100.00	80.00	
60.00					
Crit W.S. (m)	201.54	Flow Area (m2)	31.59	48.13	
51.26					
E.G. Slope (m/m)	0.000258	Area (m2)	31.59	48.13	
51.26					
Q Total (m3/s)	81.91	Flow (m3/s)	7.31	61.31	
13.29					
Top Width (m)	177.66	Top Width (m)	63.66	10.00	
104.00					
Vel Total (m/s)	0.63	Avg. Vel. (m/s)	0.23	1.27	
0.26					
Max Chl Dpth (m)	4.88	Hydr. Depth (m)	0.50	4.81	
0.49					
Conv. Total (m3/s)	5102.7	Conv. (m3/s)	455.2	3819.4	
828.1					
Length Wtd. (m)	80.00	Wetted Per. (m)	64.52	10.40	
104.94					
Min Ch El (m)	199.34	Shear (N/m2)	1.24	11.70	
1.23					
Alpha	3.15	Stream Power (N/m s)	0.29	14.90	
0.32					
Frctn Loss (m)		Cum Volume (1000 m3)	251.35	279.46	
240.86					
C & E Loss (m)		Cum SA (1000 m2)	168.37	43.69	
162.32					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2715

INPUT
Description: Hum 13A-1R. Jane Street Culverts - Twin Cell - 2.44 m W x 2.135 m H x 59 m L Concrete Box Culverts and Single Cel 2.44 W x 1.22 m H x 59 m L. Drawings by Ander Engineering Ltd. (85-101-7 & 85-101-1) 1985.

New HEC-RAS coding January 2004 by Acres
included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.
Distance from Upstream XS = 5
Deck/Roadway Width = 59
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	204	173	204

Upstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	80	204	90	201	91	200
92	199.34	100	199.34	101	200	102	201	105	202
115	203	120	204	130	204	205	204	205	206

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	80	.08	91	.035	102	.08	120	.05

Bank Sta: Left Right Coeff Contr. Expan.
91 101 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	92	204	F
100	205	204	F

Downstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	204	173	204

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	3	204	30	204	67	204	71	203
74	201	77	200	79	198.983	91	198.983	93	200
97	201	105	202	106	203	107	203.6	165	203.8

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.05	71	.08	77	.035	93	.08
106	.05								

Bank Sta: Left Right Coeff Contr. Expan.
77 93 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent

0	81	202.5	F
89	165	202.5	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 = 2

Culvert Name	Shape	Rise	Span
Culvert #1	Box	2.135	2.44

FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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
5	59	.015	.015	0	.5	1

Number of Barrels = 2
Upstream Elevation = 200.78
Centerline Stations

Sta.	Sta.
93.6	98.4

Downstream Elevation = 200.403
Centerline Stations

Sta.	Sta.
82.6	87.4

Culvert Name	Shape	Rise	Span
Culvert #2	Box	1.22	2.44

FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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
5	59	.015	.015	0	.5	1

Upstream Elevation = 199.34
Centerline Station = 96
Downstream Elevation = 198.983
Centerline Station = 85

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	16.33	Culv Full Len (m)	
# Barrels	2	Culv Vel US (m/s)	2.50
Q Barrel (m3/s)	8.16	Culv Vel DS (m/s)	1.92
E.G. US. (m)	202.60	Culv Inv El Up (m)	200.78
W.S. US. (m)	202.56	Culv Inv El Dn (m)	200.40
E.G. DS (m)	202.18	Culv Frctn Ls (m)	0.03
W.S. DS (m)	202.14	Culv Exit Loss (m)	0.15
Delta EG (m)	0.42	Culv Entr Loss (m)	0.16
Delta WS (m)	0.42	Q Weir (m3/s)	
E.G. IC (m)	202.49	Weir Sta Lft (m)	
E.G. OC (m)	202.60	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	202.12	Weir Max Depth (m)	
Culv WS Outlet (m)	202.14	Weir Avg Depth (m)	
Culv Nml Depth (m)	0.95	Weir Flow Area (m2)	

Culv Crt Depth (m)	1.05	Min El Weir Flow (m)	204.00

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	35.02	Culv Full Len (m)	59.00
# Barrels	2	Culv Vel US (m/s)	3.36
Q Barrel (m3/s)	17.51	Culv Vel DS (m/s)	3.36
E.G. US. (m)	204.28	Culv Inv El Up (m)	200.78
W.S. US. (m)	204.22	Culv Inv El Dn (m)	200.40
E.G. DS (m)	203.16	Culv Frctn Ls (m)	0.32
W.S. DS (m)	203.10	Culv Exit Loss (m)	0.52
Delta EG (m)	1.12	Culv Entr Loss (m)	0.29
Delta WS (m)	1.12	Q Weir (m3/s)	37.58
E.G. IC (m)	203.86	Weir Sta Lft (m)	25.11
E.G. OC (m)	204.28	Weir Sta Rgt (m)	205.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	202.92	Weir Max Depth (m)	0.28
Culv WS Outlet (m)	202.54	Weir Avg Depth (m)	0.27
Culv Nml Depth (m)		Weir Flow Area (m2)	49.46
Culv Crt Depth (m)	1.74	Min El Weir Flow (m)	204.00

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #2

Q Culv Group (m3/s)	5.78	Culv Full Len (m)	59.00
# Barrels	1	Culv Vel US (m/s)	1.94
Q Barrel (m3/s)	5.78	Culv Vel DS (m/s)	1.94
E.G. US. (m)	202.60	Culv Inv El Up (m)	199.34
W.S. US. (m)	202.56	Culv Inv El Dn (m)	198.98
E.G. DS (m)	202.18	Culv Frctn Ls (m)	0.17
W.S. DS (m)	202.14	Culv Exit Loss (m)	0.15
Delta EG (m)	0.42	Culv Entr Loss (m)	0.10
Delta WS (m)	0.42	Q Weir (m3/s)	
E.G. IC (m)	200.70	Weir Sta Lft (m)	
E.G. OC (m)	202.60	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	200.56	Weir Max Depth (m)	
Culv WS Outlet (m)	200.20	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.83	Min El Weir Flow (m)	204.00

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #2

Q Culv Group (m3/s)	9.31	Culv Full Len (m)	59.00
# Barrels	1	Culv Vel US (m/s)	3.13
Q Barrel (m3/s)	9.31	Culv Vel DS (m/s)	3.13
E.G. US. (m)	204.28	Culv Inv El Up (m)	199.34
W.S. US. (m)	204.22	Culv Inv El Dn (m)	198.98
E.G. DS (m)	203.16	Culv Frctn Ls (m)	0.43
W.S. DS (m)	203.10	Culv Exit Loss (m)	0.44
Delta EG (m)	1.12	Culv Entr Loss (m)	0.25
Delta WS (m)	1.12	Q Weir (m3/s)	37.58
E.G. IC (m)	201.51	Weir Sta Lft (m)	25.11
E.G. OC (m)	204.28	Weir Sta Rgt (m)	205.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	200.56	Weir Max Depth (m)	0.28
Culv WS Outlet (m)	200.20	Weir Avg Depth (m)	0.27
Culv Nml Depth (m)		Weir Flow Area (m2)	49.46
Culv Crt Depth (m)	1.14	Min El Weir Flow (m)	204.00

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.271

INPUT
Description: Section 46.271 - Jane Street - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	3	204	30	204	67	204	71	203
74	201	77	200	79	198.983	91	198.983	93	200
97	201	105	202	106	203	107	203.6	165	203.8

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.05	71	.08	77	.035	93	.08
106	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
77	93	55	60	70	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	81	202.5	F
89	165	202.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.18	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.		0.035	
W.S. Elev (m)	202.14	Reach Len. (m)	55.00	60.00	70.00
Crit W.S. (m)	199.90	Flow Area (m2)		25.27	
E.G. Slope (m/m)	0.000202	Area (m2)	5.90	48.50	11.70
Q Total (m3/s)	22.11	Flow (m3/s)		22.11	
Top Width (m)	32.85	Top Width (m)	4.71	16.00	12.14
Vel Total (m/s)	0.87	Avg. Vel. (m/s)		0.87	
Max Chl Dpth (m)	3.16	Hydr. Depth (m)		3.16	
Conv. Total (m3/s)	1554.1	Conv. (m3/s)		1554.1	
Length Wtd. (m)	61.12	Wetted Per. (m)		8.00	
Min Ch El (m)	198.98	Shear (N/m2)		6.27	
Alpha	1.00	Stream Power (N/m s)		5.48	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	98.71	145.37	62.06
C & E Loss (m)	0.00	Cum SA (1000 m2)	89.30	42.65	70.46

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	203.16	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.10	Reach Len. (m)	55.00	60.00	70.00
Crit W.S. (m)	201.18	Flow Area (m2)	11.14	63.88	23.84
E.G. Slope (m/m)	0.000255	Area (m2)	11.14	63.88	23.84
Q Total (m3/s)	81.91	Flow (m3/s)	3.09	71.91	6.92
Top Width (m)	35.58	Top Width (m)	6.41	16.00	13.17
Vel Total (m/s)	0.83	Avg. Vel. (m/s)	0.28	1.13	0.29
Max Chl Dpth (m)	4.12	Hydr. Depth (m)	1.74	3.99	1.81
Conv. Total (m3/s)	5128.7	Conv. (m3/s)	193.5	4502.2	433.0
Length Wtd. (m)	61.45	Wetted Per. (m)	7.19	16.49	13.80
Min Ch El (m)	198.98	Shear (N/m2)	3.87	9.69	4.32
Alpha	1.63	Stream Power (N/m s)	1.07	10.91	1.25
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	251.35	275.12	240.86
C & E Loss (m)	0.05	Cum SA (1000 m2)	164.87	42.65	158.81

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.27

INPUT
Description: Section 46.27 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	10	204	40	204	63	206	73	206
78	204	90	203	100	200	103	199	104	198.9
105	198.9	106	199	112	200	120	203	147	203.5

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	103	.035	106	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
103	106	100	110	120	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.16	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.13	Reach Len. (m)	100.00	110.00	120.00
Crit W.S. (m)		Flow Area (m2)	15.45	9.59	21.83
E.G. Slope (m/m)	0.000315	Area (m2)	15.45	9.59	21.83
Q Total (m3/s)	22.11	Flow (m3/s)	4.41	10.53	7.16
Top Width (m)	24.78	Top Width (m)	10.10	3.00	11.68
Vel Total (m/s)	0.47	Avg. Vel. (m/s)	0.29	1.10	0.33
Max Chl Dpth (m)	3.23	Hydr. Depth (m)	1.53	3.20	1.87
Conv. Total (m3/s)	1245.0	Conv. (m3/s)	248.6	593.1	403.2
Length Wtd. (m)	110.32	Wetted Per. (m)	10.57	3.01	12.15
Min Ch El (m)	198.90	Shear (N/m2)	4.52	9.85	5.55
Alpha	2.81	Stream Power (N/m s)	1.29	10.82	1.82
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	98.13	143.63	60.89
C & E Loss (m)	0.00	Cum SA (1000 m2)	88.89	42.08	69.63

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	203.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.22	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.85	Reach Len. (m)	100.00	110.00	120.00
Crit W.S. (m)		Flow Area (m2)	23.64	11.76	30.99
E.G. Slope (m/m)	0.001814	Area (m2)	23.64	11.76	30.99
Q Total (m3/s)	81.91	Flow (m3/s)	18.66	35.51	27.74
Top Width (m)	29.13	Top Width (m)	12.52	3.00	13.61

Vel Total (m/s)	1.23	Avg. Vel. (m/s)	0.79	3.02	0.90
Max Chl Dpth (m)	3.95	Hydr. Depth (m)	1.89	3.92	2.28
Conv. Total (m3/s)	1923.5	Conv. (m3/s)	438.2	833.9	651.4
Length Wtd. (m)	110.39	Wetted Per. (m)	13.10	3.01	14.21
Min Ch El (m)	198.90	Shear (N/m2)	32.11	69.50	38.78
Alpha	2.87	Stream Power (N/m s)	25.34	209.82	34.71
Frctn Loss (m)	0.13	Cum Volume (1000 m3)	250.40	272.85	238.94
C & E Loss (m)	0.02	Cum SA (1000 m2)	164.35	42.08	157.87

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: RIVER-1
REACH: Reach-1 RS: 46.26

INPUT
Description: Section 46.26 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	15	204	24	200	30	199	32	198.8
34	198.8	36	199	47	202	54	202.5	64	202.5
64	205	109	205						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	15	.08	30	.035	36	.08	54	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
30	36	115	120	120	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.14	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.12	Reach Len. (m)	115.00	120.00	120.00
Crit W.S. (m)		Flow Area (m2)	20.74	19.50	17.88
E.G. Slope (m/m)	0.000138	Area (m2)	20.74	19.50	17.88
Q Total (m3/s)	22.11	Flow (m3/s)	4.56	14.31	3.24
Top Width (m)	29.40	Top Width (m)	10.76	6.00	12.64
Vel Total (m/s)	0.38	Avg. Vel. (m/s)	0.22	0.73	0.18

Max Chl Dpth (m)	3.32	Hydr. Depth (m)	1.93	3.25	1.42
Conv. Total (m3/s)	1884.7	Conv. (m3/s)	388.9	1219.9	275.9
Length Wtd. (m)	119.31	Wetted Per. (m)	11.30	6.02	13.04
Min Ch El (m)	198.80	Shear (N/m2)	2.48	4.37	1.85
Alpha	2.51	Stream Power (N/m s)	0.54	3.21	0.33
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	96.32	142.03	58.50
C & E Loss (m)	0.00	Cum SA (1000 m2)	87.85	41.58	68.17

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.92	Element	Left OB	Channel	Right OB
Vel Head (m)	0.14	Wt. n-Val.	0.080	0.035	0.079
W.S. Elev (m)	202.78	Reach Len. (m)	115.00	120.00	120.00
Crit W.S. (m)		Flow Area (m2)	28.33	23.46	31.49
E.G. Slope (m/m)	0.000878	Area (m2)	28.33	23.46	31.49
Q Total (m3/s)	81.91	Flow (m3/s)	17.72	49.20	15.00
Top Width (m)	46.25	Top Width (m)	12.25	6.00	28.00
Vel Total (m/s)	0.98	Avg. Vel. (m/s)	0.63	2.10	0.48
Max Chl Dpth (m)	3.98	Hydr. Depth (m)	2.31	3.91	1.12
Conv. Total (m3/s)	2763.7	Conv. (m3/s)	597.8	1659.9	506.0
Length Wtd. (m)	119.21	Wetted Per. (m)	12.92	6.02	28.70
Min Ch El (m)	198.80	Shear (N/m2)	18.89	33.57	9.45
Alpha	2.86	Stream Power (N/m s)	11.81	70.40	4.50
Frctn Loss (m)	0.09	Cum Volume (1000 m3)	247.80	270.91	235.19
C & E Loss (m)	0.01	Cum SA (1000 m2)	163.11	41.58	155.37

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: RIVER-1
REACH: Reach-1 RS: 46.25

INPUT
Description: Section 46.25 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	26	203	36	200	40	199	44	198.6
46	198.6	50	199	68	202	84	203	154	204

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	26	.08	40	.035	50	.08	68	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
40	50	140	130	125	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.11	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.08	Reach Len. (m)	140.00	130.00	125.00
Crit W.S. (m)		Flow Area (m2)	17.56	33.23	28.54
E.G. Slope (m/m)	0.000201	Area (m2)	17.56	33.23	28.54
Q Total (m3/s)	40.81	Flow (m3/s)	4.15	29.86	6.79
Top Width (m)	40.26	Top Width (m)	10.94	10.00	19.32
Vel Total (m/s)	0.51	Avg. Vel. (m/s)	0.24	0.90	0.24
Max Chl Dpth (m)	3.48	Hydr. Depth (m)	1.60	3.32	1.48
Conv. Total (m3/s)	2880.6	Conv. (m3/s)	293.2	2108.1	479.3
Length Wtd. (m)	130.55	Wetted Per. (m)	11.37	10.04	19.57
Min Ch El (m)	198.60	Shear (N/m2)	3.04	6.51	2.87
Alpha	2.29	Stream Power (N/m s)	0.72	5.85	0.68
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	94.11	138.86	55.72
C & E Loss (m)	0.00	Cum SA (1000 m2)	86.60	40.62	66.25

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.82	Element	Left OB	Channel	Right OB
Vel Head (m)	0.12	Wt. n-Val.	0.080	0.035	0.079
W.S. Elev (m)	202.70	Reach Len. (m)	140.00	130.00	125.00

Crit W.S. (m)		Flow Area (m2)	24.93	39.38	43.48
E.G. Slope (m/m)	0.000683	Area (m2)	24.93	39.38	43.48
Q Total (m3/s)	108.10	Flow (m3/s)	12.25	73.17	22.68
Top Width (m)	52.17	Top Width (m)	13.00	10.00	29.18
Vel Total (m/s)	1.00	Avg. Vel. (m/s)	0.49	1.86	0.52
Max Chl Dpth (m)	4.10	Hydr. Depth (m)	1.92	3.94	1.49
Conv. Total (m3/s)	4135.1	Conv. (m3/s)	468.8	2798.9	867.4
Length Wtd. (m)	130.60	Wetted Per. (m)	13.51	10.04	29.45
Min Ch El (m)	198.60	Shear (N/m2)	12.36	26.29	9.89
Alpha	2.41	Stream Power (N/m s)	6.08	48.84	5.16
Frctn Loss (m)	0.11	Cum Volume (1000 m3)	244.73	267.14	230.70
C & E Loss (m)	0.01	Cum SA (1000 m2)	161.66	40.62	151.94

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.24

INPUT
Description: Section 46.24 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	13	203	30	200	34	199	36	198.4
38	198.4	43	199	52	202	60	203	80	204

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	13	.08	34	.035	43	.08	60	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
34	43	54	51	45	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.04	Reach Len. (m)	54.00	51.00	45.00
Crit W.S. (m)		Flow Area (m2)	21.94	30.65	13.86
E.G. Slope (m/m)	0.000262	Area (m2)	21.94	30.65	13.86
Q Total (m3/s)	40.81	Flow (m3/s)	5.51	31.77	3.53
Top Width (m)	33.87	Top Width (m)	15.56	9.00	

9.31				
Vel Total (m/s)	0.61	Avg. Vel. (m/s)	0.25	1.04
0.25				
Max Chl Dpth (m)	3.64	Hydr. Depth (m)	1.41	3.41
1.49				
Conv. Total (m3/s)	2523.0	Conv. (m3/s)	340.5	1964.4
218.2				
Length Wtd. (m)	50.55	Wetted Per. (m)	15.86	9.12
9.80				
Min Ch El (m)	198.40	Shear (N/m2)	3.55	8.62
3.63				
Alpha	2.26	Stream Power (N/m s)	0.89	8.93
0.92				
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	91.35	134.71
53.07				
C & E Loss (m)	0.00	Cum SA (1000 m2)	84.74	39.39
64.46				

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.70	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.21	Wt. n-Val.	0.080	0.035
0.080				
W.S. Elev (m)	202.49	Reach Len. (m)	54.00	51.00
45.00				
Crit W.S. (m)		Flow Area (m2)	29.45	34.67
18.81				
E.G. Slope (m/m)	0.001134	Area (m2)	29.45	34.67
18.81				
Q Total (m3/s)	108.10	Flow (m3/s)	16.94	81.22
9.93				
Top Width (m)	39.97	Top Width (m)	18.09	9.00
12.88				
Vel Total (m/s)	1.30	Avg. Vel. (m/s)	0.58	2.34
0.53				
Max Chl Dpth (m)	4.09	Hydr. Depth (m)	1.63	3.85
1.46				
Conv. Total (m3/s)	3209.9	Conv. (m3/s)	503.1	2411.9
294.8				
Length Wtd. (m)	50.41	Wetted Per. (m)	18.43	9.12
13.40				
Min Ch El (m)	198.40	Shear (N/m2)	17.77	42.26
15.61				
Alpha	2.47	Stream Power (N/m s)	10.23	99.01
8.24				
Frctn Loss (m)	0.06	Cum Volume (1000 m3)	240.93	262.33
226.80				
C & E Loss (m)	0.02	Cum SA (1000 m2)	159.49	39.39
149.31				

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2375

INPUT

Description: Based on Bridge Section US

Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-1380	205.2	-1375	205.1	-1370	204.5	-1360	204.5	-1340	204.4
-1330	204.2	-1320	204.4	-1318	204	-1310	203	-1305	202
-1300	201	-1295	200	-1290	199.3	-1288	199.2	-1287	198.8
-1285	198.6	-1284	198.6	-1282	199.2	-1280	199.4	-1275	200
-1270	201	-1260	201.3	-1250	202	-1242	203	-1240	204.3
-1236	204.6	-1233	204.7	-1230	204.5	-1220	204.6	-1215	205
-1200	205								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-1380	.05	-1320	.08	-1288	.035	-1282	.08	-1233	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-1288	-1282	30	30	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-1380	-1309	204	T
-1251	-1200	204	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.07	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.03	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	200.30	Flow Area (m2)	27.72	19.37	37.21
E.G. Slope (m/m)	0.000350	Area (m2)	27.72	19.37	37.28
Q Total (m3/s)	40.81	Flow (m3/s)	8.84	22.17	9.79
Top Width (m)	55.35	Top Width (m)	17.14	6.00	32.22
Vel Total (m/s)	0.48	Avg. Vel. (m/s)	0.32	1.14	0.26
Max Chl Dpth (m)	3.43	Hydr. Depth (m)	1.62	3.23	1.20
Conv. Total (m3/s)	2181.9	Conv. (m3/s)	472.7	1185.7	523.5
Length Wtd. (m)	1.00	Wetted Per. (m)	17.39	6.18	31.17
Min Ch El (m)	198.60	Shear (N/m2)	5.47	10.76	4.09
Alpha	3.20	Stream Power (N/m s)	1.74	12.31	1.08
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	90.01	133.44	51.92
C & E Loss (m)	0.00	Cum SA (1000 m2)	83.86	39.01	63.53

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.62	Element	Left OB	Channel	Right OB

Vel Head (m)	0.15	Wt. n-Val.	0.080	0.035 0.080
W.S. Elev (m)	202.47	Reach Len. (m)	1.00	1.00 1.00
Crit W.S. (m)	200.99	Flow Area (m2)	35.75	22.01 50.87
E.G. Slope (m/m)	0.001285	Area (m2)	35.75	22.01 52.24
Q Total (m3/s)	108.10	Flow (m3/s)	23.89	52.61 31.60
Top Width (m)	61.08	Top Width (m)	19.34	6.00 35.74
Vel Total (m/s)	1.00	Avg. Vel. (m/s)	0.67	2.39 0.62
Max Chl Dpth (m)	3.87	Hydr. Depth (m)	1.85	3.67 1.64
Conv. Total (m3/s)	3015.1	Conv. (m3/s)	666.3	1467.5 881.3
Length Wtd. (m)	1.00	Wetted Per. (m)	19.63	6.18 31.17
Min Ch El (m)	198.60	Shear (N/m2)	22.95	44.92 20.57
Alpha	3.02	Stream Power (N/m s)	15.33	107.37 12.78
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	239.17	260.88 225.20
C & E Loss (m)	0.01	Cum SA (1000 m2)	158.48	39.01 148.22

BRIDGE

RIVER: RIVER-1
REACH: Reach-1 RS: 46.235

INPUT
Description: Proposed Portage Parkway Extension
Distance from Upstream XS = 1
Deck/Roadway Width = 25.7
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 8

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-1400	205.3		-1360	205.3		-1309	205.5	
-1309	205.5	204	-1280	205.7	204	-1251	205.5	204
-1251	205.5		-1180	205.2				

Upstream Bridge Cross Section Data
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-1380	205.2	-1375	205.1	-1370	204.5	-1360	204.5	-1340	204.4
-1330	204.2	-1320	204.4	-1318	204	-1310	203	-1305	202
-1300	201	-1295	200	-1290	199.3	-1288	199.2	-1287	198.8
-1285	198.6	-1284	198.6	-1282	199.2	-1280	199.4	-1275	200
-1270	201	-1260	201.3	-1250	202	-1242	203	-1240	204.3
-1236	204.6	-1233	204.7	-1230	204.5	-1220	204.6	-1215	205
-1200	205								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-1380	.05	-1320	.08	-1288	.035	-1282	.08	-1233	.05

```
Bank Sta: Left   Right    Coeff Contr.   Expan.
         -1288   -1282            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -1380   -1309     204       T
   -1251   -1200     204       T

Downstream  Deck/Roadway Coordinates
    num=       8
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
   -1400   205.3           -1360   205.3           -1309   205.5
   -1309   205.5     204   -1280   205.7     204   -1251   205.5     204
   -1251   205.5           -1180   205.2

Downstream Bridge Cross Section Data
Station Elevation Data    num=      31
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   -1380   205.2   -1375   205.1   -1370   204.5   -1360   204.5   -1340   204.4
   -1330   204.2   -1320   204.4   -1318     204   -1310     203   -1305     202
   -1300     201   -1295     200   -1290   199.3   -1288   199.2   -1287   198.8
   -1285   198.6   -1284   198.6   -1282   199.2   -1280   199.4   -1275     200
   -1270     201   -1260   201.3   -1250     202   -1242     203   -1240   204.3
   -1236   204.6   -1233   204.7   -1230   204.5   -1220   204.6   -1215     205
   -1200     205

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
   -1380     .05   -1320     .08   -1288    .035   -1282     .08   -1233     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
         -1288   -1282            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -1380   -1309     204       T
   -1251   -1200     204       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 =     .98
Elevation at which weir flow begins        =
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Piers =  2

Pier Data
Pier Station     Upstream=   -1294    Downstream=   -1294
Upstream     num=       2
    Width   Elev    Width   Elev
       2     198       2     204
Downstream     num=       2
    Width   Elev    Width   Elev
       2     198       2     204

Pier Data
Pier Station     Upstream=   -1265    Downstream=   -1265
Upstream     num=       2
    Width   Elev    Width   Elev
       2     198       2     204
Downstream     num=       2
    Width   Elev    Width   Elev
```

2 198 2 204

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT Profile #100-year

E.G. US. (m)	202.07	Element	Inside BR US	Inside BR DS
W.S. US. (m)	202.03	E.G. Elev (m)	202.06	202.05
Q Total (m3/s)	40.81	W.S. Elev (m)	202.02	202.01
Q Bridge (m3/s)	40.81	Crit W.S. (m)	200.29	200.29
Q Weir (m3/s)		Max Chl Dpth (m)	3.42	3.41
Weir Sta Lft (m)		Vel Total (m/s)	0.52	0.53
Weir Sta Rgt (m)		Flow Area (m2)	77.87	77.34
Weir Submerg		Froude # Chl	0.16	0.16
Weir Max Depth (m)		Specif Force (m3)	89.50	88.71
Min El Weir Flow (m)	205.29	Hydr Depth (m)	1.55	1.55
Min El Prs (m)	204.00	W.P. Total (m)	56.83	56.73
Delta EG (m)	0.02	Conv. Total (m3/s)	2088.1	2072.3
Delta WS (m)	0.02	Top Width (m)	50.10	50.05
BR Open Area (m2)	183.23	Frctn Loss (m)	0.01	0.00
BR Open Vel (m/s)	0.53	C & E Loss (m)	0.00	0.00
BR Sluice Coef		Shear Total (N/m2)	5.13	5.18
BR Sel Method	Energy only	Power Total (N/m s)	2.69	2.74

BRIDGE OUTPUT Profile #Regional w red'n

E.G. US. (m)	202.62	Element	Inside BR US	Inside BR DS

W.S. US. (m)	202.47	E.G. Elev (m)	202.61
202.56			
Q Total (m3/s)	108.10	W.S. Elev (m)	202.41
202.35			
Q Bridge (m3/s)	108.10	Crit W.S. (m)	201.37
201.37			
Q Weir (m3/s)		Max Chl Dpth (m)	3.81
3.75			
Weir Sta Lft (m)		Vel Total (m/s)	1.11
1.14			
Weir Sta Rgt (m)		Flow Area (m2)	97.76
94.73			
Weir Submerg		Froude # Chl	0.32
0.33			
Weir Max Depth (m)		Specif Force (m3)	139.07
134.06			
Min El Weir Flow (m)	205.29	Hydr Depth (m)	1.88
1.83			
Min El Prs (m)	204.00	W.P. Total (m)	60.77
60.18			
Delta EG (m)	0.08	Conv. Total (m3/s)	2716.5
2617.0			
Delta WS (m)	0.10	Top Width (m)	52.05
51.76			
BR Open Area (m2)	183.23	Frctn Loss (m)	0.04
0.01			
BR Open Vel (m/s)	1.14	C & E Loss (m)	0.00
0.02			
BR Sluice Coef		Shear Total (N/m2)	24.98
26.34			
BR Sel Method	Energy only	Power Total (N/m s)	27.62
30.05			

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2325

INPUT
Description: Based on Bridge Section DS
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-1380	205.2	-1375	205.1	-1370	204.5	-1360	204.5	-1340	204.4
-1330	204.2	-1320	204.4	-1318	204	-1310	203	-1305	202
-1300	201	-1295	200	-1290	199.3	-1288	199.2	-1287	198.8
-1285	198.6	-1284	198.6	-1282	199.2	-1280	199.4	-1275	200
-1270	201	-1260	201.3	-1250	202	-1242	203	-1240	204.3
-1236	204.6	-1233	204.7	-1230	204.5	-1220	204.6	-1215	205
-1200	205								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-1380	.05	-1320	.08	-1288	.035	-1282	.08	-1233	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-1288	-1282	94	94	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-1380	-1309	204	T
-1251	-1200	204	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.05	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.01	Reach Len. (m)	94.00	94.00	94.00
Crit W.S. (m)		Flow Area (m2)	27.44	19.27	36.71
E.G. Slope (m/m)	0.000359	Area (m2)	27.44	19.27	36.75
Q Total (m3/s)	40.81	Flow (m3/s)	8.84	22.28	9.69
Top Width (m)	55.14	Top Width (m)	17.05	6.00	32.09
Vel Total (m/s)	0.49	Avg. Vel. (m/s)	0.32	1.16	0.26
Max Chl Dpth (m)	3.41	Hydr. Depth (m)	1.61	3.21	1.18
Conv. Total (m3/s)	2153.8	Conv. (m3/s)	466.3	1175.8	511.7
Length Wtd. (m)	94.00	Wetted Per. (m)	17.30	6.18	31.17
Min Ch El (m)	198.60	Shear (N/m2)	5.58	10.98	4.15
Alpha	3.21	Stream Power (N/m s)	1.80	12.70	1.09
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	89.30	132.86	50.86
C & E Loss (m)	0.02	Cum SA (1000 m2)	83.41	38.83	62.65

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.54	Element	Left OB	Channel	Right OB
Vel Head (m)	0.17	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.36	Reach Len. (m)	94.00	94.00	94.00
Crit W.S. (m)		Flow Area (m2)	33.77	21.39	47.65
E.G. Slope (m/m)	0.001483	Area (m2)	33.77	21.39	48.58
Q Total (m3/s)	108.10	Flow (m3/s)	23.77	53.88	30.45
Top Width (m)	59.73	Top Width (m)	18.82	6.00	34.91
Vel Total (m/s)	1.05	Avg. Vel. (m/s)	0.70	2.52	0.64
Max Chl Dpth (m)	3.76	Hydr. Depth (m)	1.79	3.56	1.54
Conv. Total (m3/s)	2806.8	Conv. (m3/s)	617.1	1399.1	

790.6					
Length Wtd. (m)	94.00	Wetted Per. (m)	19.11	6.18	31.17
Min Ch El (m)	198.60	Shear (N/m2)	25.71	50.37	22.24
Alpha	3.06	Stream Power (N/m s)	18.09	126.89	14.21
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	238.29	260.24	223.83
C & E Loss (m)	0.07	Cum SA (1000 m2)	157.96	38.83	147.34

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: RIVER-1
REACH: Reach-1 RS: 46.23

INPUT
Description: Section 46.23 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	38	204	52	201	63	200	90	199
100	198.2	113	199	118	200	126	204	160	204
160	206	210	206						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	38	.08	90	.035	113	.08	126	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	113	101	95	89	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.03	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.02	Reach Len. (m)	101.00	95.00	89.00
Crit W.S. (m)		Flow Area (m2)	87.23	78.68	16.69
E.G. Slope (m/m)	0.000033	Area (m2)	87.23	78.68	16.69
Q Total (m3/s)	40.81	Flow (m3/s)	9.99	29.10	1.72
Top Width (m)	74.81	Top Width (m)	42.76	23.00	9.04
Vel Total (m/s)	0.22	Avg. Vel. (m/s)	0.11	0.37	0.10
Max Chl Dpth (m)	3.82	Hydr. Depth (m)	2.04	3.42	1.85
Conv. Total (m3/s)	7145.7	Conv. (m3/s)	1748.9	5095.6	301.2
Length Wtd. (m)	97.05	Wetted Per. (m)	42.94	23.06	

9.62					
Min Ch El (m)	198.20	Shear (N/m2)	0.65	1.09	
0.55					
Alpha	2.03	Stream Power (N/m s)	0.07	0.40	
0.06					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	83.91	128.25	
48.35					
C & E Loss (m)	0.00	Cum SA (1000 m2)	80.59	37.46	
60.72					

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.43	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	
0.080					
W.S. Elev (m)	202.40	Reach Len. (m)	101.00	95.00	
89.00					
Crit W.S. (m)		Flow Area (m2)	103.96	87.50	
20.30					
E.G. Slope (m/m)	0.000152	Area (m2)	103.96	87.50	
20.30					
Q Total (m3/s)	108.10	Flow (m3/s)	28.13	75.09	
4.87					
Top Width (m)	77.36	Top Width (m)	44.55	23.00	
9.81					
Vel Total (m/s)	0.51	Avg. Vel. (m/s)	0.27	0.86	
0.24					
Max Chl Dpth (m)	4.20	Hydr. Depth (m)	2.33	3.80	
2.07					
Conv. Total (m3/s)	8755.4	Conv. (m3/s)	2278.8	6082.1	
394.4					
Length Wtd. (m)	97.07	Wetted Per. (m)	44.77	23.06	
10.47					
Min Ch El (m)	198.20	Shear (N/m2)	3.47	5.67	
2.90					
Alpha	2.05	Stream Power (N/m s)	0.94	4.87	
0.69					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	231.81	255.12	
220.59					
C & E Loss (m)	0.01	Cum SA (1000 m2)	154.99	37.46	
145.24					

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: RIVER-1
REACH: Reach-1 RS: 46.22

INPUT

Description: Section 46.22 - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	12	201	22	200	36	199	52	198
72	197.5	77	198	79	199	87	203	102	203
112	199	114	198	132	197.5	146	198	152	199
172	202	175	203	192	204				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	36	.035	79	.08	112	.035	152	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
112	152	125	140	115	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.02	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.039	0.035	0.050
W.S. Elev (m)	202.02	Reach Len. (m)	125.00	140.00	115.00
Crit W.S. (m)		Flow Area (m2)	243.50	164.94	30.47
E.G. Slope (m/m)	0.000002	Area (m2)	243.50	164.94	30.47
Q Total (m3/s)	40.81	Flow (m3/s)	20.86	18.71	1.24
Top Width (m)	144.77	Top Width (m)	84.70	40.00	20.07
Vel Total (m/s)	0.09	Avg. Vel. (m/s)	0.09	0.11	0.04
Max Chl Dpth (m)	4.52	Hydr. Depth (m)	2.87	4.12	1.52
Conv. Total (m3/s)	26284.7	Conv. (m3/s)	13434.2	12051.5	799.0
Length Wtd. (m)	133.79	Wetted Per. (m)	86.51	40.33	20.30
Min Ch El (m)	197.50	Shear (N/m2)	0.07	0.10	0.04
Alpha	1.12	Stream Power (N/m s)	0.01	0.01	0.00
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	67.21	116.68	46.25
C & E Loss (m)	0.00	Cum SA (1000 m2)	74.16	34.47	59.42

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.040	0.035	0.050
W.S. Elev (m)	202.42	Reach Len. (m)	125.00	140.00	115.00
Crit W.S. (m)		Flow Area (m2)	277.60	180.74	

38.63					
E.G. Slope (m/m)	0.000012	Area (m2)	277.60	180.74	
38.63					
Q Total (m3/s)	108.10	Flow (m3/s)	55.43	48.71	
3.96					
Top Width (m)	149.31	Top Width (m)	88.06	40.00	
21.26					
Vel Total (m/s)	0.22	Avg. Vel. (m/s)	0.20	0.27	
0.10					
Max Chl Dpth (m)	4.92	Hydr. Depth (m)	3.15	4.52	
1.82					
Conv. Total (m3/s)	31148.0	Conv. (m3/s)	15972.4	14035.5	
1140.2					
Length Wtd. (m)	134.82	Wetted Per. (m)	90.08	40.33	
21.55					
Min Ch El (m)	197.50	Shear (N/m2)	0.36	0.53	
0.21					
Alpha	1.13	Stream Power (N/m s)	0.07	0.14	
0.02					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	212.54	242.38	
217.97					
C & E Loss (m)	0.00	Cum SA (1000 m2)	148.29	34.47	
143.85					

Warning: Divided flow computed for this cross-section.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.214

INPUT
Description: Section 46.214 - Jane St & Hwy 7 Pond Outlet - In-Line Weir - U/S
Bounding Section
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	37	202	100	202	122	201	132	200
133	199	134	198	140	196.7	172	196.7	180	198
207	202	273	203	303	204				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	134	.035	180	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
134	180	1	1	1 .3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	123	202	F
190	303	202	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.02	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	
0.080					
W.S. Elev (m)	202.02	Reach Len. (m)	1.00	1.00	
1.00					

Crit W.S. (m)	197.02	Flow Area (m2)	34.28	235.78	54.65
E.G. Slope (m/m)	0.000001	Area (m2)	34.28	235.78	54.65
Q Total (m3/s)	19.06	Flow (m3/s)	0.30	17.82	0.93
Top Width (m)	172.41	Top Width (m)	97.87	46.00	28.55
Vel Total (m/s)	0.06	Avg. Vel. (m/s)	0.01	0.08	0.02
Max Chl Dpth (m)	5.32	Hydr. Depth (m)	0.35	5.13	1.91
Conv. Total (m3/s)	21341.3	Conv. (m3/s)	338.6	19956.5	1046.2
Length Wtd. (m)	1.00	Wetted Per. (m)	98.77	46.24	28.84
Min Ch El (m)	196.70	Shear (N/m2)	0.00	0.04	0.01
Alpha	1.56	Stream Power (N/m s)	0.00	0.00	0.00
Frctn Loss (m)		Cum Volume (1000 m3)	49.85	88.63	41.36
C & E Loss (m)		Cum SA (1000 m2)	62.75	28.45	56.63

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	202.41	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	197.69	Flow Area (m2)	75.06	253.64	70.71
E.G. Slope (m/m)	0.000019	Area (m2)	75.06	253.64	70.71
Q Total (m3/s)	108.10	Flow (m3/s)	4.99	98.51	4.60
Top Width (m)	212.40	Top Width (m)	112.23	46.00	54.17
Vel Total (m/s)	0.27	Avg. Vel. (m/s)	0.07	0.39	0.07
Max Chl Dpth (m)	5.71	Hydr. Depth (m)	0.67	5.51	1.31
Conv. Total (m3/s)	24731.7	Conv. (m3/s)	1141.8	22538.2	1051.7
Length Wtd. (m)	1.00	Wetted Per. (m)	113.14	46.24	54.47
Min Ch El (m)	196.70	Shear (N/m2)	0.12	1.03	0.24
Alpha	1.88	Stream Power (N/m s)	0.01	0.40	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	190.50	211.97	211.68
C & E Loss (m)		Cum SA (1000 m2)	135.77	28.45	139.52

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

INLINE STRUCTURE

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2135

INPUT
Description: Hum 13-5R. Jane St. & Hwy 7 Pond Outlet Weir x 45 m Drawings by Ander Engineering Ltd. (Dwg No. 85-101-5, 1986 & Figure 1, date/source unknown).

New HEC-RAS coding January 2004 by Acres
included coding of in-line in HEC-RAS.
Distance from Upstream XS = .5
Deck/Roadway Width = .25
Weir Coefficient = 1.72
Weir Embankment Coordinates num = 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
100	202	123	202	123.75	201.95	137.75	201.95	153	201.95
153	200.9	161	200.9	161	201.95	175.3	201.95	189.3	201.95
190	202	207	202						

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 =
Weir crest shape = Broad Crested

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.213

INPUT
Description: Section 46.213 - Jane St. & Hwy 7 Pond Outlet - In-Line Weir - D/S Bounding Section
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	37	202	100	202	122	201	132	200
133	199	134	198	140	196.7	172	196.7	180	198
207	202	273	203	303	204				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	134	.035	180	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
134	180	15	15	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	123	202	F
190	303	202	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.73	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	200.73	Reach Len. (m)	15.00	15.00	15.00
Crit W.S. (m)	197.02	Flow Area (m2)	6.12	176.25	19.89
E.G. Slope (m/m)	0.000002	Area (m2)	6.12	176.25	25.14
Q Total (m3/s)	19.06	Flow (m3/s)	0.13	18.34	0.58
Top Width (m)	73.71	Top Width (m)	9.29	46.00	18.42
Vel Total (m/s)	0.09	Avg. Vel. (m/s)	0.02	0.10	0.03
Max Chl Dpth (m)	4.03	Hydr. Depth (m)	0.66	3.83	1.99
Conv. Total (m3/s)	12764.2	Conv. (m3/s)	87.3	12286.7	390.2
Length Wtd. (m)	15.00	Wetted Per. (m)	10.16	46.24	10.11
Min Ch El (m)	196.70	Shear (N/m2)	0.01	0.08	0.04
Alpha	1.18	Stream Power (N/m s)	0.00	0.01	0.00
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	49.85	88.50	41.36
C & E Loss (m)	0.00	Cum SA (1000 m2)	62.69	28.41	56.61

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	202.32	Reach Len. (m)	15.00	15.00	15.00
Crit W.S. (m)	197.69	Flow Area (m2)	65.09	249.49	66.09
E.G. Slope (m/m)	0.000021	Area (m2)	65.09	249.49	66.09
Q Total (m3/s)	108.10	Flow (m3/s)	4.16	99.34	4.60
Top Width (m)	203.12	Top Width (m)	108.90	46.00	48.22
Vel Total (m/s)	0.28	Avg. Vel. (m/s)	0.06	0.40	0.07
Max Chl Dpth (m)	5.62	Hydr. Depth (m)	0.60	5.42	1.37
Conv. Total (m3/s)	23861.5	Conv. (m3/s)	918.7	21927.6	1015.2

Length Wtd. (m)	15.00	Wetted Per. (m)	109.80	46.24	48.52
Min Ch El (m)	196.70	Shear (N/m2)	0.12	1.09	0.27
Alpha	1.81	Stream Power (N/m s)	0.01	0.43	0.02
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	190.50	211.77	211.68
C & E Loss (m)	0.00	Cum SA (1000 m2)	135.66	28.41	139.47

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: RIVER-1
REACH: Reach-1 RS: 46.212

INPUT
Description: Section 46.212 - Jane St. & Hwy 7 Pond Outlet - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	37	202	100	202	122	201	132	200
133	199	134	198	140	196.6	172	196.6	180	198
207	199	252	199.5	273	203	303	204		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	133	.035	207	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
133	207	55	45	10	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	149.5	202	F
160.5	303	202	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.73	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.035	
W.S. Elev (m)	200.72	Reach Len. (m)	55.00	45.00	10.00
Crit W.S. (m)	197.27	Flow Area (m2)		45.30	
E.G. Slope (m/m)	0.000033	Area (m2)	3.80	241.75	70.52
Q Total (m3/s)	19.06	Flow (m3/s)		19.06	
Top Width (m)	134.49	Top Width (m)	8.18	74.00	52.31
Vel Total (m/s)	0.42	Avg. Vel. (m/s)		0.42	

Max Chl Dpth (m)	4.12	Hydr. Depth (m)		4.12
Conv. Total (m3/s)	3325.3	Conv. (m3/s)		3325.3
Length Wtd. (m)	45.00	Wetted Per. (m)		11.00
Min Ch El (m)	196.60	Shear (N/m2)		1.33
Alpha	1.00	Stream Power (N/m s)		0.56
Frctn Loss (m)		Cum Volume (1000 m3)	49.78	85.36 40.64
C & E Loss (m)		Cum SA (1000 m2)	62.56	27.51 56.07

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	202.32	Reach Len. (m)	55.00	45.00	10.00
Crit W.S. (m)	198.74	Flow Area (m2)	61.49	360.55	162.22
E.G. Slope (m/m)	0.000010	Area (m2)	61.49	360.55	162.22
Q Total (m3/s)	108.10	Flow (m3/s)	2.67	93.24	12.18
Top Width (m)	243.91	Top Width (m)	107.97	74.00	61.94
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.04	0.26	0.08
Max Chl Dpth (m)	5.72	Hydr. Depth (m)	0.57	4.87	2.62
Conv. Total (m3/s)	34102.2	Conv. (m3/s)	842.4	29416.7	3843.1
Length Wtd. (m)	45.00	Wetted Per. (m)	108.46	74.72	62.18
Min Ch El (m)	196.60	Shear (N/m2)	0.06	0.48	0.26
Alpha	1.71	Stream Power (N/m s)	0.00	0.12	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	189.55	207.19	209.97
C & E Loss (m)		Cum SA (1000 m2)	134.03	27.51	138.64

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2115

INPUT
Description: Hum 13-5R. Jane St & Hwy 7 Pond Outlet Culverts - Triple Cell - 3.0 m W x 1.5 m H x 23.2 m L Concrete Box Culverts. No drawings available (some info on Ander Eng Ltd Dwg 85-101-5, 1986) and York Regional Municipal Culvert Sheet.

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 10
Deck/Roadway Width = 23.2
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	202	303	202

Upstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	37	202	100	202	122	201	132	200
133	199	134	198	140	196.6	172	196.6	180	198
207	199	252	199.5	273	203	303	204		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	133	.035	207	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
133	207	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	149.5	202	F
160.5	303	202	F

Downstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	202	303	202

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	47	201	103	200	150	200	152	199
160	198	162	197	163	196.4	175	196.4	178	197
181	200	185	201	201	201	261	202	306	203

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	162	.035	178	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
162	178	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	163	200.6	F
175	306	200.6	F

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical

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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     1.5       3
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
                10    23.2     .015     .015        0                   .9
      1
Number of Barrels =  3
Upstream   Elevation =  196.6
Centerline Stations
    Sta.    Sta.    Sta.
   151.5  154.85   158.5
Downstream Elevation =  196.4
Centerline Stations
    Sta.    Sta.    Sta.
   165.5  168.85   172.5

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      19.06    Culv Full Len (m)        23.20
  # Barrels                   3     Culv Vel US (m/s)         1.41
  Q Barrel (m3/s)           6.35    Culv Vel DS (m/s)         1.41
  E.G. US. (m)            200.73    Culv Inv El Up (m)      196.60
  W.S. US. (m)            200.72    Culv Inv El Dn (m)      196.40
  E.G. DS (m)             200.52    Culv Frctn Ls (m)         0.03
  W.S. DS (m)             200.51    Culv Exit Loss (m)        0.09
  Delta EG (m)              0.21    Culv Entr Loss (m)        0.09
  Delta WS (m)              0.21    Q Weir (m3/s)
  E.G. IC (m)             197.94    Weir Sta Lft (m)
  E.G. OC (m)             200.73    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
  Culv WS Inlet (m)       198.10    Weir Max Depth (m)
  Culv WS Outlet (m)      197.90    Weir Avg Depth (m)
  Culv Nml Depth (m)                Weir Flow Area (m2)
  Culv Crt Depth (m)        0.77    Min El Weir Flow (m)    202.00


CULVERT OUTPUT  Profile #Regional w red'n  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      43.23    Culv Full Len (m)        23.20
  # Barrels                   3     Culv Vel US (m/s)         3.20
  Q Barrel (m3/s)          14.41    Culv Vel DS (m/s)         3.20
  E.G. US. (m)            202.33    Culv Inv El Up (m)      196.60
  W.S. US. (m)            202.32    Culv Inv El Dn (m)      196.40
  E.G. DS (m)             201.23    Culv Frctn Ls (m)         0.13
  W.S. DS (m)             201.20    Culv Exit Loss (m)        0.49
  Delta EG (m)              1.09    Culv Entr Loss (m)        0.47
  Delta WS (m)              1.13    Q Weir (m3/s)            64.87
  E.G. IC (m)             202.20    Weir Sta Lft (m)         24.70
  E.G. OC (m)             202.33    Weir Sta Rgt (m)        268.99
  Culvert Control         Outlet    Weir Submerg              0.00
  Culv WS Inlet (m)       198.10    Weir Max Depth (m)        0.33
  Culv WS Outlet (m)      197.90    Weir Avg Depth (m)        0.32
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Culv Nml Depth (m)		Weir Flow Area (m2)	78.79
Culv Crt Depth (m)	1.33	Min El Weir Flow (m)	202.00

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.211

INPUT
Description: Section 46.211 - Jane St. & Hwy 7 Pond Outlet - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	47	201	103	200	150	200	152	199
160	198	162	197	163	196.4	175	196.4	178	197
181	200	185	201	201	201	261	202	306	203

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	162	.035	178	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
162	178	10	10	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	163	200.6	F
175	306	200.6	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.52	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.035	
W.S. Elev (m)	200.51	Reach Len. (m)	10.00	10.00	10.00
Crit W.S. (m)	197.04	Flow Area (m2)		49.29	
E.G. Slope (m/m)	0.000028	Area (m2)	55.19	64.53	6.54
Q Total (m3/s)	19.06	Flow (m3/s)		19.06	
Top Width (m)	108.47	Top Width (m)	87.44	16.00	5.03
Vel Total (m/s)	0.39	Avg. Vel. (m/s)		0.39	
Max Chl Dpth (m)	4.11	Hydr. Depth (m)		4.11	
Conv. Total (m3/s)	3612.6	Conv. (m3/s)		3612.6	
Length Wtd. (m)	10.00	Wetted Per. (m)		12.00	
Min Ch El (m)	196.40	Shear (N/m2)		1.12	
Alpha	1.00	Stream Power (N/m s)		0.43	
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	49.78	82.05	40.64
C & E Loss (m)	0.00	Cum SA (1000 m2)	59.93	25.48	55.79

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.23	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	201.20	Reach Len. (m)	10.00	10.00	10.00
Crit W.S. (m)	198.42	Flow Area (m2)	128.26	75.57	15.24
E.G. Slope (m/m)	0.000151	Area (m2)	128.26	75.57	15.24
Q Total (m3/s)	108.10	Flow (m3/s)	32.87	73.91	1.31
Top Width (m)	170.55	Top Width (m)	119.66	16.00	34.89
Vel Total (m/s)	0.49	Avg. Vel. (m/s)	0.26	0.98	0.09
Max Chl Dpth (m)	4.80	Hydr. Depth (m)	1.07	4.72	0.44
Conv. Total (m3/s)	8807.5	Conv. (m3/s)	2678.6	6022.0	106.9
Length Wtd. (m)	10.00	Wetted Per. (m)	120.21	16.23	36.26
Min Ch El (m)	196.40	Shear (N/m2)	1.58	6.88	0.62
Alpha	2.77	Stream Power (N/m s)	0.40	6.73	0.05
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	189.55	198.58	209.97
C & E Loss (m)	0.01	Cum SA (1000 m2)	127.77	25.48	138.15

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: RIVER-1
REACH: Reach-1 RS: 46.21

INPUT
Description: Section 46.21 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	0	201	40	200	76	200	82	199
91	197	91.5	196.3	92.5	196.3	93	197	97	198

108	201	124	202	186	202	230	203

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	91	.035	93	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
91	93	30	30	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.51	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	200.51	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)		Flow Area (m2)	52.06	8.07	23.56
E.G. Slope (m/m)	0.000106	Area (m2)	52.06	8.07	23.56
Q Total (m3/s)	20.59	Flow (m3/s)	8.69	4.91	7.00
Top Width (m)	86.51	Top Width (m)	71.32	2.00	13.20
Vel Total (m/s)	0.25	Avg. Vel. (m/s)	0.17	0.61	0.30
Max Chl Dpth (m)	4.21	Hydr. Depth (m)	0.73	4.03	1.79
Conv. Total (m3/s)	1995.5	Conv. (m3/s)	841.8	475.7	678.0
Length Wtd. (m)	30.00	Wetted Per. (m)	71.62	2.72	13.65
Min Ch El (m)	196.30	Shear (N/m2)	0.76	3.10	1.80
Alpha	2.15	Stream Power (N/m s)	0.13	1.88	0.53
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	49.24	81.69	40.49
C & E Loss (m)	0.00	Cum SA (1000 m2)	59.14	25.39	55.70

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.22	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.17	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)		Flow Area (m2)	107.13	9.38	33.22
E.G. Slope (m/m)	0.000946	Area (m2)	107.13	9.38	33.22
Q Total (m3/s)	122.56	Flow (m3/s)	73.21	18.82	

30.52					
Top Width (m)	110.66	Top Width (m)	91.00	2.00	
17.66					
Vel Total (m/s)	0.82	Avg. Vel. (m/s)	0.68	2.01	
0.92					
Max Chl Dpth (m)	4.87	Hydr. Depth (m)	1.18	4.69	
1.88					
Conv. Total (m3/s)	3985.0	Conv. (m3/s)	2380.5	612.0	
992.5					
Length Wtd. (m)	30.00	Wetted Per. (m)	91.48	2.72	
18.19					
Min Ch El (m)	196.30	Shear (N/m2)	10.86	32.00	
16.94					
Alpha	1.65	Stream Power (N/m s)	7.42	64.19	
15.57					
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	188.38	198.16	
209.72					
C & E Loss (m)	0.00	Cum SA (1000 m2)	126.72	25.39	
137.89					

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: RIVER-1
REACH: Reach-1 RS: 46.202

INPUT
Description: Section 46.202 - Highway 7 - U/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	50	200	111	200	113	199	115.5	197
116	196	123	196	123.5	197	129	200	227	202
272	203								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	115.5	.035	123.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
115.5	123.5	70	70	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116	200.23	F
123	272	200.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.51	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	
0.050					
W.S. Elev (m)	200.51	Reach Len. (m)	70.00	70.00	
70.00					
Crit W.S. (m)	196.96	Flow Area (m2)	45.47	35.54	
17.28					

E.G. Slope (m/m)	0.000039	Area (m2)	45.47	35.54	17.28
Q Total (m3/s)	20.59	Flow (m3/s)	3.56	15.57	1.46
Top Width (m)	129.01	Top Width (m)	90.76	8.00	30.25
Vel Total (m/s)	0.21	Avg. Vel. (m/s)	0.08	0.44	0.08
Max Chl Dpth (m)	4.51	Hydr. Depth (m)	0.50	4.44	0.57
Conv. Total (m3/s)	3297.3	Conv. (m3/s)	569.7	2493.6	234.0
Length Wtd. (m)	70.00	Wetted Per. (m)	91.70	9.24	31.02
Min Ch El (m)	196.00	Shear (N/m2)	0.19	1.47	0.21
Alpha	3.34	Stream Power (N/m s)	0.01	0.64	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	47.78	81.04	39.88
C & E Loss (m)		Cum SA (1000 m2)	56.71	25.24	55.05

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.20	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.14	Reach Len. (m)	70.00	70.00	70.00
Crit W.S. (m)	199.15	Flow Area (m2)	112.34	40.60	46.19
E.G. Slope (m/m)	0.000409	Area (m2)	112.34	40.60	46.19
Q Total (m3/s)	122.56	Flow (m3/s)	44.31	62.91	15.34
Top Width (m)	184.72	Top Width (m)	115.50	8.00	61.22
Vel Total (m/s)	0.62	Avg. Vel. (m/s)	0.39	1.55	0.33
Max Chl Dpth (m)	5.14	Hydr. Depth (m)	0.97	5.07	0.75
Conv. Total (m3/s)	6063.7	Conv. (m3/s)	2192.0	3112.5	759.1
Length Wtd. (m)	70.00	Wetted Per. (m)	116.58	9.24	62.00
Min Ch El (m)	196.00	Shear (N/m2)	3.86	17.61	2.98
Alpha	3.44	Stream Power (N/m s)	1.52	27.29	0.99
Frctn Loss (m)		Cum Volume (1000 m3)	185.08	197.41	208.53
C & E Loss (m)		Cum SA (1000 m2)	123.62	25.24	136.71

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2015

INPUT
Description: Hum 13-4RR. Highway 7 Culvert - 3.7 m W x 1.5 m H x 64 m L
Concrete Box Culvert. Based on drawings. July 2010

New HEC-RAS
coding January 2004 by Acres included coding of culvert in
HEC-RAS, including adjustments to roadway coding and hydraulic
loss coefficients.
Distance from Upstream XS = 5
Deck/Roadway Width = 64
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201		50	200.45		95	200.23	
168	201		216	202		227	202.5	
272	203.5							

Upstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	50	200	111	200	113	199	115.5	197
116	196	123	196	123.5	197	129	200	227	202
272	203								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	115.5	.035	123.5	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
115.5	123.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116	200.23	F
123	272	200.5	F

Downstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201		50	200.45		95	200.23	
168	201		216	202		227	202.5	
272	203.5							

Downstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	50	200	111	200	113	199	115.5	197
116	196	123	196	123.5	197	129	200	227	202
272	203								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	115.5	.035	123.5	.05

```
Bank Sta: Left   Right    Coeff Contr.   Expan.
        115.5   123.5            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     116     199       F
     123     272     199       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           Box    1.52    3.66
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
                 5      64     .015     .015        0                   .5
      1
Upstream   Elevation =  196
           Centerline Station =  119.5
Downstream Elevation =  196
           Centerline Station =  119.5

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      14.09    Culv Full Len (m)        64.00
  # Barrels                   1     Culv Vel US (m/s)         2.53
  Q Barrel (m3/s)          14.09    Culv Vel DS (m/s)         2.53
  E.G. US. (m)            200.51    Culv Inv El Up (m)      196.00
  W.S. US. (m)            200.51    Culv Inv El Dn (m)      196.00
  E.G. DS (m)             199.83    Culv Frctn Ls (m)         0.21
  W.S. DS (m)             199.81    Culv Exit Loss (m)        0.31
  Delta EG (m)              0.69    Culv Entr Loss (m)        0.16
  Delta WS (m)              0.69    Q Weir (m3/s)             6.50
  E.G. IC (m)             199.01    Weir Sta Lft (m)         44.67
  E.G. OC (m)             200.51    Weir Sta Rgt (m)        121.40
  Culvert Control         Outlet    Weir Submerg              0.00
  Culv WS Inlet (m)       197.52    Weir Max Depth (m)        0.28
  Culv WS Outlet (m)      197.52    Weir Avg Depth (m)        0.15
  Culv Nml Depth (m)                Weir Flow Area (m2)      11.41
  Culv Crt Depth (m)        1.15    Min El Weir Flow (m)    200.23


Warning: During the culvert inlet control computations, the program could not
balance the culvert/weir flow.  The reported
         inlet energy grade answer may not be valid.

CULVERT OUTPUT  Profile #Regional w red'n  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       2.55    Culv Full Len (m)        64.00
  # Barrels                    1    Culv Vel US (m/s)         0.46
  Q Barrel (m3/s)           2.55    Culv Vel DS (m/s)         0.46
  E.G. US. (m)            201.20    Culv Inv El Up (m)      196.00
  W.S. US. (m)            201.14    Culv Inv El Dn (m)      196.00
```

E.G. DS (m)	201.19	Culv Frctn Ls (m)	0.01
W.S. DS (m)	201.12	Culv Exit Loss (m)	0.00
Delta EG (m)	0.01	Culv Entr Loss (m)	0.01
Delta WS (m)	0.01	Q Weir (m3/s)	120.02
E.G. IC (m)	201.19	Weir Sta Lft (m)	0.00
E.G. OC (m)	201.20	Weir Sta Rgt (m)	178.47
Culvert Control	Outlet	Weir Submerg	0.87
Culv WS Inlet (m)	197.52	Weir Max Depth (m)	0.99
Culv WS Outlet (m)	197.52	Weir Avg Depth (m)	0.61
Culv Nml Depth (m)		Weir Flow Area (m2)	109.34
Culv Crt Depth (m)	0.37	Min El Weir Flow (m)	200.23

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.201

INPUT
Description: Section 46.201 - Highway 7 - D/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	50	200	111	200	113	199	115.5	197
116	196	123	196	123.5	197	129	200	227	202
272	203								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	115.5	.035	123.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
115.5	123.5	20	25	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116	199	F
123	272	199	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.83	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.81	Reach Len. (m)	20.00	25.00	30.00
Crit W.S. (m)	196.96	Flow Area (m2)	5.18	29.98	7.24
E.G. Slope (m/m)	0.000092	Area (m2)	5.18	29.98	7.24
Q Total (m3/s)	20.59	Flow (m3/s)	1.01	17.98	1.59
Top Width (m)	17.27	Top Width (m)	4.12	8.00	5.15
Vel Total (m/s)	0.49	Avg. Vel. (m/s)	0.20	0.60	0.22
Max Chl Dpth (m)	3.81	Hydr. Depth (m)	1.26	3.75	

1.41					
Conv. Total (m3/s)	2150.8	Conv. (m3/s)	106.0	1878.2	166.6
Length Wtd. (m)	25.07	Wetted Per. (m)	5.01	9.24	5.87
Min Ch El (m)	196.00	Shear (N/m2)	0.93	2.92	1.11
Alpha	1.36	Stream Power (N/m s)	0.18	1.75	0.24
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	47.78	79.37	39.88
C & E Loss (m)	0.00	Cum SA (1000 m2)	53.39	24.68	53.81

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.19	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.12	Reach Len. (m)	20.00	25.00	30.00
Crit W.S. (m)	199.00	Flow Area (m2)	110.67	40.48	45.31
E.G. Slope (m/m)	0.000421	Area (m2)	110.67	40.48	45.31
Q Total (m3/s)	122.56	Flow (m3/s)	43.85	63.52	15.19
Top Width (m)	184.01	Top Width (m)	115.50	8.00	60.51
Vel Total (m/s)	0.62	Avg. Vel. (m/s)	0.40	1.57	0.34
Max Chl Dpth (m)	5.12	Hydr. Depth (m)	0.96	5.06	0.75
Conv. Total (m3/s)	5976.8	Conv. (m3/s)	2138.2	3097.8	740.8
Length Wtd. (m)	23.94	Wetted Per. (m)	116.57	9.24	61.29
Min Ch El (m)	196.00	Shear (N/m2)	3.92	18.08	3.05
Alpha	3.46	Stream Power (N/m s)	1.55	28.36	1.02
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	185.08	188.48	208.53
C & E Loss (m)	0.02	Cum SA (1000 m2)	115.54	24.68	132.45

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.192

INPUT
Description: Section 46.192 - Private Driveway - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	5	200	30	199	56	199	60	197
61.5	195.9	65.5	195.9	67	197	85	200	95	200
95	203	135	203						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	60	.035	67	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
60	67	25	25	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	61.5	199	F
65.5	135	199.3	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.82	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.81	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)	197.29	Flow Area (m2)	36.67	25.75	23.75
E.G. Slope (m/m)	0.000053	Area (m2)	36.67	25.75	23.75
Q Total (m3/s)	20.59	Flow (m3/s)	4.30	11.98	4.31
Top Width (m)	74.22	Top Width (m)	50.34	7.00	16.88
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.12	0.47	0.18
Max Chl Dpth (m)	3.91	Hydr. Depth (m)	0.73	3.68	1.41
Conv. Total (m3/s)	2822.8	Conv. (m3/s)	590.1	1641.9	590.9
Length Wtd. (m)	25.00	Wetted Per. (m)	50.82	7.72	17.11
Min Ch El (m)	195.90	Shear (N/m2)	0.38	1.74	0.72
Alpha	2.38	Stream Power (N/m s)	0.04	0.81	0.13
Frctn Loss (m)		Cum Volume (1000 m3)	47.36	78.68	39.41
C & E Loss (m)		Cum SA (1000 m2)	52.84	24.49	53.48

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.17	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.13	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)	199.36	Flow Area (m2)	112.00	34.98	58.73
E.G. Slope (m/m)	0.000236	Area (m2)	112.00	34.98	58.73
Q Total (m3/s)	122.56	Flow (m3/s)	51.81	42.09	28.66
Top Width (m)	95.00	Top Width (m)	60.00	7.00	28.00
Vel Total (m/s)	0.60	Avg. Vel. (m/s)	0.46	1.20	0.49
Max Chl Dpth (m)	5.23	Hydr. Depth (m)	1.87	5.00	2.10
Conv. Total (m3/s)	7969.8	Conv. (m3/s)	3368.7	2737.1	1864.0
Length Wtd. (m)	25.00	Wetted Per. (m)	60.72	7.72	29.38
Min Ch El (m)	195.90	Shear (N/m2)	4.28	10.51	4.64
Alpha	1.81	Stream Power (N/m s)	1.98	12.64	2.26
Frctn Loss (m)		Cum Volume (1000 m3)	182.86	187.54	206.97
C & E Loss (m)		Cum SA (1000 m2)	113.78	24.49	131.12

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1915

INPUT
Description: Hum-MM. Private Driveway Culvert - 3.75m x 1.5m Box culvert - sizes determined from Site visit - July 2010

New HEC-RAS coding
January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 4
Deck/Roadway Width = 17
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 3

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
30	199	56	199	85	200

Upstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	5	200	30	199	56	199	60	197
61.5	195.9	65.5	195.9	67	197	85	200	95	200

```
      95     203     135     203

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05      60    .035      67     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
            60      67             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    61.5     199       F
    65.5     135   199.3       F

Downstream  Deck/Roadway Coordinates
    num=       3
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
      30     199              56     199              85     200

Downstream Bridge Cross Section Data
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0     201       5     200      30     199      56     199      60     197
    61.5   195.9    65.5   195.9      67     197      85     200      95     200
      95     203     135     203

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05      60    .035      67     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
            60      67             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    61.5   198.5       F
    65.5     135   198.5       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           Box     1.5    3.75
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
                4      17     .013     .024        0                    .5
      1
Upstream   Elevation =  195.9
           Centerline Station =  63.5
Downstream Elevation =  195.9
           Centerline Station =  63.5

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       2.16    Culv Full Len (m)        17.00
```

# Barrels	1	Culv Vel US (m/s)	0.38
Q Barrel (m3/s)	2.16	Culv Vel DS (m/s)	0.38
E.G. US. (m)	199.82	Culv Inv El Up (m)	195.90
W.S. US. (m)	199.81	Culv Inv El Dn (m)	195.90
E.G. DS (m)	199.81	Culv Frctn Ls (m)	0.00
W.S. DS (m)	199.81	Culv Exit Loss (m)	0.00
Delta EG (m)	0.01	Culv Entr Loss (m)	0.00
Delta WS (m)	0.01	Q Weir (m3/s)	18.43
E.G. IC (m)	198.86	Weir Sta Lft (m)	9.51
E.G. OC (m)	199.82	Weir Sta Rgt (m)	79.76
Culvert Control	Outlet	Weir Submerg	0.99
Culv WS Inlet (m)	197.40	Weir Max Depth (m)	0.82
Culv WS Outlet (m)	197.40	Weir Avg Depth (m)	0.56
Culv Nml Depth (m)		Weir Flow Area (m2)	39.44
Culv Crt Depth (m)	0.32	Min El Weir Flow (m)	199.00

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	1.13	Culv Full Len (m)	17.00
# Barrels	1	Culv Vel US (m/s)	0.20
Q Barrel (m3/s)	1.13	Culv Vel DS (m/s)	0.20
E.G. US. (m)	201.17	Culv Inv El Up (m)	195.90
W.S. US. (m)	201.13	Culv Inv El Dn (m)	195.90
E.G. DS (m)	201.17	Culv Frctn Ls (m)	0.00
W.S. DS (m)	201.13	Culv Exit Loss (m)	0.00
Delta EG (m)	0.00	Culv Entr Loss (m)	0.00
Delta WS (m)	0.00	Q Weir (m3/s)	121.43
E.G. IC (m)	201.17	Weir Sta Lft (m)	0.00
E.G. OC (m)	201.17	Weir Sta Rgt (m)	95.00
Culvert Control	Outlet	Weir Submerg	0.99
Culv WS Inlet (m)	197.40	Weir Max Depth (m)	2.18
Culv WS Outlet (m)	197.40	Weir Avg Depth (m)	1.71
Culv Nml Depth (m)		Weir Flow Area (m2)	162.42
Culv Crt Depth (m)	0.21	Min El Weir Flow (m)	199.00

Warning: The weir over culvert is submerged.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.191

INPUT
Description: Section 46.191 - Private Driveway - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	5	200	30	199	56	199	60	197
61.5	195.9	65.5	195.9	67	197	85	200	95	200
95	203	135	203						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	60	.035	67	.05

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
60 67 50 50 50 .3 .5
Ineffective Flow num= 2
Sta L Sta R Elev Permanent
0 61.5 198.5 F
65.5 135 198.5 F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.81	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.81	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	197.29	Flow Area (m2)	36.37	25.70	23.64
E.G. Slope (m/m)	0.000054	Area (m2)	36.37	25.70	23.64
Q Total (m3/s)	20.59	Flow (m3/s)	4.28	12.01	4.31
Top Width (m)	74.03	Top Width (m)	50.18	7.00	16.84
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.12	0.47	0.18
Max Chl Dpth (m)	3.91	Hydr. Depth (m)	0.72	3.67	1.40
Conv. Total (m3/s)	2807.9	Conv. (m3/s)	583.1	1637.3	587.5
Length Wtd. (m)	50.00	Wetted Per. (m)	50.67	7.72	17.08
Min Ch El (m)	195.90	Shear (N/m2)	0.38	1.76	0.73
Alpha	2.38	Stream Power (N/m s)	0.04	0.82	0.13
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	47.36	77.39	39.41
C & E Loss (m)	0.00	Cum SA (1000 m2)	51.59	24.32	53.05

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.17	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.13	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	199.36	Flow Area (m2)	111.98	34.98	58.72
E.G. Slope (m/m)	0.000237	Area (m2)	111.98	34.98	58.72
Q Total (m3/s)	122.56	Flow (m3/s)	51.80	42.10	28.66
Top Width (m)	95.00	Top Width (m)	60.00	7.00	28.00

Vel Total (m/s)	0.60	Avg. Vel. (m/s)	0.46	1.20	0.49
Max Chl Dpth (m)	5.23	Hydr. Depth (m)	1.87	5.00	2.10
Conv. Total (m3/s)	7968.1	Conv. (m3/s)	3367.7	2736.8	1863.5
Length Wtd. (m)	50.00	Wetted Per. (m)	60.72	7.72	29.38
Min Ch El (m)	195.90	Shear (N/m2)	4.28	10.51	4.64
Alpha	1.81	Stream Power (N/m s)	1.98	12.65	2.26
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	182.86	183.19	206.97
C & E Loss (m)	0.01	Cum SA (1000 m2)	112.28	24.32	130.42

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.19

INPUT
Description: Section 46.19 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	0	201	8	201	50	201	58	200
63	199	94	199	104	196.5	105	195.5	106	195.5
107	196.5	114	198	119	198.7	143	198.7	143	203
169	203								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	8	.025	50	.05	104	.035	107	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
104	107	45	45	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.81	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.81	Reach Len. (m)	45.00	45.00	45.00
Crit W.S. (m)		Flow Area (m2)	47.20	11.92	51.74
E.G. Slope (m/m)	0.000048	Area (m2)	47.20	11.92	51.74
Q Total (m3/s)	20.59	Flow (m3/s)	6.69	5.01	8.89
Top Width (m)	84.03	Top Width (m)	45.03	3.00	36.00
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.14	0.42	0.17

Max Chl Dpth (m)	4.31	Hydr. Depth (m)	1.05	3.97	1.44
Conv. Total (m3/s)	2981.7	Conv. (m3/s)	968.6	726.2	1286.8
Length Wtd. (m)	45.00	Wetted Per. (m)	45.42	3.83	37.31
Min Ch El (m)	195.50	Shear (N/m2)	0.49	1.46	0.65
Alpha	1.81	Stream Power (N/m s)	0.07	0.61	0.11
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	45.27	76.45	37.53
C & E Loss (m)	0.00	Cum SA (1000 m2)	49.21	24.07	51.73

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.15	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.13	Reach Len. (m)	45.00	45.00	45.00
Crit W.S. (m)		Flow Area (m2)	119.45	15.89	99.36
E.G. Slope (m/m)	0.000201	Area (m2)	119.45	15.89	99.36
Q Total (m3/s)	122.56	Flow (m3/s)	53.01	16.63	52.92
Top Width (m)	143.00	Top Width (m)	104.00	3.00	36.00
Vel Total (m/s)	0.52	Avg. Vel. (m/s)	0.44	1.05	0.53
Max Chl Dpth (m)	5.63	Hydr. Depth (m)	1.15	5.30	2.76
Conv. Total (m3/s)	8638.4	Conv. (m3/s)	3736.2	1172.4	3729.8
Length Wtd. (m)	45.00	Wetted Per. (m)	104.60	3.83	38.64
Min Ch El (m)	195.50	Shear (N/m2)	2.25	8.19	5.08
Alpha	1.31	Stream Power (N/m s)	1.00	8.58	2.70
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	177.07	181.92	203.02
C & E Loss (m)	0.00	Cum SA (1000 m2)	108.18	24.07	128.82

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.182

INPUT
Description: Section 46.182 - Private Driveway - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 47

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.972	.42	201.961	.55	201.96	1.85	201.935	8.17	201.804
21.62	201.526	31.13	201.301	35.82	201.196	38.11	201.147	43.98	201
47.21	201	54.76	201	59.23	201.022	59.93	201.025	61.24	201.019
63.83	201.008	65.54	201	67.48	200.312	68.6	200	69.51	199.67
71.2	199	80.47	198.706	97.37	198.231	101.25	198.152	103.18	198.11
108.63	198	109.89	197.509	111.25	197	113.61	196.424	114.44	196
115	195.5	117	195.5	119.57	196.761	120.39	197	120.93	197.262
122.38	198	123.56	198.575	124.53	199	125.86	199.005	126.15	199.005
126.32	199.005	128.81	199.016	129.09	199.016	133.53	199.074	152.28	199.311
155.51	199.353	179.8	199.659						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	43.98	.025	65.54	.05	111.25	.035	120.39	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
111.25	120.39	30	30	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	114	197.8	F
118	179.8	198.1	F

Left Levee Station= 59.93 Elevation= 201.025

Blocked Obstructions num= 1

Sta L	Sta R	Elev
143.39	178.45	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.81	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.80	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)	197.06	Flow Area (m2)	57.30	33.00	21.18
E.G. Slope (m/m)	0.000028	Area (m2)	57.30	33.00	21.18
Q Total (m3/s)	20.59	Flow (m3/s)	7.39	11.17	2.03
Top Width (m)	75.60	Top Width (m)	42.11	9.14	24.35
Vel Total (m/s)	0.18	Avg. Vel. (m/s)	0.13	0.34	0.10
Max Chl Dpth (m)	4.30	Hydr. Depth (m)	1.36	3.61	0.87
Conv. Total (m3/s)	3897.4	Conv. (m3/s)	1399.5	2114.3	383.6
Length Wtd. (m)	30.00	Wetted Per. (m)	42.46	9.83	25.73
Min Ch El (m)	195.50	Shear (N/m2)	0.37	0.92	0.23
Alpha	2.02	Stream Power (N/m s)	0.05	0.31	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	42.92	75.43	35.89
C & E Loss (m)		Cum SA (1000 m2)	47.24	23.79	50.38

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.14	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.11	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)	198.95	Flow Area (m2)	117.48	44.95	53.01
E.G. Slope (m/m)	0.000169	Area (m2)	117.48	44.95	53.01
Q Total (m3/s)	122.56	Flow (m3/s)	55.11	46.00	21.45
Top Width (m)	105.23	Top Width (m)	71.74	9.14	24.35
Vel Total (m/s)	0.57	Avg. Vel. (m/s)	0.47	1.02	0.40
Max Chl Dpth (m)	5.61	Hydr. Depth (m)	1.64	4.92	2.18
Conv. Total (m3/s)	9427.7	Conv. (m3/s)	4239.3	3538.4	1650.0
Length Wtd. (m)	30.00	Wetted Per. (m)	72.29	9.83	29.65
Min Ch El (m)	195.50	Shear (N/m2)	2.69	7.58	2.96
Alpha	1.61	Stream Power (N/m s)	1.26	7.76	1.20
Frctn Loss (m)		Cum Volume (1000 m3)	171.74	180.55	199.59
C & E Loss (m)		Cum SA (1000 m2)	104.23	23.79	127.46

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1815

INPUT
Description: Hum-LL - Private Driveway Culvert - 3.23 m W x 2.1 m H x 20 m L Corrugated Metal Pipe Arch Culvert. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004
by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 20
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 68

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.814		8.43	201.594		9.83	201.579	

23.38	201.318	38.06	201.013	38.92	201.052
39.19	201.044	39.55	201.046	40.67	201.053
44.98	201.024	45.55	201	48.21	201
51.41	201	53.82	201	57.05	201.013
59.14	201.02	61.55	201.011	63.08	201.006
64.24	201	66.61	200.06	66.78	200
66.95	199.933	69.25	199	73.56	198.862
78.46	198.707	78.57	198.703	91.01	198.328
92.38	198.309	94.38	198.276	94.4	198.275
94.48	198.274	104.2	198.082	107.92	198.006
108.02	198.006	108.27	198.006	108.69	198.005
109.45	198.005	110.23	198.004	110.59	198.004
111.09	198.004	112.19	198.004	112.58	198.004
113.44	198.003	114.64	198.003	115.23	198.003
115.68	198.003	116.18	198.002	116.54	198.038
119.63	198.468	121.93	198.762	122.56	198.775
123.93	198.92	125.6	198.914	126.73	198.921
128.12	198.95	128.92	198.942	130.41	198.978
130.95	199	130.96	199	131.04	199
131.13	199	131.47	199.005	131.56	199.007
133.71	199.023	134.52	199.03	136.57	199.051
136.8	199.053	177.16	199.555		

Upstream Bridge Cross Section Data
Station Elevation Data num= 47

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.972	.42	201.961	.55	201.96	1.85	201.935	8.17	201.804
21.62	201.526	31.13	201.301	35.82	201.196	38.11	201.147	43.98	201
47.21	201	54.76	201	59.23	201.022	59.93	201.025	61.24	201.019
63.83	201.008	65.54	201	67.48	200.312	68.6	200	69.51	199.67
71.2	199	80.47	198.706	97.37	198.231	101.25	198.152	103.18	198.11
108.63	198	109.89	197.509	111.25	197	113.61	196.424	114.44	196
115	195.5	117	195.5	119.57	196.761	120.39	197	120.93	197.262
122.38	198	123.56	198.575	124.53	199	125.86	199.005	126.15	199.005
126.32	199.005	128.81	199.016	129.09	199.016	133.53	199.074	152.28	199.311
155.51	199.353	179.8	199.659						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	43.98	.025	65.54	.05	111.25	.035	120.39	.05

Bank Sta: Left Right Coeff Contr. Expan.
111.25 120.39 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	114	197.8	F
118	179.8	198.1	F

Left Levee Station= 59.93 Elevation= 201.025
Blocked Obstructions num= 1

Sta L	Sta R	Elev
143.39	178.45	204

Downstream Deck/Roadway Coordinates
num= 68

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.814		8.43	201.594		9.83	201.579	
23.38	201.318		38.06	201.013		38.92	201.052	
39.19	201.044		39.55	201.046		40.67	201.053	
44.98	201.024		45.55	201		48.21	201	
51.41	201		53.82	201		57.05	201.013	
59.14	201.02		61.55	201.011		63.08	201.006	
64.24	201		66.61	200.06		66.78	200	
66.95	199.933		69.25	199		73.56	198.862	

78.46	198.707	78.57	198.703	91.01	198.328
92.38	198.309	94.38	198.276	94.4	198.275
94.48	198.274	104.2	198.082	107.92	198.006
108.02	198.006	108.27	198.006	108.69	198.005
109.45	198.005	110.23	198.004	110.59	198.004
111.09	198.004	112.19	198.004	112.58	198.004
113.44	198.003	114.64	198.003	115.23	198.003
115.68	198.003	116.18	198.002	116.54	198.038
119.63	198.468	121.93	198.762	122.56	198.775
123.93	198.92	125.6	198.914	126.73	198.921
128.12	198.95	128.92	198.942	130.41	198.978
130.95	199	130.96	199	131.04	199
131.13	199	131.47	199.005	131.56	199.007
133.71	199.023	134.52	199.03	136.57	199.051
136.8	199.053	177.16	199.555		

Downstream Bridge Cross Section Data
Station Elevation Data num= 63

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.672	10.15	201.391	16.44	201.227	19.11	201.198	28.76	201.012
29.08	201.003	29.75	201.003	30.18	201.003	33.16	201.006	34.09	201.007
34.71	201.007	38.11	201.008	40.91	201.007	42.47	201.009	46.32	201.01
49.08	201.01	50.09	201.01	52.79	201.011	53.95	201.011	55.33	201.01
55.52	201.01	57.16	201.007	59.2	201.008	61.08	201.003	61.53	201.002
62.11	201	63.74	200.449	63.89	200.402	64.96	200	67.14	199.213
67.66	199	85.51	198.472	98.03	198.095	102.22	198.037	104.14	198.005
104.83	198	107.05	197.336	108.45	197	109.6	196.471	110.03	196.349
110.3	196.132	110.55	195.7	111.55	195.42	112.65	195.42	113.45	195.7
113.65	196.153	114.19	196.347	114.96	196.478	115.28	196.495	115.54	196.648
115.97	197	117.96	197.685	118.9	198	119.49	198.157	122.24	199
123.93	199.013	125.15	199.031	128.94	199.07	130.34	199.094	131.13	199.106
131.15	199.106	139.61	199.169	174.54	199.456				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	28.76	.025	62.11	.05	108.45	.035	115.97	.05

Bank Sta: Left Right Coeff Contr. Expan.
108.45 115.97 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	110	197.8	F
114	174.54	197.8	F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
139.13	174.54	204

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	Pipe Arch	2.1	3.23

FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef

Exit Loss Coef
5 20 .024 .024 0 .9
1
Upstream Elevation = 195.5
Centerline Station = 116
Downstream Elevation = 195.42
Centerline Station = 112

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	1.13	Culv Full Len (m)	20.00
# Barrels	1	Culv Vel US (m/s)	0.22
Q Barrel (m3/s)	1.13	Culv Vel DS (m/s)	0.22
E.G. US. (m)	199.81	Culv Inv El Up (m)	195.50
W.S. US. (m)	199.80	Culv Inv El Dn (m)	195.42
E.G. DS (m)	199.81	Culv Frctn Ls (m)	0.00
W.S. DS (m)	199.80	Culv Exit Loss (m)	0.00
Delta EG (m)	0.00	Culv Entr Loss (m)	0.00
Delta WS (m)	0.00	Q Weir (m3/s)	19.46
E.G. IC (m)	199.19	Weir Sta Lft (m)	69.13
E.G. OC (m)	199.81	Weir Sta Rgt (m)	179.80
Culvert Control	Outlet	Weir Submerg	1.00
Culv WS Inlet (m)	197.60	Weir Max Depth (m)	1.81
Culv WS Outlet (m)	197.52	Weir Avg Depth (m)	1.18
Culv Nml Depth (m)		Weir Flow Area (m2)	89.52
Culv Crt Depth (m)	0.31	Min El Weir Flow (m)	198.01

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	3.10	Culv Full Len (m)	20.00
# Barrels	1	Culv Vel US (m/s)	0.59
Q Barrel (m3/s)	3.10	Culv Vel DS (m/s)	0.59
E.G. US. (m)	201.14	Culv Inv El Up (m)	195.50
W.S. US. (m)	201.11	Culv Inv El Dn (m)	195.42
E.G. DS (m)	201.11	Culv Frctn Ls (m)	0.01
W.S. DS (m)	201.09	Culv Exit Loss (m)	0.00
Delta EG (m)	0.02	Culv Entr Loss (m)	0.02
Delta WS (m)	0.03	Q Weir (m3/s)	119.46
E.G. IC (m)	201.12	Weir Sta Lft (m)	39.13
E.G. OC (m)	201.14	Weir Sta Rgt (m)	179.80
Culvert Control	Outlet	Weir Submerg	0.99
Culv WS Inlet (m)	197.60	Weir Max Depth (m)	3.12
Culv WS Outlet (m)	197.52	Weir Avg Depth (m)	1.84
Culv Nml Depth (m)		Weir Flow Area (m2)	194.21
Culv Crt Depth (m)	0.55	Min El Weir Flow (m)	198.01

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.181

INPUT
Description: Section 46.181 - Private Driveway - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 63

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.672	10.15	201.391	16.44	201.227	19.11	201.198	28.76	201.012
29.08	201.003	29.75	201.003	30.18	201.003	33.16	201.006	34.09	201.007
34.71	201.007	38.11	201.008	40.91	201.007	42.47	201.009	46.32	201.01
49.08	201.01	50.09	201.01	52.79	201.011	53.95	201.011	55.33	201.01
55.52	201.01	57.16	201.007	59.2	201.008	61.08	201.003	61.53	201.002
62.11	201	63.74	200.449	63.89	200.402	64.96	200	67.14	199.213
67.66	199	85.51	198.472	98.03	198.095	102.22	198.037	104.14	198.005
104.83	198	107.05	197.336	108.45	197	109.6	196.471	110.03	196.349
110.3	196.132	110.55	195.7	111.55	195.42	112.65	195.42	113.45	195.7
113.65	196.153	114.19	196.347	114.96	196.478	115.28	196.495	115.54	196.648
115.97	197	117.96	197.685	118.9	198	119.49	198.157	122.24	199
123.93	199.013	125.15	199.031	128.94	199.07	130.34	199.094	131.13	199.106
131.15	199.106	139.61	199.169	174.54	199.456				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	28.76	.025	62.11	.05	108.45	.035	115.97	.05

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
108.45 115.97 10 10 10 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	110	197.8	F
114	174.54	197.8	F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
139.13	174.54	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.81	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.80	Reach Len. (m)	10.00	10.00	10.00
Crit W.S. (m)	197.07	Flow Area (m2)	59.22	27.86	23.15
E.G. Slope (m/m)	0.000032	Area (m2)	59.22	27.86	23.15
Q Total (m3/s)	20.59	Flow (m3/s)	8.22	9.83	2.54
Top Width (m)	73.62	Top Width (m)	42.94	7.52	23.16
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.14	0.35	0.11
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.38	3.70	1.00
Conv. Total (m3/s)	3657.4	Conv. (m3/s)	1460.9	1746.0	450.5
Length Wtd. (m)	10.00	Wetted Per. (m)	43.24	8.57	24.11
Min Ch El (m)	195.42	Shear (N/m2)	0.43	1.01	0.30
Alpha	1.97	Stream Power (N/m s)	0.06	0.36	0.03

Frctn Loss (m)	0.00	Cum Volume (1000 m3)	42.92	72.51 35.89
C & E Loss (m)	0.00	Cum SA (1000 m2)	45.97	23.54 49.66

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.11	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.09	Reach Len. (m)	10.00	10.00	10.00
Crit W.S. (m)	199.00	Flow Area (m2)	119.37	37.51	52.88
E.G. Slope (m/m)	0.000190	Area (m2)	119.37	37.51	52.88
Q Total (m3/s)	122.56	Flow (m3/s)	59.30	39.50	23.76
Top Width (m)	114.19	Top Width (m)	83.51	7.52	23.16
Vel Total (m/s)	0.58	Avg. Vel. (m/s)	0.50	1.05	0.45
Max Chl Dpth (m)	5.67	Hydr. Depth (m)	1.43	4.99	2.28
Conv. Total (m3/s)	8896.6	Conv. (m3/s)	4304.8	2867.1	1724.7
Length Wtd. (m)	10.00	Wetted Per. (m)	84.01	8.57	25.39
Min Ch El (m)	195.42	Shear (N/m2)	2.64	8.14	3.88
Alpha	1.51	Stream Power (N/m s)	1.31	8.58	1.74
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	171.74	174.48	199.59
C & E Loss (m)	0.00	Cum SA (1000 m2)	101.90	23.54	126.75

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.18

INPUT
Description: Section 46.18 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 36

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.977	11.8	201.517	19.72	201.217	24.63	201.027	25.49	201
25.73	200.891	27.72	200	72.09	200	72.38	200.049	72.68	200
73.08	199.878	75.33	199	90.41	198.582	110.99	198	113.81	197.148
114.16	197	114.84	196.777	115.23	196.607	117.24	196	118.92	195.419
119.01	195.418	119.32	195.43	120.38	195.971	120.82	196	123.44	196.968
123.53	197	123.87	197.147	125.89	198	126.38	198.193	128.56	199
130.21	199.025	143.32	199.109	146.37	199.102	152.23	199.148	160.44	199.206

181.15 199.373

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	117.24	.035	120.82	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
117.24	120.82	25	25	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
146.08	181.15	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.80	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)		Flow Area (m2)	64.59	14.65	30.67
E.G. Slope (m/m)	0.000038	Area (m2)	64.59	14.65	30.67
Q Total (m3/s)	20.59	Flow (m3/s)	10.15	6.30	4.14
Top Width (m)	72.80	Top Width (m)	43.96	3.58	25.26
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.16	0.43	0.14
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.47	4.09	1.21
Conv. Total (m3/s)	3360.8	Conv. (m3/s)	1657.3	1027.6	676.0
Length Wtd. (m)	25.00	Wetted Per. (m)	44.44	3.81	26.52
Min Ch El (m)	195.42	Shear (N/m2)	0.53	1.42	0.43
Alpha	2.06	Stream Power (N/m s)	0.08	0.61	0.06
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	42.30	72.30	35.62
C & E Loss (m)	0.00	Cum SA (1000 m2)	45.53	23.49	49.42

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.11	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.09	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)		Flow Area (m2)	172.08	19.25	63.15
E.G. Slope (m/m)	0.000189	Area (m2)	172.08	19.25	63.15
Q Total (m3/s)	122.56	Flow (m3/s)	70.32	22.26	29.98

Top Width (m)	122.99	Top Width (m)	94.15	3.58	25.26
Vel Total (m/s)	0.48	Avg. Vel. (m/s)	0.41	1.16	0.47
Max Chl Dpth (m)	5.67	Hydr. Depth (m)	1.83	5.38	2.50
Conv. Total (m3/s)	8920.1	Conv. (m3/s)	5117.8	1620.2	2182.2
Length Wtd. (m)	25.00	Wetted Per. (m)	94.89	3.81	27.81
Min Ch El (m)	195.42	Shear (N/m2)	3.36	9.36	4.20
Alpha	1.70	Stream Power (N/m s)	1.37	10.82	2.00
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	170.28	174.20	199.01
C & E Loss (m)	0.00	Cum SA (1000 m2)	101.01	23.49	126.51

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: RIVER-1
REACH: Reach-1 RS: 46.172

INPUT
Description: Section 46.172 - Doughton Road - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 112

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.734	12.56	201.239	18.71	201	19.16	200.796	20.83	200
22.76	199.053	22.87	199	62.25	199	63.17	199.011	64.63	199.022
66.94	199.001	66.98	199	67.01	199	68.2	198.967	103.48	198
104.09	197.739	105.82	197	106.27	196.833	107.29	196.474	107.64	196.354
108.58	196	109	195.6	109.6	195.423	111	195.423	111.7	195.6
112.13	196	114.2	196.671	115.34	197	118.55	197.877	118.99	198
121.05	198.574	123.33	199	123.42	199.001	123.5	199.001	123.54	199.001
123.9	199.003	124.23	199.004	124.61	199.005	126.14	199.011	127.45	199.01
127.51	199.01	130.18	199.02	131.13	199.023	131.75	199.022	131.93	199.022
136.67	199.034	138.19	199.034	142.37	199.028	144.48	199.031	146.18	199.033
147.98	199.03	151.4	199.025	152.23	199.024	153.19	199.023	162.26	199.102
168.85	199.106	176.2	199.054	176.37	199.053	179.61	199.282	179.92	199.303
181.07	199.326	182.68	199.444	185.09	199.554	185.23	199.561	190.14	200
190.33	200.08	192.14	200.106	194.32	200.348	197.51	200.575	198.87	200.608
201.34	200.55	205.59	200.325	205.97	200.323	207.47	200.186	208.18	200.159
208.63	200.138	208.84	200.128	209.03	200.12	209.29	200.117	209.54	200.119
210.38	200.139	210.98	200.174	211.81	200.246	213.46	200.375	218.29	200.752
218.48	200.763	218.67	200.765	219.17	200.789	219.59	200.805	220.25	200.786
223.9	200.72	227.49	200.773	227.81	200.78	230.24	200.911	230.52	200.931
231.19	201	231.74	201.005	232.08	201.007	242.92	201.282	250.3	201.41
251.76	201.387	251.9	201.386	253.2	201.371	255.13	201.441	255.57	201.457
256.04	201.474	256.2	201.479	256.73	201.495	258.39	201.529	263.36	201.693
264.27	201.707	264.32	201.707						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	108.58	.035	112.13	.05

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Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        108.58  112.13                40      40      40             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0  108.23  197.78       F
  112.38  264.32  197.78       F
Right Levee     Station=  198.87      Elevation= 200.608

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           199.80    Element                 Left OB    Channel
Right OB
  Vel Head (m)              0.00    Wt. n-Val.               0.050      0.035
0.050
  W.S. Elev (m)           199.80    Reach Len. (m)           40.00      40.00
40.00
  Crit W.S. (m)           197.01    Flow Area (m2)           97.96      15.11
68.87
  E.G. Slope (m/m)      0.000021    Area (m2)                97.96      15.11
68.87
  Q Total (m3/s)           20.59    Flow (m3/s)               9.73       4.91
5.95
  Top Width (m)           166.69    Top Width (m)            87.35       3.55
75.79
  Vel Total (m/s)           0.11    Avg. Vel. (m/s)           0.10       0.32
0.09
  Max Chl Dpth (m)          4.38    Hydr. Depth (m)           1.12       4.26
0.91
  Conv. Total (m3/s)      4455.0    Conv. (m3/s)           2105.7     1062.1
1287.3
  Length Wtd. (m)          40.00    Wetted Per. (m)          87.93       3.92
76.22
  Min Ch El (m)           195.42    Shear (N/m2)              0.23       0.81
0.19
  Alpha                     2.50    Stream Power (N/m s)      0.02       0.26
0.02
  Frctn Loss (m)                    Cum Volume (1000 m3)     40.27      71.92
34.37
  C & E Loss (m)                    Cum SA (1000 m2)         43.89      23.40
48.16


Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #Regional w red'n


  E.G. Elev (m)           201.10    Element                 Left OB    Channel
Right OB
  Vel Head (m)              0.01    Wt. n-Val.               0.050      0.035
0.050
  W.S. Elev (m)           201.09    Reach Len. (m)           40.00      40.00
40.00
  Crit W.S. (m)           199.38    Flow Area (m2)          212.63      19.69
193.70
  E.G. Slope (m/m)      0.000074    Area (m2)               212.63      19.69
193.70
  Q Total (m3/s)          122.56    Flow (m3/s)              63.45      14.21
44.90
```

Top Width (m)	219.18	Top Width (m)	92.27	3.55	123.35
Vel Total (m/s)	0.29	Avg. Vel. (m/s)	0.30	0.72	0.23
Max Chl Dpth (m)	5.67	Hydr. Depth (m)	2.30	5.55	1.57
Conv. Total (m3/s)	14244.4	Conv. (m3/s)	7373.8	1652.0	5218.7
Length Wtd. (m)	40.00	Wetted Per. (m)	93.13	3.92	123.88
Min Ch El (m)	195.42	Shear (N/m2)	1.66	3.65	1.14
Alpha	1.52	Stream Power (N/m s)	0.49	2.64	0.26
Frctn Loss (m)		Cum Volume (1000 m3)	165.48	173.71	195.80
C & E Loss (m)		Cum SA (1000 m2)	98.68	23.40	124.65

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1715

INPUT
Description: Hum 13-4R. Doughton Road Culvert - 3.54 m W x 2.27 m H x 30 m L Corrugated Metal Pipe Arch Culvert. Drawing by Paul Theil (Dwg No. 8036P-A-17, February 1998) used to code culvert in HEC-RAS format..

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 30
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 146

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.659		17.1	201		18.56	200.215	
19.04	200		20.71	199.079		20.88	199	
58.5	199		58.75	199.001		59.61	199.002	
59.67	199.002		60.49	199.079		61.88	199.001	
62.77	199		62.78	198.999		62.87	198.999	
64.51	198.988		77.88	198.499		79.03	198.456	
80.45	198.394		80.53	198.393		80.55	198.393	
82.71	198.354		101.77	198.004		101.87	198.004	
102.35	198.004		102.49	198.003		103.08	198.003	
103.88	198.003		104.94	198.002		105.2	198.001	
105.36	198.001		105.37	198.001		105.48	198.001	
105.59	198.001		106.17	198		111.07	197.984	
112.06	197.981		112.22	197.981		112.33	197.981	
112.33	197.981		114.49	197.978		114.57	197.978	
114.65	197.978		115.8	197.978		118.45	197.973	
118.88	197.972		119.32	197.973		119.67	197.973	

120.76	197.97	121.29	197.971	125.31	197.974
128.81	197.969	129.56	197.969	129.66	197.969
131.93	197.969	135.28	197.977	135.33	197.977
135.42	197.977	135.86	197.977	136.49	197.98
136.85	197.98	138.97	197.983	140.58	197.983
142.91	197.985	143.34	197.986	144	197.987
148.3	197.988	148.81	197.988	150.8	197.989
151.39	197.989	151.44	197.989	151.49	197.989
152.06	197.99	152.7	197.99	156.88	197.993
158.94	197.995	160.16	197.995	160.52	197.995
163.7	197.998	163.89	197.998	166.05	198
171.66	198.147	174	198.212	174.94	198.277
175.14	198.281	175.27	198.285	175.43	198.29
175.45	198.29	175.57	198.292	181.56	199
181.89	199	188.35	199	188.45	199
189.17	199	189.18	199	189.3	199
189.37	199	189.43	199	190.46	199
190.69	199	196.39	199	199.89	199
200.58	199	201.89	199	202.2	199
202.34	199	205.71	199	205.77	199
206.03	199	207.51	199	207.73	199
208.17	199	209.97	199	211.96	199.213
212.01	199.214	213.13	199.214	220.85	199.754
223.57	199.952	224.34	199.955	224.39	199.955
224.45	199.955	225.21	199.96	227.97	199.964
228.07	199.964	229.26	199.965	230.05	199.967
232.33	199.971	235.53	199.979	235.78	199.979
238.51	199.989	241.24	199.999	241.32	199.999
241.46	199.999	241.56	200	242.02	200.028
242.12	200.031	255.22	200.891	257.31	200.902
257.33	200.902	259.53	200.742	259.59	200.74
260.02	200.761	260.61	200.75	262.62	200.866
263.38	200.931	263.45	200.931		

Upstream Bridge Cross Section Data
Station Elevation Data num= 112

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.734	12.56	201.239	18.71	201	19.16	200.796	20.83	200
22.76	199.053	22.87	199	62.25	199	63.17	199.011	64.63	199.022
66.94	199.001	66.98	199	67.01	199	68.2	198.967	103.48	198
104.09	197.739	105.82	197	106.27	196.833	107.29	196.474	107.64	196.354
108.58	196	109	195.6	109.6	195.423	111	195.423	111.7	195.6
112.13	196	114.2	196.671	115.34	197	118.55	197.877	118.99	198
121.05	198.574	123.33	199	123.42	199.001	123.5	199.001	123.54	199.001
123.9	199.003	124.23	199.004	124.61	199.005	126.14	199.011	127.45	199.01
127.51	199.01	130.18	199.02	131.13	199.023	131.75	199.022	131.93	199.022
136.67	199.034	138.19	199.034	142.37	199.028	144.48	199.031	146.18	199.033
147.98	199.03	151.4	199.025	152.23	199.024	153.19	199.023	162.26	199.102
168.85	199.106	176.2	199.054	176.37	199.053	179.61	199.282	179.92	199.303
181.07	199.326	182.68	199.444	185.09	199.554	185.23	199.561	190.14	200
190.33	200.08	192.14	200.106	194.32	200.348	197.51	200.575	198.87	200.608
201.34	200.55	205.59	200.325	205.97	200.323	207.47	200.186	208.18	200.159
208.63	200.138	208.84	200.128	209.03	200.12	209.29	200.117	209.54	200.119
210.38	200.139	210.98	200.174	211.81	200.246	213.46	200.375	218.29	200.752
218.48	200.763	218.67	200.765	219.17	200.789	219.59	200.805	220.25	200.786
223.9	200.72	227.49	200.773	227.81	200.78	230.24	200.911	230.52	200.931
231.19	201	231.74	201.005	232.08	201.007	242.92	201.282	250.3	201.41
251.76	201.387	251.9	201.386	253.2	201.371	255.13	201.441	255.57	201.457
256.04	201.474	256.2	201.479	256.73	201.495	258.39	201.529	263.36	201.693
264.27	201.707	264.32	201.707						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val

```
       0     .05  108.58    .035  112.13     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
        108.58  112.13           .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0  108.23  197.78       F
  112.38  264.32  197.78       F
Right Levee     Station=  198.87      Elevation= 200.608

Downstream  Deck/Roadway Coordinates
    num=     146
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0 201.659            17.1     201           18.56 200.215
   19.04     200           20.71 199.079           20.88     199
    58.5     199           58.75 199.001           59.61 199.002
   59.67 199.002           60.49 199.079           61.88 199.001
   62.77     199           62.78 198.999           62.87 198.999
   64.51 198.988           77.88 198.499           79.03 198.456
   80.45 198.394           80.53 198.393           80.55 198.393
   82.71 198.354          101.77 198.004          101.87 198.004
  102.35 198.004          102.49 198.003          103.08 198.003
  103.88 198.003          104.94 198.002           105.2 198.001
  105.36 198.001          105.37 198.001          105.48 198.001
  105.59 198.001          106.17     198          111.07 197.984
  112.06 197.981          112.22 197.981          112.33 197.981
  112.33 197.981          114.49 197.978          114.57 197.978
  114.65 197.978           115.8 197.978          118.45 197.973
  118.88 197.972          119.32 197.973          119.67 197.973
  120.76  197.97          121.29 197.971          125.31 197.974
  128.81 197.969          129.56 197.969          129.66 197.969
  131.93 197.969          135.28 197.977          135.33 197.977
  135.42 197.977          135.86 197.977          136.49  197.98
  136.85  197.98          138.97 197.983          140.58 197.983
  142.91 197.985          143.34 197.986             144 197.987
   148.3 197.988          148.81 197.988           150.8 197.989
  151.39 197.989          151.44 197.989          151.49 197.989
  152.06  197.99           152.7  197.99          156.88 197.993
  158.94 197.995          160.16 197.995          160.52 197.995
   163.7 197.998          163.89 197.998          166.05     198
  171.66 198.147             174 198.212          174.94 198.277
  175.14 198.281          175.27 198.285          175.43  198.29
  175.45  198.29          175.57 198.292          181.56     199
  181.89     199          188.35     199          188.45     199
  189.17     199          189.18     199           189.3     199
  189.37     199          189.43     199          190.46     199
  190.69     199          196.39     199          199.89     199
  200.58     199          201.89     199           202.2     199
  202.34     199          205.71     199          205.77     199
  206.03     199          207.51     199          207.73     199
  208.17     199          209.97     199          211.96 199.213
  212.01 199.214          213.13 199.214          220.85 199.754
  223.57 199.952          224.34 199.955          224.39 199.955
  224.45 199.955          225.21  199.96          227.97 199.964
  228.07 199.964          229.26 199.965          230.05 199.967
  232.33 199.971          235.53 199.979          235.78 199.979
  238.51 199.989          241.24 199.999          241.32 199.999
  241.46 199.999          241.56     200          242.02 200.028
  242.12 200.031          255.22 200.891          257.31 200.902
  257.33 200.902          259.53 200.742          259.59  200.74
  260.02 200.761          260.61  200.75          262.62 200.866
  263.38 200.931          263.45 200.931
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Downstream Bridge Cross Section Data
Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.96	4.98	201.796	12.44	201.256	13.15	201.237	13.25	201.233
14.75	201.164	14.84	201.161	15.12	201.157	15.39	201.155	15.62	201.154
15.69	201.151	15.99	201	16.36	200.819	17.96	200	56.42	200
56.75	200.006	57.02	200.008	57.33	200.003	57.62	200	58.14	199.138
58.25	199.189	58.47	199	60.02	198.995	63.55	198.984	63.81	198.985
64	198.985	65.42	198.99	68.25	198.998	68.82	199	72	199.002
72.03	199.002	72.61	199.001	73.78	199.001	75.32	199	75.36	199
80.19	198.767	92.67	198.166	96.3	198	97.51	197.516	98.72	197
99.68	196.606	99.91	196.501	100.61	196.23	100.78	196	101.09	195.65
102	195.4	103	195.4	103.89	195.65	104.2	196	105.92	196.441
106.96	196.581	107.6	196.655	107.9	196.67	111.41	197	111.54	197.014
111.55	197.013	112.49	197.087	113.31	197.14	116.28	197.185	119.01	197.211
119.24	197.207	121.22	197.229	124.15	197.307	124.51	197.35	124.99	197.41
125.11	197.425	127.76	197.44	128.22	197.417	130.42	198	132.06	198.488
133.88	199	134.14	199.003	134.41	199.003	134.45	199.003	137.25	199.032
137.75	199.031	141.77	199.052	141.83	199.052	141.86	199.053	148.67	199.216
150.74	199.224	152.75	199.228	159.58	199.291	160.35	199.297	162.8	199.347
166.55	199.342	166.7	199.342	167.68	199.362	170.27	199.374	170.75	199.383
172.18	199.397	173.54	199.408	175.72	199.407	176.75	199.414	180.91	199.49
186.98	199.604	187.2	199.611	193.04	199.639	200	200	200.45	200.012
202.09	200.042	206.82	200.085	218.03	200.5	221.19	200.617	221.21	200.618
221.33	200.618	221.54	200.615	221.57	200.615	229.4	200.491	229.74	200.48
236.66	200.579	244.75	200.914	250.98	200.952	251.55	200.969	251.75	200.978
251.93	200.979	253.5	201	255.98	201.045	256.93	201.053	257.81	201.067
258.72	201.075	258.93	201.079						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100.78	.035	104.2	.05	133.88	.025

Bank Sta: Left Right Coeff Contr. Expan.
100.78 104.2 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	100.49	197.5	F
104.45	258.93	197.5	F

Right Levee Station= 221.19 Elevation= 200.62

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 Pipe Arch 2.27 3.54
FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG

Culvert Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
5	30	.024	.024	0	.9	1

Upstream Elevation = 195.423
Centerline Station = 110.35
Downstream Elevation = 195.4

Centerline Station = 102.49

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	0.95	Culv Full Len (m)	30.00
# Barrels	1	Culv Vel US (m/s)	0.15
Q Barrel (m3/s)	0.95	Culv Vel DS (m/s)	0.15
E.G. US. (m)	199.80	Culv Inv El Up (m)	195.42
W.S. US. (m)	199.80	Culv Inv El Dn (m)	195.40
E.G. DS (m)	199.80	Culv Frctn Ls (m)	0.00
W.S. DS (m)	199.80	Culv Exit Loss (m)	0.00
Delta EG (m)	0.00	Culv Entr Loss (m)	0.00
Delta WS (m)	0.00	Q Weir (m3/s)	19.64
E.G. IC (m)	198.51	Weir Sta Lft (m)	21.23
E.G. OC (m)	199.80	Weir Sta Rgt (m)	187.93
Culvert Control	Outlet	Weir Submerg	1.00
Culv WS Inlet (m)	197.69	Weir Max Depth (m)	1.83
Culv WS Outlet (m)	197.67	Weir Avg Depth (m)	0.97
Culv Nml Depth (m)		Weir Flow Area (m2)	161.62
Culv Crt Depth (m)	0.28	Min El Weir Flow (m)	197.97

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	2.17	Culv Full Len (m)	30.00
# Barrels	1	Culv Vel US (m/s)	0.35
Q Barrel (m3/s)	2.17	Culv Vel DS (m/s)	0.35
E.G. US. (m)	201.10	Culv Inv El Up (m)	195.42
W.S. US. (m)	201.09	Culv Inv El Dn (m)	195.40
E.G. DS (m)	201.09	Culv Frctn Ls (m)	0.00
W.S. DS (m)	201.08	Culv Exit Loss (m)	0.00
Delta EG (m)	0.01	Culv Entr Loss (m)	0.01
Delta WS (m)	0.01	Q Weir (m3/s)	120.40
E.G. IC (m)	201.09	Weir Sta Lft (m)	16.33
E.G. OC (m)	201.10	Weir Sta Rgt (m)	235.46
Culvert Control	Outlet	Weir Submerg	1.00
Culv WS Inlet (m)	197.69	Weir Max Depth (m)	3.12
Culv WS Outlet (m)	197.67	Weir Avg Depth (m)	1.85
Culv Nml Depth (m)		Weir Flow Area (m2)	405.36
Culv Crt Depth (m)	0.43	Min El Weir Flow (m)	197.97

Warning: The weir over culvert is submerged.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.171

INPUT
Description: Section 46.171 - Doughton Road - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.96	4.98	201.796	12.44	201.256	13.15	201.237	13.25	201.233
14.75	201.164	14.84	201.161	15.12	201.157	15.39	201.155	15.62	201.154
15.69	201.151	15.99	201	16.36	200.819	17.96	200	56.42	200

56.75	200.006	57.02	200.008	57.33	200.003	57.62	200	58.14	199.138
58.25	199.189	58.47	199	60.02	198.995	63.55	198.984	63.81	198.985
64	198.985	65.42	198.99	68.25	198.998	68.82	199	72	199.002
72.03	199.002	72.61	199.001	73.78	199.001	75.32	199	75.36	199
80.19	198.767	92.67	198.166	96.3	198	97.51	197.516	98.72	197
99.68	196.606	99.91	196.501	100.61	196.23	100.78	196	101.09	195.65
102	195.4	103	195.4	103.89	195.65	104.2	196	105.92	196.441
106.96	196.581	107.6	196.655	107.9	196.67	111.41	197	111.54	197.014
111.55	197.013	112.49	197.087	113.31	197.14	116.28	197.185	119.01	197.211
119.24	197.207	121.22	197.229	124.15	197.307	124.51	197.35	124.99	197.41
125.11	197.425	127.76	197.44	128.22	197.417	130.42	198	132.06	198.488
133.88	199	134.14	199.003	134.41	199.003	134.45	199.003	137.25	199.032
137.75	199.031	141.77	199.052	141.83	199.052	141.86	199.053	148.67	199.216
150.74	199.224	152.75	199.228	159.58	199.291	160.35	199.297	162.8	199.347
166.55	199.342	166.7	199.342	167.68	199.362	170.27	199.374	170.75	199.383
172.18	199.397	173.54	199.408	175.72	199.407	176.75	199.414	180.91	199.49
186.98	199.604	187.2	199.611	193.04	199.639	200	200	200.45	200.012
202.09	200.042	206.82	200.085	218.03	200.5	221.19	200.617	221.21	200.618
221.33	200.618	221.54	200.615	221.57	200.615	229.4	200.491	229.74	200.48
236.66	200.579	244.75	200.914	250.98	200.952	251.55	200.969	251.75	200.978
251.93	200.979	253.5	201	255.98	201.045	256.93	201.053	257.81	201.067
258.72	201.075	258.93	201.079						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100.78	.035	104.2	.05	133.88	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
100.78	104.2	20	20	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	100.49	197.5	F
104.45	258.93	197.5	F

Right Levee Station= 221.19 Elevation= 200.62

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.045
W.S. Elev (m)	199.80	Reach Len. (m)	20.00	20.00	20.00
Crit W.S. (m)	197.05	Flow Area (m2)	53.47	14.56	103.52
E.G. Slope (m/m)	0.000013	Area (m2)	53.47	14.56	103.52
Q Total (m3/s)	20.59	Flow (m3/s)	4.42	3.69	12.48
Top Width (m)	138.41	Top Width (m)	43.04	3.42	91.95
Vel Total (m/s)	0.12	Avg. Vel. (m/s)	0.08	0.25	0.12
Max Chl Dpth (m)	4.40	Hydr. Depth (m)	1.24	4.26	1.13
Conv. Total (m3/s)	5677.0	Conv. (m3/s)	1218.0	1018.1	3441.0
Length Wtd. (m)	20.00	Wetted Per. (m)	43.98	3.80	92.28
Min Ch El (m)	195.40	Shear (N/m2)	0.16	0.49	0.14
Alpha	1.51	Stream Power (N/m s)	0.01	0.13	

0.02					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	40.27	65.14	34.37
C & E Loss (m)	0.00	Cum SA (1000 m2)	41.29	23.26	44.80

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.09	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.037
W.S. Elev (m)	201.08	Reach Len. (m)	20.00	20.00	20.00
Crit W.S. (m)	198.40	Flow Area (m2)	152.90	18.95	256.04
E.G. Slope (m/m)	0.000047	Area (m2)	152.90	18.95	256.04
Q Total (m3/s)	122.56	Flow (m3/s)	30.86	10.88	80.82
Top Width (m)	243.10	Top Width (m)	84.95	3.42	154.73
Vel Total (m/s)	0.29	Avg. Vel. (m/s)	0.20	0.57	0.32
Max Chl Dpth (m)	5.68	Hydr. Depth (m)	1.80	5.54	1.65
Conv. Total (m3/s)	17786.0	Conv. (m3/s)	4478.4	1578.9	11728.6
Length Wtd. (m)	20.00	Wetted Per. (m)	86.27	3.80	155.09
Min Ch El (m)	195.40	Shear (N/m2)	0.83	2.32	0.77
Alpha	1.28	Stream Power (N/m s)	0.17	1.33	0.24
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	165.48	157.18	195.80
C & E Loss (m)	0.00	Cum SA (1000 m2)	95.14	23.26	119.09

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.17

INPUT
Description: Section 46.17 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 116

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.688	1.92	202.495	4.4	202.266	4.48	202.251	4.75	202.184
4.79	202.176	6.6	202	12.45	201.979	17.91	201.166	18.18	201.154
19.37	201.103	21.4	201	23.54	200.628	24.48	200.486	25.02	200.437

```
   25.18  200.42   27.13 200.345   28.69 200.283   51.47 200.233   52.85 200.015
    52.9 200.016   53.01 200.016   53.18 200.017    53.5 200.019   53.65 200.018
   55.08     200   55.93 199.504   57.96     199   58.81 198.999   60.02 198.998
   60.13 198.998   60.21 198.998   60.95     199   66.84 199.005   72.96 199.008
   73.69 199.009    73.9 199.009    74.3 199.009   84.33 199.001   84.69     199
   87.85 198.724    88.8  198.65   91.93 198.411   92.06 198.399   92.24 198.395
    94.4 198.329   97.14 198.228  101.19     198   104.3 197.667  105.19 197.601
  106.64 197.457  107.07 197.401  107.61  197.33  109.57 197.016  109.72     197
   111.4 196.518  112.75 196.275  112.89 196.246     114     196  115.21 195.596
  116.81 195.074  118.88 195.516  119.22  195.58     121  195.98  121.83     196
  122.59 196.161  122.66 196.178  126.09     197  126.52 197.207  127.48 197.726
  128.12     198  128.84 198.316  128.95 198.391  130.41     199  131.35 199.029
  131.66 199.042  131.84 199.047  145.77 199.679  145.82  199.68  148.15 199.686
  148.22 199.687  150.32 199.708  150.42 199.708  155.89 199.771  163.77 199.844
   166.6  199.87  172.77 199.998  172.98     200  173.86     200  177.76 200.001
  180.71 200.001  182.41 200.001  187.06     200  189.66     200  190.48     200
  191.66 199.999  192.68     200  193.35     200  195.14 200.052  210.59 200.774
  213.61 200.883  216.46 200.997  216.77 200.998   216.8     201  218.28  201.01
  220.35 201.021  223.37 201.004  223.38 201.003  223.46 201.003  223.87 201.001
     224 201.001   224.1 201.001  224.26 201.001  247.41 201.031  254.26 201.314
  261.99 201.319

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05     114    .035  121.83     .05  130.41    .025

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           114  121.83               25      25      25             .1       .3
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
     224  254.26     204

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           199.80    Element                 Left OB    Channel
Right OB
  Vel Head (m)              0.00    Wt. n-Val.               0.050      0.035
0.046
  W.S. Elev (m)           199.80    Reach Len. (m)           25.00      25.00
25.00
  Crit W.S. (m)                     Flow Area (m2)           78.43      33.06
29.72
  E.G. Slope (m/m)      0.000016    Area (m2)                78.43      33.06
29.72
  Q Total (m3/s)            20.59   Flow (m3/s)               7.48       9.53
3.58
  Top Width (m)           103.45    Top Width (m)            58.57       7.83
37.04
  Vel Total (m/s)           0.15    Avg. Vel. (m/s)           0.10       0.29
0.12
  Max Chl Dpth (m)          4.72    Hydr. Depth (m)           1.34       4.22
0.80
  Conv. Total (m3/s)      5225.2    Conv. (m3/s)             1897.9     2417.7
909.5
  Length Wtd. (m)           25.00   Wetted Per. (m)          58.93       8.08
37.62
  Min Ch El (m)           195.07    Shear (N/m2)              0.20       0.62
0.12
  Alpha                     2.08    Stream Power (N/m s)      0.02       0.18
0.01
  Frctn Loss (m)            0.00    Cum Volume (1000 m3)     38.95      64.66
33.04
```

C & E Loss (m)	0.00	Cum SA (1000 m2)	40.27	23.15 43.51

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.09	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.032
W.S. Elev (m)	201.08	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)		Flow Area (m2)	179.99	43.06	129.50
E.G. Slope (m/m)	0.000069	Area (m2)	179.99	43.06	129.50
Q Total (m3/s)	122.56	Flow (m3/s)	45.88	31.16	45.52
Top Width (m)	204.08	Top Width (m)	94.08	7.83	102.17
Vel Total (m/s)	0.35	Avg. Vel. (m/s)	0.25	0.72	0.35
Max Chl Dpth (m)	6.00	Hydr. Depth (m)	1.91	5.50	1.27
Conv. Total (m3/s)	14769.6	Conv. (m3/s)	5529.1	3754.9	5485.6
Length Wtd. (m)	25.00	Wetted Per. (m)	94.56	8.08	102.85
Min Ch El (m)	195.07	Shear (N/m2)	1.29	3.60	0.85
Alpha	1.68	Stream Power (N/m s)	0.33	2.61	0.30
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	162.15	156.56	191.95
C & E Loss (m)	0.00	Cum SA (1000 m2)	93.35	23.15	116.52

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: RIVER-1
REACH: Reach-1 RS: 46.162

INPUT
Description: Section 46.162 - Private Roadway - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 109

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.192	1.24	201.169	3.79	201.018	4.16	201	4.19	201
4.59	201	4.76	201	7.68	200.999	11.04	200.998	13.8	200.998
16.96	200.999	17.05	200.985	18.41	200.657	20.17	200.244	20.23	200.243

23.96	200	24.33	200	24.56	200	24.59	200	24.88	200
26.07	200.001	26.81	200.001	26.89	200.001	27.42	200.001	28.48	200.001
30.58	200.002	32.04	200.002	32.36	200.002	32.54	200.002	32.61	200.002
32.89	200.003	34.51	199.895	34.73	199.893	44.5	199.802	46.83	199.776
54.07	199.447	58.78	199.43	64.92	199.322	69.2	199.246	76.37	199.103
81.58	199.008	81.84	199	87.1	198.433	90.24	198	91.32	197.577
93.35	197	93.64	196.919	94.7	196.457	95.67	196.041	95.77	196
95.88	195.96	97	195.074	98.92	195.074	100.12	195.765	100.4	196
101.1	196.258	101.63	196.43	103.42	197	104.06	197.319	105.45	198
106.48	198.488	107.42	199	110.59	199.341	122.09	199.985	122.25	199.995
122.4	200	122.41	200	122.46	200	122.47	200	122.58	200
123.04	200	129.01	200	130.19	200	140.85	200	144.86	200
145.37	200	145.55	200	145.59	200	148.08	200	150.4	200
151.72	200.029	154.44	200.045	164.08	200.101	179.01	200.467	180.22	200.507
181.74	200.559	183.87	200.633	184.02	200.638	184.28	200.645	187.85	200.734
192.91	200.868	197.74	201	200.12	201.06	203.17	201.141	203.19	201.141
203.79	201.145	209.64	201.071	209.78	201.07	219.82	201.072	226.92	201.085
234.49	201.039	242.9	201.219	248.47	201.125	248.56	201.126	248.94	201.13
253.08	201.56	254.15	201.702	256.45	201.992	256.6	202		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	95.77	.035	100.4	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
95.77	100.4	30	30	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	96	198.8	F
100	256.6	198.8	F

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
154.44	183.87	204	209.64	248.47	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.80	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (m)	199.79	Reach Len. (m)	30.00	30.00
30.00				
Crit W.S. (m)	196.65	Flow Area (m2)	41.88	20.60
20.89				
E.G. Slope (m/m)	0.000060	Area (m2)	41.88	20.60
20.89				
Q Total (m3/s)	20.59	Flow (m3/s)	5.72	11.40
3.46				
Top Width (m)	73.08	Top Width (m)	50.24	4.63
18.21				
Vel Total (m/s)	0.25	Avg. Vel. (m/s)	0.14	0.55
0.17				
Max Chl Dpth (m)	4.72	Hydr. Depth (m)	0.83	4.45
1.15				
Conv. Total (m3/s)	2655.0	Conv. (m3/s)	737.6	1470.6
446.8				
Length Wtd. (m)	30.00	Wetted Per. (m)	50.67	5.22
18.88				
Min Ch El (m)	195.07	Shear (N/m2)	0.49	2.33
0.65				
Alpha	2.94	Stream Power (N/m s)	0.07	1.29
0.11				

Frctn Loss (m)		Cum Volume (1000 m3)	37.44	63.99
32.41				
C & E Loss (m)		Cum SA (1000 m2)	38.91	22.99
42.82				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.08	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (m)	201.05	Reach Len. (m)	30.00	30.00
30.00				
Crit W.S. (m)	198.81	Flow Area (m2)	135.12	26.43
85.01				
E.G. Slope (m/m)	0.000245	Area (m2)	135.12	26.43
85.01				
Q Total (m3/s)	122.56	Flow (m3/s)	54.28	34.89
33.39				
Top Width (m)	167.01	Top Width (m)	92.51	4.63
69.87				
Vel Total (m/s)	0.50	Avg. Vel. (m/s)	0.40	1.32
0.39				
Max Chl Dpth (m)	5.98	Hydr. Depth (m)	1.46	5.71
1.22				
Conv. Total (m3/s)	7825.2	Conv. (m3/s)	3465.7	2227.8
2131.7				
Length Wtd. (m)	30.00	Wetted Per. (m)	93.05	5.22
71.97				
Min Ch El (m)	195.07	Shear (N/m2)	3.49	12.19
2.84				
Alpha	2.47	Stream Power (N/m s)	1.40	16.10
1.12				
Frctn Loss (m)		Cum Volume (1000 m3)	158.21	155.69
189.26				
C & E Loss (m)		Cum SA (1000 m2)	91.01	22.99
114.37				

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1615

INPUT
Description: Hum 13-KK. Paradise Convention Centre Culvert - 3.23 m W x 2.1 m H x 20 m L Corrugated Metal Pipe Arch Culvert. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5

Deck/Roadway Width = 20
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 126

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.017		9.94	201		10.9	201	
11.2	200.998		11.24	200.998		11.49	200.997	
11.55	200.996		11.63	200.996		11.72	200.995	
11.81	200.995		12.69	200.991		13.63	200.995	
13.69	200.995		13.79	200.995		13.91	200.995	
14.12	200.995		14.43	200.995		15.32	200.994	
16.77	200.993		17.25	200.993		17.58	200.992	
17.88	200.988		18.13	200.991		18.74	201	
19.67	201		20.75	201		22.23	201	
22.68	201		23	201		25.78	200.523	
29.88	200		30.35	200		30.39	200	
30.42	200		30.46	200		30.91	200	
31.74	200		31.8	200		31.81	200	
32.21	199.978		32.38	199.976		37.76	199.901	
45.3	199.796		45.48	199.793		46.6	199.774	
47.47	199.76		48.2	199.747		48.73	199.737	
52.37	199.712		62.24	199.953		80.06	199.792	
80.14	199.784		82.52	199.86		83.52	199.767	
86.47	199.141		86.75	199.129		86.83	199.126	
86.88	199.126		87.13	199.124		87.38	199.123	
92.32	199.013		93.07	199.015		93.82	199.013	
94.29	199.014		95.15	199.016		97.02	199.018	
99.48	199.024		101.85	199.025		101.94	199.025	
102.27	199.026		102.57	199.026		108.65	199.546	
109.85	199.579		110.34	199.599		111.74	199.692	
113.68	199.827		113.8	199.834		114.21	199.865	
114.64	199.898		115.6	200		115.65	200	
115.87	200		115.88	200		116.22	200	
133.27	200.001		141.62	200.001		151.28	200	
152.5	200		152.57	200		152.67	200	
153.56	200.001		154.38	200		157.21	200.062	
161.12	200.085		198.43	201		198.44	201	
198.44	201		198.46	201		198.85	201.004	
198.89	201.004		199.24	201.005		201.34	201.009	
203.5	201.021		204.2	201.024		204.77	201.027	
206.84	201.024		207.23	201.023		207.31	201.023	
207.75	201.023		208.37	201.022		211.58	201.02	
227.39	201.113		228.72	201.124		234.54	201.088	
245.86	201		245.92	201		245.93	201	
245.97	201		247.18	201		247.71	201	
247.87	201		248.82	201.063		250.46	201.201	
257.76	202		258.46	202.763		258.74	203	

Upstream Bridge Cross Section Data
Station Elevation Data num= 109

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.192	1.24	201.169	3.79	201.018	4.16	201	4.19	201
4.59	201	4.76	201	7.68	200.999	11.04	200.998	13.8	200.998
16.96	200.999	17.05	200.985	18.41	200.657	20.17	200.244	20.23	200.243
23.96	200	24.33	200	24.56	200	24.59	200	24.88	200
26.07	200.001	26.81	200.001	26.89	200.001	27.42	200.001	28.48	200.001
30.58	200.002	32.04	200.002	32.36	200.002	32.54	200.002	32.61	200.002
32.89	200.003	34.51	199.895	34.73	199.893	44.5	199.802	46.83	199.776
54.07	199.447	58.78	199.43	64.92	199.322	69.2	199.246	76.37	199.103
81.58	199.008	81.84	199	87.1	198.433	90.24	198	91.32	197.577
93.35	197	93.64	196.919	94.7	196.457	95.67	196.041	95.77	196
95.88	195.96	97	195.074	98.92	195.074	100.12	195.765	100.4	196
101.1	196.258	101.63	196.43	103.42	197	104.06	197.319	105.45	198

106.48	198.488	107.42	199	110.59	199.341	122.09	199.985	122.25	199.995
122.4	200	122.41	200	122.46	200	122.47	200	122.58	200
123.04	200	129.01	200	130.19	200	140.85	200	144.86	200
145.37	200	145.55	200	145.59	200	148.08	200	150.4	200
151.72	200.029	154.44	200.045	164.08	200.101	179.01	200.467	180.22	200.507
181.74	200.559	183.87	200.633	184.02	200.638	184.28	200.645	187.85	200.734
192.91	200.868	197.74	201	200.12	201.06	203.17	201.141	203.19	201.141
203.79	201.145	209.64	201.071	209.78	201.07	219.82	201.072	226.92	201.085
234.49	201.039	242.9	201.219	248.47	201.125	248.56	201.126	248.94	201.13
253.08	201.56	254.15	201.702	256.45	201.992	256.6	202		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	95.77	.035	100.4	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
95.77	100.4	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	96	198.8	F
100	256.6	198.8	F

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
154.44	183.87	204	209.64	248.47	204

Downstream Deck/Roadway Coordinates

num= 126

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.017		9.94	201		10.9	201	
11.2	200.998		11.24	200.998		11.49	200.997	
11.55	200.996		11.63	200.996		11.72	200.995	
11.81	200.995		12.69	200.991		13.63	200.995	
13.69	200.995		13.79	200.995		13.91	200.995	
14.12	200.995		14.43	200.995		15.32	200.994	
16.77	200.993		17.25	200.993		17.58	200.992	
17.88	200.988		18.13	200.991		18.74	201	
19.67	201		20.75	201		22.23	201	
22.68	201		23	201		25.78	200.523	
29.88	200		30.35	200		30.39	200	
30.42	200		30.46	200		30.91	200	
31.74	200		31.8	200		31.81	200	
32.21	199.978		32.38	199.976		37.76	199.901	
45.3	199.796		45.48	199.793		46.6	199.774	
47.47	199.76		48.2	199.747		48.73	199.737	
52.37	199.712		62.24	199.953		80.06	199.792	
80.14	199.784		82.52	199.86		83.52	199.767	
86.47	199.141		86.75	199.129		86.83	199.126	
86.88	199.126		87.13	199.124		87.38	199.123	
92.32	199.013		93.07	199.015		93.82	199.013	
94.29	199.014		95.15	199.016		97.02	199.018	
99.48	199.024		101.85	199.025		101.94	199.025	
102.27	199.026		102.57	199.026		108.65	199.546	
109.85	199.579		110.34	199.599		111.74	199.692	
113.68	199.827		113.8	199.834		114.21	199.865	
114.64	199.898		115.6	200		115.65	200	
115.87	200		115.88	200		116.22	200	
133.27	200.001		141.62	200.001		151.28	200	
152.5	200		152.57	200		152.67	200	
153.56	200.001		154.38	200		157.21	200.062	
161.12	200.085		198.43	201		198.44	201	
198.44	201		198.46	201		198.85	201.004	
198.89	201.004		199.24	201.005		201.34	201.009	
203.5	201.021		204.2	201.024		204.77	201.027	

206.84	201.024		207.23	201.023		207.31	201.023				
207.75	201.023		208.37	201.022		211.58	201.02				
227.39	201.113		228.72	201.124		234.54	201.088				
245.86	201		245.92	201		245.93	201				
245.97	201		247.18	201		247.71	201				
247.87	201		248.82	201.063		250.46	201.201				
257.76	202		258.46	202.763		258.74	203				

Downstream Bridge Cross Section Data
Station Elevation Data num= 97

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.234	6.98	201.333	9.75	201.336	9.77	201.336	17.8	201.001
17.86	201.001	18.1	201.001	19.36	201.001	20.8	201.001	25.37	201
25.69	201	26.12	201	29.2	201	35.72	200.103	36.41	200
36.94	199.99	50.43	199.898	66.47	200.295	73.43	200.347	83.13	199.309
84.14	199	88.09	198.41	90.41	198	91.93	197.362	92.38	197.153
92.68	197	92.7	196.996	92.92	196.907	94.09	196.435	94.82	196.155
94.98	196.097	95.34	196	95.45	195.993	95.5	195.993	95.57	195.99
95.6	195.99	95.68	195.987	95.95	195.983	96.08	195.977	96.09	195.977
96.4	195.5	97.3	195.055	98.25	195.055	98.61	195.055	99.49	195.4
100.35	196	100.36	196.016	100.39	196.018	100.4	196.019	101.12	196.161
101.26	196.181	101.4	196.224	101.65	196.305	102.38	196.618	102.6	196.702
103.35	197	103.53	197.076	104.33	197.5	105.15	198	105.7	198.366
106.74	199	112.96	199.847	113.59	200.124	114.14	200	115.59	200
121.06	200	128.26	200.001	134.61	200.001	134.71	200.001	134.82	200.001
140.07	200.001	142.39	200.001	148.34	200.001	158.18	200.001	158.9	200.001
160.19	200	160.29	200	163.09	200.057	163.77	200.072	188.65	200.623
188.78	200.626	191.1	200.678	193.84	200.742	203.22	200.935	204.53	200.978
204.69	200.98	205.35	201	205.36	201	205.87	201	205.94	201
205.95	201	210.51	200.999	213.45	201	228.33	201.138	239.76	201.423
255.77	201.644	259.74	202						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	95.34	.035	100.35	.05

Bank Sta: Left Right Coeff Contr. Expan.
95.34 100.35 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	96	198.8	F
100	259.74	198.8	F

Left Levee Station= 73.43 Elevation= 200.35
Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
112.96	193.84	204	213.45	255.77	204

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 = 199
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 Pipe Arch 2.1 3.23
FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef

```
Exit Loss Coef
                5      20     .024     .024        0                    .9
      1
Upstream   Elevation =  195.074
           Centerline Station =  98
Downstream Elevation =  195.055
           Centerline Station =  98
```

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	3.51	Culv Full Len (m)	20.00
# Barrels	1	Culv Vel US (m/s)	0.67
Q Barrel (m3/s)	3.51	Culv Vel DS (m/s)	0.67
E.G. US. (m)	199.80	Culv Inv El Up (m)	195.07
W.S. US. (m)	199.79	Culv Inv El Dn (m)	195.05
E.G. DS (m)	199.76	Culv Frctn Ls (m)	0.01
W.S. DS (m)	199.75	Culv Exit Loss (m)	0.01
Delta EG (m)	0.04	Culv Entr Loss (m)	0.02
Delta WS (m)	0.04	Q Weir (m3/s)	17.08
E.G. IC (m)	198.77	Weir Sta Lft (m)	45.02
E.G. OC (m)	199.80	Weir Sta Rgt (m)	113.29
Culvert Control	Outlet	Weir Submerg	0.91
Culv WS Inlet (m)	197.17	Weir Max Depth (m)	0.79
Culv WS Outlet (m)	197.16	Weir Avg Depth (m)	0.41
Culv Nml Depth (m)		Weir Flow Area (m2)	17.62
Culv Crt Depth (m)	0.59	Min El Weir Flow (m)	199.02

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	1.98	Culv Full Len (m)	20.00
# Barrels	1	Culv Vel US (m/s)	0.38
Q Barrel (m3/s)	1.98	Culv Vel DS (m/s)	0.38
E.G. US. (m)	201.08	Culv Inv El Up (m)	195.07
W.S. US. (m)	201.05	Culv Inv El Dn (m)	195.05
E.G. DS (m)	201.07	Culv Frctn Ls (m)	0.00
W.S. DS (m)	200.99	Culv Exit Loss (m)	0.00
Delta EG (m)	0.01	Culv Entr Loss (m)	0.01
Delta WS (m)	0.06	Q Weir (m3/s)	118.27
E.G. IC (m)	201.07	Weir Sta Lft (m)	2.73
E.G. OC (m)	201.08	Weir Sta Rgt (m)	209.64
Culvert Control	Outlet	Weir Submerg	0.98
Culv WS Inlet (m)	197.17	Weir Max Depth (m)	2.07
Culv WS Outlet (m)	197.16	Weir Avg Depth (m)	1.03
Culv Nml Depth (m)		Weir Flow Area (m2)	175.13
Culv Crt Depth (m)	0.43	Min El Weir Flow (m)	199.02

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.161

INPUT
Description: Section 46.161 - Private Roadway - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 97

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.234	6.98	201.333	9.75	201.336	9.77	201.336	17.8	201.001
17.86	201.001	18.1	201.001	19.36	201.001	20.8	201.001	25.37	201
25.69	201	26.12	201	29.2	201	35.72	200.103	36.41	200
36.94	199.99	50.43	199.898	66.47	200.295	73.43	200.347	83.13	199.309
84.14	199	88.09	198.41	90.41	198	91.93	197.362	92.38	197.153
92.68	197	92.7	196.996	92.92	196.907	94.09	196.435	94.82	196.155
94.98	196.097	95.34	196	95.45	195.993	95.5	195.993	95.57	195.99
95.6	195.99	95.68	195.987	95.95	195.983	96.08	195.977	96.09	195.977
96.4	195.5	97.3	195.055	98.25	195.055	98.61	195.055	99.49	195.4
100.35	196	100.36	196.016	100.39	196.018	100.4	196.019	101.12	196.161
101.26	196.181	101.4	196.224	101.65	196.305	102.38	196.618	102.6	196.702
103.35	197	103.53	197.076	104.33	197.5	105.15	198	105.7	198.366
106.74	199	112.96	199.847	113.59	200.124	114.14	200	115.59	200
121.06	200	128.26	200.001	134.61	200.001	134.71	200.001	134.82	200.001
140.07	200.001	142.39	200.001	148.34	200.001	158.18	200.001	158.9	200.001
160.19	200	160.29	200	163.09	200.057	163.77	200.072	188.65	200.623
188.78	200.626	191.1	200.678	193.84	200.742	203.22	200.935	204.53	200.978
204.69	200.98	205.35	201	205.36	201	205.87	201	205.94	201
205.95	201	210.51	200.999	213.45	201	228.33	201.138	239.76	201.423
255.77	201.644	259.74	202						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	95.34	.035	100.35	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
95.34	100.35	115	115	110	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	96	198.8	F
100	259.74	198.8	F

Left Levee Station= 73.43 Elevation= 200.35
Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
112.96	193.84	204	213.45	255.77	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.76	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.75	Reach Len. (m)	115.00	115.00	110.00
Crit W.S. (m)	196.68	Flow Area (m2)	22.94	21.69	18.04
E.G. Slope (m/m)	0.000066	Area (m2)	22.94	21.69	18.04
Q Total (m3/s)	20.59	Flow (m3/s)	4.56	12.33	3.70
Top Width (m)	33.18	Top Width (m)	16.30	5.01	11.87
Vel Total (m/s)	0.33	Avg. Vel. (m/s)	0.20	0.57	0.21
Max Chl Dpth (m)	4.69	Hydr. Depth (m)	1.41	4.33	1.52
Conv. Total (m3/s)	2543.9	Conv. (m3/s)	563.8	1523.0	

457.0					
Length Wtd. (m)	114.24	Wetted Per. (m)	16.84	5.63	12.65
Min Ch El (m)	195.05	Shear (N/m2)	0.87	2.48	0.92
Alpha	1.94	Stream Power (N/m s)	0.17	1.41	0.19
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	37.44	63.00	32.41
C & E Loss (m)	0.00	Cum SA (1000 m2)	37.91	22.85	42.37

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.07	Element	Left OB	Channel	Right OB
Vel Head (m)	0.08	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	200.99	Reach Len. (m)	115.00	115.00	110.00
Crit W.S. (m)	198.80	Flow Area (m2)	85.42	27.90	35.07
E.G. Slope (m/m)	0.000494	Area (m2)	85.42	27.90	35.07
Q Total (m3/s)	122.56	Flow (m3/s)	44.76	51.49	26.31
Top Width (m)	94.74	Top Width (m)	66.04	5.01	23.68
Vel Total (m/s)	0.83	Avg. Vel. (m/s)	0.52	1.85	0.75
Max Chl Dpth (m)	5.93	Hydr. Depth (m)	1.29	5.57	1.48
Conv. Total (m3/s)	5517.0	Conv. (m3/s)	2014.8	2317.8	1184.4
Length Wtd. (m)	113.39	Wetted Per. (m)	66.70	5.63	25.86
Min Ch El (m)	195.05	Shear (N/m2)	6.20	24.00	6.56
Alpha	2.42	Stream Power (N/m s)	3.25	44.28	4.92
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	158.21	149.95	189.26
C & E Loss (m)	0.03	Cum SA (1000 m2)	88.64	22.85	112.97

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.15

INPUT
Description: Section 46.15 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 127

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.186	1.5	202.211	3.88	202.172	12.6	202	18.62	201.651
19.7	201.593	24.97	201.562	31.47	201.499	34.76	201.41	37.06	201.349
38.71	201.307	40.01	201.275	46.43	201.234	53.66	201.182	63.04	201.024
64.83	201	71.77	201	81.8	201.001	98.39	201	98.42	201
98.43	201	98.62	201	99	201	99.33	201	102.54	201
105.72	201	107.82	201	116.56	201	116.8	201	116.89	201
117.43	201	120.19	201	129	201.384	129.41	201.366	129.47	201.361
130.32	201.338	132.46	201.25	145.66	201.39	149.94	201.365	150.29	201.371
150.32	201.371	150.34	201.37	165.5	201.241	174.71	201.093	174.73	201.093
178.62	201.002	178.71	201	179.11	200.997	180.09	200.997	180.29	200.997
182.91	200.994	183.59	200.992	187.46	200.99	189.73	200.989	193.41	200.986
196.61	200.981	201.38	200.993	202.28	200.998	202.8	201	202.82	201.001
204.7	201.012	204.87	201.012	207.02	201	215.88	200.597	217.98	200.503
229.1	200	239.57	200	240.14	200	240.35	200	240.69	200
241.46	200.001	244.02	200.003	244.52	200.003	247.88	200	252.68	199.697
253.79	199.631	254.22	199.606	254.25	199.604	254.45	199.589	254.57	199.581
254.58	199.58	257.09	199.519	293.77	199	311.44	198.052	312.46	198
313.91	197.526	315.84	197	316.71	196.647	317.76	196	318.28	195.859
320.41	195.022	323.03	195.56	324.63	196	325.3	196.405	326.37	197
327.54	197.629	328.2	198	330.14	198.631	330.95	199	332.88	199.124
334.89	199.177	336.12	199.217	343.97	199.5	348.81	199.629	349.11	199.635
350.43	199.664	351.55	199.685	352.86	199.711	358.34	199.849	358.57	199.852
363.52	199.98	371.23	199.957	379.73	199.99	380.54	199.992	381.05	199.993
381.68	199.994	381.77	199.994	381.97	199.994	381.98	199.994	382.55	199.994
383.23	199.994	383.28	199.994	383.63	199.994	388.93	199.98	393.62	199.989
395.11	199.992	396.07	199.992						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	293.77	.08	317.76	.035	324.63	.08	330.95	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
317.76	324.63	50	50	.1	.3

Left Levee Station= 145.66 Elevation= 201.39
Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
38.64	61.59	204	257.09	293.77	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.75	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.061
W.S. Elev (m)	199.74	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	196.48	Flow Area (m2)	37.70	29.14	20.59
E.G. Slope (m/m)	0.000044	Area (m2)	37.70	29.14	20.59
Q Total (m3/s)	20.59	Flow (m3/s)	3.98	14.03	2.58
Top Width (m)	65.42	Top Width (m)	29.11	6.87	29.44
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.11	0.48	0.13
Max Chl Dpth (m)	4.72	Hydr. Depth (m)	1.30	4.24	

0.70					
Conv. Total (m3/s)	3113.9	Conv. (m3/s)	602.0	2122.3	389.5
Length Wtd. (m)	50.00	Wetted Per. (m)	30.50	7.16	30.16
Min Ch El (m)	195.02	Shear (N/m2)	0.53	1.74	0.29
Alpha	2.92	Stream Power (N/m s)	0.06	0.84	0.04
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	33.96	60.08	30.28
C & E Loss (m)	0.00	Cum SA (1000 m2)	35.30	22.16	40.10

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.01	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.071	0.035	0.032
W.S. Elev (m)	200.99	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	198.74	Flow Area (m2)	107.71	37.69	100.58
E.G. Slope (m/m)	0.000161	Area (m2)	107.71	37.69	100.58
Q Total (m3/s)	122.56	Flow (m3/s)	28.62	41.35	52.59
Top Width (m)	156.70	Top Width (m)	78.39	6.87	71.44
Vel Total (m/s)	0.50	Avg. Vel. (m/s)	0.27	1.10	0.52
Max Chl Dpth (m)	5.96	Hydr. Depth (m)	1.37	5.49	1.41
Conv. Total (m3/s)	9655.4	Conv. (m3/s)	2254.7	3257.8	4142.8
Length Wtd. (m)	50.00	Wetted Per. (m)	82.30	7.16	73.15
Min Ch El (m)	195.02	Shear (N/m2)	2.07	8.32	2.17
Alpha	2.18	Stream Power (N/m s)	0.55	9.12	1.14
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	147.10	146.18	181.80
C & E Loss (m)	0.01	Cum SA (1000 m2)	80.33	22.16	107.73

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.
Note: Multiple critical depths were found at this location. The critical depth

with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.142

INPUT
Description: Section 46.142 - Private Roadway - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 54

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.236	12.59	201	21	200.671	22.43	200.623	37.81	200
39.38	200	40.23	200	42.31	200.027	44.55	200.047	44.93	200.051
45.27	200.048	49.43	200	56.95	199.696	56.96	199.695	56.98	199.695
85.47	199.453	94.46	199	96.11	198.897	108.79	198	110.82	197.095
111.08	197	111.27	196.916	113.02	196	115.02	195.28	116.06	195
116.72	194.83	117.13	194.83	117.19	194.83	117.27	194.83	118.2	195
120.05	195.7	120.42	195.827	121	196	123.66	196.903	123.94	197
124.59	197.177	124.93	197.245	126.67	198	128.21	198.693	128.78	199
131.04	199.231	132.73	199.5	140.22	199.865	142.99	200	146.99	200.195
153.53	200.5	153.55	200.5	156.96	200.577	157.48	200.588	173.76	200.995
173.97	201	179.85	201.266	181.95	201.351	185.83	201.5		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	94.46	.08	113.02	.035	121	.08	142.99	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
113.02	121	60	60	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	115.11	199.5	F
119.14	185.83	199.5	F

Left Levee Station= 44.93 Elevation= 200.051
Blocked Obstructions num= 1

Sta L	Sta R	Elev
56.98	96.11	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.75	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	199.74	Reach Len. (m)	60.00	60.00	60.00
Crit W.S. (m)	196.40	Flow Area (m2)	27.82	35.17	21.08
E.G. Slope (m/m)	0.000037	Area (m2)	27.82	35.17	21.08
Q Total (m3/s)	20.59	Flow (m3/s)	2.80	15.95	1.83
Top Width (m)	42.64	Top Width (m)	18.02	7.98	16.65
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.10	0.45	0.09
Max Chl Dpth (m)	4.91	Hydr. Depth (m)	1.54	4.41	1.27
Conv. Total (m3/s)	3380.5	Conv. (m3/s)	460.2	2619.3	301.0

Length Wtd. (m)	60.00	Wetted Per. (m)	19.39	8.35	17.26
Min Ch El (m)	194.83	Shear (N/m2)	0.52	1.53	0.44
Alpha	2.69	Stream Power (N/m s)	0.05	0.69	0.04
Frctn Loss (m)		Cum Volume (1000 m3)	32.32	58.47	29.24
C & E Loss (m)		Cum SA (1000 m2)	34.12	21.79	38.95

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.00	Element	Left OB	Channel	Right OB
Vel Head (m)	0.08	Wt. n-Val.	0.071	0.035	0.069
W.S. Elev (m)	200.91	Reach Len. (m)	60.00	60.00	60.00
Crit W.S. (m)	199.50	Flow Area (m2)	76.41	44.53	56.71
E.G. Slope (m/m)	0.000350	Area (m2)	76.41	44.53	56.71
Q Total (m3/s)	122.56	Flow (m3/s)	28.44	72.59	21.53
Top Width (m)	116.53	Top Width (m)	59.07	7.98	49.48
Vel Total (m/s)	0.69	Avg. Vel. (m/s)	0.37	1.63	0.38
Max Chl Dpth (m)	6.08	Hydr. Depth (m)	1.29	5.58	1.15
Conv. Total (m3/s)	6554.2	Conv. (m3/s)	1521.0	3881.9	1151.2
Length Wtd. (m)	60.00	Wetted Per. (m)	62.81	8.35	50.12
Min Ch El (m)	194.83	Shear (N/m2)	4.17	18.28	3.88
Alpha	3.43	Stream Power (N/m s)	1.55	29.80	1.47
Frctn Loss (m)		Cum Volume (1000 m3)	142.50	144.12	177.87
C & E Loss (m)		Cum SA (1000 m2)	76.89	21.79	104.71

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1415

INPUT
Description: Hum 13-JJ. Private Driveway Culvert - 3.23 m W x 2.1 m H x 52 m L

Corrugated Metal Pipe Arch Culvert. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004
by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 52
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 76

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.501		9.03	201.276		10.69	201.235	
11.93	201.205		15.26	201.124		15.65	201.116	
17.33	201.085		18.3	201.067		21.82	201	
22.59	200.991		22.61	200.991		24.72	200.975	
26.52	200.961		27.55	200.966		33.24	200.845	
34.76	200.824		37.08	200.776		39.72	200.726	
44.95	200.557		45.1	200.554		54.53	200.18	
61.95	200		72.68	199.814		72.97	199.813	
73.26	199.813		73.34	199.813		76.99	199.789	
82.12	199.738		84.44	199.737		86.82	199.742	
87.45	199.733		88.14	199.722		88.29	199.72	
94.48	199.736		95.23	199.732		95.99	199.728	
96.52	199.728		97.04	199.728		97.15	199.728	
97.87	199.727		98.58	199.727		100.35	199.739	
106	199.685		107.51	199.675		109.42	199.671	
109.55	199.67		110.18	199.672		116.42	199.732	
116.58	199.736		116.81	199.741		117.04	199.746	
117.21	199.75		120.07	199.82		125.43	199.969	
126.11	199.987		126.2	199.988		126.71	200	
126.77	200.001		127.26	200.002		127.65	200.002	
133.77	200.118		138.89	200.206		139.11	200.209	
140.01	200.216		140.99	200.224		148.28	200.355	
148.4	200.357		153.83	200.495		154.42	200.496	
154.61	200.497		155.83	200.5		162.15	200.643	
176.54	201		177.09	201.017		191.23	201.5	
191.27	201.5							

Upstream Bridge Cross Section Data
Station Elevation Data num= 54

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.236	12.59	201	21	200.671	22.43	200.623	37.81	200
39.38	200	40.23	200	42.31	200.027	44.55	200.047	44.93	200.051
45.27	200.048	49.43	200	56.95	199.696	56.96	199.695	56.98	199.695
85.47	199.453	94.46	199	96.11	198.897	108.79	198	110.82	197.095
111.08	197	111.27	196.916	113.02	196	115.02	195.28	116.06	195
116.72	194.83	117.13	194.83	117.19	194.83	117.27	194.83	118.2	195
120.05	195.7	120.42	195.827	121	196	123.66	196.903	123.94	197
124.59	197.177	124.93	197.245	126.67	198	128.21	198.693	128.78	199
131.04	199.231	132.73	199.5	140.22	199.865	142.99	200	146.99	200.195
153.53	200.5	153.55	200.5	156.96	200.577	157.48	200.588	173.76	200.995
173.97	201	179.85	201.266	181.95	201.351	185.83	201.5		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	94.46	.08	113.02	.035	121	.08	142.99	.025

Bank Sta: Left	Right	Coeff Contr.	Expan.
113.02	121	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	115.11	199.5	F

119.14 185.83 199.5 F

Left Levee Station= 44.93 Elevation= 200.051

Blocked Obstructions num= 1

Sta L	Sta R	Elev
56.98	96.11	204

Downstream Deck/Roadway Coordinates

num= 76

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.501		9.03	201.276		10.69	201.235	
11.93	201.205		15.26	201.124		15.65	201.116	
17.33	201.085		18.3	201.067		21.82	201	
22.59	200.991		22.61	200.991		24.72	200.975	
26.52	200.961		27.55	200.966		33.24	200.845	
34.76	200.824		37.08	200.776		39.72	200.726	
44.95	200.557		45.1	200.554		54.53	200.18	
61.95	200		72.68	199.814		72.97	199.813	
73.26	199.813		73.34	199.813		76.99	199.789	
82.12	199.738		84.44	199.737		86.82	199.742	
87.45	199.733		88.14	199.722		88.29	199.72	
94.48	199.736		95.23	199.732		95.99	199.728	
96.52	199.728		97.04	199.728		97.15	199.728	
97.87	199.727		98.58	199.727		100.35	199.739	
106	199.685		107.51	199.675		109.42	199.671	
109.55	199.67		110.18	199.672		116.42	199.732	
116.58	199.736		116.81	199.741		117.04	199.746	
117.21	199.75		120.07	199.82		125.43	199.969	
126.11	199.987		126.2	199.988		126.71	200	
126.77	200.001		127.26	200.002		127.65	200.002	
133.77	200.118		138.89	200.206		139.11	200.209	
140.01	200.216		140.99	200.224		148.28	200.355	
148.4	200.357		153.83	200.495		154.42	200.496	
154.61	200.497		155.83	200.5		162.15	200.643	
176.54	201		177.09	201.017		191.23	201.5	
191.27	201.5							

Downstream Bridge Cross Section Data

Station Elevation Data num= 102

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.964	2.43	201.92	2.94	201.91	3.53	201.894	4.38	201.869
5.84	201.802	10.38	201.593	13.97	201.399	14.53	201.37	16.68	201.262
16.97	201.25	18.86	201.161	21.88	201.012	22.13	201.011	23.05	201.004
26.53	201	27.47	200.995	28.29	200.997	28.76	200.997	28.82	200.997
29.15	200.996	33.62	200.993	33.7	200.993	37.58	200.533	37.75	200.516
37.79	200.514	38.56	200.515	42.31	200.545	48.93	200.615	49.07	200.618
50.33	200.646	50.39	200.649	61.33	200.328	70.12	200.012	72.92	200.006
73.26	200.005	73.27	200.005	73.46	200.005	73.47	200.004	78.8	200.01
78.81	200.01	80.68	200	84.14	199.945	85.98	199.929	88.28	199.936
92.02	199.995	93.24	199.991	94.47	199.996	95.37	200	97.6	200.002
98.34	200.002	99.45	200.003	100.7	200.002	101.57	200.001	102.44	200
103.62	199.631	105.8	199	106.7	198.73	108.53	198.229	108.84	198.134
109.24	198	109.55	197.899	109.76	197.822	111.11	197	111.52	196.37
111.75	196	111.95	195.708	112.46	195	117.89	194.823	120.59	194.823
122.27	194.884	125.1	195	126.97	195.253	128.35	195.435	132.42	195.983
132.63	195.986	132.82	196	134.16	196.531	134.6	196.682	135.45	197
135.58	197.071	137.13	198	137.6	198.204	137.71	198.254	139.23	199
140.32	199.45	141.61	200	146.06	200.194	161.96	200.967	165.01	200.972
168.03	200.99	169.39	200.999	169.49	201	169.5	201.001	169.55	201.001
170.18	201.005	170.26	201.005	170.49	201.006	172.16	201.006	179.97	201.133
180.44	201.14	194	201.345						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val

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      0     .05   105.8     .08  112.46    .035   125.1     .08  139.23    .025

Bank Sta: Left   Right    Coeff Contr.   Expan.
        112.46   125.1            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0  116.68     197       F
   120.7     194     197       F
Left Levee      Station=   50.33      Elevation=  200.65

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     Pipe Arch     2.1    3.23
FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                 5      52     .024     .024        0                    .9
      1
Upstream   Elevation =  194.88
           Centerline Station =  117.13
Downstream Elevation =  194.82
           Centerline Station =  118.7

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      20.31    Culv Full Len (m)        52.00
  # Barrels                   1     Culv Vel US (m/s)         3.87
  Q Barrel (m3/s)          20.31    Culv Vel DS (m/s)         3.87
  E.G. US. (m)            199.75    Culv Inv El Up (m)      194.88
  W.S. US. (m)            199.74    Culv Inv El Dn (m)      194.82
  E.G. DS (m)             197.45    Culv Frctn Ls (m)         0.87
  W.S. DS (m)             197.43    Culv Exit Loss (m)        0.75
  Delta EG (m)              2.30    Culv Entr Loss (m)        0.69
  Delta WS (m)              2.31    Q Weir (m3/s)             0.28
  E.G. IC (m)             198.58    Weir Sta Lft (m)         96.11
  E.G. OC (m)             199.75    Weir Sta Rgt (m)        117.14
  Culvert Control         Outlet    Weir Submerg              0.00
  Culv WS Inlet (m)       196.98    Weir Max Depth (m)        0.08
  Culv WS Outlet (m)      196.92    Weir Avg Depth (m)        0.04
  Culv Nml Depth (m)                Weir Flow Area (m2)       0.88
  Culv Crt Depth (m)        1.65    Min El Weir Flow (m)    199.67


Warning: During the culvert inlet control computations, the program could not
balance the culvert/weir flow.  The reported
         inlet energy grade answer may not be valid.

CULVERT OUTPUT  Profile #Regional w red'n  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      19.10    Culv Full Len (m)        52.00
  # Barrels                   1     Culv Vel US (m/s)         3.64
  Q Barrel (m3/s)          19.10    Culv Vel DS (m/s)         3.64
```

E.G. US. (m)	200.99	Culv Inv El Up (m)	194.88
W.S. US. (m)	200.91	Culv Inv El Dn (m)	194.82
E.G. DS (m)	199.10	Culv Frctn Ls (m)	0.77
W.S. DS (m)	198.95	Culv Exit Loss (m)	0.52
Delta EG (m)	1.89	Culv Entr Loss (m)	0.61
Delta WS (m)	1.97	Q Weir (m3/s)	103.46
E.G. IC (m)	200.94	Weir Sta Lft (m)	22.23
E.G. OC (m)	200.99	Weir Sta Rgt (m)	173.77
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	196.98	Weir Max Depth (m)	1.33
Culv WS Outlet (m)	196.92	Weir Avg Depth (m)	0.67
Culv Nml Depth (m)		Weir Flow Area (m2)	75.53
Culv Crt Depth (m)	1.57	Min El Weir Flow (m)	199.67

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.141

INPUT
Description: Section 46.141 - Private Roadway - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 102

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.964	2.43	201.92	2.94	201.91	3.53	201.894	4.38	201.869
5.84	201.802	10.38	201.593	13.97	201.399	14.53	201.37	16.68	201.262
16.97	201.25	18.86	201.161	21.88	201.012	22.13	201.011	23.05	201.004
26.53	201	27.47	200.995	28.29	200.997	28.76	200.997	28.82	200.997
29.15	200.996	33.62	200.993	33.7	200.993	37.58	200.533	37.75	200.516
37.79	200.514	38.56	200.515	42.31	200.545	48.93	200.615	49.07	200.618
50.33	200.646	50.39	200.649	61.33	200.328	70.12	200.012	72.92	200.006
73.26	200.005	73.27	200.005	73.46	200.005	73.47	200.004	78.8	200.01
78.81	200.01	80.68	200	84.14	199.945	85.98	199.929	88.28	199.936
92.02	199.995	93.24	199.991	94.47	199.996	95.37	200	97.6	200.002
98.34	200.002	99.45	200.003	100.7	200.002	101.57	200.001	102.44	200
103.62	199.631	105.8	199	106.7	198.73	108.53	198.229	108.84	198.134
109.24	198	109.55	197.899	109.76	197.822	111.11	197	111.52	196.37
111.75	196	111.95	195.708	112.46	195	117.89	194.823	120.59	194.823
122.27	194.884	125.1	195	126.97	195.253	128.35	195.435	132.42	195.983
132.63	195.986	132.82	196	134.16	196.531	134.6	196.682	135.45	197
135.58	197.071	137.13	198	137.6	198.204	137.71	198.254	139.23	199
140.32	199.45	141.61	200	146.06	200.194	161.96	200.967	165.01	200.972
168.03	200.99	169.39	200.999	169.49	201	169.5	201.001	169.55	201.001
170.18	201.005	170.26	201.005	170.49	201.006	172.16	201.006	179.97	201.133
180.44	201.14	194	201.345						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	105.8	.08	112.46	.035	125.1	.08	139.23	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
112.46	125.1	30	25	20	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116.68	197	F
120.7	194	197	F

Left Levee Station= 50.33 Elevation= 200.65

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	197.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	197.43	Reach Len. (m)	30.00	25.00	20.00
Crit W.S. (m)	196.22	Flow Area (m2)	2.13	32.14	17.40
E.G. Slope (m/m)	0.000104	Area (m2)	2.13	32.14	17.40
Q Total (m3/s)	20.59	Flow (m3/s)	0.20	17.45	2.93
Top Width (m)	25.79	Top Width (m)	2.06	12.64	11.09
Vel Total (m/s)	0.40	Avg. Vel. (m/s)	0.10	0.54	0.17
Max Chl Dpth (m)	2.61	Hydr. Depth (m)	1.03	2.54	1.57
Conv. Total (m3/s)	2017.4	Conv. (m3/s)	20.0	1710.0	287.3
Length Wtd. (m)	24.73	Wetted Per. (m)	3.25	12.65	11.46
Min Ch El (m)	194.82	Shear (N/m2)	0.67	2.60	1.55
Alpha	1.60	Stream Power (N/m s)	0.06	1.41	0.26
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	32.32	57.70	29.24
C & E Loss (m)	0.00	Cum SA (1000 m2)	33.52	21.17	38.11

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	199.10	Element	Left OB	Channel	Right OB
Vel Head (m)	0.15	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	198.95	Reach Len. (m)	30.00	25.00	20.00
Crit W.S. (m)	197.00	Flow Area (m2)	8.15	51.27	36.30
E.G. Slope (m/m)	0.000693	Area (m2)	8.15	51.27	36.30
Q Total (m3/s)	122.56	Flow (m3/s)	2.73	98.06	21.77
Top Width (m)	33.15	Top Width (m)	6.49	12.64	14.02
Vel Total (m/s)	1.28	Avg. Vel. (m/s)	0.33	1.91	0.60
Max Chl Dpth (m)	4.12	Hydr. Depth (m)	1.26	4.06	2.59
Conv. Total (m3/s)	4654.5	Conv. (m3/s)	103.7	3724.1	826.7
Length Wtd. (m)	24.71	Wetted Per. (m)	7.94	12.65	

14.76				
Min Ch El (m)	194.82	Shear (N/m2)	6.98	27.57
16.72				
Alpha	1.83	Stream Power (N/m s)	2.34	52.73
10.03				
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	142.50	138.63
177.87				
C & E Loss (m)	0.03	Cum SA (1000 m2)	74.93	21.17
102.81				

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.14

INPUT
Description: Section 46.14 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 77

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.098	2.06	202	3.77	201.783	3.8	201.785	6.14	201.803
8.42	201.79	12.49	201.689	12.69	201.684	17.83	201.529	20.79	201.459
33.23	201.049	35.11	201.034	39.84	201.001	39.85	201.001	39.89	201.001
39.92	201.001	39.96	201.001	40.1	201	53.76	200.745	58.1	200.647
58.57	200.638	64.09	200.501	64.12	200.501	64.22	200.5	71.26	200.142
74.41	200	75.87	199.864	77.75	199.81	88.67	199.239	90.92	199.19
94.02	199.106	98.67	199.004	98.73	199.004	98.82	199.004	98.97	199.004
104.41	199	106.38	198.532	109.25	198	111.6	197.01	111.62	197
111.64	196.992	113.27	196.326	114.07	196	114.61	195.85	116.18	195.444
117.28	195	120.38	194.954	124.47	194.898	126.14	194.877	129.68	194.823
133.94	194.919	135.82	194.961	137.74	195	138.12	195.172	139.11	196
139.82	196.864	139.93	197	140.61	197.763	140.81	197.95	140.88	198
141	198.098	142.31	199	145.61	199.973	145.72	200	159.64	200.564
168.75	200.894	180.93	200.961	188.25	200.988	188.75	200.981	190	200.965
190.01	200.965	192.12	200.994	192.14	200.994	192.16	200.994	192.55	201
208.35	201.2341	216.71	201.358						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	104.41	.08	117.28	.035	137.74	.08	142.31	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
117.28	137.74	37.5	37.5	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
145.61	208.35	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	197.44	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035
0.080				
W.S. Elev (m)	197.44	Reach Len. (m)	37.50	37.50
37.50				
Crit W.S. (m)		Flow Area (m2)	8.58	51.63
3.58				
E.G. Slope (m/m)	0.000050	Area (m2)	8.58	51.63
3.58				
Q Total (m3/s)	20.59	Flow (m3/s)	0.86	19.41

0.32				
Top Width (m)	29.73	Top Width (m)	6.69	20.46
2.58				
Vel Total (m/s)	0.32	Avg. Vel. (m/s)	0.10	0.38
0.09				
Max Chl Dpth (m)	2.61	Hydr. Depth (m)	1.28	2.52
1.39				
Conv. Total (m3/s)	2899.4	Conv. (m3/s)	121.2	2733.6
44.6				
Length Wtd. (m)	37.50	Wetted Per. (m)	7.13	20.46
3.58				
Min Ch El (m)	194.82	Shear (N/m2)	0.59	1.25
0.49				
Alpha	1.28	Stream Power (N/m s)	0.06	0.47
0.04				
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	32.16	56.66
29.03				
C & E Loss (m)	0.05	Cum SA (1000 m2)	33.39	20.76
37.98				

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	199.06	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.09	Wt. n-Val.	0.080	0.035
0.080				
W.S. Elev (m)	198.97	Reach Len. (m)	37.50	37.50
37.50				
Crit W.S. (m)		Flow Area (m2)	22.93	83.00
8.88				
E.G. Slope (m/m)	0.000346	Area (m2)	22.93	83.00
8.88				
Q Total (m3/s)	122.56	Flow (m3/s)	7.63	112.26
2.66				
Top Width (m)	37.73	Top Width (m)	12.74	20.46
4.53				
Vel Total (m/s)	1.07	Avg. Vel. (m/s)	0.33	1.35
0.30				
Max Chl Dpth (m)	4.15	Hydr. Depth (m)	1.80	4.06
1.96				
Conv. Total (m3/s)	6585.2	Conv. (m3/s)	410.2	6031.9
143.1				
Length Wtd. (m)	37.50	Wetted Per. (m)	13.40	20.46
6.07				
Min Ch El (m)	194.82	Shear (N/m2)	5.81	13.78
4.97				
Alpha	1.48	Stream Power (N/m s)	1.94	18.64
1.49				
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	142.03	136.95
177.42				
C & E Loss (m)	0.05	Cum SA (1000 m2)	74.64	20.76
102.62				

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: RIVER-1
REACH: Reach-1 RS: 46.132

INPUT
Description: Section 46.132 - Private Driveway - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 158

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203.031	4.21	203	6.29	202.04	6.39	202	6.47	201.973
9.02	201	11.19	200.218	11.79	200	11.95	199.995	12.11	199.991
13.73	199.942	14.44	199.957	15.58	200	22.02	200.459	23.3	200.5
23.73	200.501	23.84	200.501	23.88	200.501	24.1	200.505	27.21	200.56
39.78	200.546	43.86	200.559	45.36	200.616	45.59	200.618	46.09	200.615
60.3	200.512	60.52	200.5	67.58	200.314	71.78	200.282	75.54	200.281
75.73	200.287	78.77	200	79.96	199.843	80.54	199.765	86.79	199
91.14	198.248	92.76	198	92.82	197.999	92.88	197.999	93.81	197.998
94.59	197.998	95.38	197.998	96.45	197.998	97.49	197.997	103.13	197.995
104.78	197.997	105.78	197.996	106.85	197.997	107.61	198	112.33	198.851
112.89	199	113.63	199	115.71	199.001	116.33	199.001	118.64	199
119.62	198.642	121.42	198	123.03	197.538	125.2	197.319	125.59	197.265
126.04	197.198	126.29	197.179	126.45	197.149	126.85	197.083	127.29	197.085
127.33	197.08	127.37	197.076	127.89	197.013	129.85	197.011	129.95	197.01
130.35	197.01	132.11	197.014	132.3	197.012	133.91	197.011	134.07	197.009
134.24	197.009	134.44	197.009	134.47	197.009	135.58	197.018	136.75	197.007
136.96	197.005	136.98	197.005	137.16	197.005	137.18	197.005	138.6	197.011
138.83	197.009	139.36	197.005	139.64	197.003	139.73	197	140.03	196.913
140.21	196.887	140.28	196.867	140.33	196.854	140.58	196.76	141.61	196.467
141.72	196.455	143.1	196	143.4	195.948	145.84	195	146.14	194.87
146.23	194.823	146.44	194.865	147.11	195	147.76	195.231	149.57	196
150.75	196.979	150.78	197	150.81	197.022	151.68	198	152.7	198.573
153.48	199	153.61	199.01	158.04	199.446	163.24	199.854	164.21	199.935
164.49	199.957	164.51	199.958	165.41	199.996	165.46	199.999	165.53	200
165.55	200.004	165.69	200.013	165.92	200.013	166.1	200.023	167.24	200.039
167.72	200.033	168.11	200.078	168.16	200.077	168.21	200.076	168.33	200.077
170.66	200.113	172.93	200.103	175.92	200.024	175.95	200.023	177.95	200.045
177.96	200.044	177.97	200.043	177.97	200.042	188.98	200.112	192.6	200.049
195.25	200	195.28	200	196.41	200	197.16	200	197.45	200
197.5	200	200.28	200	201.07	200	201.93	200	202.05	200
213.45	200.076	216.09	200.093	218.17	200.105	219.59	200.114	220.81	200.121
221.65	200.128	222.07	200.132	227.76	200.187				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	139.73	.08	145.84	.035	147.11	.08	151.68	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
145.84	147.11	27.5	27.5	27.5	.3	.5

Left Levee Station= 118.64 Elevation= 199

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	197.38	Element	Left OB	Channel	Right OB
Vel Head (m)	0.54	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	196.84	Reach Len. (m)	27.50	27.50	27.50
Crit W.S. (m)	196.84	Flow Area (m2)	4.72	2.45	3.76
E.G. Slope (m/m)	0.010373	Area (m2)	4.72	2.45	3.76
Q Total (m3/s)	20.59	Flow (m3/s)	5.25	10.72	4.62
Top Width (m)	10.22	Top Width (m)	5.47	1.27	3.47
Vel Total (m/s)	1.88	Avg. Vel. (m/s)	1.11	4.38	1.23
Max Chl Dpth (m)	2.02	Hydr. Depth (m)	0.86	1.93	1.08
Conv. Total (m3/s)	202.2	Conv. (m3/s)	51.6	105.2	45.4
Length Wtd. (m)	27.50	Wetted Per. (m)	5.78	1.33	3.97
Min Ch El (m)	194.82	Shear (N/m2)	83.04	187.78	96.36
Alpha	3.00	Stream Power (N/m s)	92.33	822.29	118.32
Frctn Loss (m)	0.06	Cum Volume (1000 m3)	31.91	55.64	28.89
C & E Loss (m)	0.24	Cum SA (1000 m2)	33.16	20.35	37.86

Warning: The energy equation could not be 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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.97	Element	Left OB	Channel	Right OB
Vel Head (m)	0.61	Wt. n-Val.	0.061	0.035	0.080
W.S. Elev (m)	198.35	Reach Len. (m)	27.50	27.50	27.50

Crit W.S. (m)	198.35	Flow Area (m2)	36.11	4.37	10.17
E.G. Slope (m/m)	0.009790	Area (m2)	36.11	4.37	10.17
Q Total (m3/s)	122.56	Flow (m3/s)	76.73	27.32	18.52
Top Width (m)	31.87	Top Width (m)	25.40	1.27	5.19
Vel Total (m/s)	2.42	Avg. Vel. (m/s)	2.12	6.26	1.82
Max Chl Dpth (m)	3.53	Hydr. Depth (m)	1.42	3.44	1.96
Conv. Total (m3/s)	1238.7	Conv. (m3/s)	775.5	276.1	187.1
Length Wtd. (m)	27.50	Wetted Per. (m)	25.90	1.33	6.29
Min Ch El (m)	194.82	Shear (N/m2)	133.89	316.13	155.28
Alpha	2.06	Stream Power (N/m s)	284.46	1978.05	282.66
Frctn Loss (m)	0.07	Cum Volume (1000 m3)	140.93	135.31	177.06
C & E Loss (m)	0.25	Cum SA (1000 m2)	73.92	20.35	102.44

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 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: RIVER-1
REACH: Reach-1 RS: 46.13

INPUT
Description: Section 46.13 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 127

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203.03	.53	203	.96	202.775	2.6	202	4.3	201.009
4.31	201	4.46	200.95	7.15	200	9.26	199.922	13.37	199.838
14.21	199.82	16.49	199.886	21.16	199.987	21.18	200	21.39	200.001
21.4	200.001	21.83	200.002	29.6	200.151	34.56	200.228	35.93	200.238
37.21	200.246	37.34	200.247	39.62	200.26	42.15	200.288	44.35	200.296
46.4	200.303	51.59	200.321	52.9	200.324	54.35	200.328	55.76	200.33

57.13	200.323	58.65	200.312	59.48	200.303	60.41	200.293	60.51	200.291
60.64	200.291	60.78	200.29	60.92	200.29	61.05	200.289	62.88	200.27
65.13	200.241	68.92	200.17	71.75	200.101	75.66	200	75.68	200
76.81	199.771	77.55	199.623	80.95	199	83.24	198.448	85.09	198
86.6	197.995	87.61	197.991	98.22	197.954	101.88	197.965	111.06	198
112.99	198.592	115.45	198.783	118.53	198.292	118.71	198.22	118.81	198.215
119.38	198	122.2	197.044	122.33	197	122.49	196.957	126.05	196
126.98	195.7	127.15	195.657	128.79	195.261	129.74	195.021	129.84	195.018
129.93	195.011	129.96	195.01	130.02	195	131.97	194.859	144.15	194
145.77	193.62	148.15	193	148.36	192.929	148.69	192.82	149.6	192.963
149.87	193	150.14	193.206	150.99	194	151.39	194.702	151.52	195
151.69	195.371	152.08	196	152.24	196.027	152.47	196.039	152.56	196.043
152.62	196.045	152.67	196.044	152.68	196.044	152.79	196.042	152.82	196.041
152.98	196.035	154.35	196.467	155.01	196.685	155.45	196.85	155.58	196.893
155.62	196.908	155.76	196.973	155.82	197	155.89	197.042	157.56	198
161.85	198.688	163.59	199	164.11	199.021	168.85	199.177	171.26	199.182
173.88	199.243	176.15	199.295	177.78	199.33	179.26	199.361	183.65	199.389
188.79	199.423	194.86	199.511	194.9	199.511	201.21	199.575	206.07	199.623
222.21	200	223.15	200.01	223.53	200.01	223.62	200.01	223.66	200.01
224.17	200.01	236.77	200.272						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	119.38	.08	148.15	.035	149.87	.08	157.56	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
148.15	149.87	25	25	.1	.3

Left Levee Station= 115.45 Elevation= 198.783

Blocked Obstructions num= 1

Sta L	Sta R	Elev
171	229	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	195.74	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.06	Wt. n-Val.	0.080	0.035
0.080				
W.S. Elev (m)	195.67	Reach Len. (m)	25.00	25.00
25.00				
Crit W.S. (m)	194.77	Flow Area (m2)	26.30	4.75
3.20				
E.G. Slope (m/m)	0.000918	Area (m2)	26.30	4.75
3.20				
Q Total (m3/s)	20.59	Flow (m3/s)	11.46	7.97
1.17				
Top Width (m)	24.79	Top Width (m)	21.07	1.72
2.01				
Vel Total (m/s)	0.60	Avg. Vel. (m/s)	0.44	1.68
0.36				
Max Chl Dpth (m)	2.85	Hydr. Depth (m)	1.25	2.76
1.59				
Conv. Total (m3/s)	679.6	Conv. (m3/s)	378.2	262.9
38.5				
Length Wtd. (m)	25.00	Wetted Per. (m)	21.31	1.76
3.40				
Min Ch El (m)	192.82	Shear (N/m2)	11.11	24.26
8.48				
Alpha	3.32	Stream Power (N/m s)	4.84	40.67
3.08				
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	31.48	55.54
28.80				

C & E Loss (m)	0.01	Cum SA (1000 m2)	32.80	20.31	37.79

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.50	Element	Left OB	Channel	Right OB
Vel Head (m)	0.12	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	198.38	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)	196.37	Flow Area (m2)	95.68	9.40	18.58
E.G. Slope (m/m)	0.001047	Area (m2)	95.68	9.40	18.58
Q Total (m3/s)	122.56	Flow (m3/s)	84.80	26.54	11.23
Top Width (m)	41.93	Top Width (m)	30.16	1.72	10.05
Vel Total (m/s)	0.99	Avg. Vel. (m/s)	0.89	2.82	0.60
Max Chl Dpth (m)	5.56	Hydr. Depth (m)	3.17	5.47	1.85
Conv. Total (m3/s)	3787.8	Conv. (m3/s)	2620.7	820.1	347.0
Length Wtd. (m)	25.00	Wetted Per. (m)	30.81	1.76	12.08
Min Ch El (m)	192.82	Shear (N/m2)	31.89	54.76	15.79
Alpha	2.34	Stream Power (N/m s)	28.26	154.56	9.54
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	139.11	135.12	176.67
C & E Loss (m)	0.00	Cum SA (1000 m2)	73.16	20.31	102.23

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.122

INPUT
Description: Section 46.122 - Peelar Road - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 153

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203.853	.23	203.855	.93	203.865	1.01	203.866	2.78	203.939
3.03	203.939	3.37	203.951	3.73	203.964	5.01	203.946	5.31	203.936
5.61	203.945	6.98	204	8.21	203.442	9.46	203	9.88	202.784
11.44	202	13.15	201.154	13.44	201	14.01	200.722	15.52	200
17.01	199.481	18.02	199	20.35	198.365	21.48	198.229	22.2	198.229

22.48	198.242	22.55	198.253	23.36	198.361	25.19	198.587
26.16	198.662	26.31	198.67	26.95	198.656	27.03	198.655
28	198.645	29.49	198.666	32.66	198.758	32.85	198.766
33.38	198.788	36.68	199	43.6	199.165	43.64	199.166
44.06	199.173	44.1	199.174	45.22	199.23	45.29	199.233
49.48	199.327	54.88	199.38	58.89	199.448	59.82	199.441
62.67	199.521	66.36	199.453	67.01	199.441	68.92	199.378
69.47	199.357	72.61	199.214	73.37	199.196	73.56	199.181
74.94	199	75.77	198.822	76.04	198.77	77.37	198.575
78.16	198.426	78.34	198.376	78.46	198.351	79.57	198
79.94	197.998	80.59	197.996	83.89	197.984	85.16	197.985
85.23	197.984	85.29	197.984	86.24	197.981	86.6	197.98
86.93	197.981	86.99	197.981	92.12	197.978	92.67	197.975
93.8	197.973	96.51	197.968	109.87	197.327	112.55	197.295
123.04	197.978	123.43	197.979	124.91	197.982	126.71	197.996
126.79	197.996	127.47	198	130.8	198	132.4	198
133.05	198	133.1	198	133.26	198	134.36	198
135.44	198	135.67	198	136.01	198	136.06	198
136.92	198	136.94	198	138.2	197.725	141.43	197
143.11	196.356	143.45	196.246	143.63	196.196	144.35	196
145.45	195.701	148.42	195	151.6	194.377	153.04	194
154.48	193.345	154.54	193.311	155.34	193	155.73	192.919
157.65	192.63	159.49	192.987	159.52	193	159.55	193.013
161.56	194	162.02	194.215	163.58	195	164.59	195.492
165.53	196	165.88	196.23	167.15	197	169.04	197.525
170.01	198	170.48	198.005	171.29	198.01	171.61	198.012
176.33	198.211	181.2	198.381	185.45	198.603	188.51	198.84
190.44	198.995	190.51	199	192.15	199.001	192.24	199.001
192.28	199.001	192.41	199.001	192.81	199.001	194.2	199.001
195.83	199.001	195.94	199.001	196.05	199.001	200.13	199.042
211.06	199.149	222.84	199.423	229.22	199.464	230.38	199.482
231.47	199.497	235.25	199.523	240.57	199.568	242.89	199.629

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	155.34	.035	159.52	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
155.34	159.52	38	38	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	155.42	196.7	F
159.34	242.89	196.7	F

Left Levee Station= 136.92 Elevation= 198

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	195.70	Element	Left OB	Channel	Right OB
Vel Head (m)	0.19	Wt. n-Val.		0.035	
W.S. Elev (m)	195.50	Reach Len. (m)	38.00	38.00	38.00
Crit W.S. (m)	194.21	Flow Area (m2)		10.61	
E.G. Slope (m/m)	0.001248	Area (m2)	9.67	11.27	6.39
Q Total (m3/s)	20.59	Flow (m3/s)		20.59	
Top Width (m)	18.32	Top Width (m)	9.05	4.18	5.09
Vel Total (m/s)	1.94	Avg. Vel. (m/s)		1.94	
Max Chl Dpth (m)	2.87	Hydr. Depth (m)		2.71	
Conv. Total (m3/s)	582.8	Conv. (m3/s)		582.8	
Length Wtd. (m)	38.00	Wetted Per. (m)		3.98	

Min Ch El (m)	192.63	Shear (N/m2)			32.62
Alpha	1.00	Stream Power (N/m s)			63.31
Frctn Loss (m)		Cum Volume (1000 m3)	31.03	55.34	28.68
C & E Loss (m)		Cum SA (1000 m2)	32.42	20.24	37.70

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.47	Element	Left OB	Channel	Right OB
Vel Head (m)	0.16	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	198.31	Reach Len. (m)	38.00	38.00	38.00
Crit W.S. (m)	196.70	Flow Area (m2)	78.09	23.01	30.08
E.G. Slope (m/m)	0.000790	Area (m2)	78.09	23.01	30.08
Q Total (m3/s)	122.56	Flow (m3/s)	44.00	57.01	21.55
Top Width (m)	102.88	Top Width (m)	78.97	4.18	19.73
Vel Total (m/s)	0.93	Avg. Vel. (m/s)	0.56	2.48	0.72
Max Chl Dpth (m)	5.68	Hydr. Depth (m)	0.99	5.50	1.52
Conv. Total (m3/s)	4359.4	Conv. (m3/s)	1564.9	2027.9	766.6
Length Wtd. (m)	38.00	Wetted Per. (m)	79.79	4.25	20.90
Min Ch El (m)	192.63	Shear (N/m2)	7.59	42.00	11.15
Alpha	3.51	Stream Power (N/m s)	4.27	104.06	7.99
Frctn Loss (m)		Cum Volume (1000 m3)	136.94	134.72	176.06
C & E Loss (m)		Cum SA (1000 m2)	71.80	20.24	101.86

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1215

INPUT
Description: Hum 13-3R. Peelar Road Culvert - 3.72 m W x 2.35 m H x 30 m L Corrugated Metal Pipe Arch Culvert. No drawings available. Size

estimated from HEC-2 coding.

HEC-2 to HEC-RAS conversion
January 2004 by Acres included recoding of culvert to HEC-RAS format, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 3
Deck/Roadway Width = 30
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 157

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	198.649		1.52	198.401		2.47	198	
2.8	198		2.85	198		3.5	198	
3.74	198		4.59	198		13.86	198	
15.45	198		15.74	198		17.17	198	
18.02	197.999		19.18	197.875		22.99	197.861	
24.53	197.999		28.09	197.999		28.15	197.999	
28.28	197.999		28.43	197.999		28.64	197.999	
29.19	197.999		31.03	197.999		31.34	197.999	
32.15	197.999		32.89	197.999		34.84	197.999	
34.92	197.999		37.18	197.998		37.71	197.998	
38.66	197.998		41.94	197.997		43.56	197.997	
44.75	197.997		45.96	197.997		46.74	197.997	
49.78	197.996		50.07	197.995		52.53	197.995	
54.64	197.995		55.11	197.995		55.42	197.995	
55.76	197.995		57.94	197.995		59.43	197.994	
60.73	197.994		61.45	197.993		62	197.993	
64.12	197.992		64.22	197.992		64.28	197.992	
65.61	197.989		67.27	197.991		68.33	197.991	
71.97	197.999		72.26	198		73.27	198.017	
76.65	198.059		77.23	198.092		78.18	198.119	
80.03	198.063		81.1	198		81.68	197.998	
81.8	197.997		82.79	197.994		83.16	197.992	
83.96	197.989		86.33	197.985		91.22	197.968	
99.31	197.849		99.61	197.847		100.72	197.846	
105.6	197.845		107.24	197.851		115.83	197.928	
117.78	197.909		118.71	197.903		119.04	197.903	
119.4	197.899		121.59	197.885		122.03	197.885	
124.28	197.863		124.74	197.388		125.47	197.26	
125.59	197.264		125.6	197.264		127.02	197.214	
127.16	197.211		127.78	197.201		139.62	197	
140.18	196.992		140.89	196.988		141.46	196.989	
142	196.987		142.75	196.987		143.84	196.986	
143.94	196.986		150.74	196.962		158.29	196.957	
158.39	196.957		160.98	196.955		164.67	196.924	
165.88	196.912		167.31	196.935		168.65	196.948	
168.79	196.948		168.84	196.949		169.49	196.951	
170.16	196.951		171.53	196.952		172.2	196.956	
172.58	196.955		172.76	196.956		172.87	196.955	
172.93	196.955		174	196.962		174.57	196.956	
175.1	196.959		175.75	196.962		178.58	196.956	
180.14	196.971		182.32	196.983		182.65	196.984	
182.82	196.987		183.42	196.997		183.61	197	
186.18	197.165		192.25	197.667		192.7	197.681	
193.37	197.689		193.89	197.919		194.46	197.92	
195.12	197.925		196.24	197.935		198.9	197.945	
202.32	197.938		208.58	197.985		210.37	197.994	
210.52	198		211.83	198.115		211.87	198.116	
222.47	198.877		223.67	198.88		226.51	198.911	
228.79	198.924		230.7	198.93		232.45	198.935	
237.16	198.966		237.24	198.966		237.7	198.968	

238.12	198.971		239.89	198.978		239.96	198.978				
240.04	198.979		240.24	198.978		240.47	198.98				
240.87	199										

Upstream Bridge Cross Section Data

Station Elevation Data num= 153

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203.853	.23	203.855	.93	203.865	1.01	203.866	2.78	203.939
3.03	203.939	3.37	203.951	3.73	203.964	5.01	203.946	5.31	203.936
5.61	203.945	6.98	204	8.21	203.442	9.46	203	9.88	202.784
11.44	202	13.15	201.154	13.44	201	14.01	200.722	15.52	200
17.01	199.481	18.02	199	20.35	198.365	21.48	198.229	22.2	198.229
22.48	198.242	22.55	198.253	23.36	198.361	25.19	198.587	26.16	198.662
26.31	198.67	26.95	198.656	27.03	198.655	28	198.645	29.49	198.666
32.66	198.758	32.85	198.766	33.38	198.788	36.68	199	43.6	199.165
43.64	199.166	44.06	199.173	44.1	199.174	45.22	199.23	45.29	199.233
49.48	199.327	54.88	199.38	58.89	199.448	59.82	199.441	62.67	199.521
66.36	199.453	67.01	199.441	68.92	199.378	69.47	199.357	72.61	199.214
73.37	199.196	73.56	199.181	74.94	199	75.77	198.822	76.04	198.77
77.37	198.575	78.16	198.426	78.34	198.376	78.46	198.351	79.57	198
79.94	197.998	80.59	197.996	83.89	197.984	85.16	197.985	85.23	197.984
85.29	197.984	86.24	197.981	86.6	197.98	86.93	197.981	86.99	197.981
92.12	197.978	92.67	197.975	93.8	197.973	96.51	197.968	109.87	197.327
112.55	197.295	123.04	197.978	123.43	197.979	124.91	197.982	126.71	197.996
126.79	197.996	127.47	198	130.8	198	132.4	198	133.05	198
133.1	198	133.26	198	134.36	198	135.44	198	135.67	198
136.01	198	136.06	198	136.92	198	136.94	198	138.2	197.725
141.43	197	143.11	196.356	143.45	196.246	143.63	196.196	144.35	196
145.45	195.701	148.42	195	151.6	194.377	153.04	194	154.48	193.345
154.54	193.311	155.34	193	155.73	192.919	157.65	192.63	159.49	192.987
159.52	193	159.55	193.013	161.56	194	162.02	194.215	163.58	195
164.59	195.492	165.53	196	165.88	196.23	167.15	197	169.04	197.525
170.01	198	170.48	198.005	171.29	198.01	171.61	198.012	176.33	198.211
181.2	198.381	185.45	198.603	188.51	198.84	190.44	198.995	190.51	199
192.15	199.001	192.24	199.001	192.28	199.001	192.41	199.001	192.81	199.001
194.2	199.001	195.83	199.001	195.94	199.001	196.05	199.001	200.13	199.042
211.06	199.149	222.84	199.423	229.22	199.464	230.38	199.482	231.47	199.497
235.25	199.523	240.57	199.568	242.89	199.629				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	155.34	.035	159.52	.05

Bank Sta: Left Right Coeff Contr. Expan.

155.34 159.52 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	155.42	196.7	F
159.34	242.89	196.7	F

Left Levee Station= 136.92 Elevation= 198

Downstream Deck/Roadway Coordinates

num= 157

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	198.649		1.52	198.401		2.47	198	
2.8	198		2.85	198		3.5	198	
3.74	198		4.59	198		13.86	198	
15.45	198		15.74	198		17.17	198	
18.02	197.999		19.18	197.875		22.99	197.861	
24.53	197.999		28.09	197.999		28.15	197.999	
28.28	197.999		28.43	197.999		28.64	197.999	
29.19	197.999		31.03	197.999		31.34	197.999	
32.15	197.999		32.89	197.999		34.84	197.999	

34.92	197.999	37.18	197.998	37.71	197.998
38.66	197.998	41.94	197.997	43.56	197.997
44.75	197.997	45.96	197.997	46.74	197.997
49.78	197.996	50.07	197.995	52.53	197.995
54.64	197.995	55.11	197.995	55.42	197.995
55.76	197.995	57.94	197.995	59.43	197.994
60.73	197.994	61.45	197.993	62	197.993
64.12	197.992	64.22	197.992	64.28	197.992
65.61	197.989	67.27	197.991	68.33	197.991
71.97	197.999	72.26	198	73.27	198.017
76.65	198.059	77.23	198.092	78.18	198.119
80.03	198.063	81.1	198	81.68	197.998
81.8	197.997	82.79	197.994	83.16	197.992
83.96	197.989	86.33	197.985	91.22	197.968
99.31	197.849	99.61	197.847	100.72	197.846
105.6	197.845	107.24	197.851	115.83	197.928
117.78	197.909	118.71	197.903	119.04	197.903
119.4	197.899	121.59	197.885	122.03	197.885
124.28	197.863	124.74	197.388	125.47	197.26
125.59	197.264	125.6	197.264	127.02	197.214
127.16	197.211	127.78	197.201	139.62	197
140.18	196.992	140.89	196.988	141.46	196.989
142	196.987	142.75	196.987	143.84	196.986
143.94	196.986	150.74	196.962	158.29	196.957
158.39	196.957	160.98	196.955	164.67	196.924
165.88	196.912	167.31	196.935	168.65	196.948
168.79	196.948	168.84	196.949	169.49	196.951
170.16	196.951	171.53	196.952	172.2	196.956
172.58	196.955	172.76	196.956	172.87	196.955
172.93	196.955	174	196.962	174.57	196.956
175.1	196.959	175.75	196.962	178.58	196.956
180.14	196.971	182.32	196.983	182.65	196.984
182.82	196.987	183.42	196.997	183.61	197
186.18	197.165	192.25	197.667	192.7	197.681
193.37	197.689	193.89	197.919	194.46	197.92
195.12	197.925	196.24	197.935	198.9	197.945
202.32	197.938	208.58	197.985	210.37	197.994
210.52	198	211.83	198.115	211.87	198.116
222.47	198.877	223.67	198.88	226.51	198.911
228.79	198.924	230.7	198.93	232.45	198.935
237.16	198.966	237.24	198.966	237.7	198.968
238.12	198.971	239.89	198.978	239.96	198.978
240.04	198.979	240.24	198.978	240.47	198.98
240.87	199				

Downstream Bridge Cross Section Data
Station Elevation Data num= 193

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.116	.09	201.103	.16	201.086	2.46	201.134	2.97	201
4.37	200.471	4.61	200.366	5.6	200.081	5.84	200	5.96	199.911
5.99	199.908	6.02	199.896	6.07	199.878	6.15	199.835	7.19	199.231
7.68	199	8.13	198.755	8.5	198.631	8.62	198.603	9.26	198.509
9.72	198.47	10.14	198.456	10.23	198.452	10.32	198.448	11.96	198.458
17.93	198.627	18.79	198.683	20.17	198.853	21.45	198.905	21.67	198.908
22.9	198.868	23.49	198.882	23.72	198.871	24.78	198.788	24.93	198.787
28.22	198.487	32.27	198.564	32.41	198.559	32.55	198.553	32.7	198.554
34.55	198.443	36.02	198.405	47.41	198.657	48.15	198.664	48.64	198.668
48.8	198.663	49	198.655	56.83	198.515	56.94	198.515	57.21	198.506
57.47	198.5	59.64	198.564	60.7	198.535	64.04	198.604	69.34	198.85
70.1	198.861	70.3	198.882	70.32	198.882	71.57	199	74.15	199
75.35	199	76.07	199	76.75	199	77.12	199	78.35	199
79.35	199	79.82	199	81.11	199	81.15	199	81.23	199
81.33	199	81.52	199	84.17	199	85.18	199	86.83	199

86.9	199	86.98	199	91.42	199	92.96	199	96.93	199		
97.22	199	97.61	199	98.45	199	98.47	199	98.92	199		
99.22	199	101.39	199	102.08	199	102.12	199	102.14	199		
103.01	199	103.02	199	106.1	198.877	110.03	198.634	110.07	198.631		
110.12	198.629	110.16	198.627	112.11	198.13	112.47	198.125	114.53	198.075		
115.89	198.061	116.61	198.058	116.85	198.054	117.55	198.032	119.12	198		
121.6	197.696	125.61	197.384	130.31	197	130.42	196.977	131.19	196.835		
134.73	196.198	135.06	196.126	135.92	196	136.57	195.912	137.53	195.823		
137.73	195.805	139.61	195.582	141.72	195.474	142.72	195.431	142.83	195.423		
146.3	195	146.85	194.937	146.93	194.922	147.7	194.851	147.91	194.818		
150.84	194.094	151.01	194.05	151.08	194.036	151.14	194.027	151.23	194		
151.49	193.87	152.54	193.041	152.6	193	152.61	192.999	152.94	192.956		
153.08	192.961	153.39	192.841	153.59	192.827	154.01	192	154.29	191.839		
154.31	191.823	154.36	191.841	154.5	191.889	154.85	192	155.27	192.599		
155.43	192.632	156.55	192.853	157.2	192.963	157.33	193	157.71	193.1		
157.92	193.149	158.07	193.188	158.44	193.273	159.2	193.41	159.73	193.495		
161.66	194	161.73	194.024	162.6	194.305	162.76	194.371	163.8	195		
164.8	195.636	165.37	196	166.09	196.414	167	197	168.71	197.76		
169.29	198	170.4	198.016	170.43	198.017	170.57	198.018	172.02	198.031		
174.94	198.052	176.13	198.07	176.47	198.141	179.95	198.291	191.32	198.853		
196.68	199	198.11	199.013	201.12	199.029	202.88	199.024	217.21	199.414		
218.54	199.448	219.63	199.477	219.66	199.478	219.79	199.484	219.93	199.488		
227.87	199.454	235.99	199.769	237.56	199.797	238.2	199.8	238.42	199.808		
238.61	199.813	239.21	199.826	239.73	199.834						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	152.6	.035	157.33	.05

Bank Sta: Left Right Coeff Contr. Expan.
152.6 157.33 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	152.9	196.51	F
156.88	239.73	196.51	F

Left Levee Station= 103.02 Elevation= 199

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	Pipe Arch	2.35	3.72

FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	3	30	.024	.024	0	.9	1

Upstream Elevation = 192.63
Centerline Station = 157.4
Downstream Elevation = 192.37
Centerline Station = 154.9

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	20.59	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	3.64
Q Barrel (m3/s)	20.59	Culv Vel DS (m/s)	4.09
E.G. US. (m)	195.70	Culv Inv El Up (m)	192.63
W.S. US. (m)	195.50	Culv Inv El Dn (m)	192.37
E.G. DS (m)	194.62	Culv Frctn Ls (m)	0.00
W.S. DS (m)	193.92	Culv Exit Loss (m)	0.16
Delta EG (m)	1.08	Culv Entr Loss (m)	0.61
Delta WS (m)	1.58	Q Weir (m3/s)	
E.G. IC (m)	195.55	Weir Sta Lft (m)	
E.G. OC (m)	195.70	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	194.41	Weir Max Depth (m)	
Culv WS Outlet (m)	193.92	Weir Avg Depth (m)	
Culv Nml Depth (m)	1.90	Weir Flow Area (m2)	
Culv Crt Depth (m)	1.53	Min El Weir Flow (m)	196.92

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	10.85	Culv Full Len (m)	30.00
# Barrels	1	Culv Vel US (m/s)	1.62
Q Barrel (m3/s)	10.85	Culv Vel DS (m/s)	1.62
E.G. US. (m)	198.47	Culv Inv El Up (m)	192.63
W.S. US. (m)	198.31	Culv Inv El Dn (m)	192.37
E.G. DS (m)	198.23	Culv Frctn Ls (m)	0.07
W.S. DS (m)	198.14	Culv Exit Loss (m)	0.04
Delta EG (m)	0.24	Culv Entr Loss (m)	0.12
Delta WS (m)	0.17	Q Weir (m3/s)	111.71
E.G. IC (m)	198.34	Weir Sta Lft (m)	19.96
E.G. OC (m)	198.47	Weir Sta Rgt (m)	182.92
Culvert Control	Outlet	Weir Submerg	0.64
Culv WS Inlet (m)	194.98	Weir Max Depth (m)	1.56
Culv WS Outlet (m)	194.72	Weir Avg Depth (m)	0.74
Culv Nml Depth (m)		Weir Flow Area (m2)	80.97
Culv Crt Depth (m)	1.08	Min El Weir Flow (m)	196.92

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.121

INPUT
Description: Section 46.121 - Peelar Road - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 193

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.116	.09	201.103	.16	201.086	2.46	201.134	2.97	201
4.37	200.471	4.61	200.366	5.6	200.081	5.84	200	5.96	199.911
5.99	199.908	6.02	199.896	6.07	199.878	6.15	199.835	7.19	199.231
7.68	199	8.13	198.755	8.5	198.631	8.62	198.603	9.26	198.509
9.72	198.47	10.14	198.456	10.23	198.452	10.32	198.448	11.96	198.458
17.93	198.627	18.79	198.683	20.17	198.853	21.45	198.905	21.67	198.908
22.9	198.868	23.49	198.882	23.72	198.871	24.78	198.788	24.93	198.787
28.22	198.487	32.27	198.564	32.41	198.559	32.55	198.553	32.7	198.554
34.55	198.443	36.02	198.405	47.41	198.657	48.15	198.664	48.64	198.668
48.8	198.663	49	198.655	56.83	198.515	56.94	198.515	57.21	198.506
57.47	198.5	59.64	198.564	60.7	198.535	64.04	198.604	69.34	198.85
70.1	198.861	70.3	198.882	70.32	198.882	71.57	199	74.15	199
75.35	199	76.07	199	76.75	199	77.12	199	78.35	199
79.35	199	79.82	199	81.11	199	81.15	199	81.23	199

81.33	199	81.52	199	84.17	199	85.18	199	86.83	199		
86.9	199	86.98	199	91.42	199	92.96	199	96.93	199		
97.22	199	97.61	199	98.45	199	98.47	199	98.92	199		
99.22	199	101.39	199	102.08	199	102.12	199	102.14	199		
103.01	199	103.02	199	106.1	198.877	110.03	198.634	110.07	198.631		
110.12	198.629	110.16	198.627	112.11	198.13	112.47	198.125	114.53	198.075		
115.89	198.061	116.61	198.058	116.85	198.054	117.55	198.032	119.12	198		
121.6	197.696	125.61	197.384	130.31	197	130.42	196.977	131.19	196.835		
134.73	196.198	135.06	196.126	135.92	196	136.57	195.912	137.53	195.823		
137.73	195.805	139.61	195.582	141.72	195.474	142.72	195.431	142.83	195.423		
146.3	195	146.85	194.937	146.93	194.922	147.7	194.851	147.91	194.818		
150.84	194.094	151.01	194.05	151.08	194.036	151.14	194.027	151.23	194		
151.49	193.87	152.54	193.041	152.6	193	152.61	192.999	152.94	192.956		
153.08	192.961	153.39	192.841	153.59	192.827	154.01	192	154.29	191.839		
154.31	191.823	154.36	191.841	154.5	191.889	154.85	192	155.27	192.599		
155.43	192.632	156.55	192.853	157.2	192.963	157.33	193	157.71	193.1		
157.92	193.149	158.07	193.188	158.44	193.273	159.2	193.41	159.73	193.495		
161.66	194	161.73	194.024	162.6	194.305	162.76	194.371	163.8	195		
164.8	195.636	165.37	196	166.09	196.414	167	197	168.71	197.76		
169.29	198	170.4	198.016	170.43	198.017	170.57	198.018	172.02	198.031		
174.94	198.052	176.13	198.07	176.47	198.141	179.95	198.291	191.32	198.853		
196.68	199	198.11	199.013	201.12	199.029	202.88	199.024	217.21	199.414		
218.54	199.448	219.63	199.477	219.66	199.478	219.79	199.484	219.93	199.488		
227.87	199.454	235.99	199.769	237.56	199.797	238.2	199.8	238.42	199.808		
238.61	199.813	239.21	199.826	239.73	199.834						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	152.6	.035	157.33	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
152.6	157.33	20	20	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	152.9	196.51	F
156.88	239.73	196.51	F

Left Levee Station= 103.02 Elevation= 199

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	194.62	Element	Left OB	Channel	Right OB
Vel Head (m)	0.69	Wt. n-Val.		0.035	
W.S. Elev (m)	193.92	Reach Len. (m)	20.00	20.00	20.00
Crit W.S. (m)	193.92	Flow Area (m2)		5.58	
E.G. Slope (m/m)	0.014163	Area (m2)	0.54	6.30	1.90
Q Total (m3/s)	20.59	Flow (m3/s)		20.59	
Top Width (m)	9.97	Top Width (m)	1.21	4.73	4.03
Vel Total (m/s)	3.69	Avg. Vel. (m/s)		3.69	
Max Chl Dpth (m)	2.10	Hydr. Depth (m)		1.40	
Conv. Total (m3/s)	173.0	Conv. (m3/s)		173.0	
Length Wtd. (m)	20.00	Wetted Per. (m)		4.93	

Min Ch El (m)	191.82	Shear (N/m2)			157.14
Alpha	1.00	Stream Power (N/m s)			580.15
Frctn Loss (m)	0.24	Cum Volume (1000 m3)	31.03	55.08	28.68
C & E Loss (m)	0.15	Cum SA (1000 m2)	32.22	20.07	37.53

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 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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.23	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	198.14	Reach Len. (m)	20.00	20.00	20.00
Crit W.S. (m)	196.51	Flow Area (m2)	68.57	26.25	37.11
E.G. Slope (m/m)	0.000574	Area (m2)	68.57	26.25	37.11
Q Total (m3/s)	122.56	Flow (m3/s)	46.17	49.79	26.60
Top Width (m)	64.38	Top Width (m)	40.52	4.73	19.13
Vel Total (m/s)	0.93	Avg. Vel. (m/s)	0.67	1.90	0.72
Max Chl Dpth (m)	6.32	Hydr. Depth (m)	1.69	5.55	1.94
Conv. Total (m3/s)	5115.7	Conv. (m3/s)	1927.2	2078.2	1110.4
Length Wtd. (m)	20.00	Wetted Per. (m)	41.16	5.69	20.27
Min Ch El (m)	191.82	Shear (N/m2)	9.38	25.96	10.30
Alpha	2.02	Stream Power (N/m s)	6.31	49.24	7.39
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	136.94	131.43	176.06
C & E Loss (m)	0.03	Cum SA (1000 m2)	69.53	20.07	101.12

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: RIVER-1
REACH: Reach-1 RS: 46.12

INPUT
Description: Section 46.12 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 121

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204.017	.64	204	1.57	203.584	2.88	203	4.16	202.234
4.52	202	5.56	201.407	6.37	201	10.22	201	14.03	201
15.11	201.341	17.03	201.774	17.39	201.08	19.08	201.047	20.72	201
24.05	200.087	24.34	200	25.06	199.958	40.15	199.007	40.26	199.007
42.43	199.003	42.76	199.003	45.21	199.27	45.36	199.272	47	199.255
47.99	199.251	57.78	199.012	58.42	199.012	60	199.011	66.24	199
66.68	199	66.83	199	67.45	199	68.32	199	70.6	199
78.32	199	82.38	198.38	85.31	198	86.68	197.459	88	197
88.9	197	89.01	197	89.06	197	89.47	197	90.05	197
90.13	197	90.19	197	92.58	197	93.92	197	95.28	197
98.06	197	98.16	197	98.96	197	104.19	196.364	106.24	196.391
109.27	196	109.29	195.994	109.82	195.992	109.83	195.992	110.07	195.99
110.19	195.988	111.79	195.978	112.9	195.816	112.97	195.809	116.66	195.626
117.36	195.562	117.5	195.552	118.97	195.46	120.07	195.413	121.94	195.336
125.09	195	127.14	194.798	128.66	194.593	128.86	194.565	129.9	194.436
130.12	194.409	133.39	194	134.46	193.993	134.62	193.992	134.65	193.992
134.67	193.992	136.01	193.914	142.87	193.531	143.04	193.525	143.27	193.512
144.35	193.401	148.02	193	149.07	192.548	150.54	192	150.66	191.955
150.99	191.823	151.13	191.883	151.39	192	153.89	192.96	154.01	193
154.32	193.077	156.61	193.626	157.62	193.852	158.11	194	159.55	194.326
162.27	195	164.16	195.858	164.18	195.863	164.2	195.868	164.23	195.877
164.52	196	165.52	196.466	165.69	196.535	166.77	196.945	166.9	197
167	197.043	168.84	198	179.75	198.43	194.54	199	199.89	199.172
218.12	199.701	222.85	199.836	227.56	199.963	228.52	200	228.56	200
228.84	200								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	148.02	.035	154.01	.05

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
148.02 154.01 35 38 40 .1 .3
Left Levee Station= 45.21 Elevation= 199.27

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	193.92	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.40	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (m)	193.51	Reach Len. (m)	35.00	38.00
40.00				
Crit W.S. (m)	193.51	Flow Area (m2)	1.22	6.62
0.55				
E.G. Slope (m/m)	0.009935	Area (m2)	1.22	6.62

0.55					
Q Total (m3/s)	20.59	Flow (m3/s)	0.97	19.19	
0.43					
Top Width (m)	12.93	Top Width (m)	4.80	5.99	
2.14					
Vel Total (m/s)	2.46	Avg. Vel. (m/s)	0.80	2.90	
0.79					
Max Chl Dpth (m)	1.69	Hydr. Depth (m)	0.25	1.10	
0.26					
Conv. Total (m3/s)	206.6	Conv. (m3/s)	9.7	192.5	
4.3					
Length Wtd. (m)	37.95	Wetted Per. (m)	4.83	6.44	
2.20					
Min Ch El (m)	191.82	Shear (N/m2)	24.55	100.14	
24.27					
Alpha	1.31	Stream Power (N/m s)	19.52	290.43	
19.16					
Frctn Loss (m)	0.15	Cum Volume (1000 m3)	31.02	54.95	
28.65					
C & E Loss (m)	0.07	Cum SA (1000 m2)	32.16	19.96	
37.46					

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 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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.19	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	
0.050					
W.S. Elev (m)	198.17	Reach Len. (m)	35.00	38.00	
40.00					
Crit W.S. (m)	194.95	Flow Area (m2)	170.19	34.50	
46.06					
E.G. Slope (m/m)	0.000121	Area (m2)	170.19	34.50	
46.06					
Q Total (m3/s)	122.56	Flow (m3/s)	71.65	33.24	
17.68					
Top Width (m)	89.13	Top Width (m)	64.02	5.99	
19.13					
Vel Total (m/s)	0.49	Avg. Vel. (m/s)	0.42	0.96	
0.38					
Max Chl Dpth (m)	6.35	Hydr. Depth (m)	2.66	5.76	
2.41					
Conv. Total (m3/s)	11128.4	Conv. (m3/s)	6505.3	3018.1	

1605.0					
Length Wtd. (m)	37.26	Wetted Per. (m)	64.42	6.44	
20.03					
Min Ch El (m)	191.82	Shear (N/m2)	3.14	6.37	
2.74					
Alpha	1.58	Stream Power (N/m s)	1.32	6.14	
1.05					
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	134.55	130.82	
175.23					
C & E Loss (m)	0.05	Cum SA (1000 m2)	68.48	19.96	
100.74					

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.

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.11

INPUT
Description: Station 46.11 - Highway 407 - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 157

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204.194	7.42	204	8.35	203.615	9.72	203	10.51	202.654
11.9	202	13.52	201.278	13.79	201.12	14.04	201	14.65	200.732
16.39	200	19.18	199.003	19.19	199	19.21	199	19.73	199
20.17	199	20.27	199	21.54	199.137	21.57	199.136	22.93	199.296
27.45	199.348	31.63	199.351	31.74	199.347	35.8	199.168	40.37	199.056
40.58	199.048	41.65	199	41.8	199	43.05	199	44.74	199
45.85	199	51.4	198.797	51.94	198.785	52.27	198.776	52.69	198.777
53.03	198.784	53.16	198.787	53.2	198.788	53.37	198.79	53.4	198.791
61.25	199	65.25	199	67.89	199	69.57	199	71.3	199
72.99	198.774	81.96	199	82.48	199	82.91	199	87.13	199
87.27	199	89.8	199.348	92.33	199.42	92.43	199.422	92.63	199.428
92.82	199.435	93.33	199.424	96.19	199	96.38	199	96.8	199
96.94	199	97.06	198.997	97.07	198.997	97.08	198.997	97.09	198.997
97.3	198.997	98.11	198.973	108.25	198.335	110.22	198.302	111.36	198.277
114.19	198.195	116.72	198.145	119.02	198.024	119.8	198.022	120.85	198.023
124.59	198.036	124.96	198.033	126.47	198.02	128.17	198.004	128.71	198.001
128.74	198	129.24	197.91	129.28	197.902	129.33	197.895	131.38	197.515
132.26	197.384	132.42	197.378	134.55	197.078	134.78	197.085	136.08	197.005
136.09	197.005	136.2	197	137.94	196.567	140.2	196	140.31	195.965
140.65	195.808	142.27	195.002	142.28	195	142.86	194.747	143.59	194.559
143.95	194.432	145.52	194	147.05	193.476	147.49	193.353	148.41	193
149.22	192.702	149.63	192.585	149.8	192	150	191.725	153.14	191.725
153.57	191.725	156	191.725	156.2	192	156.84	193	157.12	193.11
157.35	193.215	158.69	194	160.15	194.705	160.84	195	161.92	195.417
163.52	196	165.53	196.656	166.54	197	169.15	197.405	171.98	197.769
172.73	197.841	173.74	198	174.74	198.01	174.77	198.01	175.33	198.016
176.17	198.026	176.63	198.028	178.63	198.05	178.89	198.05	193.15	198.522
195.72	198.556	198.31	198.69	202.36	198.883	204.46	199	222.27	199.574
235.58	200	245.55	200.352	249	200.514	250.09	200.573	255.18	200.87

```
  257.13 200.961  257.34 200.963   257.9 200.992  261.45 200.989  261.74  200.99
  264.23 200.975  264.53 200.978  266.78 200.994  266.87     201  268.79 201.048
  272.01 201.138  283.95 201.338

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   149.8    .035   156.2     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         149.8   156.2              235     235     235             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   149.5  200.65       F
   156.5  283.95   200.5       F
Left Levee      Station=   92.82      Elevation= 199.435

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           193.64    Element                Left OB    Channel
Right OB
  Vel Head (m)              0.16    Wt. n-Val.              0.050      0.035
0.050
  W.S. Elev (m)           193.48    Reach Len. (m)         235.00     235.00
235.00
  Crit W.S. (m)           192.75    Flow Area (m2)           0.32      11.17
0.37
  E.G. Slope (m/m)      0.002016    Area (m2)                1.36      11.17
0.88
  Q Total (m3/s)            20.59   Flow (m3/s)              0.16      20.17
0.26
  Top Width (m)             10.76   Top Width (m)            2.76       6.40
1.60
  Vel Total (m/s)            1.74   Avg. Vel. (m/s)          0.51       1.81
0.69
  Max Chl Dpth (m)           1.75   Hydr. Depth (m)          1.05       1.74
1.24
  Conv. Total (m3/s)        458.6   Conv. (m3/s)             3.6       449.3
5.7
  Length Wtd. (m)         235.00    Wetted Per. (m)          0.74       6.68
0.56
  Min Ch El (m)           191.73    Shear (N/m2)             8.37      33.04
13.26
  Alpha                      1.06   Stream Power (N/m s)     4.24      59.70
9.12
  Frctn Loss (m)                    Cum Volume (1000 m3)    30.97      54.61
28.63
  C & E Loss (m)                    Cum SA (1000 m2)        32.03      19.73
37.39



Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #Regional w red'n


  E.G. Elev (m)           198.13    Element                Left OB    Channel
Right OB
  Vel Head (m)              0.49    Wt. n-Val.              0.050      0.035
0.050
  W.S. Elev (m)           197.64    Reach Len. (m)         235.00     235.00
```

235.00					
Crit W.S. (m)	195.01	Flow Area (m2)	1.56	37.83	1.62
E.G. Slope (m/m)	0.001191	Area (m2)	40.24	37.83	28.33
Q Total (m3/s)	122.56	Flow (m3/s)	1.77	118.50	2.29
Top Width (m)	40.33	Top Width (m)	19.12	6.40	14.81
Vel Total (m/s)	2.99	Avg. Vel. (m/s)	1.13	3.13	1.41
Max Chl Dpth (m)	5.92	Hydr. Depth (m)	5.22	5.91	5.41
Conv. Total (m3/s)	3551.8	Conv. (m3/s)	51.4	3434.2	66.3
Length Wtd. (m)	235.00	Wetted Per. (m)	0.74	6.68	0.56
Min Ch El (m)	191.73	Shear (N/m2)	24.55	66.13	34.06
Alpha	1.07	Stream Power (N/m s)	27.80	207.16	47.99
Frctn Loss (m)		Cum Volume (1000 m3)	130.87	129.45	173.74
C & E Loss (m)		Cum SA (1000 m2)	67.03	19.73	100.06

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1015

INPUT
Description: Hum 13-2R. Highway 407 Culvert - 6.0 m W x 4.3 m H x 215 m L Concrete Box Culvert. Drawings by MTO (WP 140-87-08, Sheet 76, 1993) used to code in new culvert not previously coded in HEC-2.

HEC-2 to HEC-RAS conversion January 2004 by Acres
included coding of culvert to HEC-RAS format, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 12
Deck/Roadway Width = 215
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 146

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	204.208		4.75	204.007		4.97	204.007	
5.27	204.006		5.82	204.006		6.46	204.006	
7.86	204.005		8.62	204.005		8.71	204.005	
8.78	204.005		15.85	204.005		16.29	204.005	
17.76	204.004		17.9	204.004		18.19	204.004	
18.94	204.004		19.1	204.004		19.28	204.004	
20.12	204.004		21.34	204.004		21.76	204.004	
23.12	204.003		23.2	204.003		23.24	204.003	
23.33	204.003		23.38	204.003		23.44	204.003	
23.71	204.003		26.02	204.003		26.83	204.003	
28.53	204.003		34.85	204.001		37.83	204	

37.89	204	37.96	204	37.98	204				
38.02	204	43.02	203.56	47.14	203.538				
50.92	203.25	56.58	203.216	56.61	203.216				
56.64	203.216	56.83	203.213	57.93	203.201				
60.55	203.159	62.45	203.15	64.39	203.13				
64.6	203.129	64.76	203.127	69.02	203.102				
72.02	203.093	74.17	203.074	74.23	203.074				
75.29	203.068	75.83	203.062	76.16	203.061				
76.51	203.057	76.78	203.053	83.95	203				
84.95	202.936	85.88	202.932	86.17	202.919				
91.34	202.663	92.19	202.66	93.67	202.607				
93.81	202.601	95.31	202.52	102.69	202.429				
106.82	202.107	109.74	202.092	114.1	202.071				
117.19	202.043	117.24	202.043	117.39	202.042				
117.45	202.041	118.91	202.033	121.76	202				
126.9	201.626	135.34	201.601	138.96	201.498				
146.46	201.017	146.74	201.017	147.02	201.017				
147.32	201.017	148.59	201.016	150.04	201.016				
150.78	201.016	152	201.015	152.08	201.014				
152.54	201.014	153.09	201.014	153.16	201.014				
157.65	201.014	158.63	201.014	159.79	201.014				
159.86	201.014	159.95	201.014	163.62	201.013				
167.46	201.011	171.93	201.294	176.54	201.237				
179.73	201.007	180.03	201.007	180.13	201.007				
182.08	201.007	183.45	201.007	196.02	201.006				
199.93	201.005	200.98	201.005	201.21	201.005				
203.84	201.005	219.13	201.005	223.98	201.005				
224.97	201.005	225.02	201.005	225.67	201.005				
226.17	201.005	226.62	201.005	226.68	201.005				
228.24	201.005	228.93	201.005	238.94	201.006				
244.81	201.005	246.52	201.005	249.44	201.005				
251.75	201.154	255.03	201.173	256.62	201.006				
259.78	201.005	260.65	201.005	262.23	201.005				
262.29	201.005	262.38	201.005	265.7	201.004				
265.92	201.004	266.14	201.004	266.66	201.004				
268.21	201.004	270.47	201.004	270.83	201.004				
271.72	201.005	271.99	201.005	272.99	201.005				
279.13	201.004	279.54	201.004						

Upstream Bridge Cross Section Data
Station Elevation Data num= 157

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204.194	7.42	204	8.35	203.615	9.72	203	10.51	202.654
11.9	202	13.52	201.278	13.79	201.12	14.04	201	14.65	200.732
16.39	200	19.18	199.003	19.19	199	19.21	199	19.73	199
20.17	199	20.27	199	21.54	199.137	21.57	199.136	22.93	199.296
27.45	199.348	31.63	199.351	31.74	199.347	35.8	199.168	40.37	199.056
40.58	199.048	41.65	199	41.8	199	43.05	199	44.74	199
45.85	199	51.4	198.797	51.94	198.785	52.27	198.776	52.69	198.777
53.03	198.784	53.16	198.787	53.2	198.788	53.37	198.79	53.4	198.791
61.25	199	65.25	199	67.89	199	69.57	199	71.3	199
72.99	198.774	81.96	199	82.48	199	82.91	199	87.13	199
87.27	199	89.8	199.348	92.33	199.42	92.43	199.422	92.63	199.428
92.82	199.435	93.33	199.424	96.19	199	96.38	199	96.8	199
96.94	199	97.06	198.997	97.07	198.997	97.08	198.997	97.09	198.997
97.3	198.997	98.11	198.973	108.25	198.335	110.22	198.302	111.36	198.277
114.19	198.195	116.72	198.145	119.02	198.024	119.8	198.022	120.85	198.023
124.59	198.036	124.96	198.033	126.47	198.02	128.17	198.004	128.71	198.001
128.74	198	129.24	197.91	129.28	197.902	129.33	197.895	131.38	197.515
132.26	197.384	132.42	197.378	134.55	197.078	134.78	197.085	136.08	197.005
136.09	197.005	136.2	197	137.94	196.567	140.2	196	140.31	195.965
140.65	195.808	142.27	195.002	142.28	195	142.86	194.747	143.59	194.559
143.95	194.432	145.52	194	147.05	193.476	147.49	193.353	148.41	193

149.22	192.702	149.63	192.585	149.8	192	150	191.725	153.14	191.725		
153.57	191.725	156	191.725	156.2	192	156.84	193	157.12	193.11		
157.35	193.215	158.69	194	160.15	194.705	160.84	195	161.92	195.417		
163.52	196	165.53	196.656	166.54	197	169.15	197.405	171.98	197.769		
172.73	197.841	173.74	198	174.74	198.01	174.77	198.01	175.33	198.016		
176.17	198.026	176.63	198.028	178.63	198.05	178.89	198.05	193.15	198.522		
195.72	198.556	198.31	198.69	202.36	198.883	204.46	199	222.27	199.574		
235.58	200	245.55	200.352	249	200.514	250.09	200.573	255.18	200.87		
257.13	200.961	257.34	200.963	257.9	200.992	261.45	200.989	261.74	200.99		
264.23	200.975	264.53	200.978	266.78	200.994	266.87	201	268.79	201.048		
272.01	201.138	283.95	201.338								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	149.8	.035	156.2	.05

Bank Sta: Left Right Coeff Contr. Expan.

Left	Right		
149.8	156.2	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	149.5	200.65	F
156.5	283.95	200.5	F

Left Levee Station= 92.82 Elevation= 199.435

Downstream Deck/Roadway Coordinates

num= 146

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	204.208		4.75	204.007		4.97	204.007	
5.27	204.006		5.82	204.006		6.46	204.006	
7.86	204.005		8.62	204.005		8.71	204.005	
8.78	204.005		15.85	204.005		16.29	204.005	
17.76	204.004		17.9	204.004		18.19	204.004	
18.94	204.004		19.1	204.004		19.28	204.004	
20.12	204.004		21.34	204.004		21.76	204.004	
23.12	204.003		23.2	204.003		23.24	204.003	
23.33	204.003		23.38	204.003		23.44	204.003	
23.71	204.003		26.02	204.003		26.83	204.003	
28.53	204.003		34.85	204.001		37.83	204	
37.89	204		37.96	204		37.98	204	
38.02	204		43.02	203.56		47.14	203.538	
50.92	203.25		56.58	203.216		56.61	203.216	
56.64	203.216		56.83	203.213		57.93	203.201	
60.55	203.159		62.45	203.15		64.39	203.13	
64.6	203.129		64.76	203.127		69.02	203.102	
72.02	203.093		74.17	203.074		74.23	203.074	
75.29	203.068		75.83	203.062		76.16	203.061	
76.51	203.057		76.78	203.053		83.95	203	
84.95	202.936		85.88	202.932		86.17	202.919	
91.34	202.663		92.19	202.66		93.67	202.607	
93.81	202.601		95.31	202.52		102.69	202.429	
106.82	202.107		109.74	202.092		114.1	202.071	
117.19	202.043		117.24	202.043		117.39	202.042	
117.45	202.041		118.91	202.033		121.76	202	
126.9	201.626		135.34	201.601		138.96	201.498	
146.46	201.017		146.74	201.017		147.02	201.017	
147.32	201.017		148.59	201.016		150.04	201.016	
150.78	201.016		152	201.015		152.08	201.014	
152.54	201.014		153.09	201.014		153.16	201.014	
157.65	201.014		158.63	201.014		159.79	201.014	
159.86	201.014		159.95	201.014		163.62	201.013	
167.46	201.011		171.93	201.294		176.54	201.237	
179.73	201.007		180.03	201.007		180.13	201.007	
182.08	201.007		183.45	201.007		196.02	201.006	

199.93 201.005	200.98 201.005	201.21 201.005
203.84 201.005	219.13 201.005	223.98 201.005
224.97 201.005	225.02 201.005	225.67 201.005
226.17 201.005	226.62 201.005	226.68 201.005
228.24 201.005	228.93 201.005	238.94 201.006
244.81 201.005	246.52 201.005	249.44 201.005
251.75 201.154	255.03 201.173	256.62 201.006
259.78 201.005	260.65 201.005	262.23 201.005
262.29 201.005	262.38 201.005	265.7 201.004
265.92 201.004	266.14 201.004	266.66 201.004
268.21 201.004	270.47 201.004	270.83 201.004
271.72 201.005	271.99 201.005	272.99 201.005
279.13 201.004	279.54 201.004	

Downstream Bridge Cross Section Data

Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.016	1.7	202.008	3.31	202	6.36	201.056	6.55	201
9.56	200.072	9.81	200	10.8	199.702	11.4	199.711	13.91	199.257
20.78	199.071	21.41	199.041	21.73	199.035	22.13	199.012	28.32	199.055
30.43	199.043	30.53	199.043	30.61	199	34.33	198.39	36.83	198
38.26	197.761	38.91	197.735	42.59	197.626	45.28	197.715	49.27	197.928
49.51	197.912	49.64	197.913	50.24	198	54.26	198.904	54.69	199
55.54	199.006	55.6	199.007	56.47	199.015	56.56	199.016	58.01	199.028
58.36	199.031	64.08	199.075	66.11	199.058	71.53	199.016	73.74	199
78.09	198.205	79.43	198	80.3	197.717	82.64	197	84.16	196.504
85.78	196	87.38	195.494	88.82	195	90.55	194.411	91.82	194
93.73	193.361	95.06	193	96.61	192.832	96.99	192.821	97.75	192.766
99.02	192.647	104.34	192.001	104.36	192.001	104.39	192	107.5	192
108	191.6	114	191.6	114.5	192	116.67	192	119.53	192.809
120.23	193	120.93	193.226	123.26	194	125.52	194.789	126.17	195
129.05	195.811	130	196	130.82	196.156	134.81	197	136.27	197.006
139.91	197.009	140.26	197.01	149.58	197.28	159.19	197.543	159.78	197.568
160.61	197.581	161.67	197.609	161.81	197.612	162.94	197.638	163.7	197.652
169.85	197.681	172.35	197.776	174.11	197.816	175.39	197.838	176.32	197.837
176.8	197.835	177.83	197.831	178.38	197.827	178.95	197.822	180.79	197.795
184.91	197.765	186.04	197.738	186.65	197.724	187.33	197.708	192.06	197.647
192.56	197.637	195.08	197.575	199.98	197.49	201.37	197.459	203.14	197.409
207.72	197.255	214.28	197.01	214.52	197	219.09	196.443	220.61	196.279
221.92	196.225	229.69	196.45	231.97	196.372	232.71	196.357	233.41	196.345
235.42	196.321	237.27	196.318	238.24	196.334	239.43	196.362	242.98	196.554
248.74	196.965	250.8	197						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	107.5	.035	114.5	.05

Bank Sta: Left Right Coeff Contr. Expan.

107.5 114.5 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	107.5	200	F
114.5	250.8	200	F

Left Levee Station= 64.08 Elevation= 199.075

Right Levee Station= 175.39 Elevation= 197.838

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	4.3	6

FHWA Chart # 58- Rectangular concrete
FHWA Scale # 2 - Side tapered; More favorable edges
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	12	215	.015	.015	0	.5	1

Upstream Elevation = 191.725
Centerline Station = 153
Downstream Elevation = 191.6
Centerline Station = 111

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	20.59	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	2.24
Q Barrel (m3/s)	20.59	Culv Vel DS (m/s)	3.23
E.G. US. (m)	193.64	Culv Inv El Up (m)	191.73
W.S. US. (m)	193.48	Culv Inv El Dn (m)	191.60
E.G. DS (m)	193.07	Culv Frctn Ls (m)	0.00
W.S. DS (m)	192.59	Culv Exit Loss (m)	0.13
Delta EG (m)	0.57	Culv Entr Loss (m)	0.13
Delta WS (m)	0.89	Q Weir (m3/s)	
E.G. IC (m)	193.62	Weir Sta Lft (m)	
E.G. OC (m)	193.64	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	193.26	Weir Max Depth (m)	
Culv WS Outlet (m)	192.66	Weir Avg Depth (m)	
Culv Nml Depth (m)	1.92	Weir Flow Area (m2)	
Culv Crt Depth (m)	1.06	Min El Weir Flow (m)	201.01

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	122.56	Culv Full Len (m)	119.53
# Barrels	1	Culv Vel US (m/s)	4.75
Q Barrel (m3/s)	122.56	Culv Vel DS (m/s)	5.85
E.G. US. (m)	198.13	Culv Inv El Up (m)	191.73
W.S. US. (m)	197.64	Culv Inv El Dn (m)	191.60
E.G. DS (m)	196.35	Culv Frctn Ls (m)	0.45
W.S. DS (m)	194.78	Culv Exit Loss (m)	0.48
Delta EG (m)	1.78	Culv Entr Loss (m)	0.58
Delta WS (m)	2.86	Q Weir (m3/s)	
E.G. IC (m)	198.26	Weir Sta Lft (m)	
E.G. OC (m)	198.13	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	196.03	Weir Max Depth (m)	
Culv WS Outlet (m)	195.09	Weir Avg Depth (m)	
Culv Nml Depth (m)	4.30	Weir Flow Area (m2)	
Culv Crt Depth (m)	3.49	Min El Weir Flow (m)	201.01

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.
Note: During supercritical analysis, the culvert direct step method went to critical depth. The program then assumed critical depth at the outlet.

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: 46.10

INPUT
Description: Station 46.10 - Highway 407 - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.016	1.7	202.008	3.31	202	6.36	201.056	6.55	201
9.56	200.072	9.81	200	10.8	199.702	11.4	199.711	13.91	199.257
20.78	199.071	21.41	199.041	21.73	199.035	22.13	199.012	28.32	199.055
30.43	199.043	30.53	199.043	30.61	199	34.33	198.39	36.83	198
38.26	197.761	38.91	197.735	42.59	197.626	45.28	197.715	49.27	197.928
49.51	197.912	49.64	197.913	50.24	198	54.26	198.904	54.69	199
55.54	199.006	55.6	199.007	56.47	199.015	56.56	199.016	58.01	199.028
58.36	199.031	64.08	199.075	66.11	199.058	71.53	199.016	73.74	199
78.09	198.205	79.43	198	80.3	197.717	82.64	197	84.16	196.504
85.78	196	87.38	195.494	88.82	195	90.55	194.411	91.82	194
93.73	193.361	95.06	193	96.61	192.832	96.99	192.821	97.75	192.766
99.02	192.647	104.34	192.001	104.36	192.001	104.39	192	107.5	192
108	191.6	114	191.6	114.5	192	116.67	192	119.53	192.809
120.23	193	120.93	193.226	123.26	194	125.52	194.789	126.17	195
129.05	195.811	130	196	130.82	196.156	134.81	197	136.27	197.006
139.91	197.009	140.26	197.01	149.58	197.28	159.19	197.543	159.78	197.568
160.61	197.581	161.67	197.609	161.81	197.612	162.94	197.638	163.7	197.652
169.85	197.681	172.35	197.776	174.11	197.816	175.39	197.838	176.32	197.837
176.8	197.835	177.83	197.831	178.38	197.827	178.95	197.822	180.79	197.795
184.91	197.765	186.04	197.738	186.65	197.724	187.33	197.708	192.06	197.647
192.56	197.637	195.08	197.575	199.98	197.49	201.37	197.459	203.14	197.409
207.72	197.255	214.28	197.01	214.52	197	219.09	196.443	220.61	196.279
221.92	196.225	229.69	196.45	231.97	196.372	232.71	196.357	233.41	196.345
235.42	196.321	237.27	196.318	238.24	196.334	239.43	196.362	242.98	196.554
248.74	196.965	250.8	197						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	107.5	.035	114.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
107.5	114.5	130	200	160	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	107.5	200	F
114.5	250.8	200	F

Left Levee Station= 64.08 Elevation= 199.075
Right Levee Station= 175.39 Elevation= 197.838

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	193.07	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.48	Wt. n-Val.		0.035

W.S. Elev (m)	192.59	Reach Len. (m)	130.00	200.00	160.00
Crit W.S. (m)	192.59	Flow Area (m2)		6.72	
E.G. Slope (m/m)	0.012821	Area (m2)	3.28	6.72	1.89
Q Total (m3/s)	20.59	Flow (m3/s)		20.59	
Top Width (m)	19.24	Top Width (m)	7.99	7.00	4.25
Vel Total (m/s)	3.07	Avg. Vel. (m/s)		3.07	
Max Chl Dpth (m)	0.99	Hydr. Depth (m)		0.96	
Conv. Total (m3/s)	181.8	Conv. (m3/s)		181.8	
Length Wtd. (m)	199.34	Wetted Per. (m)		7.28	
Min Ch El (m)	191.60	Shear (N/m2)		115.98	
Alpha	1.00	Stream Power (N/m s)		355.55	
Frctn Loss (m)	1.06	Cum Volume (1000 m3)	30.97	52.54	28.63
C & E Loss (m)	0.13	Cum SA (1000 m2)	30.77	18.15	36.70

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 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, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	196.35	Element	Left OB	Channel	Right OB
Vel Head (m)	1.57	Wt. n-Val.		0.035	
W.S. Elev (m)	194.78	Reach Len. (m)	130.00	200.00	160.00
Crit W.S. (m)	194.78	Flow Area (m2)		22.09	
E.G. Slope (m/m)	0.008591	Area (m2)	34.85	22.09	18.94

Q Total (m3/s)	122.56	Flow (m3/s)			122.56
Top Width (m)	36.05	Top Width (m)	18.04	7.00	11.00
Vel Total (m/s)	5.55	Avg. Vel. (m/s)			5.55
Max Chl Dpth (m)	3.18	Hydr. Depth (m)			3.16
Conv. Total (m3/s)	1322.3	Conv. (m3/s)			1322.3
Length Wtd. (m)	184.22	Wetted Per. (m)			7.28
Min Ch El (m)	191.60	Shear (N/m2)			255.57
Alpha	1.00	Stream Power (N/m s)			1418.26
Frctn Loss (m)	0.11	Cum Volume (1000 m3)	130.87	122.47	173.74
C & E Loss (m)	0.77	Cum SA (1000 m2)	62.66	18.15	97.02

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, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.09

INPUT
Description: Section 46.09 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	199.5	20	198	60	198	92	191	93	190
95	189	99	189	100	190	102	191	146	192
173	194	210	196	255	197				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	93	.035	100	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
93	100	80	95	125	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	191.07	Element	Left OB	Channel	Right OB
Vel Head (m)	0.22	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	190.85	Reach Len. (m)	80.00	95.00	125.00
Crit W.S. (m)		Flow Area (m2)	0.36	11.45	0.72
E.G. Slope (m/m)	0.003188	Area (m2)	0.36	11.45	0.72
Q Total (m3/s)	24.80	Flow (m3/s)	0.18	24.18	0.43
Top Width (m)	9.55	Top Width (m)	0.85	7.00	1.70
Vel Total (m/s)	1.98	Avg. Vel. (m/s)	0.51	2.11	0.59
Max Chl Dpth (m)	1.85	Hydr. Depth (m)	0.43	1.64	0.43
Conv. Total (m3/s)	439.2	Conv. (m3/s)	3.2	428.3	7.6
Length Wtd. (m)	95.20	Wetted Per. (m)	1.20	7.65	1.90
Min Ch El (m)	189.00	Shear (N/m2)	9.40	46.80	11.89
Alpha	1.11	Stream Power (N/m s)	4.77	98.81	7.05
Frctn Loss (m)	0.21	Cum Volume (1000 m3)	30.73	50.72	28.42
C & E Loss (m)	0.02	Cum SA (1000 m2)	30.19	16.75	36.23

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	194.31	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	194.28	Reach Len. (m)	80.00	95.00	125.00
Crit W.S. (m)		Flow Area (m2)	28.44	35.49	165.48
E.G. Slope (m/m)	0.000218	Area (m2)	28.44	35.49	165.48
Q Total (m3/s)	133.76	Flow (m3/s)	11.93	41.61	80.23
Top Width (m)	101.27	Top Width (m)	16.01	7.00	78.25
Vel Total (m/s)	0.58	Avg. Vel. (m/s)	0.42	1.17	0.48
Max Chl Dpth (m)	5.28	Hydr. Depth (m)	1.78	5.07	2.11
Conv. Total (m3/s)	9065.7	Conv. (m3/s)	808.3	2820.1	5437.3
Length Wtd. (m)	115.54	Wetted Per. (m)	16.78	7.65	78.58
Min Ch El (m)	189.00	Shear (N/m2)	3.62	9.90	

4.50					
Alpha	1.72	Stream Power (N/m s)	1.52	11.61	2.18
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	126.76	116.71	158.99
C & E Loss (m)	0.01	Cum SA (1000 m2)	60.44	16.75	89.88

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: RIVER-1
REACH: Reach-1 RS: 46.082

INPUT
Description: Section 46.082 - Jane Steet - U/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	196	50	195	94	194	116	192	122	189
123	188.7	129	188.7	129.5	189	132	189.5	175	190
192	191	220	192	225	193	267	194	300	195

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	122	.035	129.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
122	129.5	75	75	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	122.5	196.5	F
129.5	300	193.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	190.84	Element	Left OB	Channel	Right OB
Vel Head (m)	0.17	Wt. n-Val.		0.035	
W.S. Elev (m)	190.68	Reach Len. (m)	75.00	75.00	75.00
Crit W.S. (m)	189.80	Flow Area (m2)		13.72	
E.G. Slope (m/m)	0.001663	Area (m2)	2.81	14.60	47.27
Q Total (m3/s)	24.80	Flow (m3/s)		24.80	
Top Width (m)	67.85	Top Width (m)	3.35	7.50	56.99
Vel Total (m/s)	1.81	Avg. Vel. (m/s)		1.81	
Max Chl Dpth (m)	1.98	Hydr. Depth (m)		1.96	
Conv. Total (m3/s)	607.9	Conv. (m3/s)		607.9	

Length Wtd. (m)	75.00	Wetted Per. (m)			7.11
Min Ch El (m)	188.70	Shear (N/m2)			31.50
Alpha	1.00	Stream Power (N/m s)			56.93
Frctn Loss (m)		Cum Volume (1000 m3)	30.61	49.48	25.42
C & E Loss (m)		Cum SA (1000 m2)	30.03	16.06	32.56

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	194.30	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.035	0.050
W.S. Elev (m)	194.29	Reach Len. (m)	75.00	75.00	75.00
Crit W.S. (m)	192.06	Flow Area (m2)		39.01	393.75
E.G. Slope (m/m)	0.000051	Area (m2)	52.93	41.70	393.75
Q Total (m3/s)	133.76	Flow (m3/s)		24.89	108.87
Top Width (m)	195.26	Top Width (m)	40.72	7.50	147.04
Vel Total (m/s)	0.31	Avg. Vel. (m/s)		0.64	0.28
Max Chl Dpth (m)	5.59	Hydr. Depth (m)		5.57	2.68
Conv. Total (m3/s)	18640.6	Conv. (m3/s)		3469.1	15171.5
Length Wtd. (m)	75.00	Wetted Per. (m)		7.11	147.25
Min Ch El (m)	188.70	Shear (N/m2)		2.77	1.35
Alpha	1.44	Stream Power (N/m s)		1.77	0.37
Frctn Loss (m)		Cum Volume (1000 m3)	123.50	113.05	124.03
C & E Loss (m)		Cum SA (1000 m2)	58.18	16.06	75.80

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.0815

INPUT
Description: Hum 13-1R. Jane Street. 6.0 m W x 4.3 m H x 65 m L Concrete Box

Culvert. Previous drawings by Ducan Hopper (1964) are out of date. Culvert modified as part of Highway 407, but no drawings available. Field observations used to update previous HEC-2 coding.

HEC-2 to HEC-RAS conversion January 2004 by Acres
included recoding of culvert to HEC-RAS format, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 65
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 5

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	200		126	196.5		235	193.5	
267	194		300	195				

Upstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	196	50	195	94	194	116	192	122	189
123	188.7	129	188.7	129.5	189	132	189.5	175	190
192	191	220	192	225	193	267	194	300	195

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	122	.035	129.5	.05

Bank Sta: Left Right Coeff Contr. Expan.
122 129.5 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	122.5	196.5	F
129.5	300	193.5	F

Downstream Deck/Roadway Coordinates
num= 5

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	200		126	196.5		235	193.5	
267	194		300	195				

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	196	50	195	94	194	116	192	122	189
123	188.7	129	188.7	129.5	189	132	189.5	175	190
192	191	220	192	225	193	267	194	300	195

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	122	.035	129.5	.08	225	.05

Bank Sta: Left Right Coeff Contr. Expan.
122 129.5 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	122.5	196.5	F
129.5	300	191.8	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 = 193.5

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	4.3	6

FHWA Chart # 58- Rectangular concrete
FHWA Scale # 2 - Side tapered; More favorable edges
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	5	65	.015	.015	0	.5	1

Upstream Elevation = 188.7
Centerline Station = 126
Downstream Elevation = 188.7
Centerline Station = 126

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	24.80	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	2.57
Q Barrel (m3/s)	24.80	Culv Vel DS (m/s)	3.02
E.G. US. (m)	190.84	Culv Inv El Up (m)	188.70
W.S. US. (m)	190.68	Culv Inv El Dn (m)	188.70
E.G. DS (m)	190.42	Culv Frctn Ls (m)	0.00
W.S. DS (m)	190.07	Culv Exit Loss (m)	0.12
Delta EG (m)	0.43	Culv Entr Loss (m)	0.20
Delta WS (m)	0.61	Q Weir (m3/s)	
E.G. IC (m)	190.84	Weir Sta Lft (m)	
E.G. OC (m)	190.81	Weir Sta Rgt (m)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (m)	190.31	Weir Max Depth (m)	
Culv WS Outlet (m)	190.07	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	1.20	Min El Weir Flow (m)	193.50

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	104.27	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	4.54
Q Barrel (m3/s)	104.27	Culv Vel DS (m/s)	5.54
E.G. US. (m)	194.30	Culv Inv El Up (m)	188.70
W.S. US. (m)	194.29	Culv Inv El Dn (m)	188.70
E.G. DS (m)	191.93	Culv Frctn Ls (m)	0.06
W.S. DS (m)	191.80	Culv Exit Loss (m)	1.47
Delta EG (m)	2.37	Culv Entr Loss (m)	0.72
Delta WS (m)	2.49	Q Weir (m3/s)	29.50
E.G. IC (m)	194.30	Weir Sta Lft (m)	205.90
E.G. OC (m)	194.25	Weir Sta Rgt (m)	276.93
Culvert Control	Inlet	Weir Submerg	0.00
Culv WS Inlet (m)	192.53	Weir Max Depth (m)	0.80
Culv WS Outlet (m)	191.83	Weir Avg Depth (m)	0.43
Culv Nml Depth (m)		Weir Flow Area (m2)	30.77
Culv Crt Depth (m)	3.13	Min El Weir Flow (m)	193.50

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.081

INPUT
Description: Section 46.081 - Jane Steet - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	196	50	195	94	194	116	192	122	189
123	188.7	129	188.7	129.5	189	132	189.5	175	190
192	191	220	192	225	193	267	194	300	195

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	122	.035	129.5	.08	225	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
122	129.5	185	175	145	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	122.5	196.5	F
129.5	300	191.8	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	190.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.		0.035	
W.S. Elev (m)	190.07	Reach Len. (m)	185.00	175.00	145.00
Crit W.S. (m)	189.80	Flow Area (m2)		9.46	
E.G. Slope (m/m)	0.005752	Area (m2)	1.14	10.03	15.71
Q Total (m3/s)	24.80	Flow (m3/s)		24.80	
Top Width (m)	56.27	Top Width (m)	2.13	7.50	46.64
Vel Total (m/s)	2.62	Avg. Vel. (m/s)		2.62	
Max Chl Dpth (m)	1.37	Hydr. Depth (m)		1.35	
Conv. Total (m3/s)	326.9	Conv. (m3/s)		326.9	
Length Wtd. (m)	166.20	Wetted Per. (m)		7.11	
Min Ch El (m)	188.70	Shear (N/m2)		75.07	
Alpha	1.00	Stream Power (N/m s)		196.84	
Frctn Loss (m)	1.19	Cum Volume (1000 m3)	30.61	48.52	25.42
C & E Loss (m)	0.11	Cum SA (1000 m2)	29.82	15.50	28.67

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.93	Element	Left OB	Channel	Right OB
Vel Head (m)	0.13	Wt. n-Val.		0.035	0.080
W.S. Elev (m)	191.80	Reach Len. (m)	185.00	175.00	145.00
Crit W.S. (m)	191.80	Flow Area (m2)		21.59	125.59
E.G. Slope (m/m)	0.001613	Area (m2)	7.84	23.03	125.59
Q Total (m3/s)	133.76	Flow (m3/s)		51.97	81.79
Top Width (m)	98.00	Top Width (m)	5.60	7.50	84.90
Vel Total (m/s)	0.91	Avg. Vel. (m/s)		2.41	0.65
Max Chl Dpth (m)	3.10	Hydr. Depth (m)		3.08	1.48
Conv. Total (m3/s)	3330.5	Conv. (m3/s)		1294.0	2036.5
Length Wtd. (m)	155.29	Wetted Per. (m)		7.11	85.00
Min Ch El (m)	188.70	Shear (N/m2)		48.07	23.37
Alpha	3.04	Stream Power (N/m s)		115.71	15.22
Frctn Loss (m)	0.24	Cum Volume (1000 m3)	123.50	106.93	124.03
C & E Loss (m)	0.04	Cum SA (1000 m2)	56.44	15.50	67.10

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1   RS: 46.07

INPUT
Description: Section 46.07 - J.D. Barnes 2003 topo mapping

Section 46.06
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	193	15	190	20	189	24	188	25	188
25	187.7	27	187.7	27	188	30	188	64	189
70	190	102	193	146	193	157	194		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	25	.035	27	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
25	27	95	165	125	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	189.12	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.13	Wt. n-Val.	0.080	0.035
0.080				
W.S. Elev (m)	188.99	Reach Len. (m)	95.00	165.00
125.00				
Crit W.S. (m)		Flow Area (m2)	2.93	2.57
19.49				
E.G. Slope (m/m)	0.009195	Area (m2)	2.93	2.57
19.49				
Q Total (m3/s)	24.80	Flow (m3/s)	2.44	7.00
15.36				
Top Width (m)	43.47	Top Width (m)	4.94	2.00
36.52				
Vel Total (m/s)	0.99	Avg. Vel. (m/s)	0.83	2.72
0.79				
Max Chl Dpth (m)	1.29	Hydr. Depth (m)	0.59	1.29
0.53				
Conv. Total (m3/s)	258.6	Conv. (m3/s)	25.4	73.0
160.2				
Length Wtd. (m)	133.79	Wetted Per. (m)	5.07	2.60
36.54				
Min Ch El (m)	187.70	Shear (N/m2)	52.17	89.20
48.09				
Alpha	2.58	Stream Power (N/m s)	43.42	242.64
37.91				
Frctn Loss (m)	1.22	Cum Volume (1000 m3)	30.23	47.42
22.87				
C & E Loss (m)	0.01	Cum SA (1000 m2)	29.16	14.67
22.64				

Warning: The energy loss was 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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.31	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.06	Wt. n-Val.	0.080	0.035
0.080				
W.S. Elev (m)	191.26	Reach Len. (m)	95.00	165.00
125.00				

Crit W.S. (m)		Flow Area (m2)	27.00	7.11	122.40
E.G. Slope (m/m)	0.001526	Area (m2)	27.00	7.11	122.40
Q Total (m3/s)	133.76	Flow (m3/s)	18.22	15.53	100.02
Top Width (m)	74.67	Top Width (m)	16.28	2.00	56.39
Vel Total (m/s)	0.85	Avg. Vel. (m/s)	0.67	2.18	0.82
Max Chl Dpth (m)	3.56	Hydr. Depth (m)	1.66	3.56	2.17
Conv. Total (m3/s)	3423.9	Conv. (m3/s)	466.3	397.4	2560.2
Length Wtd. (m)	117.48	Wetted Per. (m)	16.62	2.60	56.55
Min Ch El (m)	187.70	Shear (N/m2)	24.31	40.94	32.40
Alpha	1.53	Stream Power (N/m s)	16.40	89.38	26.47
Frctn Loss (m)	0.05	Cum Volume (1000 m3)	120.28	104.29	106.05
C & E Loss (m)	0.01	Cum SA (1000 m2)	54.41	14.67	56.86

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: RIVER-1
REACH: Reach-1 RS: 46.06

INPUT
Description: Section 46.06 - J.D. Barnes 2003 topo mapping
Section 46.06
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	192	25	191	47	190	55	188	114	187
118	186.9	119	186.4	121	186.4	122	186.9	125	187
142	192	187	192	217	192	222	191	255	191
257	192	275	193						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	118	.035	122	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
118	122	130	165	145	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
142	275	192.1	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	187.89	Element	Left OB	Channel	Right OB
Vel Head (m)	0.23	Wt. n-Val.	0.080	0.035	

0.080					
W.S. Elev (m)	187.66	Reach Len. (m)	130.00	165.00	145.00
Crit W.S. (m)	187.66	Flow Area (m2)	15.80	4.55	2.88
E.G. Slope (m/m)	0.008997	Area (m2)	15.80	4.55	2.88
Q Total (m3/s)	24.80	Flow (m3/s)	9.60	12.93	2.27
Top Width (m)	52.35	Top Width (m)	43.09	4.00	5.25
Vel Total (m/s)	1.07	Avg. Vel. (m/s)	0.61	2.84	0.79
Max Chl Dpth (m)	1.26	Hydr. Depth (m)	0.37	1.14	0.55
Conv. Total (m3/s)	261.4	Conv. (m3/s)	101.2	136.3	23.9
Length Wtd. (m)	156.17	Wetted Per. (m)	43.10	4.24	5.35
Min Ch El (m)	186.40	Shear (N/m2)	32.35	94.77	47.56
Alpha	3.88	Stream Power (N/m s)	19.65	269.37	37.36
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	29.34	46.83	21.47
C & E Loss (m)	0.07	Cum SA (1000 m2)	26.88	14.17	20.03

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 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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.25	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	191.23	Reach Len. (m)	130.00	165.00	145.00
Crit W.S. (m)		Flow Area (m2)	271.80	18.82	43.27
E.G. Slope (m/m)	0.000217	Area (m2)	271.80	18.82	51.07
Q Total (m3/s)	133.76	Flow (m3/s)	98.07	21.40	14.29

Top Width (m)	154.77	Top Width (m)	98.77	4.00	52.00
Vel Total (m/s)	0.40	Avg. Vel. (m/s)	0.36	1.14	0.33
Max Chl Dpth (m)	4.83	Hydr. Depth (m)	2.75	4.71	2.49
Conv. Total (m3/s)	9083.5	Conv. (m3/s)	6659.4	1453.4	970.7
Length Wtd. (m)	148.83	Wetted Per. (m)	99.05	4.24	18.00
Min Ch El (m)	186.40	Shear (N/m2)	5.84	9.45	5.11
Alpha	1.96	Stream Power (N/m s)	2.11	10.75	1.69
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	106.09	102.15	95.21
C & E Loss (m)	0.00	Cum SA (1000 m2)	48.95	14.17	50.09

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.05

INPUT
Description: Section 46.05 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	193	30	192	72	191	90	186	93	185
95	184.8	100	184.5	123	184.5	128	184.8	150	189
170	190	190	191	210	192	217	191	260	190
280	190	292	193						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	95	.035	128	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
95	128	70	70	65	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
210	292	192.1	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	187.52	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	187.52	Reach Len. (m)	70.00	70.00	65.00
Crit W.S. (m)	184.93	Flow Area (m2)	15.47	98.20	19.40
E.G. Slope (m/m)	0.000015	Area (m2)	15.47	98.20	

19.40					
Q Total (m3/s)	24.80	Flow (m3/s)	0.96	22.69	
1.15					
Top Width (m)	57.73	Top Width (m)	10.48	33.00	
14.25					
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.06	0.23	
0.06					
Max Chl Dpth (m)	3.02	Hydr. Depth (m)	1.48	2.98	
1.36					
Conv. Total (m3/s)	6342.1	Conv. (m3/s)	245.0	5802.9	
294.2					
Length Wtd. (m)	69.23	Wetted Per. (m)	10.86	33.02	
14.51					
Min Ch El (m)	184.50	Shear (N/m2)	0.21	0.45	
0.20					
Alpha	1.42	Stream Power (N/m s)	0.01	0.10	
0.01					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	27.31	38.36	
19.85					
C & E Loss (m)	0.00	Cum SA (1000 m2)	23.40	11.12	
18.62					

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.24	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	
0.080					
W.S. Elev (m)	191.23	Reach Len. (m)	70.00	70.00	
65.00					
Crit W.S. (m)	185.72	Flow Area (m2)	79.98	220.47	
144.74					
E.G. Slope (m/m)	0.000024	Area (m2)	79.98	220.47	
203.68					
Q Total (m3/s)	133.76	Flow (m3/s)	8.82	110.04	
14.90					
Top Width (m)	201.52	Top Width (m)	32.51	33.00	
136.02					
Vel Total (m/s)	0.30	Avg. Vel. (m/s)	0.11	0.50	
0.10					
Max Chl Dpth (m)	6.73	Hydr. Depth (m)	2.46	6.68	
2.18					
Conv. Total (m3/s)	27150.8	Conv. (m3/s)	1790.8	22336.0	
3024.0					
Length Wtd. (m)	68.38	Wetted Per. (m)	33.36	33.02	
66.98					
Min Ch El (m)	184.50	Shear (N/m2)	0.57	1.59	
0.51					
Alpha	2.29	Stream Power (N/m s)	0.06	0.79	
0.05					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	83.22	82.41	
76.74					
C & E Loss (m)	0.00	Cum SA (1000 m2)	40.42	11.12	
36.45					

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.04

INPUT
Description: Section 46.04 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	192	38	192	65	191	107	190	120	189
126	185	127	184	130	184	131	184.5	135	185
148	189	190	189.5	205	189	220	189	232	192

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	126	.035	131	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
126	131	115	100	70	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
190	232	190	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	187.52	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	187.48	Reach Len. (m)	115.00	100.00	70.00
Crit W.S. (m)	185.46	Flow Area (m2)	4.60	16.64	20.88
E.G. Slope (m/m)	0.000306	Area (m2)	4.60	16.64	20.88
Q Total (m3/s)	24.80	Flow (m3/s)	1.03	17.32	6.44
Top Width (m)	20.77	Top Width (m)	3.72	5.00	12.05
Vel Total (m/s)	0.59	Avg. Vel. (m/s)	0.22	1.04	0.31
Max Chl Dpth (m)	3.48	Hydr. Depth (m)	1.24	3.33	1.73
Conv. Total (m3/s)	1417.3	Conv. (m3/s)	58.7	990.2	368.4
Length Wtd. (m)	98.06	Wetted Per. (m)	4.47	5.53	12.45
Min Ch El (m)	184.00	Shear (N/m2)	3.09	9.03	5.03
Alpha	2.26	Stream Power (N/m s)	0.69	9.40	1.55

Frctn Loss (m)	0.03	Cum Volume (1000 m3)	26.61	34.34	18.54
C & E Loss (m)	0.00	Cum SA (1000 m2)	22.90	9.79	17.76

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.23	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	191.19	Reach Len. (m)	115.00	100.00	70.00
Crit W.S. (m)	187.49	Flow Area (m2)	76.88	35.22	233.69
E.G. Slope (m/m)	0.000190	Area (m2)	76.88	35.22	233.69
Q Total (m3/s)	133.76	Flow (m3/s)	14.46	47.70	71.61
Top Width (m)	169.03	Top Width (m)	66.26	5.00	97.78
Vel Total (m/s)	0.39	Avg. Vel. (m/s)	0.19	1.35	0.31
Max Chl Dpth (m)	7.19	Hydr. Depth (m)	1.16	7.04	2.39
Conv. Total (m3/s)	9694.4	Conv. (m3/s)	1047.8	3457.0	5189.6
Length Wtd. (m)	95.43	Wetted Per. (m)	67.52	5.53	98.69
Min Ch El (m)	184.00	Shear (N/m2)	2.13	11.89	4.42
Alpha	4.73	Stream Power (N/m s)	0.40	16.10	1.35
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	77.73	73.46	62.53
C & E Loss (m)	0.01	Cum SA (1000 m2)	36.96	9.79	28.86

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: RIVER-1
REACH: Reach-1 RS: 46.032

INPUT
Description: Section 46.032 - CNR - U/S Bounding Section - J.D. Barnes 2003

topo mapping
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	191.25	6	191	9.7	190	13.7	189.8	58	189
88.3	188	109.3	185	121.7	184.2	125	184	181.4	182.6
195.4	182.6	209	184	287.6	185	289.7	187	297.1	188
316	189	328	189	334	185.4	350	192		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	125	.035	209	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
125	209	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	182.9	189.8	F
193.9	350	191.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	187.49	Element	Left OB	Channel	Right OB
Vel Head (m)	0.08	Wt. n-Val.		0.035	
W.S. Elev (m)	187.41	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	184.15	Flow Area (m2)		52.87	
E.G. Slope (m/m)	0.000242	Area (m2)	65.97	354.71	240.20
Q Total (m3/s)	66.97	Flow (m3/s)		66.97	
Top Width (m)	208.45	Top Width (m)	32.54	84.00	91.91
Vel Total (m/s)	1.27	Avg. Vel. (m/s)		1.27	
Max Chl Dpth (m)	4.81	Hydr. Depth (m)		4.81	
Conv. Total (m3/s)	4301.8	Conv. (m3/s)		4301.8	
Length Wtd. (m)	50.00	Wetted Per. (m)		11.00	
Min Ch El (m)	182.60	Shear (N/m2)		11.42	
Alpha	1.00	Stream Power (N/m s)		14.47	
Frctn Loss (m)		Cum Volume (1000 m3)	22.55	15.77	9.41
C & E Loss (m)		Cum SA (1000 m2)	20.82	5.34	14.12

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.22	Element	Left OB	Channel	Right OB

Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035
W.S. Elev (m)	191.22	Reach Len. (m)	50.00	50.00
50.00				
Crit W.S. (m)	185.84	Flow Area (m2)	375.67	554.11
E.G. Slope (m/m)	0.000007	Area (m2)	375.67	674.68
709.24				
Q Total (m3/s)	200.64	Flow (m3/s)	26.82	173.83
Top Width (m)	347.26	Top Width (m)	124.16	84.00
139.10				
Vel Total (m/s)	0.22	Avg. Vel. (m/s)	0.07	0.31
Max Chl Dpth (m)	8.62	Hydr. Depth (m)	3.03	8.04
Conv. Total (m3/s)	73340.5	Conv. (m3/s)	9801.9	63538.5
Length Wtd. (m)	50.00	Wetted Per. (m)	124.57	68.92
Min Ch El (m)	182.60	Shear (N/m2)	0.22	0.59
Alpha	1.85	Stream Power (N/m s)	0.02	0.19
Frctn Loss (m)		Cum Volume (1000 m3)	51.71	37.97
29.53				
C & E Loss (m)		Cum SA (1000 m2)	26.01	5.34
20.57				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.0315

INPUT
Description: Hum 13-1RR. CNR Culvert. Twin 3.0 m W x 3.5 m H x 32 m L
Structural Steel Plate Arch Culverts. No drawings available.
Size estimated from HEC-2 coding.

HEC-2 to HEC-RAS conversion
January 2004 by Acres included recoding of culvert to HEC-RAS format, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 13
Deck/Roadway Width = 32
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 10

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	191.2		5	191		8.7	190	
12.7	189.8		16.6	190		25	190.3	
115.5	191		274.1	192		335	192.5	
350	192.65							

Upstream Bridge Cross Section Data
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

```
      0  191.25       6     191     9.7     190    13.7   189.8      58     189
   88.3     188   109.3     185   121.7   184.2     125     184   181.4   182.6
  195.4   182.6     209     184   287.6     185   289.7     187   297.1     188
    316     189     328     189     334   185.4     350     192

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .08     125    .035     209     .08

Bank Sta: Left   Right    Coeff Contr.   Expan.
          125     209             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   182.9   189.8       F
   193.9     350   191.5       F

Downstream  Deck/Roadway Coordinates
    num=      10
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0   191.2               5     191             8.7     190
    12.7   189.8            16.6     190              25   190.3
   115.5     191           274.1     192             335   192.5
     350  192.65

Downstream Bridge Cross Section Data
Station Elevation Data    num=      15
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   191.2       6     191     9.7     190    13.7   189.8      58     189
    88.3     188   109.3     185   121.7   184.2     125     184     170   183.2
     171   182.6     180   182.6     181   183.2     195     184     310     190

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .08     170    .035     181     .08

Bank Sta: Left   Right    Coeff Contr.   Expan.
          170     181             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     170     187       F
     181     310     187       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         =   190.5
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       Ellipse     3.5       3
FHWA Chart # 30- Vertical Ellipse; Concrete
FHWA Scale # 1 - Square edge with headwall
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                13      32     .024     .024        0                   .7
      1
Number of Barrels =  2
Upstream   Elevation =  182.6
```

Centerline Stations
Sta. Sta.
185.4 191.4
Downstream Elevation = 182.6
Centerline Stations
Sta. Sta.
172 178

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	66.97	Culv Full Len (m)	
# Barrels	2	Culv Vel US (m/s)	4.07
Q Barrel (m3/s)	33.49	Culv Vel DS (m/s)	5.02
E.G. US. (m)	187.49	Culv Inv El Up (m)	182.60
W.S. US. (m)	187.41	Culv Inv El Dn (m)	182.60
E.G. DS (m)	184.99	Culv Frctn Ls (m)	0.00
W.S. DS (m)	184.22	Culv Exit Loss (m)	1.53
Delta EG (m)	2.50	Culv Entr Loss (m)	0.59
Delta WS (m)	3.19	Q Weir (m3/s)	
E.G. IC (m)	187.09	Weir Sta Lft (m)	
E.G. OC (m)	187.49	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	186.05	Weir Max Depth (m)	
Culv WS Outlet (m)	185.24	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	2.64	Min El Weir Flow (m)	190.50

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	112.90	Culv Full Len (m)	29.43
# Barrels	2	Culv Vel US (m/s)	6.84
Q Barrel (m3/s)	56.45	Culv Vel DS (m/s)	7.01
E.G. US. (m)	191.22	Culv Inv El Up (m)	182.60
W.S. US. (m)	191.22	Culv Inv El Dn (m)	182.60
E.G. DS (m)	187.51	Culv Frctn Ls (m)	1.06
W.S. DS (m)	185.89	Culv Exit Loss (m)	0.89
Delta EG (m)	3.71	Culv Entr Loss (m)	1.67
Delta WS (m)	5.32	Q Weir (m3/s)	87.74
E.G. IC (m)	191.21	Weir Sta Lft (m)	0.68
E.G. OC (m)	191.22	Weir Sta Rgt (m)	150.71
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	186.10	Weir Max Depth (m)	1.40
Culv WS Outlet (m)	185.89	Weir Avg Depth (m)	0.51
Culv Nml Depth (m)		Weir Flow Area (m2)	76.97
Culv Crt Depth (m)	3.25	Min El Weir Flow (m)	190.50

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.031

INPUT
Description: Section 46.031 - CNR - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	191.2	6	191	9.7	190	13.7	189.8	58	189
88.3	188	109.3	185	121.7	184.2	125	184	170	183.2
171	182.6	180	182.6	181	183.2	195	184	310	190

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	170	.035	181	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
170	181	90	110	75	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	170	187	F
181	310	187	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	184.99	Element	Left OB	Channel	Right OB
Vel Head (m)	0.77	Wt. n-Val.		0.035	
W.S. Elev (m)	184.22	Reach Len. (m)	90.00	110.00	75.00
Crit W.S. (m)	184.22	Flow Area (m2)		17.18	
E.G. Slope (m/m)	0.010691	Area (m2)	28.11	17.18	9.07
Q Total (m3/s)	66.97	Flow (m3/s)		66.97	
Top Width (m)	77.69	Top Width (m)	48.55	11.00	18.14
Vel Total (m/s)	3.90	Avg. Vel. (m/s)		3.90	
Max Chl Dpth (m)	1.62	Hydr. Depth (m)		1.56	
Conv. Total (m3/s)	647.7	Conv. (m3/s)		647.7	
Length Wtd. (m)	102.88	Wetted Per. (m)		11.33	
Min Ch El (m)	182.60	Shear (N/m2)		158.94	
Alpha	1.00	Stream Power (N/m s)		619.61	
Frctn Loss (m)	0.24	Cum Volume (1000 m3)	22.55	6.82	9.41
C & E Loss (m)	0.37	Cum SA (1000 m2)	18.79	2.97	11.37

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 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, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	187.51	Element	Left OB	Channel	Right OB
Vel Head (m)	1.62	Wt. n-Val.		0.035	
W.S. Elev (m)	185.89	Reach Len. (m)	90.00	110.00	75.00
Crit W.S. (m)	185.89	Flow Area (m2)		35.64	
E.G. Slope (m/m)	0.008428	Area (m2)	128.00	35.64	66.50
Q Total (m3/s)	200.64	Flow (m3/s)		200.64	
Top Width (m)	128.26	Top Width (m)	66.96	11.00	50.30
Vel Total (m/s)	5.63	Avg. Vel. (m/s)		5.63	
Max Chl Dpth (m)	3.29	Hydr. Depth (m)		3.24	
Conv. Total (m3/s)	2185.5	Conv. (m3/s)		2185.5	
Length Wtd. (m)	101.96	Wetted Per. (m)		11.33	
Min Ch El (m)	182.60	Shear (N/m2)		259.91	
Alpha	1.00	Stream Power (N/m s)		1463.36	
Frctn Loss (m)	0.23	Cum Volume (1000 m3)	51.71	11.26	29.53
C & E Loss (m)	0.78	Cum SA (1000 m2)	21.23	2.97	15.83

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 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, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.03

INPUT
Description: Section 46.03 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	189	17	183	34	182.3	35	182	39	182
40	182.3	43	183	88	182.5	89	181.5	93	181.5
94	182.5	96	183	100	184	103	185	138	187
187	188								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	88	.035	94	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
88	94	185	205	150	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	43	183.1	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	184.04	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	184.00	Reach Len. (m)	185.00	205.00	150.00
Crit W.S. (m)	183.28	Flow Area (m2)	96.30	14.00	4.49
E.G. Slope (m/m)	0.000995	Area (m2)	96.30	14.00	4.49
Q Total (m3/s)	66.97	Flow (m3/s)	45.19	20.35	1.43
Top Width (m)	85.83	Top Width (m)	73.83	6.00	6.00
Vel Total (m/s)	0.58	Avg. Vel. (m/s)	0.47	1.45	0.32
Max Chl Dpth (m)	2.50	Hydr. Depth (m)	1.30	2.33	0.75
Conv. Total (m3/s)	2122.9	Conv. (m3/s)	1432.3	645.2	45.4
Length Wtd. (m)	184.84	Wetted Per. (m)	74.19	6.83	6.18
Min Ch El (m)	181.50	Shear (N/m2)	12.67	20.00	7.10
Alpha	2.33	Stream Power (N/m s)	5.94	29.09	2.26
Frctn Loss (m)	0.32	Cum Volume (1000 m3)	16.95	5.11	8.90
C & E Loss (m)	0.01	Cum SA (1000 m2)	13.29	2.03	10.47

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	185.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	185.39	Reach Len. (m)	185.00	205.00	150.00
Crit W.S. (m)	183.85	Flow Area (m2)	201.48	22.32	16.79
E.G. Slope (m/m)	0.000999	Area (m2)	201.48	22.32	16.79
Q Total (m3/s)	200.64	Flow (m3/s)	149.42	44.40	6.81
Top Width (m)	99.53	Top Width (m)	77.76	6.00	15.77
Vel Total (m/s)	0.83	Avg. Vel. (m/s)	0.74	1.99	0.41
Max Chl Dpth (m)	3.89	Hydr. Depth (m)	2.59	3.72	1.06
Conv. Total (m3/s)	6347.1	Conv. (m3/s)	4726.9	1404.7	215.6
Length Wtd. (m)	181.78	Wetted Per. (m)	78.36	6.83	16.13
Min Ch El (m)	181.50	Shear (N/m2)	25.20	32.03	10.20
Alpha	1.86	Stream Power (N/m s)	18.69	63.72	4.14
Frctn Loss (m)	0.29	Cum Volume (1000 m3)	36.88	8.07	26.40
C & E Loss (m)	0.01	Cum SA (1000 m2)	14.72	2.03	13.35

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: RIVER-1
REACH: Reach-1 RS: 46.02

INPUT
Description: Section 46.02 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	189	18	183	41	182	44	181.7	44	181
46	181	47	181.7	50	182	70	183	78	185
90	186	120	187	150	188				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	44	.035	47	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
44	47	110	120	110	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	183.71	Element	Left OB	Channel	Right OB
Vel Head (m)	0.13	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	183.57	Reach Len. (m)	110.00	120.00	110.00
Crit W.S. (m)		Flow Area (m2)	30.30	7.36	27.25
E.G. Slope (m/m)	0.003860	Area (m2)	30.30	7.36	27.25
Q Total (m3/s)	66.97	Flow (m3/s)	24.89	19.90	22.18
Top Width (m)	56.00	Top Width (m)	27.71	3.00	25.29
Vel Total (m/s)	1.03	Avg. Vel. (m/s)	0.82	2.70	0.81
Max Chl Dpth (m)	2.57	Hydr. Depth (m)	1.09	2.45	1.08
Conv. Total (m3/s)	1077.9	Conv. (m3/s)	400.7	320.3	356.9
Length Wtd. (m)	113.76	Wetted Per. (m)	27.84	3.92	25.40
Min Ch El (m)	181.00	Shear (N/m2)	41.19	71.11	40.62
Alpha	2.48	Stream Power (N/m s)	33.85	192.16	33.06
Frctn Loss (m)	0.34	Cum Volume (1000 m3)	5.24	2.92	6.52
C & E Loss (m)	0.00	Cum SA (1000 m2)	3.89	1.11	8.12

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	185.15	Element	Left OB	Channel	Right OB
Vel Head (m)	0.16	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	184.99	Reach Len. (m)	110.00	120.00	110.00
Crit W.S. (m)		Flow Area (m2)	72.73	11.63	67.24
E.G. Slope (m/m)	0.003026	Area (m2)	72.73	11.63	67.24
Q Total (m3/s)	200.64	Flow (m3/s)	85.86	37.73	77.05
Top Width (m)	65.95	Top Width (m)	31.98	3.00	30.97
Vel Total (m/s)	1.32	Avg. Vel. (m/s)	1.18	3.24	1.15
Max Chl Dpth (m)	3.99	Hydr. Depth (m)	2.27	3.88	2.17
Conv. Total (m3/s)	3647.3	Conv. (m3/s)	1560.7	685.9	1400.7

Length Wtd. (m)	112.32	Wetted Per. (m)	32.34	3.92	31.26
Min Ch El (m)	181.00	Shear (N/m2)	66.75	88.03	63.84
Alpha	1.76	Stream Power (N/m s)	78.79	285.62	73.15
Frctn Loss (m)	0.25	Cum Volume (1000 m3)	11.52	4.59	20.10
C & E Loss (m)	0.01	Cum SA (1000 m2)	4.57	1.11	9.85

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.01

INPUT
Description: Section 46.01 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	189	14	188	20	182	33	181	34	180.4
37	180.4	38	182	87	183	98	185	106	186
126	187	180	188						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	33	.035	38	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
33	38	95	105	95	.1 .3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	183.36	Element	Left OB	Channel	Right OB
Vel Head (m)	0.14	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	183.22	Reach Len. (m)	95.00	105.00	95.00
Crit W.S. (m)		Flow Area (m2)	23.16	13.02	35.59
E.G. Slope (m/m)	0.002412	Area (m2)	23.16	13.02	35.59
Q Total (m3/s)	66.97	Flow (m3/s)	19.18	30.43	17.36
Top Width (m)	69.45	Top Width (m)	14.22	5.00	50.23
Vel Total (m/s)	0.93	Avg. Vel. (m/s)	0.83	2.34	0.49
Max Chl Dpth (m)	2.82	Hydr. Depth (m)	1.63	2.60	0.71
Conv. Total (m3/s)	1363.7	Conv. (m3/s)	390.6	619.7	353.4
Length Wtd. (m)	100.25	Wetted Per. (m)	14.77	6.05	50.26
Min Ch El (m)	180.40	Shear (N/m2)	37.08	50.86	16.75
Alpha	3.15	Stream Power (N/m s)	30.72	118.91	8.17

Frctn Loss (m)	0.19	Cum Volume (1000 m3)	2.30	1.70	3.06
C & E Loss (m)	0.00	Cum SA (1000 m2)	1.59	0.63	3.97

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	184.89	Element	Left OB	Channel	Right OB
Vel Head (m)	0.13	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	184.76	Reach Len. (m)	95.00	105.00	95.00
Crit W.S. (m)		Flow Area (m2)	46.23	20.71	119.40
E.G. Slope (m/m)	0.001702	Area (m2)	46.23	20.71	119.40
Q Total (m3/s)	200.64	Flow (m3/s)	46.54	55.43	98.67
Top Width (m)	79.46	Top Width (m)	15.76	5.00	58.69
Vel Total (m/s)	1.08	Avg. Vel. (m/s)	1.01	2.68	0.83
Max Chl Dpth (m)	4.36	Hydr. Depth (m)	2.93	4.14	2.03
Conv. Total (m3/s)	4863.7	Conv. (m3/s)	1128.2	1343.8	2391.7
Length Wtd. (m)	98.47	Wetted Per. (m)	16.95	6.05	58.86
Min Ch El (m)	180.40	Shear (N/m2)	45.53	57.11	33.85
Alpha	2.20	Stream Power (N/m s)	45.84	152.85	27.97
Frctn Loss (m)	0.16	Cum Volume (1000 m3)	4.97	2.65	9.84
C & E Loss (m)	0.01	Cum SA (1000 m2)	1.94	0.63	4.92

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.00

INPUT
Description: Section 46.00 - J.D. Barnes 2003 topo mapping (This section location corresponds to D/S HEC-RAS model section 475.53)

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	188	20	187	40	182	55	181	57	180
60	180	62	181	73	182	95	183	103	184
110	185	123	187	180	187				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	55	.035	62	.08

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

55 62 0 0 0 .1 .3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	183.18	Element	Left OB	Channel	Right OB
Vel Head (m)	0.14	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	183.04	Reach Len. (m)			
Crit W.S. (m)	182.26	Flow Area (m2)	25.26	19.28	28.83
E.G. Slope (m/m)	0.001480	Area (m2)	25.26	19.28	28.83
Q Total (m3/s)	66.97	Flow (m3/s)	14.53	39.87	12.57
Top Width (m)	59.48	Top Width (m)	19.16	7.00	33.32
Vel Total (m/s)	0.91	Avg. Vel. (m/s)	0.58	2.07	0.44
Max Chl Dpth (m)	3.04	Hydr. Depth (m)	1.32	2.75	0.87
Conv. Total (m3/s)	1740.6	Conv. (m3/s)	377.6	1036.3	326.7
Length Wtd. (m)		Wetted Per. (m)	19.32	7.47	33.39
Min Ch El (m)	180.00	Shear (N/m2)	18.98	37.46	12.53
Alpha	3.19	Stream Power (N/m s)	10.92	77.47	5.47
Frctn Loss (m)		Cum Volume (1000 m3)			
C & E Loss (m)		Cum SA (1000 m2)			

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	184.73	Element	Left OB	Channel	Right OB
Vel Head (m)	0.19	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	184.54	Reach Len. (m)			
Crit W.S. (m)	183.38	Flow Area (m2)	58.50	29.78	87.66
E.G. Slope (m/m)	0.001535	Area (m2)	58.50	29.78	87.66
Q Total (m3/s)	200.64	Flow (m3/s)	49.83	83.80	67.01
Top Width (m)	76.94	Top Width (m)	25.16	7.00	44.78
Vel Total (m/s)	1.14	Avg. Vel. (m/s)	0.85	2.81	0.76
Max Chl Dpth (m)	4.54	Hydr. Depth (m)	2.33	4.25	1.96
Conv. Total (m3/s)	5120.9	Conv. (m3/s)	1271.8	2138.8	1710.3
Length Wtd. (m)		Wetted Per. (m)	25.51	7.47	44.95

Min Ch El (m)	180.00	Shear (N/m2)	34.53	60.00	29.36
Alpha	2.83	Stream Power (N/m s)	29.41	168.84	22.44
Frctn Loss (m)		Cum Volume (1000 m3)			
C & E Loss (m)		Cum SA (1000 m2)			

SUMMARY OF MANNING'S N VALUES

River:RIVER-1

Reach	River Sta.	n1	n2	n3	n4	n5	n6	n7
Reach-1	46.45	.05	.035	.08				
Reach-1	46.44	.05	.035	.05				
Reach-1	46.43	.05	.08	.035	.08	.05		
Reach-1	46.42	.05	.08	.035	.08	.05		
Reach-1	46.413	.05	.08	.035	.08	.05		
Reach-1	46.4125	Inl Struct						
Reach-1	46.412	.05	.08	.035	.08	.05		
Reach-1	46.4115	Culvert						
Reach-1	46.411	.05	.08	.035	.08	.05		
Reach-1	46.41	.05	.08	.035	.08	.035	.08	.05
Reach-1	46.402	.05	.08	.035	.08	.05		
Reach-1	46.4015	Culvert						
Reach-1	46.401	.05	.08	.035	.08	.05		
Reach-1	46.392	.05	.025	.05	.08	.035	.08	.05
Reach-1	46.3915	Mult Open						
Reach-1	46.391	.05	.025	.05	.08	.05		
Reach-1	46.39	.05	.025	.05	.08	.035	.08	.05
Reach-1	46.382	.025	.08	.035	.08	.05		
Reach-1	46.3815	Culvert						
Reach-1	46.381	.025	.05	.08	.035	.08	.05	
Reach-1	46.36	.025	.05	.08	.035	.08		

.05
Reach-1 46.35 .025 .05 .08 .035 .08
.05
Reach-1 46.34 .025 .05 .08 .035 .08
.05
Reach-1 46.33 .05 .08 .035 .08 .05

Reach-1 46.322 .05 .08 .035 .08 .05

Reach-1 46.3215 Culvert

Reach-1 46.321 .05 .08 .035 .08 .05

Reach-1 46.32 .05 .08 .035 .08 .05

Reach-1 46.312 .05 .08 .035 .08 .05

Reach-1 46.3115 Culvert

Reach-1 46.311 .05 .08 .035 .08 .05

Reach-1 46.31 .05 .08 .035 .08 .05

Reach-1 46.30 .05 .08 .035 .08 .025
.05
Reach-1 46.292 .05 .08 .035 .08 .05

Reach-1 46.2915 Culvert

Reach-1 46.291 .05 .08 .035 .08 .05

Reach-1 46.29 .05 .08 .035 .08 .05

Reach-1 46.282 .05 .08 .035 .08 .05
.025 .05
Reach-1 46.2815 Culvert

Reach-1 46.281 .05 .08 .035 .08 .05
.025 .05
Reach-1 46.28 .05 .08 .035 .08 .05
.025 .05
Reach-1 46.274 .05 .08 .035 .08 .05

Reach-1 46.2735 Bridge

Reach-1 46.273 .05 .08 .035 .08 .05

Reach-1 46.272 .05 .08 .035 .08 .05

Reach-1 46.2715 Culvert

Reach-1 46.271 .05 .05 .08 .035 .08
.05
Reach-1 46.27 .08 .035 .08

Reach-1 46.26 .05 .08 .035 .08 .05

Reach-1 46.25 .05 .08 .035 .08 .05

Reach-1 46.24 .05 .08 .035 .08 .05

Reach-1 46.2375 .05 .08 .035 .08 .05

Reach-1	46.235	Bridge				
Reach-1	46.2325	.05	.08	.035	.08	.05
Reach-1	46.23	.05	.08	.035	.08	.05
Reach-1	46.22	.08	.035	.08	.035	.05
Reach-1	46.214	.05	.035	.08		
Reach-1	46.2135	Inl Struct				
Reach-1	46.213	.05	.035	.08		
Reach-1	46.212	.05	.035	.08		
Reach-1	46.2115	Culvert				
Reach-1	46.211	.05	.035	.08		
Reach-1	46.21	.05	.035	.05		
Reach-1	46.202	.05	.035	.05		
Reach-1	46.2015	Culvert				
Reach-1	46.201	.05	.035	.05		
Reach-1	46.192	.05	.035	.05		
Reach-1	46.1915	Culvert				
Reach-1	46.191	.05	.035	.05		
Reach-1	46.19	.05	.025	.05	.035	.05
Reach-1	46.182	.05	.025	.05	.035	.05
Reach-1	46.1815	Culvert				
Reach-1	46.181	.05	.025	.05	.035	.05
Reach-1	46.18	.05	.035	.05		
Reach-1	46.172	.05	.035	.05		
Reach-1	46.1715	Culvert				
Reach-1	46.171	.05	.035	.05	.025	
Reach-1	46.17	.05	.035	.05	.025	
Reach-1	46.162	.05	.035	.05		
Reach-1	46.1615	Culvert				
Reach-1	46.161	.05	.035	.05		
Reach-1	46.15	.05	.08	.035	.08	.025
Reach-1	46.142	.05	.08	.035	.08	.025
Reach-1	46.1415	Culvert				

Reach-1	46.141		.05	.08	.035	.08	.025
Reach-1	46.14		.05	.08	.035	.08	.025
Reach-1	46.132		.05	.08	.035	.08	.05
Reach-1	46.13		.05	.08	.035	.08	.05
Reach-1	46.122		.05	.035	.05		
Reach-1	46.1215	Culvert					
Reach-1	46.121		.05	.035	.05		
Reach-1	46.12		.05	.035	.05		
Reach-1	46.11		.05	.035	.05		
Reach-1	46.1015	Culvert					
Reach-1	46.10		.05	.035	.05		
Reach-1	46.09		.05	.035	.05		
Reach-1	46.082		.05	.035	.05		
Reach-1	46.0815	Culvert					
Reach-1	46.081		.08	.035	.08	.05	
Reach-1	46.07		.08	.035	.08		
Reach-1	46.06		.08	.035	.08		
Reach-1	46.05		.08	.035	.08		
Reach-1	46.04		.08	.035	.08		
Reach-1	46.032		.08	.035	.08		
Reach-1	46.0315	Culvert					
Reach-1	46.031		.08	.035	.08		
Reach-1	46.03		.08	.035	.08		
Reach-1	46.02		.08	.035	.08		
Reach-1	46.01		.08	.035	.08		
Reach-1	46.00		.08	.035	.08		

SUMMARY OF REACH LENGTHS

River: RIVER-1

Reach	River Sta.	Left	Channel	Right

Reach-1	46.45		180	180	170
Reach-1	46.44		130	130	125
Reach-1	46.43		100	100	95
Reach-1	46.42		295	240	190
Reach-1	46.413		5	5	5
Reach-1	46.4125	Inl Struct			
Reach-1	46.412		45	45	45
Reach-1	46.4115	Culvert			
Reach-1	46.411		80	80	90
Reach-1	46.41		140	140	120
Reach-1	46.402		100	100	100
Reach-1	46.4015	Culvert			
Reach-1	46.401		80	95	100
Reach-1	46.392		70	70	70
Reach-1	46.3915	Mult Open			
Reach-1	46.391		45	35	25
Reach-1	46.39		50	35	25
Reach-1	46.382		45	45	45
Reach-1	46.3815	Culvert			
Reach-1	46.381		260	275	290
Reach-1	46.36		150	150	150
Reach-1	46.35		120	120	120
Reach-1	46.34		225	205	190
Reach-1	46.33		130	130	130
Reach-1	46.322		50	50	50
Reach-1	46.3215	Culvert			
Reach-1	46.321		50	50	50
Reach-1	46.32		110	110	110
Reach-1	46.312		60	60	60
Reach-1	46.3115	Culvert			
Reach-1	46.311		150	150	150
Reach-1	46.31		150	150	150
Reach-1	46.30		110	110	110
Reach-1	46.292		55	55	55
Reach-1	46.2915	Culvert			
Reach-1	46.291		145	150	155
Reach-1	46.29		135	145	150
Reach-1	46.282		50	50	50
Reach-1	46.2815	Culvert			
Reach-1	46.281		40	40	40
Reach-1	46.28		50	50	50
Reach-1	46.274		1	1	1
Reach-1	46.2735	Bridge			
Reach-1	46.273		4	4	4
Reach-1	46.272		100	80	60
Reach-1	46.2715	Culvert			
Reach-1	46.271		55	60	70
Reach-1	46.27		100	110	120
Reach-1	46.26		115	120	120
Reach-1	46.25		140	130	125
Reach-1	46.24		54	51	45
Reach-1	46.2375		30	30	30
Reach-1	46.235	Bridge			
Reach-1	46.2325		94	94	94
Reach-1	46.23		101	95	89
Reach-1	46.22		125	140	115
Reach-1	46.214		1	1	1
Reach-1	46.2135	Inl Struct			
Reach-1	46.213		15	15	15
Reach-1	46.212		55	45	10
Reach-1	46.2115	Culvert			
Reach-1	46.211		10	10	10

Reach-1	46.21	30	30	30
Reach-1	46.202	70	70	70
Reach-1	46.2015	Culvert		
Reach-1	46.201	20	25	30
Reach-1	46.192	25	25	25
Reach-1	46.1915	Culvert		
Reach-1	46.191	50	50	50
Reach-1	46.19	45	45	45
Reach-1	46.182	30	30	30
Reach-1	46.1815	Culvert		
Reach-1	46.181	10	10	10
Reach-1	46.18	25	25	25
Reach-1	46.172	40	40	40
Reach-1	46.1715	Culvert		
Reach-1	46.171	20	20	20
Reach-1	46.17	25	25	25
Reach-1	46.162	30	30	30
Reach-1	46.1615	Culvert		
Reach-1	46.161	115	115	110
Reach-1	46.15	50	50	50
Reach-1	46.142	60	60	60
Reach-1	46.1415	Culvert		
Reach-1	46.141	30	25	20
Reach-1	46.14	37.5	37.5	37.5
Reach-1	46.132	27.5	27.5	27.5
Reach-1	46.13	25	25	25
Reach-1	46.122	38	38	38
Reach-1	46.1215	Culvert		
Reach-1	46.121	20	20	20
Reach-1	46.12	35	38	40
Reach-1	46.11	235	235	235
Reach-1	46.1015	Culvert		
Reach-1	46.10	130	200	160
Reach-1	46.09	80	95	125
Reach-1	46.082	75	75	75
Reach-1	46.0815	Culvert		
Reach-1	46.081	185	175	145
Reach-1	46.07	95	165	125
Reach-1	46.06	130	165	145
Reach-1	46.05	70	70	65
Reach-1	46.04	115	100	70
Reach-1	46.032	50	50	50
Reach-1	46.0315	Culvert		
Reach-1	46.031	90	110	75
Reach-1	46.03	185	205	150
Reach-1	46.02	110	120	110
Reach-1	46.01	95	105	95
Reach-1	46.00	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: RIVER-1

Reach	River Sta.	Contr.	Expan.
Reach-1	46.45	.1	.3
Reach-1	46.44	.1	.3
Reach-1	46.43	.1	.3
Reach-1	46.42	.1	.3
Reach-1	46.413	.3	.5

Reach-1	46.4125	Inl Struct		
Reach-1	46.412		.3	.5
Reach-1	46.4115	Culvert		
Reach-1	46.411		.3	.5
Reach-1	46.41		.1	.3
Reach-1	46.402		.3	.5
Reach-1	46.4015	Culvert		
Reach-1	46.401		.3	.5
Reach-1	46.392		.3	.5
Reach-1	46.3915	Mult Open		
Reach-1	46.391		.3	.5
Reach-1	46.39		.1	.3
Reach-1	46.382		.3	.5
Reach-1	46.3815	Culvert		
Reach-1	46.381		.3	.5
Reach-1	46.36		.1	.3
Reach-1	46.35		.1	.3
Reach-1	46.34		.1	.3
Reach-1	46.33		.1	.3
Reach-1	46.322		.3	.5
Reach-1	46.3215	Culvert		
Reach-1	46.321		.3	.5
Reach-1	46.32		.1	.3
Reach-1	46.312		.3	.5
Reach-1	46.3115	Culvert		
Reach-1	46.311		.3	.5
Reach-1	46.31		.1	.3
Reach-1	46.30		.1	.3
Reach-1	46.292		.3	.5
Reach-1	46.2915	Culvert		
Reach-1	46.291		.3	.5
Reach-1	46.29		.1	.3
Reach-1	46.282		.3	.5
Reach-1	46.2815	Culvert		
Reach-1	46.281		.3	.5
Reach-1	46.28		.1	.3
Reach-1	46.274		.3	.5
Reach-1	46.2735	Bridge		
Reach-1	46.273		.3	.5
Reach-1	46.272		.3	.5
Reach-1	46.2715	Culvert		
Reach-1	46.271		.3	.5
Reach-1	46.27		.1	.3
Reach-1	46.26		.1	.3
Reach-1	46.25		.1	.3
Reach-1	46.24		.1	.3
Reach-1	46.2375		.3	.5
Reach-1	46.235	Bridge		
Reach-1	46.2325		.3	.5
Reach-1	46.23		.1	.3
Reach-1	46.22		.1	.3
Reach-1	46.214		.3	.5
Reach-1	46.2135	Inl Struct		
Reach-1	46.213		.3	.5
Reach-1	46.212		.3	.5
Reach-1	46.2115	Culvert		
Reach-1	46.211		.3	.5
Reach-1	46.21		.1	.3
Reach-1	46.202		.3	.5
Reach-1	46.2015	Culvert		
Reach-1	46.201		.3	.5
Reach-1	46.192		.3	.5
Reach-1	46.1915	Culvert		

Reach-1	46.191	.3	.5
Reach-1	46.19	.1	.3
Reach-1	46.182	.3	.5
Reach-1	46.1815	Culvert	
Reach-1	46.181	.3	.5
Reach-1	46.18	.1	.3
Reach-1	46.172	.3	.5
Reach-1	46.1715	Culvert	
Reach-1	46.171	.3	.5
Reach-1	46.17	.1	.3
Reach-1	46.162	.3	.5
Reach-1	46.1615	Culvert	
Reach-1	46.161	.3	.5
Reach-1	46.15	.1	.3
Reach-1	46.142	.3	.5
Reach-1	46.1415	Culvert	
Reach-1	46.141	.3	.5
Reach-1	46.14	.1	.3
Reach-1	46.132	.3	.5
Reach-1	46.13	.1	.3
Reach-1	46.122	.3	.5
Reach-1	46.1215	Culvert	
Reach-1	46.121	.3	.5
Reach-1	46.12	.1	.3
Reach-1	46.11	.3	.5
Reach-1	46.1015	Culvert	
Reach-1	46.10	.3	.5
Reach-1	46.09	.1	.3
Reach-1	46.082	.3	.5
Reach-1	46.0815	Culvert	
Reach-1	46.081	.3	.5
Reach-1	46.07	.1	.3
Reach-1	46.06	.1	.3
Reach-1	46.05	.1	.3
Reach-1	46.04	.1	.3
Reach-1	46.032	.3	.5
Reach-1	46.0315	Culvert	
Reach-1	46.031	.3	.5
Reach-1	46.03	.1	.3
Reach-1	46.02	.1	.3
Reach-1	46.01	.1	.3
Reach-1	46.00	.1	.3

HEC-RAS HEC-RAS 5.0.0 February 2016
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

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

PROJECT DATA
Project Title: Black Creek Update (2016-02-26)
Project File : BlackCreekUpdate.prj
Run Date and Time: 6/30/2016 2:55:15 PM

Project in SI units

Project Description:
Main Humber River and Tributaries Digital Flood Plain Mapping
Hec-Ras File:
Black Creek Geometry.gxx covers Sheets HUM 13 (Converted Hec-2 file 46f1tbc.dat using new mapping), HUM 13A, HUM 13B & HUM 13C (New HEC-RAS based on new mapping)

PLAN DATA

Plan Title: PortageParkway Feb'16 Alternative#1 12m
Plan File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.p13

Geometry Title: BlackCreekPortage Feb'16 Alt#1 12m
Geometry File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.g12

Flow Title : Black Creek EXISTING Flows - April '10
Flow File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.f04

Plan Summary Information:

Number of: Cross Sections	=	86	Multiple Openings	=	1
Culverts	=	20	Inline Structures	=	2
Bridges	=	1	Lateral Structures	=	0

Computational Information
Water surface calculation tolerance = 0.003
Critical depth calculation tolerance = 0.003
Maximum number of iterations = 20

Maximum difference tolerance = 0.1
Flow tolerance factor = 0.001

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

FLOW DATA

Flow Title: Black Creek EXISTING Flows - April '10
Flow File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.f04

Flow Data (m3/s)

River	Reach	RS	2-year	5-year	10-year	25-year	50-year	100-year	Aug. 19th	Regional w red'n
RIVER-1	Reach-1	46.45	3.729	4.826	5.609	6.57	7.342	7.79	16.701	42.698
RIVER-1	Reach-1	46.413	1.611	2.011	2.244	2.66	3.591	4.753	10.797	42.698
RIVER-1	Reach-1	46.41	3.066	4.074	4.85	5.926	6.831	7.624	17.745	47.801
RIVER-1	Reach-1	46.36	6.209	8.542	10.169	12.321	14.297	16.307	41.071	66.485
RIVER-1	Reach-1	46.33	8.661	12.09	14.453	17.546	20.243	22.971	57.024	74.783
RIVER-1	Reach-1	46.30	10.769	15.139	18.134	22.036	25.353	28.697	70.731	81.913
RIVER-1	Reach-1	46.274	8.055	11.399	13.737	17.024	19.57	22.105	52.858	81.913
RIVER-1	Reach-1	46.25	15.029	21.487	25.936	31.807	36.287	40.806	96.524	108.096
RIVER-1	Reach-1	46.214	3.775	6.823	9.185	12.675	15.796	19.055	49.3	108.096
RIVER-1	Reach-1	46.21	7.789	11.08	13.186	15.823	17.823	20.589	50.389	122.563
RIVER-1	Reach-1	46.09	8.997	12.899	15.58	19.072	21.783	24.795	62.776	133.764
RIVER-1	Reach-1	46.032	19.481	29.214	36.46	51.57	58.851	66.972	191.204	200.643

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
RIVER-1	Reach-1	2-year		
Known WS = 181.99				
RIVER-1	Reach-1	5-year		
Known WS = 182.42				
RIVER-1	Reach-1	10-year		
Known WS = 182.66				
RIVER-1	Reach-1	25-year		
Known WS = 182.73				
RIVER-1	Reach-1	50-year		
Known WS = 182.89				
RIVER-1	Reach-1	100-year		
Known WS = 183.04				
RIVER-1	Reach-1	Aug. 19th		
Known WS = 184.54				
RIVER-1	Reach-1	Regional w red'n		
Known WS = 184.54				

GEOMETRY DATA

Geometry Title: BlackCreekPortage Feb'16 Alt#1 12m
Geometry File : m:\Active\2015\3 Proj\1522372 CIMA_EA PortageParkway_ON\04 SWM, Hydraulics and Geomorph\1. SWM\3. Analysis\1. HecRAS\BlackCreekUpdate.g12

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.45

INPUT
Description: Section 46.45 - J.D. Barnes 2003 topo mapping - U/S Study Limit
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	209	30	208	75	207.5	84	206.5	85	206.5
90	207.5	130	208	136	209				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	75	.035	90	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
75	90	180	180	170	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	207.38	Element	Left OB	Channel	Right OB
Vel Head (m)	0.19	Wt. n-Val.		0.035	

W.S. Elev (m)	207.19	Reach Len. (m)	180.00	180.00
170.00				
Crit W.S. (m)	207.19	Flow Area (m2)		4.02
E.G. Slope (m/m)	0.017095	Area (m2)		4.02
Q Total (m3/s)	7.79	Flow (m3/s)		7.79
Top Width (m)	10.66	Top Width (m)		10.66
Vel Total (m/s)	1.94	Avg. Vel. (m/s)		1.94
Max Chl Dpth (m)	0.69	Hydr. Depth (m)		0.38
Conv. Total (m3/s)	59.6	Conv. (m3/s)		59.6
Length Wtd. (m)	179.49	Wetted Per. (m)		10.76
Min Ch El (m)	206.50	Shear (N/m2)		62.62
Alpha	1.00	Stream Power (N/m s)		121.33
Frctn Loss (m)	0.16	Cum Volume (1000 m3)	119.59	216.59
76.98				
C & E Loss (m)	0.05	Cum SA (1000 m2)	121.72	84.02
93.75				

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 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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	208.17	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.22	Wt. n-Val.	0.050	0.035
0.080				
W.S. Elev (m)	207.95	Reach Len. (m)	180.00	180.00
170.00				
Crit W.S. (m)	207.95	Flow Area (m2)	8.94	14.69
7.94				
E.G. Slope (m/m)	0.006925	Area (m2)	8.94	14.69
7.94				
Q Total (m3/s)	42.70	Flow (m3/s)	5.47	34.19
3.04				
Top Width (m)	90.74	Top Width (m)	40.10	15.00

35.64					
Vel Total (m/s)	1.35	Avg. Vel. (m/s)	0.61	2.33	
0.38					
Max Chl Dpth (m)	1.45	Hydr. Depth (m)	0.22	0.98	
0.22					
Conv. Total (m3/s)	513.1	Conv. (m3/s)	65.7	410.9	
36.5					
Length Wtd. (m)	177.73	Wetted Per. (m)	40.10	15.15	
35.65					
Min Ch El (m)	206.50	Shear (N/m2)	15.13	65.81	
15.13					
Alpha	2.40	Stream Power (N/m s)	9.26	153.23	
5.79					
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	451.02	444.08	
388.09					
C & E Loss (m)	0.07	Cum SA (1000 m2)	335.59	84.42	
331.50					

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 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: RIVER-1
REACH: Reach-1 RS: 46.44

INPUT
Description: Section 46.44 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	209	84	208	118	205	126	204	129	203.7
131	203.7	132	204	136	205	139	206	216	207
224	208	300	209						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	126	.035	132	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
126	132	130	130	125	.1 .3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	205.29	Element	Left OB	Channel

Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	205.28	Reach Len. (m)	130.00	130.00	125.00
Crit W.S. (m)		Flow Area (m2)	6.69	8.88	3.24
E.G. Slope (m/m)	0.000274	Area (m2)	6.69	8.88	3.24
Q Total (m3/s)	7.79	Flow (m3/s)	1.57	5.42	0.80
Top Width (m)	22.02	Top Width (m)	11.18	6.00	4.84
Vel Total (m/s)	0.41	Avg. Vel. (m/s)	0.23	0.61	0.25
Max Chl Dpth (m)	1.58	Hydr. Depth (m)	0.60	1.48	0.67
Conv. Total (m3/s)	470.5	Conv. (m3/s)	94.6	327.5	48.4
Length Wtd. (m)	129.13	Wetted Per. (m)	11.25	6.06	5.01
Min Ch El (m)	203.70	Shear (N/m2)	1.60	3.94	1.74
Alpha	1.61	Stream Power (N/m s)	0.37	2.41	0.43
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	118.99	215.43	76.71
C & E Loss (m)	0.00	Cum SA (1000 m2)	120.71	82.52	93.34

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.46	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	207.46	Reach Len. (m)	130.00	130.00	125.00
Crit W.S. (m)		Flow Area (m2)	57.86	21.94	92.22
E.G. Slope (m/m)	0.000074	Area (m2)	57.86	21.94	92.22
Q Total (m3/s)	42.70	Flow (m3/s)	13.64	12.70	16.35
Top Width (m)	129.50	Top Width (m)	35.84	6.00	87.66
Vel Total (m/s)	0.25	Avg. Vel. (m/s)	0.24	0.58	0.18
Max Chl Dpth (m)	3.76	Hydr. Depth (m)	1.61	3.66	1.05
Conv. Total (m3/s)	4969.1	Conv. (m3/s)	1587.5	1478.4	1903.2
Length Wtd. (m)	128.13	Wetted Per. (m)	36.02	6.06	87.98
Min Ch El (m)	203.70	Shear (N/m2)	1.16	2.62	0.76

Alpha	2.10	Stream Power (N/m s)	0.27	1.52
0.13				
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	445.01	440.79
379.58				
C & E Loss (m)	0.00	Cum SA (1000 m2)	328.76	82.53
321.02				

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.43

INPUT
Description: Section 46.43 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	95	210	95	208.3	105	208	116	205
143	204	145	203.5	149	203.5	150	204	177	205
180	206	187	207	231	208	310	208.6		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	105	.08	143	.035	150	.08	177	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
143	150	100	100	95	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	205.27	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035
0.080				
W.S. Elev (m)	205.27	Reach Len. (m)	100.00	100.00
95.00				
Crit W.S. (m)		Flow Area (m2)	20.95	11.65
20.93				
E.G. Slope (m/m)	0.000076	Area (m2)	20.95	11.65
20.93				
Q Total (m3/s)	7.79	Flow (m3/s)	1.88	4.00
1.91				
Top Width (m)	62.81	Top Width (m)	27.99	7.00
27.81				
Vel Total (m/s)	0.15	Avg. Vel. (m/s)	0.09	0.34
0.09				
Max Chl Dpth (m)	1.77	Hydr. Depth (m)	0.75	1.66
0.75				
Conv. Total (m3/s)	894.4	Conv. (m3/s)	215.7	459.5
219.3				
Length Wtd. (m)	99.26	Wetted Per. (m)	28.05	7.18
27.88				
Min Ch El (m)	203.50	Shear (N/m2)	0.56	1.21
0.56				
Alpha	3.05	Stream Power (N/m s)	0.05	0.41
0.05				
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	117.19	214.09
75.20				
C & E Loss (m)	0.00	Cum SA (1000 m2)	118.17	81.68
91.30				

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.46	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035	0.077
W.S. Elev (m)	207.45	Reach Len. (m)	100.00	100.00	95.00
Crit W.S. (m)		Flow Area (m2)	90.70	26.91	96.67
E.G. Slope (m/m)	0.000047	Area (m2)	90.70	26.91	96.67
Q Total (m3/s)	42.70	Flow (m3/s)	14.32	12.73	15.65
Top Width (m)	99.83	Top Width (m)	35.99	7.00	56.85
Vel Total (m/s)	0.20	Avg. Vel. (m/s)	0.16	0.47	0.16
Max Chl Dpth (m)	3.95	Hydr. Depth (m)	2.52	3.84	1.70
Conv. Total (m3/s)	6221.5	Conv. (m3/s)	2086.2	1854.9	2280.4
Length Wtd. (m)	98.70	Wetted Per. (m)	36.33	7.18	57.10
Min Ch El (m)	203.50	Shear (N/m2)	1.15	1.73	0.78
Alpha	2.13	Stream Power (N/m s)	0.18	0.82	0.13
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	435.35	437.61	367.77
C & E Loss (m)	0.00	Cum SA (1000 m2)	324.09	81.69	311.98

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.42

INPUT
Description: Section 46.42 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208.5	13	208	29	207	31	206	52	205
64	204	66	203.3	70	203.3	74	204	80	205
84	206	105	207	215	208	231	208.3		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	29	.08	64	.035	74	.08	105	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
64	74	295	240	190	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	205.27	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	205.26	Reach Len. (m)	295.00	240.00	190.00
Crit W.S. (m)		Flow Area (m2)	9.83	17.50	4.69
E.G. Slope (m/m)	0.000085	Area (m2)	9.83	17.50	4.69
Q Total (m3/s)	7.79	Flow (m3/s)	0.77	6.61	0.41
Top Width (m)	34.50	Top Width (m)	17.46	10.00	7.04
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.08	0.38	0.09
Max Chl Dpth (m)	1.96	Hydr. Depth (m)	0.56	1.75	0.67
Conv. Total (m3/s)	845.3	Conv. (m3/s)	83.6	717.4	44.3
Length Wtd. (m)	241.75	Wetted Per. (m)	17.51	10.18	7.15
Min Ch El (m)	203.30	Shear (N/m2)	0.47	1.43	0.55
Alpha	2.06	Stream Power (N/m s)	0.04	0.54	0.05
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	115.65	212.64	73.98
C & E Loss (m)	0.00	Cum SA (1000 m2)	115.90	80.83	89.65

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.077
W.S. Elev (m)	207.44	Reach Len. (m)	295.00	240.00	190.00
Crit W.S. (m)		Flow Area (m2)	79.45	39.30	55.78
E.G. Slope (m/m)	0.000067	Area (m2)	79.45	39.30	55.78
Q Total (m3/s)	42.70	Flow (m3/s)	13.58	22.59	6.53
Top Width (m)	131.42	Top Width (m)	42.04	10.00	79.38
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.17	0.57	0.12
Max Chl Dpth (m)	4.14	Hydr. Depth (m)	1.89	3.93	0.70
Conv. Total (m3/s)	5223.7	Conv. (m3/s)	1661.7	2763.2	798.8
Length Wtd. (m)	248.69	Wetted Per. (m)	42.35	10.18	79.62
Min Ch El (m)	203.30	Shear (N/m2)	1.23	2.53	

0.46					
Alpha	3.11	Stream Power (N/m s)	0.21	1.45	
0.05					
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	426.85	434.30	
360.53					
C & E Loss (m)	0.00	Cum SA (1000 m2)	320.19	80.84	
305.51					

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: RIVER-1
REACH: Reach-1 RS: 46.413

INPUT
Description: Section 46.413 - Creditview Road - Inline Weir Section
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	203.05	144.7	203.05	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
128	146	5	5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	129.7	207.11	F
144.7	352	207.4	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	205.26	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.00	Wt. n-Val.		0.035	
W.S. Elev (m)	205.26	Reach Len. (m)	5.00	5.00	
5.00					
Crit W.S. (m)	203.27	Flow Area (m2)		33.11	
E.G. Slope (m/m)	0.000009	Area (m2)	29.76	39.05	
14.63					
Q Total (m3/s)	4.75	Flow (m3/s)		4.75	
Top Width (m)	52.28	Top Width (m)	22.19	18.00	
12.09					
Vel Total (m/s)	0.14	Avg. Vel. (m/s)		0.14	
Max Chl Dpth (m)	2.21	Hydr. Depth (m)		2.21	
Conv. Total (m3/s)	1603.4	Conv. (m3/s)		1603.4	
Length Wtd. (m)	5.00	Wetted Per. (m)		15.00	

Min Ch El (m)	203.05	Shear (N/m2)		0.19
Alpha	1.00	Stream Power (N/m s)		0.03
Frctn Loss (m)		Cum Volume (1000 m3)	109.81	205.85
72.14				
C & E Loss (m)		Cum SA (1000 m2)	110.05	77.47
87.83				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.44	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.00	Wt. n-Val.	0.079	0.035	
0.080					
W.S. Elev (m)	207.44	Reach Len. (m)	5.00	5.00	
5.00					
Crit W.S. (m)	203.99	Flow Area (m2)	93.26	78.25	
48.66					
E.G. Slope (m/m)	0.000021	Area (m2)	93.26	78.25	
48.66					
Q Total (m3/s)	42.70	Flow (m3/s)	10.48	27.13	
5.09					
Top Width (m)	99.98	Top Width (m)	62.82	18.00	
19.16					
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.11	0.35	
0.10					
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.48	4.35	
2.54					
Conv. Total (m3/s)	9326.4	Conv. (m3/s)	2288.6	5926.3	
1111.4					
Length Wtd. (m)	5.00	Wetted Per. (m)	63.27	18.13	
19.70					
Min Ch El (m)	203.05	Shear (N/m2)	0.30	0.89	
0.51					
Alpha	2.15	Stream Power (N/m s)	0.03	0.31	
0.05					
Frctn Loss (m)		Cum Volume (1000 m3)	401.37	420.19	
350.61					
C & E Loss (m)		Cum SA (1000 m2)	304.72	77.48	
296.15					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

INLINE STRUCTURE

RIVER: RIVER-1
REACH: Reach-1 RS: 46.4125

INPUT
Description: Hum 13B-4R. Creditview Road - 4 Cell - 3.0 m W x 1.5 m H x 41 m L Concrete Box Culverts and 6.5 m W Weir with Drop Inlet Structure.

Drawings by Urban Ecosystems Ltd. (DT-2 & G-4), 1999.

New
HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 1
Deck/Roadway Width = .5
Weir Coefficient = 1.75
Weir Embankment Coordinates num = 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	129.75	207.11	129.75	207	133.95	207
133.95	204.7	137.2	204.7	140.45	204.7	140.45	207	144.65	207
144.65	207.4	205	207.79	305	208.3	352	208.6		

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 =
Weir crest shape = Broad Crested

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.412

INPUT
Description: Section 46.412 - Creditview Road - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	203.05	144.7	203.05	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
128	146	45	45	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	129.7	207.11	F
144.7	352	207.4	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.92	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.01	Wt. n-Val.		0.035
W.S. Elev (m)	203.91	Reach Len. (m)	45.00	45.00
45.00				
Crit W.S. (m)	203.27	Flow Area (m2)		12.91
E.G. Slope (m/m)	0.000203	Area (m2)	3.03	14.81
1.35				
Q Total (m3/s)	4.75	Flow (m3/s)		4.75

Top Width (m)	39.35	Top Width (m)	14.78	18.00	6.57
Vel Total (m/s)	0.37	Avg. Vel. (m/s)		0.37	
Max Chl Dpth (m)	0.86	Hydr. Depth (m)		0.86	
Conv. Total (m3/s)	333.6	Conv. (m3/s)		333.6	
Length Wtd. (m)	45.00	Wetted Per. (m)		15.00	
Min Ch El (m)	203.05	Shear (N/m2)		1.71	
Alpha	1.00	Stream Power (N/m s)		0.63	
Frctn Loss (m)		Cum Volume (1000 m3)	109.81	205.65	72.14
C & E Loss (m)		Cum SA (1000 m2)	109.95	77.38	87.78

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	207.37	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	
W.S. Elev (m)	207.37	Reach Len. (m)	45.00	45.00	45.00
Crit W.S. (m)	203.99	Flow Area (m2)	89.20	71.72	
E.G. Slope (m/m)	0.000032	Area (m2)	89.20	77.04	47.37
Q Total (m3/s)	42.70	Flow (m3/s)	12.31	30.39	
Top Width (m)	94.35	Top Width (m)	57.41	18.00	18.94
Vel Total (m/s)	0.27	Avg. Vel. (m/s)	0.14	0.42	
Max Chl Dpth (m)	4.32	Hydr. Depth (m)	1.55	4.29	
Conv. Total (m3/s)	7588.4	Conv. (m3/s)	2187.2	5401.2	
Length Wtd. (m)	45.00	Wetted Per. (m)	57.86	16.76	
Min Ch El (m)	203.05	Shear (N/m2)	0.48	1.33	
Alpha	1.89	Stream Power (N/m s)	0.07	0.56	
Frctn Loss (m)		Cum Volume (1000 m3)	401.37	419.61	350.61
C & E Loss (m)		Cum SA (1000 m2)	304.42	77.39	296.06

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.4115

INPUT
Description: Hum 13B-4R. Creditview Road - 4 Cell - 3.0 m W x 1.5 m H x 45 m L
Concrete Box Culverts and 6.5 m W Weir with Drop Inlet Structure.
Drawings by Urban Ecosystems Ltd. (DT-2 & G-4), 1999.

New
HEC-RAS coding January 2004 by Acres included coding of culvert
in HEC-RAS, including adjustments to roadway coding and hydraulic
loss coefficients.

Distance from Upstream XS = 10
Deck/Roadway Width = 25
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 11

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	208		60	207.5		129.7	207.11	
129.7	208.5		137.2	208.5		144.7	208.5	
144.7	207.4		205	207.79		265	208	
305	208.3		352	208.6				

Upstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	203.05	144.7	203.05	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
128	146	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	129.7	207.11	F
144.7	352	207.4	F

Downstream Deck/Roadway Coordinates
num= 11

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	208		60	207.5		129.7	207.11	
129.7	208.5		137.2	208.5		144.7	208.5	
144.7	207.4		205	207.79		265	208	
305	208.3		352	208.6				

Downstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	202.96	144.7	202.96	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

```
Bank Sta: Left   Right    Coeff Contr.   Expan.
          128     146           .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   129.7   206.8       F
   144.7     352   206.8       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           Box     1.5       3
FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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      41     .015     .015        0                   .5
      1
Number of Barrels =  4
Upstream   Elevation =  203.05
Centerline Stations
    Sta.    Sta.    Sta.    Sta.
   132.1   135.5   138.9   142.3
Downstream Elevation =  202.96
Centerline Stations
    Sta.    Sta.    Sta.    Sta.
   132.1   135.5   138.9   142.3

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       4.75    Culv Full Len (m)
  # Barrels                    4    Culv Vel US (m/s)         0.47
  Q Barrel (m3/s)           1.19    Culv Vel DS (m/s)         0.42
  E.G. US. (m)            203.92    Culv Inv El Up (m)      203.05
  W.S. US. (m)            203.91    Culv Inv El Dn (m)      202.96
  E.G. DS (m)             203.90    Culv Frctn Ls (m)         0.01
  W.S. DS (m)             203.90    Culv Exit Loss (m)        0.00
  Delta EG (m)              0.01    Culv Entr Loss (m)        0.01
  Delta WS (m)              0.01    Q Weir (m3/s)
  E.G. IC (m)             203.46    Weir Sta Lft (m)
  E.G. OC (m)             203.92    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
  Culv WS Inlet (m)       203.90    Weir Max Depth (m)
  Culv WS Outlet (m)      203.90    Weir Avg Depth (m)
  Culv Nml Depth (m)        0.31    Weir Flow Area (m2)
  Culv Crt Depth (m)        0.25    Min El Weir Flow (m)    207.11


CULVERT OUTPUT  Profile #Regional w red'n  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      39.14    Culv Full Len (m)        41.00
  # Barrels                   4     Culv Vel US (m/s)         2.17
  Q Barrel (m3/s)           9.79    Culv Vel DS (m/s)         2.17
  E.G. US. (m)            207.37    Culv Inv El Up (m)      203.05
  W.S. US. (m)            207.37    Culv Inv El Dn (m)      202.96
```

E.G. DS (m)	206.91	Culv Frctn Ls (m)	0.11
W.S. DS (m)	206.90	Culv Exit Loss (m)	0.24
Delta EG (m)	0.47	Culv Entr Loss (m)	0.12
Delta WS (m)	0.46	Q Weir (m3/s)	3.55
E.G. IC (m)	204.84	Weir Sta Lft (m)	82.56
E.G. OC (m)	207.37	Weir Sta Rgt (m)	129.70
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	204.55	Weir Max Depth (m)	0.26
Culv WS Outlet (m)	204.46	Weir Avg Depth (m)	0.13
Culv Nml Depth (m)		Weir Flow Area (m2)	6.21
Culv Crt Depth (m)	1.03	Min El Weir Flow (m)	207.11

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.411

INPUT
Description: Section 46.411 - Creditview Road - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	60	207.5	100	207	110	204	128	203.5
129.7	202.96	144.7	202.96	146	203.5	154	204	167	208
235	208	294	208.5	352	208.6				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100	.08	128	.035	146	.08	167	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
128	146	80	80	90	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	129.7	206.8	F
144.7	352	206.8	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.90	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.035	
W.S. Elev (m)	203.90	Reach Len. (m)	80.00	80.00	90.00
Crit W.S. (m)	203.18	Flow Area (m2)		14.09	
E.G. Slope (m/m)	0.000152	Area (m2)	2.87	16.09	1.27
Q Total (m3/s)	4.75	Flow (m3/s)		4.75	
Top Width (m)	38.75	Top Width (m)	14.37	18.00	6.38
Vel Total (m/s)	0.34	Avg. Vel. (m/s)		0.34	
Max Chl Dpth (m)	0.94	Hydr. Depth (m)		0.94	

Conv. Total (m3/s)	385.9	Conv. (m3/s)		385.9
Length Wtd. (m)	80.76	Wetted Per. (m)		15.00
Min Ch El (m)	202.96	Shear (N/m2)		1.40
Alpha	1.00	Stream Power (N/m s)		0.47
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	109.81	205.48
72.14				
C & E Loss (m)	0.00	Cum SA (1000 m2)	109.30	76.57
87.49				

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.91	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	
0.080					
W.S. Elev (m)	206.90	Reach Len. (m)	80.00	80.00	
90.00					
Crit W.S. (m)	203.90	Flow Area (m2)	70.79	70.16	
38.91					
E.G. Slope (m/m)	0.000033	Area (m2)	70.79	70.16	
38.91					
Q Total (m3/s)	42.70	Flow (m3/s)	9.47	28.50	
4.72					
Top Width (m)	63.11	Top Width (m)	27.68	18.00	
17.43					
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.13	0.41	
0.12					
Max Chl Dpth (m)	3.94	Hydr. Depth (m)	2.56	3.90	
2.23					
Conv. Total (m3/s)	7384.4	Conv. (m3/s)	1638.0	4929.7	
816.7					
Length Wtd. (m)	81.46	Wetted Per. (m)	28.11	18.19	
17.89					
Min Ch El (m)	202.96	Shear (N/m2)	0.83	1.26	
0.71					
Alpha	2.05	Stream Power (N/m s)	0.11	0.51	
0.09					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	401.37	418.50	
350.61					
C & E Loss (m)	0.00	Cum SA (1000 m2)	302.51	76.58	
295.24					

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: RIVER-1
REACH: Reach-1 RS: 46.41

INPUT
Description: Section 46.41 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207.5	71	207	83	204	84	203.56	123	203.56
126	205	136	205	140	204	156	203.1	161	202.5
164	202.5	166	203	195	204	206	208	234	208.2

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	71	.08	83	.035	126	.08	156	.035
166	.08	195	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
156	166	140	140	120	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.89	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.043	0.035	0.080
W.S. Elev (m)	203.89	Reach Len. (m)	140.00	140.00	120.00
Crit W.S. (m)		Flow Area (m2)	18.59	11.89	11.46
E.G. Slope (m/m)	0.000128	Area (m2)	18.59	11.89	11.46
Q Total (m3/s)	7.62	Flow (m3/s)	2.40	4.28	0.94
Top Width (m)	90.24	Top Width (m)	54.46	10.00	25.78
Vel Total (m/s)	0.18	Avg. Vel. (m/s)	0.13	0.36	0.08
Max Chl Dpth (m)	1.39	Hydr. Depth (m)	0.34	1.19	0.44
Conv. Total (m3/s)	674.5	Conv. (m3/s)	212.4	378.8	83.4
Length Wtd. (m)	138.76	Wetted Per. (m)	54.62	10.10	25.80
Min Ch El (m)	202.50	Shear (N/m2)	0.43	1.48	0.56
Alpha	2.39	Stream Power (N/m s)	0.06	0.53	0.05
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	108.96	204.36	71.57
C & E Loss (m)	0.00	Cum SA (1000 m2)	106.55	75.45	86.04

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.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.91	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.044	0.035	0.077
W.S. Elev (m)	206.90	Reach Len. (m)	140.00	140.00	120.00
Crit W.S. (m)		Flow Area (m2)	240.60	42.04	110.32
E.G. Slope (m/m)	0.000008	Area (m2)	240.60	42.04	110.32
Q Total (m3/s)	47.80	Flow (m3/s)	30.75	8.57	8.48
Top Width (m)	131.60	Top Width (m)	84.62	10.00	36.99
Vel Total (m/s)	0.12	Avg. Vel. (m/s)	0.13	0.20	0.08
Max Chl Dpth (m)	4.40	Hydr. Depth (m)	2.84	4.20	2.98
Conv. Total (m3/s)	17337.4	Conv. (m3/s)	11152.2	3108.6	3076.7
Length Wtd. (m)	135.44	Wetted Per. (m)	85.54	10.10	37.51
Min Ch El (m)	202.50	Shear (N/m2)	0.21	0.31	0.22
Alpha	1.28	Stream Power (N/m s)	0.03	0.06	0.02
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	388.92	414.01	343.89
C & E Loss (m)	0.00	Cum SA (1000 m2)	298.01	75.46	292.79

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: RIVER-1
REACH: Reach-1 RS: 46.402

INPUT
Description: Section 46.402 - Highway 400 - U/S Bounding Section - J.D. Barnes
2003 topo mapping

Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	212	21	206	97	205	104	203	105	202.4
115	202.4	116	203	125	205	136	206	187	206
250	206	270	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	97	.08	104	.035	116	.08	136	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
104	116	100	100	100	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	106	206.7	F
114.5	270	206.7	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.87	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.85	Reach Len. (m)	100.00	100.00	100.00
Crit W.S. (m)	202.83	Flow Area (m2)		12.29	
E.G. Slope (m/m)	0.000288	Area (m2)	1.25	16.75	1.61
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	18.77	Top Width (m)	2.96	12.00	3.81
Vel Total (m/s)	0.62	Avg. Vel. (m/s)		0.62	
Max Chl Dpth (m)	1.45	Hydr. Depth (m)		1.45	
Conv. Total (m3/s)	449.2	Conv. (m3/s)		449.2	
Length Wtd. (m)	100.00	Wetted Per. (m)		8.50	
Min Ch El (m)	202.40	Shear (N/m2)		4.09	
Alpha	1.00	Stream Power (N/m s)		2.53	
Frctn Loss (m)		Cum Volume (1000 m3)	107.57	202.35	70.79
C & E Loss (m)		Cum SA (1000 m2)	102.53	73.91	84.27

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.90	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.055	0.035	0.059
W.S. Elev (m)	206.90	Reach Len. (m)	100.00	100.00	100.00
Crit W.S. (m)	203.88	Flow Area (m2)	128.12	53.40	148.16
E.G. Slope (m/m)	0.000023	Area (m2)	128.12	53.40	148.16
Q Total (m3/s)	47.80	Flow (m3/s)	15.09	19.42	13.30
Top Width (m)	241.15	Top Width (m)	86.15	12.00	143.00
Vel Total (m/s)	0.14	Avg. Vel. (m/s)	0.12	0.36	0.09
Max Chl Dpth (m)	4.50	Hydr. Depth (m)	1.49	4.45	

1.04					
Conv. Total (m3/s)	9978.9	Conv. (m3/s)	3149.8	4053.4	2775.8
Length Wtd. (m)	100.00	Wetted Per. (m)	86.56	12.33	143.31
Min Ch El (m)	202.40	Shear (N/m2)	0.33	0.97	0.23
Alpha	2.87	Stream Power (N/m s)	0.04	0.35	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	363.11	407.33	328.39
C & E Loss (m)		Cum SA (1000 m2)	286.06	73.92	281.99

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.4015

INPUT
Description: Hum 13B-3R. Highway 400 - 3 Cell - 2.4 m W x 2.4 m H x 80 m L Concrete Box Culverts. Drawings by McCormick Rankin (Sheet 40 & 47, no date) used to code culvert in HEC-RAS format.

New
HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 14
Deck/Roadway Width = 80
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	206.5		189	207		270	207.8	

Upstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	212	21	206	97	205	104	203	105	202.4
115	202.4	116	203	125	205	136	206	187	206
250	206	270	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	97	.08	104	.035	116	.08	136	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
104	116	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	106	206.7	F
114.5	270	206.7	F

Downstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord

```
       0   206.5             189     207             270   207.8

Downstream Bridge Cross Section Data
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0     212      21     206      97     205     104     203     105   202.4
     115   202.4     116     203     125     205     136     206     187     206
     270   206.5

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05      21     .08     104    .035     116     .08     136     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
           104     116            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     106     206       F
   114.5     270     206       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           Box     2.4     2.4
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
                14      80     .015     .015        0                    .4
      1
Number of Barrels =  3
Upstream   Elevation =  202.4
Centerline Stations
    Sta.    Sta.    Sta.
   107.5   110.2   112.9
Downstream Elevation =  202.4
Centerline Stations
    Sta.    Sta.    Sta.
   107.5   110.2   112.9

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       7.62    Culv Full Len (m)
  # Barrels                    3    Culv Vel US (m/s)         0.74
  Q Barrel (m3/s)           2.54    Culv Vel DS (m/s)         0.75
  E.G. US. (m)            203.87    Culv Inv El Up (m)      202.40
  W.S. US. (m)            203.85    Culv Inv El Dn (m)      202.40
  E.G. DS (m)             203.83    Culv Frctn Ls (m)         0.01
  W.S. DS (m)             203.81    Culv Exit Loss (m)        0.01
  Delta EG (m)              0.04    Culv Entr Loss (m)        0.01
  Delta WS (m)              0.04    Q Weir (m3/s)
  E.G. IC (m)             203.16    Weir Sta Lft (m)
  E.G. OC (m)             203.87    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
```

Culv WS Inlet (m)	203.83	Weir Max Depth (m)	
Culv WS Outlet (m)	203.81	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.49	Min El Weir Flow (m)	206.70

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	31.75	Culv Full Len (m)	80.00
# Barrels	3	Culv Vel US (m/s)	1.84
Q Barrel (m3/s)	10.58	Culv Vel DS (m/s)	1.84
E.G. US. (m)	206.90	Culv Inv El Up (m)	202.40
W.S. US. (m)	206.90	Culv Inv El Dn (m)	202.40
E.G. DS (m)	206.55	Culv Frctn Ls (m)	0.12
W.S. DS (m)	206.54	Culv Exit Loss (m)	0.16
Delta EG (m)	0.35	Culv Entr Loss (m)	0.07
Delta WS (m)	0.36	Q Weir (m3/s)	16.05
E.G. IC (m)	205.08	Weir Sta Lft (m)	17.83
E.G. OC (m)	206.90	Weir Sta Rgt (m)	153.01
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	204.80	Weir Max Depth (m)	0.35
Culv WS Outlet (m)	204.80	Weir Avg Depth (m)	0.18
Culv Nml Depth (m)		Weir Flow Area (m2)	23.95
Culv Crt Depth (m)	1.26	Min El Weir Flow (m)	206.70

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.401

INPUT
Description: Section 46.401 - Highway 400 - D/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	212	21	206	97	205	104	203	105	202.4
115	202.4	116	203	125	205	136	206	187	206
270	206.5								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	21	.08	104	.035	116	.08	136	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
104	116	80	95	100	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	106	206	F
114.5	270	206	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.83	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	

W.S. Elev (m)	203.81	Reach Len. (m)	80.00	95.00	100.00
Crit W.S. (m)	202.83	Flow Area (m2)		11.97	
E.G. Slope (m/m)	0.000315	Area (m2)	1.14	16.30	1.47
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	18.46	Top Width (m)	2.83	12.00	3.64
Vel Total (m/s)	0.64	Avg. Vel. (m/s)		0.64	
Max Chl Dpth (m)	1.41	Hydr. Depth (m)		1.41	
Conv. Total (m3/s)	429.6	Conv. (m3/s)		429.6	
Length Wtd. (m)	95.00	Wetted Per. (m)		8.50	
Min Ch El (m)	202.40	Shear (N/m2)		4.35	
Alpha	1.00	Stream Power (N/m s)		2.77	
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	107.57	201.76	70.79
C & E Loss (m)	0.00	Cum SA (1000 m2)	102.24	72.71	83.90

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.55	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.066
W.S. Elev (m)	206.54	Reach Len. (m)	80.00	95.00	100.00
Crit W.S. (m)	203.88	Flow Area (m2)	97.50	49.10	86.22
E.G. Slope (m/m)	0.000063	Area (m2)	97.50	49.10	86.22
Q Total (m3/s)	47.80	Flow (m3/s)	10.67	27.93	9.20
Top Width (m)	250.90	Top Width (m)	84.90	12.00	154.00
Vel Total (m/s)	0.21	Avg. Vel. (m/s)	0.11	0.57	0.11
Max Chl Dpth (m)	4.14	Hydr. Depth (m)	1.15	4.09	0.56
Conv. Total (m3/s)	6031.7	Conv. (m3/s)	1346.0	3524.5	1161.2
Length Wtd. (m)	90.36	Wetted Per. (m)	85.26	12.33	154.31
Min Ch El (m)	202.40	Shear (N/m2)	0.70	2.45	0.34
Alpha	4.60	Stream Power (N/m s)	0.08	1.39	0.04
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	363.11	399.92	328.39

C & E Loss (m)	0.00	Cum SA (1000 m2)	277.51	72.72	267.14

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: RIVER-1
REACH: Reach-1 RS: 46.392

INPUT
Description: Section 46.392 - Langstaff Road - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	15	206	30	206	103	206	106	205
130	205	135	203	136	202.5	145	202.5	147	203
153	205	175	205	191	210	203	210		

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.025	103	.05	130	.08	135	.035
147	.08	153	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
135	147	70	70	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	136.4	206.2	F
145	203	212.9	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.79	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.77	Reach Len. (m)	70.00	70.00	70.00
Crit W.S. (m)	202.93	Flow Area (m2)		10.90	
E.G. Slope (m/m)	0.000437	Area (m2)	0.74	14.46	0.88
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	16.22	Top Width (m)	1.92	12.00	2.30
Vel Total (m/s)	0.70	Avg. Vel. (m/s)		0.70	
Max Chl Dpth (m)	1.27	Hydr. Depth (m)		1.27	
Conv. Total (m3/s)	364.7	Conv. (m3/s)		364.7	
Length Wtd. (m)	70.00	Wetted Per. (m)		8.60	
Min Ch El (m)	202.50	Shear (N/m2)		5.43	

Alpha	1.00	Stream Power (N/m s)		3.80
Frctn Loss (m)		Cum Volume (1000 m3)	107.49	200.30
70.67				
C & E Loss (m)		Cum SA (1000 m2)	102.05	71.57
83.60				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.54	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.01	Wt. n-Val.	0.043	0.035
W.S. Elev (m)	206.53	Reach Len. (m)	70.00	70.00
70.00				
Crit W.S. (m)	203.97	Flow Area (m2)	99.87	40.07
E.G. Slope (m/m)	0.000081	Area (m2)	99.87	47.63
52.65				
Q Total (m3/s)	47.80	Flow (m3/s)	21.97	25.84
Top Width (m)	166.90	Top Width (m)	121.99	12.00
32.90				
Vel Total (m/s)	0.34	Avg. Vel. (m/s)	0.22	0.64
Max Chl Dpth (m)	4.03	Hydr. Depth (m)	0.82	4.01
Conv. Total (m3/s)	5302.3	Conv. (m3/s)	2436.5	2865.8
Length Wtd. (m)	70.00	Wetted Per. (m)	122.61	10.12
Min Ch El (m)	202.50	Shear (N/m2)	0.65	3.16
Alpha	2.12	Stream Power (N/m s)	0.14	2.04
Frctn Loss (m)		Cum Volume (1000 m3)	355.21	395.33
321.44				
C & E Loss (m)		Cum SA (1000 m2)	269.23	71.58
257.79				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

MULTIPLE OPENING

RIVER: RIVER-1
REACH: Reach-1 RS: 46.3915

INPUT
Description: Hum 13B-2R. Langstaff Road - 3 Cell - 2.4 m W x 2.4 m H x 60 m L Concrete Box Culverts. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004 by Acres
included coding of culvert in HEC-RAS, including adjustments to
roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 60
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 9

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	212.8		8	213	212	28	213.2	212.3
73	213.82	212.82	103	213.4	212.4	103	213.4	206
142	213		182	212		203	211.5	

Upstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	15	206	30	206	103	206	106	205
130	205	135	203	136	202.5	145	202.5	147	203
153	205	175	205	191	210	203	210		

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.025	103	.05	130	.08	135	.035
147	.08	153	.05						

Bank Sta: Left	Right	Coeff Contr.	Expan.
135	147	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	136.4	206.2	F
145	203	212.9	F

Downstream Deck/Roadway Coordinates
num= 9

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	212.8		8	213	212	28	213.2	212.3
73	213.82	212.82	103	213.4	212.4	103	213.4	206
142	213		182	212		203	211.5	

Downstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	15	206	30	206	103	206	106	205
130	205	135	203	136	202.4	145	202.4	147	203
153	205	175	205	191	210	203	210		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.025	103	.05	130	.08	153	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
135	147	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	136.4	206	F
145	203	211	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 Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Box	2.4	2.4

FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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
	5	60	.015	.015	0	.5	1

Number of Barrels = 3
Upstream Elevation = 202.5
Centerline Stations

Sta.	Sta.	Sta.
138	140.7	143.4

Downstream Elevation = 202.4
Centerline Stations

Sta.	Sta.	Sta.
138	140.7	143.4

Multiple Opening Stagnation Limits

	Upstream		Downstream	
Opening Type	Sta. Left	Sta. Right	Sta. Left	Sta. Right
Bridge	0	120	0	120
Culvert Group	120	203	120	203

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.391

INPUT
Description: Section 46.391 - Langstaff Road - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	210	15	206	30	206	103	206	106	205
130	205	135	203	136	202.4	145	202.4	147	203
153	205	175	205	191	210	203	210		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.025	103	.05	130	.08	153	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
135	147	45	35	25	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	136.4	206	F
145	203	211	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.75	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.080	
W.S. Elev (m)	203.72	Reach Len. (m)	45.00	35.00	25.00
Crit W.S. (m)	202.83	Flow Area (m2)		11.38	
E.G. Slope (m/m)	0.001975	Area (m2)	0.65	14.99	0.79
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	15.98	Top Width (m)	1.81	12.00	2.17
Vel Total (m/s)	0.67	Avg. Vel. (m/s)		0.67	
Max Chl Dpth (m)	1.32	Hydr. Depth (m)		1.32	
Conv. Total (m3/s)	171.6	Conv. (m3/s)		171.6	
Length Wtd. (m)	35.03	Wetted Per. (m)		8.60	
Min Ch El (m)	202.40	Shear (N/m2)		25.64	
Alpha	1.00	Stream Power (N/m s)		17.17	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	107.49	200.30	70.67
C & E Loss (m)	0.01	Cum SA (1000 m2)	101.92	70.73	83.44

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.045	0.080	
W.S. Elev (m)	206.44	Reach Len. (m)	45.00	35.00	25.00

Crit W.S. (m)	203.87	Flow Area (m2)	89.26	40.15	49.80
E.G. Slope (m/m)	0.000212	Area (m2)	89.26	47.64	49.80
Q Total (m3/s)	47.80	Flow (m3/s)	29.55	18.25	32.62
Top Width (m)	166.29	Top Width (m)	121.67	12.00	32.62
Vel Total (m/s)	0.37	Avg. Vel. (m/s)	0.33	0.45	
Max Chl Dpth (m)	4.04	Hydr. Depth (m)	0.73	4.01	
Conv. Total (m3/s)	3284.6	Conv. (m3/s)	2030.7	1253.9	
Length Wtd. (m)	38.91	Wetted Per. (m)	122.27	10.17	
Min Ch El (m)	202.40	Shear (N/m2)	1.52	8.20	
Alpha	1.07	Stream Power (N/m s)	0.50	3.73	
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	355.21	395.33	321.44
C & E Loss (m)	0.00	Cum SA (1000 m2)	260.70	70.74	255.50

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: RIVER-1
REACH: Reach-1 RS: 46.39

INPUT
Description: Section 46.39 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	20	205	45	205	51	206.5	133	206.3
142	206	152	205	161	204	185	204	193	203
195	202.4	204	202.4	206	203	212	204	236	205
268	210								

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	51	.025	142	.05	185	.08	193	.035
206	.08	212	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
193	206	50	35	25	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	51	206.6	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.72	Element	Left OB	Channel

Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.71	Reach Len. (m)	50.00	35.00	25.00
Crit W.S. (m)	202.80	Flow Area (m2)	2.04	15.88	1.53
E.G. Slope (m/m)	0.000202	Area (m2)	2.04	15.88	1.53
Q Total (m3/s)	7.62	Flow (m3/s)	0.18	7.31	0.14
Top Width (m)	22.99	Top Width (m)	5.71	13.00	4.28
Vel Total (m/s)	0.39	Avg. Vel. (m/s)	0.09	0.46	0.09
Max Chl Dpth (m)	1.31	Hydr. Depth (m)	0.36	1.22	0.36
Conv. Total (m3/s)	536.1	Conv. (m3/s)	12.8	513.8	9.5
Length Wtd. (m)	35.09	Wetted Per. (m)	5.76	13.18	4.34
Min Ch El (m)	202.40	Shear (N/m2)	0.70	2.39	0.70
Alpha	1.32	Stream Power (N/m s)	0.06	1.10	0.06
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	107.43	199.76	70.64
C & E Loss (m)	0.00	Cum SA (1000 m2)	101.75	70.29	83.36

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.055	0.035	0.057
W.S. Elev (m)	206.44	Reach Len. (m)	50.00	35.00	25.00
Crit W.S. (m)	203.62	Flow Area (m2)	116.10	51.38	71.01
E.G. Slope (m/m)	0.000029	Area (m2)	166.82	51.38	71.01
Q Total (m3/s)	47.80	Flow (m3/s)	18.06	19.51	10.23
Top Width (m)	216.72	Top Width (m)	164.48	13.00	39.24
Vel Total (m/s)	0.20	Avg. Vel. (m/s)	0.16	0.38	0.14
Max Chl Dpth (m)	4.04	Hydr. Depth (m)	0.97	3.95	1.81
Conv. Total (m3/s)	8912.1	Conv. (m3/s)	3367.6	3636.6	1907.9
Length Wtd. (m)	40.73	Wetted Per. (m)	119.43	13.18	39.46

Min Ch El (m)	202.40	Shear (N/m2)	0.27	1.10	0.51
Alpha	1.80	Stream Power (N/m s)	0.04	0.42	0.07
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	349.45	393.59	319.93
C & E Loss (m)	0.00	Cum SA (1000 m2)	254.27	70.30	254.60

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: RIVER-1
REACH: Reach-1 RS: 46.382

INPUT
Description: Section 46.382 - Hwy 400 / Langstaff Rd Ramp - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	50	206.5	95	205	220	204	227	203
235	202.4	244	202.4	247	203	252	204	257	205
269	206	300	206	300	209.5				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	50	.08	227	.035	247	.08	257	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
227	247	45	45	45	.3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235.2	206.38	F
243.8	300	207.55	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.71	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.69	Reach Len. (m)	45.00	45.00	45.00
Crit W.S. (m)	202.83	Flow Area (m2)		11.08	
E.G. Slope (m/m)	0.000413	Area (m2)	1.66	22.48	1.19
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	28.27	Top Width (m)	4.82	20.00	3.44
Vel Total (m/s)	0.69	Avg. Vel. (m/s)		0.69	
Max Chl Dpth (m)	1.29	Hydr. Depth (m)		1.29	
Conv. Total (m3/s)	375.0	Conv. (m3/s)		375.0	

Length Wtd. (m)	45.00	Wetted Per. (m)			8.60
Min Ch El (m)	202.40	Shear (N/m2)			5.22
Alpha	1.00	Stream Power (N/m s)			3.59
Frctn Loss (m)		Cum Volume (1000 m3)	107.34	199.09	70.61
C & E Loss (m)		Cum SA (1000 m2)	101.48	69.71	83.26

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035	
W.S. Elev (m)	206.44	Reach Len. (m)	45.00	45.00	45.00
Crit W.S. (m)	203.86	Flow Area (m2)	294.86	65.54	
E.G. Slope (m/m)	0.000024	Area (m2)	294.86	77.58	49.52
Q Total (m3/s)	47.80	Flow (m3/s)	25.30	22.51	
Top Width (m)	248.32	Top Width (m)	175.32	20.00	53.00
Vel Total (m/s)	0.13	Avg. Vel. (m/s)	0.09	0.34	
Max Chl Dpth (m)	4.04	Hydr. Depth (m)	1.68	3.90	
Conv. Total (m3/s)	9846.7	Conv. (m3/s)	5210.7	4636.0	
Length Wtd. (m)	45.00	Wetted Per. (m)	175.42	16.82	
Min Ch El (m)	202.40	Shear (N/m2)	0.39	0.90	
Alpha	3.38	Stream Power (N/m s)	0.03	0.31	
Frctn Loss (m)		Cum Volume (1000 m3)	337.91	391.34	318.42
C & E Loss (m)		Cum SA (1000 m2)	245.77	69.72	253.45

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.3815

INPUT

Description: Hum 13B-1R. Hwy 400 / Langstaff Rd Ramp - 3 Cell - 2.4 m W x 2.4 m H x 38 m L Concrete Box Culverts. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004
by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 2
Deck/Roadway Width = 38
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	207		130	206.38		200	206	
230	207		260	208		285	209	
300	209.5							

Upstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	50	206.5	95	205	220	204	227	203
235	202.4	244	202.4	247	203	252	204	257	205
269	206	300	206	300	209.5				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	50	.08	227	.035	247	.08	257	.05

Bank Sta: Left Right Coeff Contr. Expan.
227 247 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235.2	206.38	F
243.8	300	207.55	F

Downstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	207		130	206.38		200	206	
230	207		260	208		285	209	
300	209.5							

Downstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	50	206.5	95	205	220	204	227	203
235	202.3	244	202.3	247	203	252	204	257	205
269	206	300	206	300	209.5				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	50	.05	220	.08	227	.035	247	.08
257	.05								

Bank Sta: Left Right Coeff Contr. Expan.
227 247 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235.2	205.5	F
243.8	300	205.5	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           Box     2.4     2.4
FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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
                 2      38     .015     .015        0                    .7
      1
Number of Barrels =  3
Upstream   Elevation =  202.4
Centerline Stations
    Sta.    Sta.    Sta.
   236.9   239.5   242.1
Downstream Elevation =  202.3
Centerline Stations
    Sta.    Sta.    Sta.
   236.9   239.5   242.1

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       7.62    Culv Full Len (m)
  # Barrels                    3    Culv Vel US (m/s)         0.85
  Q Barrel (m3/s)           2.54    Culv Vel DS (m/s)         0.79
  E.G. US. (m)            203.71    Culv Inv El Up (m)      202.40
  W.S. US. (m)            203.69    Culv Inv El Dn (m)      202.30
  E.G. DS (m)             203.67    Culv Frctn Ls (m)         0.01
  W.S. DS (m)             203.65    Culv Exit Loss (m)        0.01
  Delta EG (m)              0.05    Culv Entr Loss (m)        0.03
  Delta WS (m)              0.04    Q Weir (m3/s)
  E.G. IC (m)             203.19    Weir Sta Lft (m)
  E.G. OC (m)             203.71    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
  Culv WS Inlet (m)       203.65    Weir Max Depth (m)
  Culv WS Outlet (m)      203.65    Weir Avg Depth (m)
  Culv Nml Depth (m)        0.58    Weir Flow Area (m2)
  Culv Crt Depth (m)        0.49    Min El Weir Flow (m)    206.38


CULVERT OUTPUT  Profile #Regional w red'n  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      32.68    Culv Full Len (m)        38.00
  # Barrels                   3     Culv Vel US (m/s)         1.89
  Q Barrel (m3/s)          10.89    Culv Vel DS (m/s)         1.89
  E.G. US. (m)            206.45    Culv Inv El Up (m)      202.40
  W.S. US. (m)            206.44    Culv Inv El Dn (m)      202.30
  E.G. DS (m)             206.08    Culv Frctn Ls (m)         0.06
  W.S. DS (m)             206.08    Culv Exit Loss (m)        0.18
  Delta EG (m)              0.37    Culv Entr Loss (m)        0.13
  Delta WS (m)              0.37    Q Weir (m3/s)            15.13
  E.G. IC (m)             205.10    Weir Sta Lft (m)        116.37
  E.G. OC (m)             206.45    Weir Sta Rgt (m)        213.35
  Culvert Control         Outlet    Weir Submerg              0.00
  Culv WS Inlet (m)       204.80    Weir Max Depth (m)        0.45
  Culv WS Outlet (m)      204.70    Weir Avg Depth (m)        0.22
```

Culv Nml Depth (m)		Weir Flow Area (m2)	21.27
Culv Crt Depth (m)	1.28	Min El Weir Flow (m)	206.38

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.381

INPUT
Description: Section 46.381 - Hwy 400 / Langstaff Rd Ramp - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	50	206.5	95	205	220	204	227	203
235	202.3	244	202.3	247	203	252	204	257	205
269	206	300	206	300	209.5				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	50	.05	220	.08	227	.035	247	.08
257	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
227	247	260	275	290	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	235.2	205.5	F
243.8	300	205.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.67	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.65	Reach Len. (m)	260.00	275.00	290.00
Crit W.S. (m)	202.73	Flow Area (m2)		11.57	
E.G. Slope (m/m)	0.000358	Area (m2)	1.46	23.06	1.04
Q Total (m3/s)	7.62	Flow (m3/s)		7.62	
Top Width (m)	27.74	Top Width (m)	4.52	20.00	3.23
Vel Total (m/s)	0.66	Avg. Vel. (m/s)		0.66	
Max Chl Dpth (m)	1.35	Hydr. Depth (m)		1.35	
Conv. Total (m3/s)	402.8	Conv. (m3/s)		402.8	
Length Wtd. (m)	275.05	Wetted Per. (m)		8.60	
Min Ch El (m)	202.30	Shear (N/m2)		4.73	
Alpha	1.00	Stream Power (N/m s)		3.11	

Frctn Loss (m)	0.11	Cum Volume (1000 m3)	107.34	198.91	70.61
C & E Loss (m)	0.00	Cum SA (1000 m2)	101.27	68.81	83.11

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.052	0.035	0.076
W.S. Elev (m)	206.08	Reach Len. (m)	260.00	275.00	290.00
Crit W.S. (m)	203.77	Flow Area (m2)	232.30	71.66	29.99
E.G. Slope (m/m)	0.000019	Area (m2)	232.30	71.66	29.99
Q Total (m3/s)	47.80	Flow (m3/s)	24.84	20.86	2.11
Top Width (m)	237.26	Top Width (m)	164.26	20.00	53.00
Vel Total (m/s)	0.14	Avg. Vel. (m/s)	0.11	0.29	0.07
Max Chl Dpth (m)	3.78	Hydr. Depth (m)	1.41	3.58	0.57
Conv. Total (m3/s)	10945.9	Conv. (m3/s)	5687.0	4776.1	482.8
Length Wtd. (m)	272.95	Wetted Per. (m)	164.36	20.11	53.32
Min Ch El (m)	202.30	Shear (N/m2)	0.26	0.67	0.11
Alpha	2.10	Stream Power (N/m s)	0.03	0.19	0.01
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	337.91	389.41	318.42
C & E Loss (m)	0.01	Cum SA (1000 m2)	238.13	68.82	251.06

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: RIVER-1
REACH: Reach-1 RS: 46.36

INPUT

Description: Section 46.36 - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207.4	29	207	39	205	50	202	52	201.6
57	201.6	59	202	71	205	130	205.8		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	29	.05	39	.08	50	.035	59	.08
71	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
50	59	150	150	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
110	130	208	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.55	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.52	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)		Flow Area (m2)	4.22	16.46	4.60
E.G. Slope (m/m)	0.000427	Area (m2)	4.22	16.46	4.60
Q Total (m3/s)	16.31	Flow (m3/s)	0.89	14.45	0.97
Top Width (m)	20.63	Top Width (m)	5.56	9.00	6.07
Vel Total (m/s)	0.64	Avg. Vel. (m/s)	0.21	0.88	0.21
Max Chl Dpth (m)	1.92	Hydr. Depth (m)	0.76	1.83	0.76
Conv. Total (m3/s)	788.8	Conv. (m3/s)	42.9	699.0	46.9
Length Wtd. (m)	150.00	Wetted Per. (m)	5.77	9.08	6.26
Min Ch El (m)	201.60	Shear (N/m2)	3.07	7.60	3.08
Alpha	1.65	Stream Power (N/m s)	0.64	6.67	0.65
Frctn Loss (m)	0.05	Cum Volume (1000 m3)	106.60	193.48	69.79
C & E Loss (m)	0.00	Cum SA (1000 m2)	99.96	64.83	81.77

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.05	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.079	0.035	0.068
W.S. Elev (m)	206.02	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)		Flow Area (m2)	30.26	38.95	

59.52					
E.G. Slope (m/m)	0.000195	Area (m2)	30.26	38.95	
66.56					
Q Total (m3/s)	66.49	Flow (m3/s)	9.17	40.99	
16.32					
Top Width (m)	96.08	Top Width (m)	16.08	9.00	
71.00					
Vel Total (m/s)	0.52	Avg. Vel. (m/s)	0.30	1.05	
0.27					
Max Chl Dpth (m)	4.42	Hydr. Depth (m)	1.88	4.33	
1.17					
Conv. Total (m3/s)	4764.8	Conv. (m3/s)	657.5	2938.0	
1169.4					
Length Wtd. (m)	150.00	Wetted Per. (m)	16.58	9.08	
51.37					
Min Ch El (m)	201.60	Shear (N/m2)	3.48	8.19	
2.21					
Alpha	2.68	Stream Power (N/m s)	1.06	8.62	
0.61					
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	303.77	374.20	
304.42					
C & E Loss (m)	0.00	Cum SA (1000 m2)	214.68	64.83	
233.08					

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.35

INPUT
Description: Section 46.35 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	206.8	29	206.5	35	206	49	202	52	201.4
56	201.4	59	202	79	205	100	205.5	100	208
139	208								

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	29	.05	35	.08	49	.035	59	.08
79	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
49	59	120	120	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.50	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	
0.080					
W.S. Elev (m)	203.47	Reach Len. (m)	120.00	120.00	
120.00					
Crit W.S. (m)		Flow Area (m2)	3.78	18.90	
7.20					
E.G. Slope (m/m)	0.000308	Area (m2)	3.78	18.90	

Q Total (m3/s)	16.31	Flow (m3/s)	0.66	14.37
Top Width (m)	24.94	Top Width (m)	5.14	10.00
Vel Total (m/s)	0.55	Avg. Vel. (m/s)	0.17	0.76
Max Chl Dpth (m)	2.07	Hydr. Depth (m)	0.73	1.89
Conv. Total (m3/s)	928.9	Conv. (m3/s)	37.5	818.7
Length Wtd. (m)	120.00	Wetted Per. (m)	5.35	10.12
Min Ch El (m)	201.40	Shear (N/m2)	2.14	5.64
Alpha	1.72	Stream Power (N/m s)	0.37	4.29
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	106.00	190.83
C & E Loss (m)	0.00	Cum SA (1000 m2)	99.16	63.40

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.03	Element	Left OB	Channel
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035
W.S. Elev (m)	205.99	Reach Len. (m)	120.00	120.00
Crit W.S. (m)		Flow Area (m2)	27.92	44.14
E.G. Slope (m/m)	0.000158	Area (m2)	27.92	44.14
Q Total (m3/s)	66.49	Flow (m3/s)	6.77	42.26
Top Width (m)	64.98	Top Width (m)	13.98	10.00
Vel Total (m/s)	0.48	Avg. Vel. (m/s)	0.24	0.96
Max Chl Dpth (m)	4.59	Hydr. Depth (m)	2.00	4.41
Conv. Total (m3/s)	5296.8	Conv. (m3/s)	539.1	3367.0
Length Wtd. (m)	120.00	Wetted Per. (m)	14.54	10.12
Min Ch El (m)	201.40	Shear (N/m2)	2.97	6.74
Alpha	2.60	Stream Power (N/m s)	0.72	6.45
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	299.41	367.97
C & E Loss (m)	0.00	Cum SA (1000 m2)	212.43	63.41

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.34

INPUT
Description: Section 46.34 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	206.4	30	206.4	36	206	46	202	51	201.2
53	201.2	58	202	68	205	144	205.4		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	30	.05	36	.08	46	.035	58	.08
68	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
46	58	225	205	190	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
100	144	208	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.46	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.44	Reach Len. (m)	225.00	205.00	190.00
Crit W.S. (m)		Flow Area (m2)	2.59	22.88	3.46
E.G. Slope (m/m)	0.000238	Area (m2)	2.59	22.88	3.46
Q Total (m3/s)	16.31	Flow (m3/s)	0.38	15.40	0.52
Top Width (m)	20.40	Top Width (m)	3.60	12.00	4.80
Vel Total (m/s)	0.56	Avg. Vel. (m/s)	0.15	0.67	0.15
Max Chl Dpth (m)	2.24	Hydr. Depth (m)	0.72	1.91	0.72
Conv. Total (m3/s)	1056.8	Conv. (m3/s)	24.8	998.3	33.7
Length Wtd. (m)	204.98	Wetted Per. (m)	3.88	12.13	5.01
Min Ch El (m)	201.20	Shear (N/m2)	1.56	4.41	1.61
Alpha	1.35	Stream Power (N/m s)	0.23	2.97	0.24
Frctn Loss (m)	0.07	Cum Volume (1000 m3)	105.62	188.32	68.26
C & E Loss (m)	0.00	Cum SA (1000 m2)	98.64	62.08	79.70

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	206.01	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	

0.065					
W.S. Elev (m)	205.97	Reach Len. (m)	225.00	205.00	190.00
Crit W.S. (m)		Flow Area (m2)	19.74	53.29	53.21
E.G. Slope (m/m)	0.000144	Area (m2)	19.74	53.29	83.56
Q Total (m3/s)	66.49	Flow (m3/s)	4.46	49.09	12.94
Top Width (m)	107.94	Top Width (m)	9.94	12.00	86.00
Vel Total (m/s)	0.53	Avg. Vel. (m/s)	0.23	0.92	0.24
Max Chl Dpth (m)	4.77	Hydr. Depth (m)	1.99	4.44	1.27
Conv. Total (m3/s)	5532.1	Conv. (m3/s)	371.2	4084.4	1076.5
Length Wtd. (m)	205.80	Wetted Per. (m)	10.70	12.13	42.44
Min Ch El (m)	201.20	Shear (N/m2)	2.61	6.22	1.78
Alpha	2.31	Stream Power (N/m s)	0.59	5.73	0.43
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	296.55	362.13	285.58
C & E Loss (m)	0.00	Cum SA (1000 m2)	211.00	62.09	217.06

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.33

INPUT
Description: Section 46.33 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	67	205	75	202	78	201	83	201
86	202	97	205	115	205	115	208	180	208

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	67	.08	75	.035	86	.08	97	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
75	86	130	130	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.39	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.35	Reach Len. (m)	130.00	130.00	130.00
Crit W.S. (m)		Flow Area (m2)	2.42	22.81	

3.33				
E.G. Slope (m/m)	0.000442	Area (m2)	2.42	22.81
3.33				
Q Total (m3/s)	22.97	Flow (m3/s)	0.47	21.85
0.66				
Top Width (m)	19.53	Top Width (m)	3.59	11.00
4.94				
Vel Total (m/s)	0.80	Avg. Vel. (m/s)	0.19	0.96
0.20				
Max Chl Dpth (m)	2.35	Hydr. Depth (m)	0.67	2.07
0.67				
Conv. Total (m3/s)	1093.2	Conv. (m3/s)	22.2	1039.8
31.2				
Length Wtd. (m)	130.00	Wetted Per. (m)	3.84	11.32
5.12				
Min Ch El (m)	201.00	Shear (N/m2)	2.73	8.72
2.81				
Alpha	1.35	Stream Power (N/m s)	0.53	8.35
0.55				
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	105.05	183.64
67.62				
C & E Loss (m)	0.00	Cum SA (1000 m2)	97.83	59.72
78.78				

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.98	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.03	Wt. n-Val.	0.058	0.035
0.070				
W.S. Elev (m)	205.95	Reach Len. (m)	130.00	130.00
130.00				
Crit W.S. (m)		Flow Area (m2)	83.33	51.46
44.08				
E.G. Slope (m/m)	0.000128	Area (m2)	83.33	51.46
44.08				
Q Total (m3/s)	74.78	Flow (m3/s)	18.67	45.71
10.40				
Top Width (m)	115.00	Top Width (m)	75.00	11.00
29.00				
Vel Total (m/s)	0.42	Avg. Vel. (m/s)	0.22	0.89
0.24				
Max Chl Dpth (m)	4.95	Hydr. Depth (m)	1.11	4.68
1.52				
Conv. Total (m3/s)	6599.4	Conv. (m3/s)	1647.5	4033.8
918.2				
Length Wtd. (m)	130.00	Wetted Per. (m)	76.50	11.32
30.35				
Min Ch El (m)	201.00	Shear (N/m2)	1.37	5.72
1.83				
Alpha	2.88	Stream Power (N/m s)	0.31	5.08
0.43				
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	284.96	351.39
273.45				
C & E Loss (m)	0.00	Cum SA (1000 m2)	201.44	59.73
206.14				

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

water surface.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.322

INPUT
Description: Section 46.322 - Applewod Crescent - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	58	208	58	205.5	66	205.5	78.5	201.8
79.15	201	91	201	91.5	201.8	100.5	205.7	115	205.7
115	208	175	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	66	.08	78.5	.035	91.5	.08	100.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
78.5	91.5	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	78.5	205.6	F
91.5	175	205.6	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.34	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.035	
W.S. Elev (m)	203.31	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	201.71	Flow Area (m2)		29.60	
E.G. Slope (m/m)	0.000267	Area (m2)	3.87	29.60	2.64
Q Total (m3/s)	22.97	Flow (m3/s)		22.97	
Top Width (m)	21.60	Top Width (m)	5.11	13.00	3.49
Vel Total (m/s)	0.78	Avg. Vel. (m/s)		0.78	
Max Chl Dpth (m)	2.31	Hydr. Depth (m)		2.28	
Conv. Total (m3/s)	1405.3	Conv. (m3/s)		1405.3	
Length Wtd. (m)	50.00	Wetted Per. (m)		13.82	
Min Ch El (m)	201.00	Shear (N/m2)		5.61	
Alpha	1.00	Stream Power (N/m s)		4.35	
Frctn Loss (m)		Cum Volume (1000 m3)	104.65	180.23	67.23
C & E Loss (m)		Cum SA (1000 m2)	97.26	58.16	78.23

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.96	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.078	0.035	0.078
W.S. Elev (m)	205.92	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	202.54	Flow Area (m2)	31.66	63.45	22.63
E.G. Slope (m/m)	0.000153	Area (m2)	31.66	63.45	22.63
Q Total (m3/s)	74.78	Flow (m3/s)	7.79	61.95	5.04
Top Width (m)	57.00	Top Width (m)	20.50	13.00	23.50
Vel Total (m/s)	0.64	Avg. Vel. (m/s)	0.25	0.98	0.22
Max Chl Dpth (m)	4.92	Hydr. Depth (m)	1.54	4.88	0.96
Conv. Total (m3/s)	6044.5	Conv. (m3/s)	630.0	5006.9	407.6
Length Wtd. (m)	50.00	Wetted Per. (m)	21.45	13.82	24.53
Min Ch El (m)	201.00	Shear (N/m2)	2.22	6.89	1.39
Alpha	1.98	Stream Power (N/m s)	0.55	6.73	0.31
Frctn Loss (m)		Cum Volume (1000 m3)	277.48	343.92	269.11
C & E Loss (m)		Cum SA (1000 m2)	195.23	58.17	202.73

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.3215

INPUT
Description: Hum 13A-4R. Applewood Crescent - Twin Cell - 4.3 m W x 2.4 m H x 30 m L Concrete Box Culverts. Based on Drawings - July 2010

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.
Distance from Upstream XS = 10
Deck/Roadway Width = 30
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 2
Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord

58	205.6	115	205.6

Upstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	58	208	58	205.5	66	205.5	78.5	201.8
79.15	201	91	201	91.5	201.8	100.5	205.7	115	205.7
115	208	175	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	66	.08	78.5	.035	91.5	.08	100.5	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
78.5	91.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	78.5	205.6	F
91.5	175	205.6	F

Downstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
58	205.6	115	205.6

Downstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	58	208	58	205.5	66	205.5	78.5	201.8
79.15	200.6	91	200.6	91.5	201.8	100.5	205.7	115	205.7
115	208	175	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	66	.08	78.5	.035	91.5	.08	100.5	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
78.5	91.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	78.5	205	F
91.5	175	205	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	Box	2.44	4.27

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
10	30	.015	.015	0	.4	1

Number of Barrels = 2

Upstream Elevation = 201
Centerline Stations
Sta. Sta.
82.5 87.5
Downstream Elevation = 200.6
Centerline Stations
Sta. Sta.
82.5 87.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	22.97	Culv Full Len (m)	15.64
# Barrels	2	Culv Vel US (m/s)	1.20
Q Barrel (m3/s)	11.49	Culv Vel DS (m/s)	1.10
E.G. US. (m)	203.34	Culv Inv El Up (m)	201.00
W.S. US. (m)	203.31	Culv Inv El Dn (m)	200.60
E.G. DS (m)	203.27	Culv Frctn Ls (m)	0.01
W.S. DS (m)	203.24	Culv Exit Loss (m)	0.04
Delta EG (m)	0.08	Culv Entr Loss (m)	0.03
Delta WS (m)	0.07	Q Weir (m3/s)	
E.G. IC (m)	202.42	Weir Sta Lft (m)	
E.G. OC (m)	203.34	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	203.24	Weir Max Depth (m)	
Culv WS Outlet (m)	203.04	Weir Avg Depth (m)	
Culv Nml Depth (m)	0.59	Weir Flow Area (m2)	
Culv Crt Depth (m)	0.90	Min El Weir Flow (m)	205.60

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	58.91	Culv Full Len (m)	30.00
# Barrels	2	Culv Vel US (m/s)	2.83
Q Barrel (m3/s)	29.45	Culv Vel DS (m/s)	2.83
E.G. US. (m)	205.96	Culv Inv El Up (m)	201.00
W.S. US. (m)	205.92	Culv Inv El Dn (m)	200.60
E.G. DS (m)	205.36	Culv Frctn Ls (m)	0.08
W.S. DS (m)	205.31	Culv Exit Loss (m)	0.35
Delta EG (m)	0.59	Culv Entr Loss (m)	0.16
Delta WS (m)	0.61	Q Weir (m3/s)	15.87
E.G. IC (m)	204.55	Weir Sta Lft (m)	58.00
E.G. OC (m)	205.96	Weir Sta Rgt (m)	115.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	203.44	Weir Max Depth (m)	0.36
Culv WS Outlet (m)	203.04	Weir Avg Depth (m)	0.33
Culv Nml Depth (m)		Weir Flow Area (m2)	18.97
Culv Crt Depth (m)	1.69	Min El Weir Flow (m)	205.60

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.321

INPUT
Description: Section 46.322 - Applewod Crescent - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	58	208	58	205.5	66	205.5	78.5	201.8
79.15	200.6	91	200.6	91.5	201.8	100.5	205.7	115	205.7
115	208	175	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	66	.08	78.5	.035	91.5	.08	100.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
78.5	91.5	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	78.5	205	F
91.5	175	205	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.27	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.24	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	201.32	Flow Area (m2)		33.66	
E.G. Slope (m/m)	0.000186	Area (m2)	3.52	33.66	2.40
Q Total (m3/s)	22.97	Flow (m3/s)		22.97	
Top Width (m)	21.20	Top Width (m)	4.87	13.00	3.33
Vel Total (m/s)	0.68	Avg. Vel. (m/s)		0.68	
Max Chl Dpth (m)	2.64	Hydr. Depth (m)		2.59	
Conv. Total (m3/s)	1685.3	Conv. (m3/s)		1685.3	
Length Wtd. (m)	50.00	Wetted Per. (m)		14.51	
Min Ch El (m)	200.60	Shear (N/m2)		4.23	
Alpha	1.00	Stream Power (N/m s)		2.88	
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	104.65	179.47	67.23
C & E Loss (m)	0.02	Cum SA (1000 m2)	97.01	57.51	78.06

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.36	Element	Left OB	Channel	Right OB

Vel Head (m)	0.05	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	205.31	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	202.15	Flow Area (m2)	20.82	60.56	14.22
E.G. Slope (m/m)	0.000215	Area (m2)	20.82	60.56	14.22
Q Total (m3/s)	74.78	Flow (m3/s)	5.40	65.79	3.59
Top Width (m)	32.96	Top Width (m)	11.86	13.00	8.10
Vel Total (m/s)	0.78	Avg. Vel. (m/s)	0.26	1.09	0.25
Max Chl Dpth (m)	4.71	Hydr. Depth (m)	1.76	4.66	1.76
Conv. Total (m3/s)	5096.5	Conv. (m3/s)	368.3	4483.8	244.3
Length Wtd. (m)	50.00	Wetted Per. (m)	12.37	14.51	8.83
Min Ch El (m)	200.60	Shear (N/m2)	3.55	8.81	3.40
Alpha	1.71	Stream Power (N/m s)	0.92	9.57	0.86
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	277.48	341.57	269.11
C & E Loss (m)	0.02	Cum SA (1000 m2)	194.42	57.52	201.94

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: RIVER-1
REACH: Reach-1 RS: 46.32

INPUT
Description: Section 46.32 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	208	45	208	45	205.5	52	205	66	201
68	200.6	69	200.6	71	201	84	205	102	206
102	208	152	208						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	52	.08	66	.035	71	.08	84	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
66	71	110	110	110	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.23	Element	Left OB	Channel	Right OB

Vel Head (m)	0.08	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.15	Reach Len. (m)	110.00	110.00	110.00
Crit W.S. (m)		Flow Area (m2)	8.09	11.95	7.51
E.G. Slope (m/m)	0.000819	Area (m2)	8.09	11.95	7.51
Q Total (m3/s)	22.97	Flow (m3/s)	2.96	17.28	2.73
Top Width (m)	19.51	Top Width (m)	7.52	5.00	6.99
Vel Total (m/s)	0.83	Avg. Vel. (m/s)	0.37	1.45	0.36
Max Chl Dpth (m)	2.55	Hydr. Depth (m)	1.07	2.39	1.07
Conv. Total (m3/s)	802.9	Conv. (m3/s)	103.3	604.0	95.6
Length Wtd. (m)	110.00	Wetted Per. (m)	7.83	5.08	7.31
Min Ch El (m)	200.60	Shear (N/m2)	8.30	18.89	8.25
Alpha	2.31	Stream Power (N/m s)	3.03	27.31	3.00
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	104.36	178.32	66.98
C & E Loss (m)	0.02	Cum SA (1000 m2)	96.70	57.06	77.80

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.12	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	205.21	Reach Len. (m)	110.00	110.00	110.00
Crit W.S. (m)		Flow Area (m2)	31.24	22.25	29.12
E.G. Slope (m/m)	0.000649	Area (m2)	31.24	22.25	29.12
Q Total (m3/s)	74.78	Flow (m3/s)	16.32	43.36	15.10
Top Width (m)	38.71	Top Width (m)	16.93	5.00	16.77
Vel Total (m/s)	0.91	Avg. Vel. (m/s)	0.52	1.95	0.52
Max Chl Dpth (m)	4.61	Hydr. Depth (m)	1.84	4.45	1.74
Conv. Total (m3/s)	2934.9	Conv. (m3/s)	640.4	1701.8	592.8
Length Wtd. (m)	110.00	Wetted Per. (m)	17.50	5.08	17.38
Min Ch El (m)	200.60	Shear (N/m2)	11.37	27.89	10.67
Alpha	2.83	Stream Power (N/m s)	5.94	54.35	

5.53					
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	276.18	339.50	268.03
C & E Loss (m)	0.02	Cum SA (1000 m2)	193.70	57.07	201.32

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: RIVER-1
REACH: Reach-1 RS: 46.312

INPUT
Description: Section 46.312 - Edgeley Blvd - U/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	43	207	43	204.6	49	204.6	52	204.1
60.5	201.1	61.15	200.6	72.85	200.6	73.5	201.1	82	204.1
84	204.7	90	204.7	90	207	150	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	49	.08	60.5	.035	73.5	.08	84	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
60.5	73.5	60	60	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	60.5	204.7	F
73.5	150	204.7	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.18	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.15	Reach Len. (m)	60.00	60.00	60.00
Crit W.S. (m)	201.31	Flow Area (m2)		32.87	
E.G. Slope (m/m)	0.000180	Area (m2)	5.97	32.87	5.97
Q Total (m3/s)	22.97	Flow (m3/s)		22.97	
Top Width (m)	24.63	Top Width (m)	5.82	13.00	5.82
Vel Total (m/s)	0.70	Avg. Vel. (m/s)		0.70	
Max Chl Dpth (m)	2.55	Hydr. Depth (m)		2.53	
Conv. Total (m3/s)	1712.9	Conv. (m3/s)		1712.9	
Length Wtd. (m)	60.00	Wetted Per. (m)		13.34	

Min Ch El (m)	200.60	Shear (N/m2)			4.34
Alpha	1.00	Stream Power (N/m s)			3.04
Frctn Loss (m)		Cum Volume (1000 m3)	103.58	175.86	66.24
C & E Loss (m)		Cum SA (1000 m2)	95.97	56.07	77.10

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	205.27	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.077	0.035	0.078
W.S. Elev (m)	205.23	Reach Len. (m)	60.00	60.00	60.00
Crit W.S. (m)	202.13	Flow Area (m2)	28.77	59.86	27.19
E.G. Slope (m/m)	0.000169	Area (m2)	28.77	59.86	27.19
Q Total (m3/s)	74.78	Flow (m3/s)	7.28	60.47	7.04
Top Width (m)	47.00	Top Width (m)	17.50	13.00	16.50
Vel Total (m/s)	0.65	Avg. Vel. (m/s)	0.25	1.01	0.26
Max Chl Dpth (m)	4.63	Hydr. Depth (m)	1.64	4.60	1.65
Conv. Total (m3/s)	5754.5	Conv. (m3/s)	559.9	4653.2	541.3
Length Wtd. (m)	60.00	Wetted Per. (m)	18.69	13.34	17.63
Min Ch El (m)	200.60	Shear (N/m2)	2.55	7.43	2.55
Alpha	2.01	Stream Power (N/m s)	0.64	7.51	0.66
Frctn Loss (m)		Cum Volume (1000 m3)	272.88	334.98	264.93
C & E Loss (m)		Cum SA (1000 m2)	191.81	56.08	199.49

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.3115

INPUT
Description: Hum 13A-3R. Edgeley Blvd - Twin Cell - 4.3 m W x 2.4 m H x 35 m L Concrete Box Culverts. July 2010

Drawing by Ander Engineering Ltd. (Dwg No. 88-150-7, October 1989) used to recode culvert in HEC-RAS format.

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 10
Deck/Roadway Width = 35
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
43	204.7	90	204.7

Upstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	43	207	43	204.6	49	204.6	52	204.1
60.5	201.1	61.15	200.6	72.85	200.6	73.5	201.1	82	204.1
84	204.7	90	204.7	90	207	150	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	49	.08	60.5	.035	73.5	.08	84	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
60.5	73.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	60.5	204.7	F
73.5	150	204.7	F

Downstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
43	204.7	90	204.7

Downstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	43	207	43	204.6	49	204.6	52	204.1
60.5	201.1	61.15	200.5	72.85	200.5	73.5	201.1	82	204.1
84	204.7	90	204.7	90	207	150	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	49	.08	60.5	.035	73.5	.08	84	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
60.5	73.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	60.5	203.5	F
73.5	150	203.5	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	Box	2.44	4.27

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
	10	35	.015	.015	0	.4	1

Number of Barrels = 2
Upstream Elevation = 200.6
Centerline Stations

Sta.	Sta.
64.5	69.5

Downstream Elevation = 200.5
Centerline Stations

Sta.	Sta.
64.5	69.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	22.97	Culv Full Len (m)	35.00
# Barrels	2	Culv Vel US (m/s)	1.10
Q Barrel (m3/s)	11.49	Culv Vel DS (m/s)	1.10
E.G. US. (m)	203.18	Culv Inv El Up (m)	200.60
W.S. US. (m)	203.15	Culv Inv El Dn (m)	200.50
E.G. DS (m)	203.10	Culv Frctn Ls (m)	0.01
W.S. DS (m)	203.08	Culv Exit Loss (m)	0.04
Delta EG (m)	0.08	Culv Entr Loss (m)	0.02
Delta WS (m)	0.08	Q Weir (m3/s)	
E.G. IC (m)	202.03	Weir Sta Lft (m)	
E.G. OC (m)	203.18	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	203.04	Weir Max Depth (m)	
Culv WS Outlet (m)	202.94	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.90	Min El Weir Flow (m)	204.70

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	45.51	Culv Full Len (m)	35.00
# Barrels	2	Culv Vel US (m/s)	2.18
Q Barrel (m3/s)	22.76	Culv Vel DS (m/s)	2.18
E.G. US. (m)	205.27	Culv Inv El Up (m)	200.60
W.S. US. (m)	205.23	Culv Inv El Dn (m)	200.50
E.G. DS (m)	204.93	Culv Frctn Ls (m)	0.05
W.S. DS (m)	204.88	Culv Exit Loss (m)	0.19
Delta EG (m)	0.34	Culv Entr Loss (m)	0.10
Delta WS (m)	0.35	Q Weir (m3/s)	29.27
E.G. IC (m)	204.16	Weir Sta Lft (m)	43.00
E.G. OC (m)	205.27	Weir Sta Rgt (m)	90.00
Culvert Control	Outlet	Weir Submerg	0.31
Culv WS Inlet (m)	203.04	Weir Max Depth (m)	0.57
Culv WS Outlet (m)	202.94	Weir Avg Depth (m)	0.57
Culv Nml Depth (m)		Weir Flow Area (m2)	26.87
Culv Crt Depth (m)	1.43	Min El Weir Flow (m)	204.70

Warning: During the culvert inlet control computations, the program could not

balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.311

INPUT
Description: Section 46.311 - Edgeley Blvd - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	43	207	43	204.6	49	204.6	52	204.1
60.5	201.1	61.15	200.5	72.85	200.5	73.5	201.1	82	204.1
84	204.7	90	204.7	90	207	150	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	49	.08	60.5	.035	73.5	.08	84	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
60.5	73.5	150	150	150	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	60.5	203.5	F
73.5	150	203.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.10	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.		0.035	
W.S. Elev (m)	203.08	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)	201.21	Flow Area (m2)		33.12	
E.G. Slope (m/m)	0.000177	Area (m2)	5.54	33.12	5.54
Q Total (m3/s)	22.97	Flow (m3/s)		22.97	
Top Width (m)	24.21	Top Width (m)	5.60	13.00	5.60
Vel Total (m/s)	0.69	Avg. Vel. (m/s)		0.69	
Max Chl Dpth (m)	2.58	Hydr. Depth (m)		2.55	
Conv. Total (m3/s)	1724.2	Conv. (m3/s)		1724.2	
Length Wtd. (m)	150.00	Wetted Per. (m)		13.47	
Min Ch El (m)	200.50	Shear (N/m2)		4.28	
Alpha	1.00	Stream Power (N/m s)		2.97	
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	103.58	174.94	66.24
C & E Loss (m)	0.00	Cum SA (1000 m2)	95.62	55.29	76.75

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.93	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.079	0.035	0.079
W.S. Elev (m)	204.88	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)	202.03	Flow Area (m2)	22.64	56.54	21.41
E.G. Slope (m/m)	0.000225	Area (m2)	22.64	56.54	21.41
Q Total (m3/s)	74.78	Flow (m3/s)	5.89	63.08	5.81
Top Width (m)	47.00	Top Width (m)	17.50	13.00	16.50
Vel Total (m/s)	0.74	Avg. Vel. (m/s)	0.26	1.12	0.27
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.29	4.35	1.30
Conv. Total (m3/s)	4984.3	Conv. (m3/s)	392.9	4204.2	387.2
Length Wtd. (m)	150.00	Wetted Per. (m)	18.33	13.47	17.28
Min Ch El (m)	200.50	Shear (N/m2)	2.73	9.27	2.74
Alpha	1.92	Stream Power (N/m s)	0.71	10.34	0.74
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	272.88	332.15	264.93
C & E Loss (m)	0.00	Cum SA (1000 m2)	190.76	55.30	198.50

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.31

INPUT
Description: Section 46.31 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	40	207	40	204.5	46	204.5	49	204
58	201	61	200.4	67	200.4	70	201	81	204
85	204.6	107	204.6	107	207	148	207		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	46	.08	58	.035	70	.08	85	.05

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

58 70 150 150 150 .1 .3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.07	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.05	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)		Flow Area (m2)	6.32	30.03	7.73
E.G. Slope (m/m)	0.000173	Area (m2)	6.32	30.03	7.73
Q Total (m3/s)	22.97	Flow (m3/s)	1.02	20.69	1.26
Top Width (m)	25.69	Top Width (m)	6.16	12.00	7.53
Vel Total (m/s)	0.52	Avg. Vel. (m/s)	0.16	0.69	0.16
Max Chl Dpth (m)	2.65	Hydr. Depth (m)	1.03	2.50	1.03
Conv. Total (m3/s)	1745.1	Conv. (m3/s)	77.6	1571.5	95.9
Length Wtd. (m)	150.00	Wetted Per. (m)	6.49	12.12	7.80
Min Ch El (m)	200.40	Shear (N/m2)	1.65	4.21	1.68
Alpha	1.58	Stream Power (N/m s)	0.27	2.90	0.28
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	102.69	170.21	65.25
C & E Loss (m)	0.00	Cum SA (1000 m2)	94.74	53.42	75.77

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.90	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.079	0.035	0.078
W.S. Elev (m)	204.84	Reach Len. (m)	150.00	150.00	150.00
Crit W.S. (m)		Flow Area (m2)	24.95	51.54	33.35
E.G. Slope (m/m)	0.000235	Area (m2)	24.95	51.54	33.35
Q Total (m3/s)	74.78	Flow (m3/s)	6.86	59.31	8.61
Top Width (m)	67.00	Top Width (m)	18.00	12.00	37.00
Vel Total (m/s)	0.68	Avg. Vel. (m/s)	0.27	1.15	0.26
Max Chl Dpth (m)	4.44	Hydr. Depth (m)	1.39	4.29	0.90
Conv. Total (m3/s)	4873.2	Conv. (m3/s)	447.1	3865.0	561.2
Length Wtd. (m)	150.00	Wetted Per. (m)	18.87	12.12	37.69

Min Ch El (m)	200.40	Shear (N/m2)	3.05	9.82	2.04
Alpha	2.30	Stream Power (N/m s)	0.84	11.30	0.53
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	269.31	324.04	260.83
C & E Loss (m)	0.00	Cum SA (1000 m2)	188.10	53.43	194.48

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.30

INPUT
Description: Section 46.30 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	20	207	20	205	46	205	56	201
59	200.3	65	200.3	68	201	80	204	83	204.7
119	205	119	207	146	207				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	46	.08	56	.035	68	.08	83	.025
119	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
56	68	110	110	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.04	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.01	Reach Len. (m)	110.00	110.00	110.00
Crit W.S. (m)		Flow Area (m2)	5.03	30.38	8.05
E.G. Slope (m/m)	0.000267	Area (m2)	5.03	30.38	8.05
Q Total (m3/s)	28.70	Flow (m3/s)	0.98	26.10	1.61
Top Width (m)	25.04	Top Width (m)	5.02	12.00	8.03
Vel Total (m/s)	0.66	Avg. Vel. (m/s)	0.19	0.86	0.20
Max Chl Dpth (m)	2.71	Hydr. Depth (m)	1.00	2.53	1.00
Conv. Total (m3/s)	1756.7	Conv. (m3/s)	60.0	1597.8	98.8
Length Wtd. (m)	110.00	Wetted Per. (m)	5.40	12.16	8.27
Min Ch El (m)	200.30	Shear (N/m2)	2.44	6.54	2.55
Alpha	1.55	Stream Power (N/m s)	0.47	5.62	0.51
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	101.84	165.68	

64.06
  C & E Loss (m) 0.00 Cum SA (1000 m2) 93.90 51.62
74.60

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.86	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	204.79	Reach Len. (m)	110.00	110.00	110.00
Crit W.S. (m)		Flow Area (m2)	17.93	51.75	29.21
E.G. Slope (m/m)	0.000297	Area (m2)	17.93	51.75	29.21
Q Total (m3/s)	81.91	Flow (m3/s)	5.62	66.88	9.41
Top Width (m)	46.92	Top Width (m)	9.47	12.00	25.45
Vel Total (m/s)	0.83	Avg. Vel. (m/s)	0.31	1.29	0.32
Max Chl Dpth (m)	4.49	Hydr. Depth (m)	1.89	4.31	1.15
Conv. Total (m3/s)	4754.7	Conv. (m3/s)	326.4	3882.1	546.2
Length Wtd. (m)	110.00	Wetted Per. (m)	10.20	12.16	25.90
Min Ch El (m)	200.30	Shear (N/m2)	5.12	12.38	3.28
Alpha	2.01	Stream Power (N/m s)	1.61	16.01	1.06
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	266.09	316.29	256.13
C & E Loss (m)	0.01	Cum SA (1000 m2)	186.04	51.63	189.80

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.292

INPUT
Description: Section 46.292 - Millway Avenue - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	25	207	25	204	40	204	50	201
50.5	200.3	63	200.3	64	201	72	204	75	204.5
85	204.7	85	207	142	207				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	40	.08	50	.035	64	.08	72	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
50	64	55	55	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	50.5	204.1	F
63	142	204.1	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	203.01	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.		0.035	
W.S. Elev (m)	202.98	Reach Len. (m)	55.00	55.00	55.00
Crit W.S. (m)	201.11	Flow Area (m2)		33.44	
E.G. Slope (m/m)	0.000243	Area (m2)	6.50	36.93	5.20
Q Total (m3/s)	28.70	Flow (m3/s)		28.70	
Top Width (m)	25.85	Top Width (m)	6.58	14.00	5.27
Vel Total (m/s)	0.86	Avg. Vel. (m/s)		0.86	
Max Chl Dpth (m)	2.68	Hydr. Depth (m)		2.68	
Conv. Total (m3/s)	1841.1	Conv. (m3/s)		1841.1	
Length Wtd. (m)	55.00	Wetted Per. (m)		12.50	
Min Ch El (m)	200.30	Shear (N/m2)		6.37	
Alpha	1.00	Stream Power (N/m s)		5.47	
Frctn Loss (m)		Cum Volume (1000 m3)	101.21	161.97	63.33
C & E Loss (m)		Cum SA (1000 m2)	93.27	50.19	73.87

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.82	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.071	0.035	0.078
W.S. Elev (m)	204.78	Reach Len. (m)	55.00	55.00	55.00
Crit W.S. (m)	201.94	Flow Area (m2)	34.40	62.14	21.54
E.G. Slope (m/m)	0.000204	Area (m2)	34.40	62.14	21.54
Q Total (m3/s)	81.91	Flow (m3/s)	9.54	66.61	5.76
Top Width (m)	60.00	Top Width (m)	25.00	14.00	21.00
Vel Total (m/s)	0.69	Avg. Vel. (m/s)	0.28	1.07	0.27

Max Chl Dpth (m)	4.48	Hydr. Depth (m)	1.38	4.44	1.03
Conv. Total (m3/s)	5738.3	Conv. (m3/s)	668.3	4666.5	403.6
Length Wtd. (m)	55.00	Wetted Per. (m)	26.22	14.58	21.66
Min Ch El (m)	200.30	Shear (N/m2)	2.62	8.52	1.99
Alpha	1.97	Stream Power (N/m s)	0.73	9.13	0.53
Frctn Loss (m)		Cum Volume (1000 m3)	263.22	310.03	253.34
C & E Loss (m)		Cum SA (1000 m2)	184.14	50.20	187.24

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2915

INPUT
Description: Hum 13A-2RR. Millway Avenue Culvert - Twin Cell - 4.3 m W x 2.4 m H x 30 m L Concrete Box Culverts. Based on drawings - July 2010

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 15
Deck/Roadway Width = 30
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
25	204.1		75	204.1		85	204.7	

Upstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	25	207	25	204	40	204	50	201
50.5	200.3	63	200.3	64	201	72	204	75	204.5
85	204.7	85	207	142	207				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	40	.08	50	.035	64	.08	72	.05

Bank Sta: Left Right Coeff Contr. Expan.
50 64 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	50.5	204.1	F
63	142	204.1	F

Downstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord

25	204.1	75	204.1	85	204.7

Downstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	25	207	25	204	40	204	50	201
50.5	200.2	63	200.2	64	201	72	204	75	204.5
85	204.7	85	207	142	207				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	40	.08	50	.035	64	.08	72	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
50	64	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	50.5	203.4	F
63	142	203.4	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	Box	2.44	4.27

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
	15	30	.015	.015	0	.4	1

Number of Barrels = 2
Upstream Elevation = 200.3
Centerline Stations

Sta.	Sta.
54.3	59.3

Downstream Elevation = 200.2
Centerline Stations

Sta.	Sta.
54.3	59.3

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	28.70	Culv Full Len (m)	30.00
# Barrels	2	Culv Vel US (m/s)	1.38
Q Barrel (m3/s)	14.35	Culv Vel DS (m/s)	1.38
E.G. US. (m)	203.01	Culv Inv El Up (m)	200.30
W.S. US. (m)	202.98	Culv Inv El Dn (m)	200.20
E.G. DS (m)	202.90	Culv Frctn Ls (m)	0.02
W.S. DS (m)	202.86	Culv Exit Loss (m)	0.06
Delta EG (m)	0.12	Culv Entr Loss (m)	0.04
Delta WS (m)	0.12	Q Weir (m3/s)	
E.G. IC (m)	201.97	Weir Sta Lft (m)	
E.G. OC (m)	203.01	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	

Culv WS Inlet (m)	202.74	Weir Max Depth (m)	
Culv WS Outlet (m)	202.64	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	1.05	Min El Weir Flow (m)	204.10

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	36.65	Culv Full Len (m)	30.00
# Barrels	2	Culv Vel US (m/s)	1.76
Q Barrel (m3/s)	18.33	Culv Vel DS (m/s)	1.76
E.G. US. (m)	204.82	Culv Inv El Up (m)	200.30
W.S. US. (m)	204.78	Culv Inv El Dn (m)	200.20
E.G. DS (m)	204.63	Culv Frctn Ls (m)	0.03
W.S. DS (m)	204.57	Culv Exit Loss (m)	0.10
Delta EG (m)	0.19	Culv Entr Loss (m)	0.06
Delta WS (m)	0.20	Q Weir (m3/s)	45.26
E.G. IC (m)	204.15	Weir Sta Lft (m)	25.00
E.G. OC (m)	204.82	Weir Sta Rgt (m)	85.00
Culvert Control	Outlet	Weir Submerg	0.63
Culv WS Inlet (m)	202.74	Weir Max Depth (m)	0.73
Culv WS Outlet (m)	202.64	Weir Avg Depth (m)	0.63
Culv Nml Depth (m)		Weir Flow Area (m2)	38.06
Culv Crt Depth (m)	1.23	Min El Weir Flow (m)	204.10

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.291

INPUT
Description: Section 46.291 - Millway Avenue - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	25	207	25	204	40	204	50	201
50.5	200.2	63	200.2	64	201	72	204	75	204.5
85	204.7	85	207	142	207				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	40	.08	50	.035	64	.08	72	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
50	64	145	150	155	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	50.5	203.4	F
63	142	203.4	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.90	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.		0.035	

W.S. Elev (m)	202.86	Reach Len. (m)	145.00	150.00	155.00
Crit W.S. (m)	201.01	Flow Area (m2)		33.24	
E.G. Slope (m/m)	0.000248	Area (m2)	5.76	36.63	4.61
Q Total (m3/s)	28.70	Flow (m3/s)		28.70	
Top Width (m)	25.16	Top Width (m)	6.20	14.00	4.96
Vel Total (m/s)	0.86	Avg. Vel. (m/s)		0.86	
Max Chl Dpth (m)	2.66	Hydr. Depth (m)		2.66	
Conv. Total (m3/s)	1823.2	Conv. (m3/s)		1823.2	
Length Wtd. (m)	149.98	Wetted Per. (m)		12.50	
Min Ch El (m)	200.20	Shear (N/m2)		6.46	
Alpha	1.00	Stream Power (N/m s)		5.58	
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	101.21	160.78	63.33
C & E Loss (m)	0.00	Cum SA (1000 m2)	92.91	49.42	73.59

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.63	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.073	0.035	0.079
W.S. Elev (m)	204.57	Reach Len. (m)	145.00	150.00	155.00
Crit W.S. (m)	201.84	Flow Area (m2)	29.37	60.64	17.71
E.G. Slope (m/m)	0.000238	Area (m2)	29.37	60.64	17.71
Q Total (m3/s)	81.91	Flow (m3/s)	8.12	68.71	5.09
Top Width (m)	53.73	Top Width (m)	25.00	14.00	14.73
Vel Total (m/s)	0.76	Avg. Vel. (m/s)	0.28	1.13	0.29
Max Chl Dpth (m)	4.37	Hydr. Depth (m)	1.17	4.33	1.20
Conv. Total (m3/s)	5307.9	Conv. (m3/s)	526.1	4452.1	329.6
Length Wtd. (m)	149.85	Wetted Per. (m)	26.01	14.72	15.31
Min Ch El (m)	200.20	Shear (N/m2)	2.64	9.62	2.70
Alpha	1.88	Stream Power (N/m s)	0.73	10.90	0.78
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	263.22	306.08	253.34

C & E Loss (m)	0.00	Cum SA (1000 m2)	182.77	49.43	186.26

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.29

INPUT
Description: Section 46.29 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	30	207	30	204.5	54	204	64	201
71	200.2	78	201	86	204	110	205	156	205

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	54	.08	64	.035	78	.08	86	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
64	78	135	145	150	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.85	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.82	Reach Len. (m)	135.00	145.00	150.00
Crit W.S. (m)		Flow Area (m2)	5.51	31.07	4.41
E.G. Slope (m/m)	0.000315	Area (m2)	5.51	31.07	4.41
Q Total (m3/s)	28.70	Flow (m3/s)	1.12	26.70	0.88
Top Width (m)	24.91	Top Width (m)	6.06	14.00	4.85
Vel Total (m/s)	0.70	Avg. Vel. (m/s)	0.20	0.86	0.20
Max Chl Dpth (m)	2.62	Hydr. Depth (m)	0.91	2.22	0.91
Conv. Total (m3/s)	1616.0	Conv. (m3/s)	62.9	1503.6	49.5
Length Wtd. (m)	144.88	Wetted Per. (m)	6.33	14.09	5.18
Min Ch El (m)	200.20	Shear (N/m2)	2.69	6.82	2.63
Alpha	1.41	Stream Power (N/m s)	0.55	5.86	0.53
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	100.39	155.70	62.64
C & E Loss (m)	0.00	Cum SA (1000 m2)	92.03	47.32	72.83

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.59	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.076	0.035	0.078
W.S. Elev (m)	204.52	Reach Len. (m)	135.00	145.00	150.00
Crit W.S. (m)		Flow Area (m2)	26.69	54.88	19.41
E.G. Slope (m/m)	0.000309	Area (m2)	26.69	54.88	19.41
Q Total (m3/s)	81.91	Flow (m3/s)	7.84	68.18	5.89
Top Width (m)	68.49	Top Width (m)	34.00	14.00	20.49
Vel Total (m/s)	0.81	Avg. Vel. (m/s)	0.29	1.24	0.30
Max Chl Dpth (m)	4.32	Hydr. Depth (m)	0.78	3.92	0.95
Conv. Total (m3/s)	4663.5	Conv. (m3/s)	446.3	3881.7	335.4
Length Wtd. (m)	144.53	Wetted Per. (m)	34.47	14.09	21.04
Min Ch El (m)	200.20	Shear (N/m2)	2.34	11.78	2.79
Alpha	1.97	Stream Power (N/m s)	0.69	14.64	0.85
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	259.15	297.41	250.47
C & E Loss (m)	0.01	Cum SA (1000 m2)	178.49	47.33	183.53

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.282

INPUT
Description: Section 46.282 - Pennsylvania Avenue - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	60	207	60	204	73	204	81	201
83	200.4	84	199.9	96	199.9	97	200.4	99	202
101	203	103	204	118	204	145	204	180	204.64
225	204.64								

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	83	.035	97	.08	103	.05
118	.025	145	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
83	97	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	83.5	204.1	F

96.5 225 204.05 F
Right Levee Station= 180 Elevation= 207

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.82	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.035	
W.S. Elev (m)	202.79	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	200.70	Flow Area (m2)		37.43	
E.G. Slope (m/m)	0.000178	Area (m2)	8.45	39.95	3.80
Q Total (m3/s)	28.70	Flow (m3/s)		28.70	
Top Width (m)	24.35	Top Width (m)	6.77	14.00	3.58
Vel Total (m/s)	0.77	Avg. Vel. (m/s)		0.77	
Max Chl Dpth (m)	2.89	Hydr. Depth (m)		2.88	
Conv. Total (m3/s)	2151.6	Conv. (m3/s)		2151.6	
Length Wtd. (m)	50.00	Wetted Per. (m)		13.12	
Min Ch El (m)	199.90	Shear (N/m2)		4.98	
Alpha	1.00	Stream Power (N/m s)		3.82	
Frctn Loss (m)		Cum Volume (1000 m3)	99.45	150.55	62.02
C & E Loss (m)		Cum SA (1000 m2)	91.16	45.29	72.20

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.55	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.076	0.035	0.048
W.S. Elev (m)	204.50	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	201.50	Flow Area (m2)	30.21	63.97	40.81
E.G. Slope (m/m)	0.000169	Area (m2)	30.21	63.97	40.81
Q Total (m3/s)	81.91	Flow (m3/s)	7.61	64.79	9.51
Top Width (m)	112.61	Top Width (m)	23.00	14.00	75.61
Vel Total (m/s)	0.61	Avg. Vel. (m/s)	0.25	1.01	0.23
Max Chl Dpth (m)	4.60	Hydr. Depth (m)	1.31	4.57	0.54

Conv. Total (m3/s)	6292.1	Conv. (m3/s)	584.9	4976.5	730.7
Length Wtd. (m)	50.00	Wetted Per. (m)	24.14	14.24	76.65
Min Ch El (m)	199.90	Shear (N/m2)	2.08	7.47	0.88
Alpha	2.24	Stream Power (N/m s)	0.52	7.56	0.21
Frctn Loss (m)		Cum Volume (1000 m3)	255.31	288.80	245.95
C & E Loss (m)		Cum SA (1000 m2)	174.64	45.30	176.33

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2815

INPUT
Description: Hum 13A-2R. Pennsylvania Avenue Culvert - Twin Cell - 5.7 m W x 2.4 m H x 40 m L Concrete Box Culverts. Drawing by Ander Engineering Ltd. (Dwg No. 85-102-9, December 1989) shows 4 Cell Culvert, but only two cells observed in field.

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 40
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 6

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	205	103	204	133	203.53
145	204	180	204	225	204

Upstream Bridge Cross Section Data
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	207	60	207	60	204	73	204	81	201
83	200.4	84	199.9	96	199.9	97	200.4	99	202
101	203	103	204	118	204	145	204	180	204.64
225	204.64								

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	83	.035	97	.08	103	.05
118	.025	145	.05						

Bank Sta: Left	Right	Coeff Contr.	Expan.
83	97	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	83.5	204.1	F
96.5	225	204.05	F

Right Levee Station= 180 Elevation= 207

Downstream Deck/Roadway Coordinates
num= 5

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	205	103	204	133	203.53
160	204	200	204		

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	73	204	81	201	83	200.4	84	199.8
96	199.8	97	200.4	99	202	101	203	103	204
118	204	145	204	160	204	200	204	200	206

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	83	.035	97	.08	103	.05
118	.025	145	.05						

Bank Sta: Left	Right	Coeff Contr.	Expan.
83	97	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	83.5	203.4	F
96.5	200	203.4	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	Box	3.05	4.57

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	40	.015	.015	0	.4	1

Number of Barrels = 2
Upstream Elevation = 199.3
Centerline Stations

Sta.	Sta.
87.5	92.5

Downstream Elevation = 199.2
Centerline Stations

Sta.	Sta.
87.5	92.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	28.70	Culv Full Len (m)	40.00
# Barrels	2	Culv Vel US (m/s)	1.03
Q Barrel (m3/s)	14.35	Culv Vel DS (m/s)	1.03
E.G. US. (m)	202.82	Culv Inv El Up (m)	199.30
W.S. US. (m)	202.79	Culv Inv El Dn (m)	199.20
E.G. DS (m)	202.76	Culv Frctn Ls (m)	0.01

W.S. DS (m)	202.73	Culv Exit Loss (m)	0.02
Delta EG (m)	0.06	Culv Entr Loss (m)	0.02
Delta WS (m)	0.06	Q Weir (m3/s)	
E.G. IC (m)	200.88	Weir Sta Lft (m)	
E.G. OC (m)	202.82	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	202.35	Weir Max Depth (m)	
Culv WS Outlet (m)	202.25	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	1.00	Min El Weir Flow (m)	204.05

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	39.39	Culv Full Len (m)	40.00
# Barrels	2	Culv Vel US (m/s)	1.41
Q Barrel (m3/s)	19.70	Culv Vel DS (m/s)	1.41
E.G. US. (m)	204.54	Culv Inv El Up (m)	199.30
W.S. US. (m)	204.50	Culv Inv El Dn (m)	199.20
E.G. DS (m)	204.43	Culv Frctn Ls (m)	0.02
W.S. DS (m)	204.38	Culv Exit Loss (m)	0.06
Delta EG (m)	0.12	Culv Entr Loss (m)	0.04
Delta WS (m)	0.12	Q Weir (m3/s)	42.52
E.G. IC (m)	202.56	Weir Sta Lft (m)	60.00
E.G. OC (m)	204.54	Weir Sta Rgt (m)	174.65
Culvert Control	Outlet	Weir Submerg	0.62
Culv WS Inlet (m)	202.35	Weir Max Depth (m)	0.54
Culv WS Outlet (m)	202.25	Weir Avg Depth (m)	0.39
Culv Nml Depth (m)		Weir Flow Area (m2)	45.15
Culv Crt Depth (m)	1.24	Min El Weir Flow (m)	204.05

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.281

INPUT
Description: Section 46.281 - Pennsylvania Avenue - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	73	204	81	201	83	200.4	84	199.8
96	199.8	97	200.4	99	202	101	203	103	204
118	204	145	204	160	204	200	204	200	206

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	83	.035	97	.08	103	.05
118	.025	145	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
83	97	40	40	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	83.5	203.4	F
96.5	200	203.4	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.76	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.		0.035	
W.S. Elev (m)	202.73	Reach Len. (m)	40.00	40.00	40.00
Crit W.S. (m)	200.60	Flow Area (m2)		37.98	
E.G. Slope (m/m)	0.000170	Area (m2)	8.07	40.46	3.60
Q Total (m3/s)	28.70	Flow (m3/s)		28.70	
Top Width (m)	24.09	Top Width (m)	6.62	14.00	3.47
Vel Total (m/s)	0.76	Avg. Vel. (m/s)		0.76	
Max Chl Dpth (m)	2.93	Hydr. Depth (m)		2.92	
Conv. Total (m3/s)	2198.5	Conv. (m3/s)		2198.5	
Length Wtd. (m)	40.00	Wetted Per. (m)		13.17	
Min Ch El (m)	199.80	Shear (N/m2)		4.82	
Alpha	1.00	Stream Power (N/m s)		3.64	
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	99.45	149.66	62.02
C & E Loss (m)	0.01	Cum SA (1000 m2)	90.82	44.59	72.02

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, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.43	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.078	0.035	0.051
W.S. Elev (m)	204.38	Reach Len. (m)	40.00	40.00	40.00
Crit W.S. (m)	201.40	Flow Area (m2)	27.75	63.55	48.97
E.G. Slope (m/m)	0.000180	Area (m2)	27.75	63.55	48.97
Q Total (m3/s)	81.91	Flow (m3/s)	6.66	65.74	9.51
Top Width (m)	154.90	Top Width (m)	37.90	14.00	103.00
Vel Total (m/s)	0.58	Avg. Vel. (m/s)	0.24	1.03	0.19
Max Chl Dpth (m)	4.58	Hydr. Depth (m)	0.73	4.54	0.48

Conv. Total (m3/s)	6105.9	Conv. (m3/s)	496.3	4900.4	709.2
Length Wtd. (m)	40.00	Wetted Per. (m)	38.53	14.33	104.42
Min Ch El (m)	199.80	Shear (N/m2)	1.27	7.83	0.83
Alpha	2.55	Stream Power (N/m s)	0.30	8.10	0.16
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	255.31	285.46	245.95
C & E Loss (m)	0.02	Cum SA (1000 m2)	173.12	44.60	171.86

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: RIVER-1
REACH: Reach-1 RS: 46.28

INPUT
Description: Section 46.28 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	73	204	83	201	87	200	89	199.8
91	199.8	93	200	95	201	98	202	101	203
103	204	117	204	142	204	173	204	173	206

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73	.08	87	.035	93	.08	103	.05
117	.025	142	.05						

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
87	93	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.74	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.68	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)		Flow Area (m2)	13.40	16.86	8.57
E.G. Slope (m/m)	0.000504	Area (m2)	13.40	16.86	8.57
Q Total (m3/s)	28.70	Flow (m3/s)	4.58	21.49	2.62
Top Width (m)	22.62	Top Width (m)	9.59	6.00	7.03
Vel Total (m/s)	0.74	Avg. Vel. (m/s)	0.34	1.27	0.31
Max Chl Dpth (m)	2.88	Hydr. Depth (m)	1.40	2.81	

1.22					
Conv. Total (m3/s)	1278.2	Conv. (m3/s)	204.1	957.4	
116.8					
Length Wtd. (m)	50.00	Wetted Per. (m)	9.96	6.02	
7.54					
Min Ch El (m)	199.80	Shear (N/m2)	6.65	13.85	
5.62					
Alpha	2.28	Stream Power (N/m s)	2.27	17.65	
1.72					
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	99.02	148.51	
61.78					
C & E Loss (m)	0.01	Cum SA (1000 m2)	90.50	44.19	
71.81					

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.40	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.10	Wt. n-Val.	0.079	0.035	
0.065					
W.S. Elev (m)	204.30	Reach Len. (m)	50.00	50.00	
50.00					
Crit W.S. (m)		Flow Area (m2)	36.43	26.59	
43.88					
E.G. Slope (m/m)	0.000545	Area (m2)	36.43	26.59	
43.88					
Q Total (m3/s)	81.91	Flow (m3/s)	17.18	47.73	
17.00					
Top Width (m)	121.79	Top Width (m)	35.79	6.00	
80.00					
Vel Total (m/s)	0.77	Avg. Vel. (m/s)	0.47	1.80	
0.39					
Max Chl Dpth (m)	4.50	Hydr. Depth (m)	1.02	4.43	
0.55					
Conv. Total (m3/s)	3509.8	Conv. (m3/s)	736.3	2045.2	
728.3					
Length Wtd. (m)	50.00	Wetted Per. (m)	36.36	6.02	
81.10					
Min Ch El (m)	199.80	Shear (N/m2)	5.35	23.59	
2.89					
Alpha	3.33	Stream Power (N/m s)	2.52	42.35	
1.12					
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	254.03	283.66	
244.09					
C & E Loss (m)	0.02	Cum SA (1000 m2)	171.65	44.20	
168.20					

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: RIVER-1
REACH: Reach-1 RS: 46.274

INPUT
Description: Section 46.274 - Jane Street - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	76	204	83	201	90	200
94	199.34	98	199.34	102	200	106	201	116	204
130	204	205	204	205	206				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	76	.08	90	.035	106	.08	116	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	102	1	1	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	89	203.21	F
103	205	203.21	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.72	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.035
W.S. Elev (m)	202.70	Reach Len. (m)	0.50	0.50	0.50
Crit W.S. (m)	200.27	Flow Area (m2)	2.63	37.71	2.58
E.G. Slope (m/m)	0.000078	Area (m2)	18.80	37.71	13.64
Q Total (m3/s)	22.11	Flow (m3/s)	0.55	20.35	1.20
Top Width (m)	32.65	Top Width (m)	10.97	12.00	9.67
Vel Total (m/s)	0.52	Avg. Vel. (m/s)	0.21	0.54	0.47
Max Chl Dpth (m)	3.36	Hydr. Depth (m)	2.63	3.14	2.58
Conv. Total (m3/s)	2495.6	Conv. (m3/s)	62.3	2297.7	135.7
Length Wtd. (m)	0.50	Wetted Per. (m)	1.01	12.11	1.03
Min Ch El (m)	199.34	Shear (N/m2)	2.00	2.40	1.92
Alpha	1.06	Stream Power (N/m s)	0.42	1.29	0.90
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	98.21	147.15	61.22
C & E Loss (m)	0.04	Cum SA (1000 m2)	89.99	43.74	71.39

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.36	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.076	0.035	0.047
W.S. Elev (m)	204.34	Reach Len. (m)	0.50	0.50	0.50
Crit W.S. (m)	201.18	Flow Area (m2)	55.62	57.34	63.86
E.G. Slope (m/m)	0.000122	Area (m2)	55.62	57.34	63.86
Q Total (m3/s)	81.91	Flow (m3/s)	12.24	51.09	18.59
Top Width (m)	181.84	Top Width (m)	66.84	12.00	103.00
Vel Total (m/s)	0.46	Avg. Vel. (m/s)	0.22	0.89	0.29
Max Chl Dpth (m)	5.00	Hydr. Depth (m)	0.83	4.78	0.62
Conv. Total (m3/s)	7407.4	Conv. (m3/s)	1106.9	4619.9	1680.7
Length Wtd. (m)	0.50	Wetted Per. (m)	67.54	12.11	103.90
Min Ch El (m)	199.34	Shear (N/m2)	0.99	5.68	0.74
Alpha	2.43	Stream Power (N/m s)	0.22	5.06	0.21
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	251.73	281.56	241.40
C & E Loss (m)	0.02	Cum SA (1000 m2)	169.08	43.75	163.63

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.

BRIDGE

RIVER: RIVER-1
REACH: Reach-1   RS: 46.2735

INPUT
Description: Hum 13A-1R. Jane Street Culverts - Upstream In-Line Weir Coded as
             Bridge. Weir is 25 m L. Drawings by Ander Engineering Ltd.
             (85-101-7 & 85-101-1) 1985.

New HEC-RAS coding January 2004 by
             Acres included coding of in-line weir (as a bridge) and culverts
             in HEC-RAS.
Distance from Upstream XS =   .5
Deck/Roadway Width   =   .25
Weir Coefficient   =   1.72
Upstream Deck/Roadway Coordinates
    num=   8

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
76	204	204	83.5	204		83.5	203.21	
90	203.21	200.7	102	203.21	200.7	108.5	203.21	
108.5	204		116	204				

Upstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	76	204	83	201	90	200
94	199.34	98	199.34	102	200	106	201	116	204
130	204	205	204	205	206				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	76	.08	90	.035	106	.08	116	.05

Bank Sta: Left Right Coeff Contr. Expan.
90 102 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	89	203.21	F
103	205	203.21	F

Downstream Deck/Roadway Coordinates
num= 8

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
76	204	204	83.5	204		83.5	203.21	
90	203.21	200.7	102	203.21	200.7	108.5	203.21	
108.5	204		116	204				

Downstream Bridge Cross Section Data
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	76	204	83	201	90	200
94	199.34	98	199.34	102	200	106	201	116	204
130	204	205	204	205	206				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	76	.08	90	.035	106	.08	116	.05

Bank Sta: Left Right Coeff Contr. Expan.
90 102 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	89	203.2	F
103	205	203.2	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 Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method

Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT Profile #100-year

E.G. US. (m)	202.72	Element	Inside BR US	Inside BR DS
W.S. US. (m)	202.70	E.G. Elev (m)	202.68	202.68
Q Total (m3/s)	22.11	W.S. Elev (m)	202.55	202.55
Q Bridge (m3/s)	22.11	Crit W.S. (m)	200.26	200.26
Q Weir (m3/s)		Max Chl Dpth (m)	3.21	3.21
Weir Sta Lft (m)		Vel Total (m/s)	1.62	1.62
Weir Sta Rgt (m)		Flow Area (m2)	13.69	13.69
Weir Submerg		Froude # Chl	0.29	0.29
Weir Max Depth (m)		Specif Force (m3)	37.02	37.00
Min El Weir Flow (m)	203.21	Hydr Depth (m)		
Min El Prs (m)	200.70	W.P. Total (m)	25.52	25.52
Delta EG (m)	0.10	Conv. Total (m3/s)	267.9	267.9
Delta WS (m)	0.10	Top Width (m)		
BR Open Area (m2)	13.69	Frctn Loss (m)	0.00	0.00
BR Open Vel (m/s)	1.62	C & E Loss (m)	0.00	0.06
BR Sluice Coef		Shear Total (N/m2)	35.80	35.80
BR Sel Method	Energy only	Power Total (N/m s)	57.81	57.81

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
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.

BRIDGE OUTPUT Profile #Regional w red'n

E.G. US. (m)	204.36	Element	Inside BR US	Inside BR DS
W.S. US. (m)	204.34	E.G. Elev (m)	204.34	

Q Total (m3/s)	81.91	W.S. Elev (m)	204.24
Q Bridge (m3/s)	20.01	Crit W.S. (m)	203.76
Q Weir (m3/s)		Max Chl Dpth (m)	4.90
Weir Sta Lft (m)		Vel Total (m/s)	1.09
Weir Sta Rgt (m)		Flow Area (m2)	75.34
Weir Submerg		Froude # Chl	0.20
Weir Max Depth (m)		Specif Force (m3)	85.09
Min El Weir Flow (m)	203.21	Hydr Depth (m)	0.42
Min El Prs (m)	200.70	W.P. Total (m)	205.77
Delta EG (m)	0.06	Conv. Total (m3/s)	1066.4
Delta WS (m)	0.06	Top Width (m)	178.42
BR Open Area (m2)	13.69	Frctn Loss (m)	0.00
BR Open Vel (m/s)	1.46	C & E Loss (m)	0.00
BR Sluice Coef		Shear Total (N/m2)	21.19
BR Sel Method	Energy only	Power Total (N/m s)	23.03

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
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: RIVER-1
REACH: Reach-1 RS: 46.273

INPUT
Description: Section 46.273 - Jane Street - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	76	204	83	201	90	200
94	199.34	98	199.34	102	200	106	201	116	204
130	204	205	204	205	206				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	76	.08	90	.035	106	.08	116	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	102	4	4	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	89	203.2	F
103	205	203.2	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.62	Element	Left OB	Channel Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035 0.035
W.S. Elev (m)	202.61	Reach Len. (m)	4.00	4.00 4.00
Crit W.S. (m)	200.27	Flow Area (m2)	2.53	36.54 2.48
E.G. Slope (m/m)	0.000087	Area (m2)	17.74	36.54 12.71
Q Total (m3/s)	22.11	Flow (m3/s)	0.55	20.37 1.19
Top Width (m)	32.10	Top Width (m)	10.75	12.00 9.35
Vel Total (m/s)	0.53	Avg. Vel. (m/s)	0.22	0.56 0.48
Max Chl Dpth (m)	3.27	Hydr. Depth (m)	2.53	3.05 2.48
Conv. Total (m3/s)	2365.9	Conv. (m3/s)	58.5	2180.2 127.2
Length Wtd. (m)	4.00	Wetted Per. (m)	1.01	12.11 1.03
Min Ch El (m)	199.34	Shear (N/m2)	2.15	2.58 2.06
Alpha	1.06	Stream Power (N/m s)	0.46	1.44 0.99
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	98.21	147.13 61.22
C & E Loss (m)	0.01	Cum SA (1000 m2)	89.98	43.73 71.39

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.30	Element	Left OB	Channel Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.077	0.035 0.046
W.S. Elev (m)	204.28	Reach Len. (m)	4.00	4.00 4.00
Crit W.S. (m)	201.19	Flow Area (m2)	51.48	56.58 57.38
E.G. Slope (m/m)	0.000133	Area (m2)	51.48	56.58 57.38
Q Total (m3/s)	81.91	Flow (m3/s)	11.88	52.16 17.88
Top Width (m)	179.64	Top Width (m)	64.64	12.00

103.00					
Vel Total (m/s)	0.50	Avg. Vel. (m/s)	0.23	0.92	
0.31					
Max Chl Dpth (m)	4.94	Hydr. Depth (m)	0.80	4.72	
0.56					
Conv. Total (m3/s)	7096.7	Conv. (m3/s)	1029.1	4519.0	
1548.6					
Length Wtd. (m)	4.00	Wetted Per. (m)	65.33	12.11	
103.84					
Min Ch El (m)	199.34	Shear (N/m2)	1.03	6.11	
0.72					
Alpha	2.33	Stream Power (N/m s)	0.24	5.63	
0.22					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	251.69	281.52	
241.36					
C & E Loss (m)	0.01	Cum SA (1000 m2)	169.02	43.73	
163.52					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.272

INPUT
Description: Section 46.272 - Jane Street - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	80	204	90	201	91	200
92	199.34	100	199.34	101	200	102	201	105	202
115	203	120	204	130	204	205	204	205	206

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	80	.08	91	.035	102	.08	120	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
91	101	100	80	60	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	92	204	F
100	205	204	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.61	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.04	Wt. n-Val.		0.035	
W.S. Elev (m)	202.58	Reach Len. (m)	100.00	80.00	
60.00					
Crit W.S. (m)	200.26	Flow Area (m2)		25.89	
E.G. Slope (m/m)	0.000187	Area (m2)	6.22	31.70	
6.96					
Q Total (m3/s)	22.11	Flow (m3/s)		22.11	

Top Width (m)	26.02	Top Width (m)	6.25	10.00	9.76
Vel Total (m/s)	0.85	Avg. Vel. (m/s)		0.85	
Max Chl Dpth (m)	3.24	Hydr. Depth (m)		3.24	
Conv. Total (m3/s)	1618.3	Conv. (m3/s)		1618.3	
Length Wtd. (m)	80.00	Wetted Per. (m)		8.00	
Min Ch El (m)	199.34	Shear (N/m2)		5.92	
Alpha	1.00	Stream Power (N/m s)		5.06	
Frctn Loss (m)		Cum Volume (1000 m3)	98.16	146.99	61.18
C & E Loss (m)		Cum SA (1000 m2)	89.95	43.69	71.35

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	204.29	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.075	0.035	0.064
W.S. Elev (m)	204.23	Reach Len. (m)	100.00	80.00	60.00
Crit W.S. (m)	201.54	Flow Area (m2)	32.49	48.27	52.72
E.G. Slope (m/m)	0.000252	Area (m2)	32.49	48.27	52.72
Q Total (m3/s)	81.91	Flow (m3/s)	7.44	60.96	13.52
Top Width (m)	178.15	Top Width (m)	64.15	10.00	104.00
Vel Total (m/s)	0.61	Avg. Vel. (m/s)	0.23	1.26	0.26
Max Chl Dpth (m)	4.89	Hydr. Depth (m)	0.51	4.83	0.51
Conv. Total (m3/s)	5157.5	Conv. (m3/s)	468.2	3838.0	851.3
Length Wtd. (m)	80.00	Wetted Per. (m)	65.01	10.40	104.96
Min Ch El (m)	199.34	Shear (N/m2)	1.24	11.48	1.24
Alpha	3.19	Stream Power (N/m s)	0.28	14.50	0.32
Frctn Loss (m)		Cum Volume (1000 m3)	251.53	281.31	241.14
C & E Loss (m)		Cum SA (1000 m2)	168.76	43.69	163.11

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2715

INPUT
Description: Hum 13A-1R. Jane Street Culverts - Twin Cell - 2.44 m W x 2.135 m H x 59 m L Concrete Box Culverts and Single Cel 2.44 W x 1.22 m H x 59 m L. Drawings by Ander Engineering Ltd. (85-101-7 & 85-101-1) 1985.

New HEC-RAS coding January 2004 by Acres
included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.
Distance from Upstream XS = 5
Deck/Roadway Width = 59
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	204	173	204

Upstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	35	204	80	204	90	201	91	200
92	199.34	100	199.34	101	200	102	201	105	202
115	203	120	204	130	204	205	204	205	206

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	80	.08	91	.035	102	.08	120	.05

Bank Sta: Left Right Coeff Contr. Expan.
91 101 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	92	204	F
100	205	204	F

Downstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	204	173	204

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	3	204	30	204	67	204	71	203
74	201	77	200	79	198.983	91	198.983	93	200
97	201	105	202	106	203	107	203.6	165	203.8

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.05	71	.08	77	.035	93	.08
106	.05								

Bank Sta: Left Right Coeff Contr. Expan.
77 93 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent

```
       0      81   202.5       F
      89     165   202.5       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 =  2

Culvert Name     Shape      Rise    Span
Culvert #1           Box   2.135    2.44
FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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
                 5      59     .015     .015        0                   .5
      1
Number of Barrels =  2
Upstream   Elevation =  200.78
Centerline Stations
    Sta.    Sta.
    93.6    98.4
Downstream Elevation =  200.403
Centerline Stations
    Sta.    Sta.
    82.6    87.4

Culvert Name     Shape      Rise    Span
Culvert #2           Box    1.22    2.44
FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
FHWA Scale # 1 - 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
                 5      59     .015     .015        0                   .5
      1
Upstream   Elevation =  199.34
           Centerline Station =  96
Downstream Elevation =  198.983
           Centerline Station =  85

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      16.43    Culv Full Len (m)
  # Barrels                   2     Culv Vel US (m/s)        2.45
  Q Barrel (m3/s)          8.22     Culv Vel DS (m/s)        1.90
  E.G. US. (m)           202.61     Culv Inv El Up (m)     200.78
  W.S. US. (m)           202.58     Culv Inv El Dn (m)     200.40
  E.G. DS (m)            202.21     Culv Frctn Ls (m)        0.03
  W.S. DS (m)            202.17     Culv Exit Loss (m)       0.15
  Delta EG (m)             0.40     Culv Entr Loss (m)       0.15
  Delta WS (m)             0.40     Q Weir (m3/s)
  E.G. IC (m)            202.50     Weir Sta Lft (m)
  E.G. OC (m)            202.61     Weir Sta Rgt (m)
  Culvert Control        Outlet     Weir Submerg
  Culv WS Inlet (m)      202.16     Weir Max Depth (m)
  Culv WS Outlet (m)     202.17     Weir Avg Depth (m)
  Culv Nml Depth (m)       0.96     Weir Flow Area (m2)
```

Culv Crt Depth (m)	1.05	Min El Weir Flow (m)	204.00

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	33.12	Culv Full Len (m)	59.00
# Barrels	2	Culv Vel US (m/s)	3.18
Q Barrel (m3/s)	16.56	Culv Vel DS (m/s)	3.18
E.G. US. (m)	204.30	Culv Inv El Up (m)	200.78
W.S. US. (m)	204.23	Culv Inv El Dn (m)	200.40
E.G. DS (m)	203.29	Culv Frctn Ls (m)	0.28
W.S. DS (m)	203.24	Culv Exit Loss (m)	0.46
Delta EG (m)	1.00	Culv Entr Loss (m)	0.26
Delta WS (m)	0.99	Q Weir (m3/s)	40.01
E.G. IC (m)	203.69	Weir Sta Lft (m)	24.69
E.G. OC (m)	204.30	Weir Sta Rgt (m)	205.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	202.92	Weir Max Depth (m)	0.29
Culv WS Outlet (m)	202.54	Weir Avg Depth (m)	0.29
Culv Nml Depth (m)		Weir Flow Area (m2)	51.61
Culv Crt Depth (m)	1.67	Min El Weir Flow (m)	204.00

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #2

Q Culv Group (m3/s)	5.67	Culv Full Len (m)	59.00
# Barrels	1	Culv Vel US (m/s)	1.91
Q Barrel (m3/s)	5.67	Culv Vel DS (m/s)	1.91
E.G. US. (m)	202.61	Culv Inv El Up (m)	199.34
W.S. US. (m)	202.58	Culv Inv El Dn (m)	198.98
E.G. DS (m)	202.21	Culv Frctn Ls (m)	0.16
W.S. DS (m)	202.17	Culv Exit Loss (m)	0.15
Delta EG (m)	0.40	Culv Entr Loss (m)	0.09
Delta WS (m)	0.40	Q Weir (m3/s)	
E.G. IC (m)	200.68	Weir Sta Lft (m)	
E.G. OC (m)	202.61	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	200.56	Weir Max Depth (m)	
Culv WS Outlet (m)	200.20	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.82	Min El Weir Flow (m)	204.00

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #2

Q Culv Group (m3/s)	8.78	Culv Full Len (m)	59.00
# Barrels	1	Culv Vel US (m/s)	2.95
Q Barrel (m3/s)	8.78	Culv Vel DS (m/s)	2.95
E.G. US. (m)	204.30	Culv Inv El Up (m)	199.34
W.S. US. (m)	204.23	Culv Inv El Dn (m)	198.98
E.G. DS (m)	203.29	Culv Frctn Ls (m)	0.38
W.S. DS (m)	203.24	Culv Exit Loss (m)	0.39
Delta EG (m)	1.00	Culv Entr Loss (m)	0.22
Delta WS (m)	0.99	Q Weir (m3/s)	40.01
E.G. IC (m)	201.37	Weir Sta Lft (m)	24.69
E.G. OC (m)	204.29	Weir Sta Rgt (m)	205.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	200.56	Weir Max Depth (m)	0.29
Culv WS Outlet (m)	200.20	Weir Avg Depth (m)	0.29
Culv Nml Depth (m)		Weir Flow Area (m2)	51.61
Culv Crt Depth (m)	1.10	Min El Weir Flow (m)	204.00

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.271

INPUT
Description: Section 46.271 - Jane Street - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	3	204	30	204	67	204	71	203
74	201	77	200	79	198.983	91	198.983	93	200
97	201	105	202	106	203	107	203.6	165	203.8

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	30	.05	71	.08	77	.035	93	.08
106	.05								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
77	93	55	60	70	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	81	202.5	F
89	165	202.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.21	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.		0.035	
W.S. Elev (m)	202.17	Reach Len. (m)	55.00	60.00	70.00
Crit W.S. (m)	199.90	Flow Area (m2)		25.53	
E.G. Slope (m/m)	0.000195	Area (m2)	6.06	49.03	12.11
Q Total (m3/s)	22.11	Flow (m3/s)		22.11	
Top Width (m)	32.94	Top Width (m)	4.76	16.00	12.17
Vel Total (m/s)	0.87	Avg. Vel. (m/s)		0.87	
Max Chl Dpth (m)	3.19	Hydr. Depth (m)		3.19	
Conv. Total (m3/s)	1581.5	Conv. (m3/s)		1581.5	
Length Wtd. (m)	61.12	Wetted Per. (m)		8.00	
Min Ch El (m)	198.98	Shear (N/m2)		6.11	
Alpha	1.00	Stream Power (N/m s)		5.29	
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	98.16	146.33	61.18
C & E Loss (m)	0.00	Cum SA (1000 m2)	89.40	42.65	70.69

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	203.29	Element	Left OB	Channel	Right OB
Vel Head (m)	0.05	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.24	Reach Len. (m)	55.00	60.00	70.00
Crit W.S. (m)	201.18	Flow Area (m2)	12.06	66.10	25.68
E.G. Slope (m/m)	0.000224	Area (m2)	12.06	66.10	25.68
Q Total (m3/s)	81.91	Flow (m3/s)	3.27	71.32	7.32
Top Width (m)	36.37	Top Width (m)	6.97	16.00	13.40
Vel Total (m/s)	0.79	Avg. Vel. (m/s)	0.27	1.08	0.29
Max Chl Dpth (m)	4.26	Hydr. Depth (m)	1.73	4.13	1.92
Conv. Total (m3/s)	5473.6	Conv. (m3/s)	218.7	4765.8	489.2
Length Wtd. (m)	61.42	Wetted Per. (m)	7.76	16.49	14.07
Min Ch El (m)	198.98	Shear (N/m2)	3.41	8.80	4.01
Alpha	1.65	Stream Power (N/m s)	0.93	9.50	1.14
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	251.53	276.82	241.14
C & E Loss (m)	0.04	Cum SA (1000 m2)	165.20	42.65	159.59

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: RIVER-1
REACH: Reach-1 RS: 46.27

INPUT
Description: Section 46.27 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	205	10	204	40	204	63	206	73	206
78	204	90	203	100	200	103	199	104	198.9
105	198.9	106	199	112	200	120	203	147	203.5

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	103	.035	106	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
103	106	100	110	120	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.19	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.16	Reach Len. (m)	100.00	110.00	120.00
Crit W.S. (m)		Flow Area (m2)	15.79	9.69	22.22
E.G. Slope (m/m)	0.000301	Area (m2)	15.79	9.69	22.22
Q Total (m3/s)	22.11	Flow (m3/s)	4.45	10.48	7.18
Top Width (m)	24.98	Top Width (m)	10.21	3.00	11.77
Vel Total (m/s)	0.46	Avg. Vel. (m/s)	0.28	1.08	0.32
Max Chl Dpth (m)	3.26	Hydr. Depth (m)	1.55	3.23	1.89
Conv. Total (m3/s)	1273.1	Conv. (m3/s)	256.1	603.7	413.3
Length Wtd. (m)	110.31	Wetted Per. (m)	10.69	3.01	12.25
Min Ch El (m)	198.90	Shear (N/m2)	4.37	9.52	5.37
Alpha	2.82	Stream Power (N/m s)	1.23	10.30	1.73
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	97.56	144.57	59.97
C & E Loss (m)	0.00	Cum SA (1000 m2)	88.99	42.08	69.85

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	203.22	Element	Left OB	Channel	Right OB
Vel Head (m)	0.20	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	203.02	Reach Len. (m)	100.00	110.00	120.00
Crit W.S. (m)		Flow Area (m2)	25.74	12.25	33.26
E.G. Slope (m/m)	0.001569	Area (m2)	25.74	12.25	33.26
Q Total (m3/s)	81.91	Flow (m3/s)	19.29	35.36	27.27
Top Width (m)	31.21	Top Width (m)	13.22	3.00	14.99
Vel Total (m/s)	1.15	Avg. Vel. (m/s)	0.75	2.89	0.82
Max Chl Dpth (m)	4.12	Hydr. Depth (m)	1.95	4.08	

2.22					
Conv. Total (m3/s)	2068.0	Conv. (m3/s)	487.0	892.7	688.4
Length Wtd. (m)	110.44	Wetted Per. (m)	13.82	3.01	15.62
Min Ch El (m)	198.90	Shear (N/m2)	28.65	62.64	32.77
Alpha	2.99	Stream Power (N/m s)	21.47	180.75	26.86
Frctn Loss (m)	0.11	Cum Volume (1000 m3)	250.49	274.47	239.07
C & E Loss (m)	0.03	Cum SA (1000 m2)	164.65	42.08	158.59

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: RIVER-1
REACH: Reach-1 RS: 46.26

INPUT
Description: Section 46.26 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	15	204	24	200	30	199	32	198.8
34	198.8	36	199	47	202	54	202.5	64	202.5
64	205	109	205						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	15	.08	30	.035	36	.08	54	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
30	36	115	120	120	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.17	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.15	Reach Len. (m)	115.00	120.00	120.00
Crit W.S. (m)		Flow Area (m2)	21.12	19.71	18.33
E.G. Slope (m/m)	0.000132	Area (m2)	21.12	19.71	18.33
Q Total (m3/s)	22.11	Flow (m3/s)	4.59	14.29	3.23
Top Width (m)	29.96	Top Width (m)	10.84	6.00	13.12
Vel Total (m/s)	0.37	Avg. Vel. (m/s)	0.22	0.73	0.18
Max Chl Dpth (m)	3.35	Hydr. Depth (m)	1.95	3.28	1.40
Conv. Total (m3/s)	1920.6	Conv. (m3/s)	398.6	1241.6	

280.5					
Length Wtd. (m)	119.30	Wetted Per. (m)	11.38	6.02	13.53
Min Ch El (m)	198.80	Shear (N/m2)	2.41	4.25	1.76
Alpha	2.54	Stream Power (N/m s)	0.52	3.08	0.31
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	95.71	142.95	57.54
C & E Loss (m)	0.00	Cum SA (1000 m2)	87.93	41.58	68.36

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	203.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.12	Wt. n-Val.	0.080	0.035	0.077
W.S. Elev (m)	202.97	Reach Len. (m)	115.00	120.00	120.00
Crit W.S. (m)		Flow Area (m2)	30.71	24.60	36.83
E.G. Slope (m/m)	0.000697	Area (m2)	30.71	24.60	36.83
Q Total (m3/s)	81.91	Flow (m3/s)	17.63	47.45	16.83
Top Width (m)	46.68	Top Width (m)	12.68	6.00	28.00
Vel Total (m/s)	0.89	Avg. Vel. (m/s)	0.57	1.93	0.46
Max Chl Dpth (m)	4.17	Hydr. Depth (m)	2.42	4.10	1.32
Conv. Total (m3/s)	3102.1	Conv. (m3/s)	667.6	1797.0	637.5
Length Wtd. (m)	119.20	Wetted Per. (m)	13.39	6.02	28.89
Min Ch El (m)	198.80	Shear (N/m2)	15.68	27.95	8.72
Alpha	2.87	Stream Power (N/m s)	9.00	53.90	3.98
Frctn Loss (m)	0.07	Cum Volume (1000 m3)	247.66	272.44	234.87
C & E Loss (m)	0.00	Cum SA (1000 m2)	163.35	41.58	156.01

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.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.25

INPUT
Description: Section 46.25 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	26	203	36	200	40	199	44	198.6
46	198.6	50	199	68	202	84	203	154	204

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	26	.08	40	.035	50	.08	68	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
40	50	140	130	125	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.15	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035
0.080				
W.S. Elev (m)	202.12	Reach Len. (m)	140.00	130.00
125.00				
Crit W.S. (m)		Flow Area (m2)	17.96	33.59
29.25				
E.G. Slope (m/m)	0.000192	Area (m2)	17.96	33.59
29.25				
Q Total (m3/s)	40.81	Flow (m3/s)	4.18	29.73
6.89				
Top Width (m)	40.96	Top Width (m)	11.06	10.00
19.90				
Vel Total (m/s)	0.51	Avg. Vel. (m/s)	0.23	0.89
0.24				
Max Chl Dpth (m)	3.52	Hydr. Depth (m)	1.62	3.36
1.47				
Conv. Total (m3/s)	2946.2	Conv. (m3/s)	302.1	2146.3
497.8				
Length Wtd. (m)	130.56	Wetted Per. (m)	11.50	10.04
20.15				
Min Ch El (m)	198.60	Shear (N/m2)	2.94	6.29
2.73				
Alpha	2.30	Stream Power (N/m s)	0.68	5.57
0.64				
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	93.47	139.76
54.69				
C & E Loss (m)	0.00	Cum SA (1000 m2)	86.67	40.62
66.38				

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	203.01	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.10	Wt. n-Val.	0.080	0.035
0.078				
W.S. Elev (m)	202.90	Reach Len. (m)	140.00	130.00
125.00				
Crit W.S. (m)		Flow Area (m2)	27.67	41.44
49.81				
E.G. Slope (m/m)	0.000546	Area (m2)	27.67	41.44

49.81					
Q Total (m3/s)	108.10	Flow (m3/s)	12.60	71.22	
24.28					
Top Width (m)	56.15	Top Width (m)	13.68	10.00	
32.47					
Vel Total (m/s)	0.91	Avg. Vel. (m/s)	0.46	1.72	
0.49					
Max Chl Dpth (m)	4.30	Hydr. Depth (m)	2.02	4.14	
1.53					
Conv. Total (m3/s)	4624.0	Conv. (m3/s)	538.9	3046.4	
1038.7					
Length Wtd. (m)	130.62	Wetted Per. (m)	14.23	10.04	
32.74					
Min Ch El (m)	198.60	Shear (N/m2)	10.42	22.12	
8.15					
Alpha	2.45	Stream Power (N/m s)	4.74	38.02	
3.97					
Frctn Loss (m)	0.09	Cum Volume (1000 m3)	244.31	268.48	
229.67					
C & E Loss (m)	0.01	Cum SA (1000 m2)	161.84	40.62	
152.39					

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.24

INPUT
Description: Section 46.24 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	13	203	30	200	34	199	36	198.4
38	198.4	43	199	52	202	60	203	80	204

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	13	.08	34	.035	43	.08	60	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
34	43	54	51	45	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.12	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	
0.080					
W.S. Elev (m)	202.08	Reach Len. (m)	54.00	51.00	
45.00					
Crit W.S. (m)		Flow Area (m2)	22.53	30.99	
14.21					
E.G. Slope (m/m)	0.000251	Area (m2)	22.53	30.99	
14.21					
Q Total (m3/s)	40.81	Flow (m3/s)	5.59	31.69	
3.53					
Top Width (m)	34.38	Top Width (m)	15.77	9.00	
9.61					
Vel Total (m/s)	0.60	Avg. Vel. (m/s)	0.25	1.02	
0.25					

Max Chl Dpth (m)	3.68	Hydr. Depth (m)	1.43	3.44	1.48
Conv. Total (m3/s)	2576.2	Conv. (m3/s)	352.6	2000.5	223.0
Length Wtd. (m)	50.86	Wetted Per. (m)	16.07	9.12	10.10
Min Ch El (m)	198.40	Shear (N/m2)	3.45	8.36	3.46
Alpha	2.27	Stream Power (N/m s)	0.85	8.55	0.86
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	90.63	135.56	51.97
C & E Loss (m)	0.00	Cum SA (1000 m2)	84.80	39.39	64.54

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.91	Element	Left OB	Channel	Right OB
Vel Head (m)	0.18	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.73	Reach Len. (m)	54.00	51.00	45.00
Crit W.S. (m)		Flow Area (m2)	34.10	36.90	22.25
E.G. Slope (m/m)	0.000880	Area (m2)	34.10	36.90	22.25
Q Total (m3/s)	108.10	Flow (m3/s)	18.14	79.40	10.55
Top Width (m)	43.36	Top Width (m)	19.49	9.00	14.87
Vel Total (m/s)	1.16	Avg. Vel. (m/s)	0.53	2.15	0.47
Max Chl Dpth (m)	4.33	Hydr. Depth (m)	1.75	4.10	1.50
Conv. Total (m3/s)	3643.2	Conv. (m3/s)	611.5	2676.2	355.5
Length Wtd. (m)	50.84	Wetted Per. (m)	19.85	9.12	15.40
Min Ch El (m)	198.40	Shear (N/m2)	14.83	34.91	12.47
Alpha	2.58	Stream Power (N/m s)	7.89	75.13	5.91
Frctn Loss (m)	0.07	Cum Volume (1000 m3)	239.98	263.39	225.17
C & E Loss (m)	0.03	Cum SA (1000 m2)	159.51	39.39	149.43

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: RIVER-1
REACH: Reach-1 RS: 46.2375

INPUT
Description: Based on Bridge Section US
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-1380	205.2	-1375	205.1	-1370	204.5	-1360	204.5	-1340	204.4
-1330	204.2	-1320	204.4	-1318	204	-1310	203	-1305	202
-1300	201	-1295	200	-1290	199.3	-1288	199.2	-1287	198.8
-1285	198.6	-1284	198.6	-1282	199.2	-1280	199.4	-1275	200
-1270	201	-1260	201.3	-1250	202	-1242	203	-1240	204.3
-1236	204.6	-1233	204.7	-1230	204.5	-1220	204.6	-1215	205
-1200	205								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-1380	.05	-1320	.08	-1288	.035	-1282	.08	-1233	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-1288	-1282	30	30	.3	.5

Ineffective Flow num= 4

Sta L	Sta R	Elev	Permanent
-1320	-1300.25	204	T
-1295.75	-1291	204	T
-1279	-1264.25	204	T
-1259.75	-1240	204	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.10	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.01	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)	200.25	Flow Area (m2)	14.49	19.26	11.42
E.G. Slope (m/m)	0.000618	Area (m2)	27.39	19.26	36.67
Q Total (m3/s)	40.81	Flow (m3/s)	6.93	29.19	4.69
Top Width (m)	55.11	Top Width (m)	17.04	6.00	32.06
Vel Total (m/s)	0.90	Avg. Vel. (m/s)	0.48	1.52	0.41
Max Chl Dpth (m)	3.41	Hydr. Depth (m)	1.93	3.21	1.52
Conv. Total (m3/s)	1641.3	Conv. (m3/s)	278.6	1174.1	188.6
Length Wtd. (m)	30.00	Wetted Per. (m)	7.60	6.18	7.52
Min Ch El (m)	198.60	Shear (N/m2)	11.56	18.90	9.21
Alpha	2.09	Stream Power (N/m s)	5.52	28.65	3.78
Frctn Loss (m)		Cum Volume (1000 m3)	89.28	134.28	50.83

C & E Loss (m)		Cum SA (1000 m2)	83.91	39.01	63.60

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.81	Element	Left OB	Channel	Right OB
Vel Head (m)	0.44	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.37	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)	201.65	Flow Area (m2)	17.22	21.44	14.15
E.G. Slope (m/m)	0.002794	Area (m2)	33.92	21.44	48.86
Q Total (m3/s)	108.10	Flow (m3/s)	19.63	74.22	14.25
Top Width (m)	59.84	Top Width (m)	18.86	6.00	34.98
Vel Total (m/s)	2.05	Avg. Vel. (m/s)	1.14	3.46	1.01
Max Chl Dpth (m)	3.77	Hydr. Depth (m)	2.30	3.57	1.89
Conv. Total (m3/s)	2045.1	Conv. (m3/s)	371.3	1404.2	269.6
Length Wtd. (m)	30.00	Wetted Per. (m)	7.60	6.18	7.52
Min Ch El (m)	198.60	Shear (N/m2)	62.06	95.09	51.55
Alpha	2.05	Stream Power (N/m s)	70.73	329.21	51.90
Frctn Loss (m)		Cum Volume (1000 m3)	238.15	261.90	223.57
C & E Loss (m)		Cum SA (1000 m2)	158.48	39.01	148.31

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.235

INPUT
Description: Proposed Portage Parkway Extension
Distance from Upstream XS = 1
Deck/Roadway Width = 25.7
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 5

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-1400	205.3		-1380	205		-1310	204.5	
-1220	205		-1190	205.2				

Upstream Bridge Cross Section Data
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-1380	205.2	-1375	205.1	-1370	204.5	-1360	204.5	-1340	204.4
-1330	204.2	-1320	204.4	-1318	204	-1310	203	-1305	202

-1300	201	-1295	200	-1290	199.3	-1288	199.2	-1287	198.8		
-1285	198.6	-1284	198.6	-1282	199.2	-1280	199.4	-1275	200		
-1270	201	-1260	201.3	-1250	202	-1242	203	-1240	204.3		
-1236	204.6	-1233	204.7	-1230	204.5	-1220	204.6	-1215	205		
-1200	205										

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-1380	.05	-1320	.08	-1288	.035	-1282	.08	-1233	.05

Bank Sta: Left Right Coeff Contr. Expan.
-1288 -1282 .3 .5

Ineffective Flow num= 4

Sta L	Sta R	Elev	Permanent
-1320	-1300.25	204	T
-1295.75	-1291	204	T
-1279	-1264.25	204	T
-1259.75	-1240	204	T

Downstream Deck/Roadway Coordinates
num= 5

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-1400	205.3		-1380	205		-1310	204.5	
-1220	205		-1190	205.2				

Downstream Bridge Cross Section Data
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-1380	205.2	-1375	205.1	-1370	204.5	-1360	204.5	-1340	204.4
-1330	204.2	-1320	204.4	-1318	204	-1310	203	-1305	202
-1300	201	-1295	200	-1290	199.3	-1288	199.2	-1287	198.8
-1285	198.6	-1284	198.6	-1282	199.2	-1280	199.4	-1275	200
-1270	201	-1260	201.3	-1250	202	-1242	203	-1240	204.3
-1236	204.6	-1233	204.7	-1230	204.5	-1220	204.6	-1215	205
-1200	205								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-1380	.05	-1320	.08	-1288	.035	-1282	.08	-1233	.05

Bank Sta: Left Right Coeff Contr. Expan.
-1288 -1282 .3 .5

Ineffective Flow num= 4

Sta L	Sta R	Elev	Permanent
-1320	-1300.25	204	T
-1295.75	-1291	204	T
-1279	-1264.25	204	T
-1259.75	-1240	204	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 = .98
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 = 3

Culvert Name	Shape	Rise	Span
Culvert #1	Box	2.5	4.5

FHWA Chart # 8 - flared wingwalls
FHWA Scale # 3 - Wingwall flared 0 deg. (sides extended straight)

```
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                1    25.7     .013     .013        0                  .5
      1
Upstream   Elevation =  201
           Centerline Station = -1298
Downstream Elevation =  201
           Centerline Station = -1298

Culvert Name     Shape      Rise    Span
Culvert #2  Conspan Arch       5      12
FHWA Chart # 60- Span/Rise ratio approximate 2:1
FHWA Scale # 1 - 0 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    25.7     .013     .035        0                  .5
      1
Upstream   Elevation =  198.6
           Centerline Station = -1285
Downstream Elevation =  198.6
           Centerline Station = -1285

Culvert Name     Shape      Rise    Span
Culvert #3           Box     2.5     4.5
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 3 - Wingwall flared 0 deg. (sides extended straight)
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                1    25.7     .013     .013        0                  .5
      1
Upstream   Elevation =  201
           Centerline Station = -1262
Downstream Elevation =  201
           Centerline Station = -1262

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       3.88    Culv Full Len (m)
  # Barrels                    1    Culv Vel US (m/s)         0.82
  Q Barrel (m3/s)           3.88    Culv Vel DS (m/s)         0.83
  E.G. US. (m)            202.10    Culv Inv El Up (m)      201.00
  W.S. US. (m)            202.01    Culv Inv El Dn (m)      201.00
  E.G. DS (m)             202.08    Culv Frctn Ls (m)         0.03
  W.S. DS (m)             201.99    Culv Exit Loss (m)        0.00
  Delta EG (m)              0.02    Culv Entr Loss (m)        0.02
  Delta WS (m)              0.02    Q Weir (m3/s)
  E.G. IC (m)             201.71    Weir Sta Lft (m)
  E.G. OC (m)             202.10    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
  Culv WS Inlet (m)       202.05    Weir Max Depth (m)
  Culv WS Outlet (m)      202.04    Weir Avg Depth (m)
  Culv Nml Depth (m)                Weir Flow Area (m2)
  Culv Crt Depth (m)        0.42    Min El Weir Flow (m)    204.50


Warning: During subcritical analysis, with the exit loss set =1.0, the projected
WSEL in culvert has a lower energy than the
         downstream energy.  Most likely, the downstream cross section blocks part
of the culvert or the ineffective area is
         set too far in.  Instead of projecting the WSEL, the program did an energy
```

balance to get the WSEL inside the
culvert at the downstream end.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	13.10	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	1.88
Q Barrel (m3/s)	13.10	Culv Vel DS (m/s)	1.91
E.G. US. (m)	202.81	Culv Inv El Up (m)	201.00
W.S. US. (m)	202.37	Culv Inv El Dn (m)	201.00
E.G. DS (m)	202.71	Culv Frctn Ls (m)	0.13
W.S. DS (m)	202.20	Culv Exit Loss (m)	0.00
Delta EG (m)	0.10	Culv Entr Loss (m)	0.09
Delta WS (m)	0.17	Q Weir (m3/s)	
E.G. IC (m)	202.62	Weir Sta Lft (m)	
E.G. OC (m)	202.82	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	202.55	Weir Max Depth (m)	
Culv WS Outlet (m)	202.53	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.95	Min El Weir Flow (m)	204.50

Warning: During subcritical analysis, with the exit loss set =1.0, the projected WSEL in culvert has a lower energy than the
downstream energy. Most likely, the downstream cross section blocks part of the culvert or the ineffective area is
set too far in. Instead of projecting the WSEL, the program did an energy balance to get the WSEL inside the
culvert at the downstream end.

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #2

Q Culv Group (m3/s)	33.05	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	0.81
Q Barrel (m3/s)	33.05	Culv Vel DS (m/s)	0.81
E.G. US. (m)	202.10	Culv Inv El Up (m)	198.60
W.S. US. (m)	202.01	Culv Inv El Dn (m)	198.60
E.G. DS (m)	202.08	Culv Frctn Ls (m)	0.14
W.S. DS (m)	201.99	Culv Exit Loss (m)	0.00
Delta EG (m)	0.02	Culv Entr Loss (m)	0.02
Delta WS (m)	0.02	Q Weir (m3/s)	
E.G. IC (m)	200.11	Weir Sta Lft (m)	
E.G. OC (m)	202.10	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	202.05	Weir Max Depth (m)	
Culv WS Outlet (m)	202.04	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.92	Min El Weir Flow (m)	204.50

Warning: During subcritical analysis, with the exit loss set =1.0, the projected WSEL in culvert has a lower energy than the
downstream energy. Most likely, the downstream cross section blocks part of the culvert or the ineffective area is
set too far in. Instead of projecting the WSEL, the program did an energy balance to get the WSEL inside the
culvert at the downstream end.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #2

Q Culv Group (m3/s)	81.90	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	1.77

Q Barrel (m3/s)	81.90	Culv Vel DS (m/s)	1.77
E.G. US. (m)	202.81	Culv Inv El Up (m)	198.60
W.S. US. (m)	202.37	Culv Inv El Dn (m)	198.60
E.G. DS (m)	202.71	Culv Frctn Ls (m)	0.43
W.S. DS (m)	202.20	Culv Exit Loss (m)	0.00
Delta EG (m)	0.10	Culv Entr Loss (m)	0.08
Delta WS (m)	0.17	Q Weir (m3/s)	
E.G. IC (m)	201.36	Weir Sta Lft (m)	
E.G. OC (m)	202.81	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	202.57	Weir Max Depth (m)	
Culv WS Outlet (m)	202.55	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	1.68	Min El Weir Flow (m)	204.50

Warning: During subcritical analysis, with the exit loss set =1.0, the projected WSEL in culvert has a lower energy than the
downstream energy. Most likely, the downstream cross section blocks part of the culvert or the ineffective area is
set too far in. Instead of projecting the WSEL, the program did an energy balance to get the WSEL inside the
culvert at the downstream end.

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #3

Q Culv Group (m3/s)	3.88	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	0.82
Q Barrel (m3/s)	3.88	Culv Vel DS (m/s)	0.83
E.G. US. (m)	202.10	Culv Inv El Up (m)	201.00
W.S. US. (m)	202.01	Culv Inv El Dn (m)	201.00
E.G. DS (m)	202.08	Culv Frctn Ls (m)	0.00
W.S. DS (m)	201.99	Culv Exit Loss (m)	0.00
Delta EG (m)	0.02	Culv Entr Loss (m)	0.02
Delta WS (m)	0.02	Q Weir (m3/s)	
E.G. IC (m)	201.71	Weir Sta Lft (m)	
E.G. OC (m)	202.10	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	202.05	Weir Max Depth (m)	
Culv WS Outlet (m)	202.04	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.42	Min El Weir Flow (m)	204.50

Warning: During subcritical analysis, with the exit loss set =1.0, the projected WSEL in culvert has a lower energy than the
downstream energy. Most likely, the downstream cross section blocks part of the culvert or the ineffective area is
set too far in. Instead of projecting the WSEL, the program did an energy balance to get the WSEL inside the
culvert at the downstream end.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #3

Q Culv Group (m3/s)	13.10	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	1.88
Q Barrel (m3/s)	13.10	Culv Vel DS (m/s)	1.91
E.G. US. (m)	202.81	Culv Inv El Up (m)	201.00
W.S. US. (m)	202.37	Culv Inv El Dn (m)	201.00
E.G. DS (m)	202.71	Culv Frctn Ls (m)	0.00
W.S. DS (m)	202.20	Culv Exit Loss (m)	0.00
Delta EG (m)	0.10	Culv Entr Loss (m)	0.09
Delta WS (m)	0.17	Q Weir (m3/s)	

E.G. IC (m)	202.62	Weir Sta Lft (m)	
E.G. OC (m)	202.82	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	202.55	Weir Max Depth (m)	
Culv WS Outlet (m)	202.53	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.95	Min El Weir Flow (m)	204.50

Warning: During subcritical analysis, with the exit loss set =1.0, the projected WSEL in culvert has a lower energy than the
downstream energy. Most likely, the downstream cross section blocks part of the culvert or the ineffective area is
set too far in. Instead of projecting the WSEL, the program did an energy balance to get the WSEL inside the
culvert at the downstream end.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2325

INPUT
Description: Based on Bridge Section DS
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-1380	205.2	-1375	205.1	-1370	204.5	-1360	204.5	-1340	204.4
-1330	204.2	-1320	204.4	-1318	204	-1310	203	-1305	202
-1300	201	-1295	200	-1290	199.3	-1288	199.2	-1287	198.8
-1285	198.6	-1284	198.6	-1282	199.2	-1280	199.4	-1275	200
-1270	201	-1260	201.3	-1250	202	-1242	203	-1240	204.3
-1236	204.6	-1233	204.7	-1230	204.5	-1220	204.6	-1215	205
-1200	205								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-1380	.05	-1320	.08	-1288	.035	-1282	.08	-1233	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-1288	-1282	94	94	.3	.5

Ineffective Flow num= 4

Sta L	Sta R	Elev	Permanent
-1320	-1300.25	204	T
-1295.75	-1291	204	T
-1279	-1264.25	204	T
-1259.75	-1240	204	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	201.99	Reach Len. (m)	94.00	94.00	94.00
Crit W.S. (m)		Flow Area (m2)	14.34	19.13	11.26
E.G. Slope (m/m)	0.000635	Area (m2)	27.03	19.13	35.99
Q Total (m3/s)	40.81	Flow (m3/s)	6.89	29.27	4.65

Top Width (m)	54.75	Top Width (m)	16.94	6.00	31.82
Vel Total (m/s)	0.91	Avg. Vel. (m/s)	0.48	1.53	0.41
Max Chl Dpth (m)	3.39	Hydr. Depth (m)	1.91	3.19	1.50
Conv. Total (m3/s)	1619.1	Conv. (m3/s)	273.5	1161.3	184.3
Length Wtd. (m)	94.00	Wetted Per. (m)	7.60	6.18	7.52
Min Ch El (m)	198.60	Shear (N/m2)	11.75	19.29	9.33
Alpha	2.09	Stream Power (N/m s)	5.65	29.51	3.85
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	89.28	132.85	50.83
C & E Loss (m)	0.04	Cum SA (1000 m2)	83.40	38.83	62.64

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.71	Element	Left OB	Channel	Right OB
Vel Head (m)	0.51	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.20	Reach Len. (m)	94.00	94.00	94.00
Crit W.S. (m)		Flow Area (m2)	15.95	20.42	12.88
E.G. Slope (m/m)	0.003405	Area (m2)	30.80	20.42	43.06
Q Total (m3/s)	108.10	Flow (m3/s)	19.07	75.57	13.45
Top Width (m)	57.64	Top Width (m)	18.01	6.00	33.62
Vel Total (m/s)	2.19	Avg. Vel. (m/s)	1.20	3.70	1.04
Max Chl Dpth (m)	3.60	Hydr. Depth (m)	2.13	3.40	1.72
Conv. Total (m3/s)	1852.5	Conv. (m3/s)	326.9	1295.1	230.5
Length Wtd. (m)	94.00	Wetted Per. (m)	7.60	6.18	7.52
Min Ch El (m)	198.60	Shear (N/m2)	70.07	110.41	57.19
Alpha	2.07	Stream Power (N/m s)	83.77	408.55	59.71
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	238.15	260.19	223.57
C & E Loss (m)	0.24	Cum SA (1000 m2)	157.93	38.83	147.28

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: RIVER-1
REACH: Reach-1 RS: 46.23

INPUT
Description: Section 46.23 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	38	204	52	201	63	200	90	199
100	198.2	113	199	118	200	126	204	160	204
160	206	210	206						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	38	.08	90	.035	113	.08	126	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	113	101	95	89	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.03	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.02	Reach Len. (m)	101.00	95.00	89.00
Crit W.S. (m)		Flow Area (m2)	87.23	78.68	16.69
E.G. Slope (m/m)	0.000033	Area (m2)	87.23	78.68	16.69
Q Total (m3/s)	40.81	Flow (m3/s)	9.99	29.10	1.72
Top Width (m)	74.81	Top Width (m)	42.76	23.00	9.04
Vel Total (m/s)	0.22	Avg. Vel. (m/s)	0.11	0.37	0.10
Max Chl Dpth (m)	3.82	Hydr. Depth (m)	2.04	3.42	1.85
Conv. Total (m3/s)	7145.7	Conv. (m3/s)	1748.9	5095.6	301.2
Length Wtd. (m)	97.05	Wetted Per. (m)	42.94	23.06	9.62
Min Ch El (m)	198.20	Shear (N/m2)	0.65	1.09	0.55
Alpha	2.03	Stream Power (N/m s)	0.07	0.40	0.06
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	83.91	128.25	48.35
C & E Loss (m)	0.00	Cum SA (1000 m2)	80.59	37.46	60.72

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)

is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.43	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	202.40	Reach Len. (m)	101.00	95.00	89.00
Crit W.S. (m)		Flow Area (m2)	103.96	87.50	20.30
E.G. Slope (m/m)	0.000152	Area (m2)	103.96	87.50	20.30
Q Total (m3/s)	108.10	Flow (m3/s)	28.13	75.09	4.87
Top Width (m)	77.36	Top Width (m)	44.55	23.00	9.81
Vel Total (m/s)	0.51	Avg. Vel. (m/s)	0.27	0.86	0.24
Max Chl Dpth (m)	4.20	Hydr. Depth (m)	2.33	3.80	2.07
Conv. Total (m3/s)	8755.4	Conv. (m3/s)	2278.8	6082.1	394.4
Length Wtd. (m)	97.07	Wetted Per. (m)	44.77	23.06	10.47
Min Ch El (m)	198.20	Shear (N/m2)	3.47	5.67	2.90
Alpha	2.05	Stream Power (N/m s)	0.94	4.87	0.69
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	231.81	255.12	220.59
C & E Loss (m)	0.01	Cum SA (1000 m2)	154.99	37.46	145.24

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: RIVER-1
REACH: Reach-1 RS: 46.22

INPUT
Description: Section 46.22 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	12	201	22	200	36	199	52	198
72	197.5	77	198	79	199	87	203	102	203
112	199	114	198	132	197.5	146	198	152	199
172	202	175	203	192	204				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	36	.035	79	.08	112	.035	152	.05

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

112 152 125 140 115 .1 .3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.02	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.039	0.035	0.050
W.S. Elev (m)	202.02	Reach Len. (m)	125.00	140.00	115.00
Crit W.S. (m)		Flow Area (m2)	243.50	164.94	30.47
E.G. Slope (m/m)	0.000002	Area (m2)	243.50	164.94	30.47
Q Total (m3/s)	40.81	Flow (m3/s)	20.86	18.71	1.24
Top Width (m)	144.77	Top Width (m)	84.70	40.00	20.07
Vel Total (m/s)	0.09	Avg. Vel. (m/s)	0.09	0.11	0.04
Max Chl Dpth (m)	4.52	Hydr. Depth (m)	2.87	4.12	1.52
Conv. Total (m3/s)	26284.7	Conv. (m3/s)	13434.2	12051.5	799.0
Length Wtd. (m)	133.79	Wetted Per. (m)	86.51	40.33	20.30
Min Ch El (m)	197.50	Shear (N/m2)	0.07	0.10	0.04
Alpha	1.12	Stream Power (N/m s)	0.01	0.01	0.00
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	67.21	116.68	46.25
C & E Loss (m)	0.00	Cum SA (1000 m2)	74.16	34.47	59.42

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.040	0.035	0.050
W.S. Elev (m)	202.42	Reach Len. (m)	125.00	140.00	115.00
Crit W.S. (m)		Flow Area (m2)	277.60	180.74	38.63
E.G. Slope (m/m)	0.000012	Area (m2)	277.60	180.74	38.63
Q Total (m3/s)	108.10	Flow (m3/s)	55.43	48.71	3.96
Top Width (m)	149.31	Top Width (m)	88.06	40.00	21.26
Vel Total (m/s)	0.22	Avg. Vel. (m/s)	0.20	0.27	0.10
Max Chl Dpth (m)	4.92	Hydr. Depth (m)	3.15	4.52	1.82
Conv. Total (m3/s)	31148.0	Conv. (m3/s)	15972.4	14035.5	1140.2

Length Wtd. (m)	134.82	Wetted Per. (m)	90.08	40.33	21.55
Min Ch El (m)	197.50	Shear (N/m2)	0.36	0.53	0.21
Alpha	1.13	Stream Power (N/m s)	0.07	0.14	0.02
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	212.54	242.38	217.97
C & E Loss (m)	0.00	Cum SA (1000 m2)	148.29	34.47	143.85

Warning: Divided flow computed for this cross-section.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.214

INPUT
Description: Section 46.214 - Jane St & Hwy 7 Pond Outlet - In-Line Weir - U/S Bounding Section

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	37	202	100	202	122	201	132	200
133	199	134	198	140	196.7	172	196.7	180	198
207	202	273	203	303	204				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	134	.035	180	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
134	180	1	1	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	123	202	F
190	303	202	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	202.02	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	202.02	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	197.02	Flow Area (m2)	34.28	235.78	54.65
E.G. Slope (m/m)	0.000001	Area (m2)	34.28	235.78	54.65
Q Total (m3/s)	19.06	Flow (m3/s)	0.30	17.82	0.93
Top Width (m)	172.41	Top Width (m)	97.87	46.00	28.55
Vel Total (m/s)	0.06	Avg. Vel. (m/s)	0.01	0.08	0.02
Max Chl Dpth (m)	5.32	Hydr. Depth (m)	0.35	5.13	1.91
Conv. Total (m3/s)	21341.3	Conv. (m3/s)	338.6	19956.5	

1046.2					
Length Wtd. (m)	1.00	Wetted Per. (m)	98.77	46.24	28.84
Min Ch El (m)	196.70	Shear (N/m2)	0.00	0.04	0.01
Alpha	1.56	Stream Power (N/m s)	0.00	0.00	0.00
Frctn Loss (m)		Cum Volume (1000 m3)	49.85	88.63	41.36
C & E Loss (m)		Cum SA (1000 m2)	62.75	28.45	56.63

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	202.41	Reach Len. (m)	1.00	1.00	1.00
Crit W.S. (m)	197.69	Flow Area (m2)	75.06	253.64	70.71
E.G. Slope (m/m)	0.000019	Area (m2)	75.06	253.64	70.71
Q Total (m3/s)	108.10	Flow (m3/s)	4.99	98.51	4.60
Top Width (m)	212.40	Top Width (m)	112.23	46.00	54.17
Vel Total (m/s)	0.27	Avg. Vel. (m/s)	0.07	0.39	0.07
Max Chl Dpth (m)	5.71	Hydr. Depth (m)	0.67	5.51	1.31
Conv. Total (m3/s)	24731.7	Conv. (m3/s)	1141.8	22538.2	1051.7
Length Wtd. (m)	1.00	Wetted Per. (m)	113.14	46.24	54.47
Min Ch El (m)	196.70	Shear (N/m2)	0.12	1.03	0.24
Alpha	1.88	Stream Power (N/m s)	0.01	0.40	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	190.50	211.97	211.68
C & E Loss (m)		Cum SA (1000 m2)	135.77	28.45	139.52

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

INLINE STRUCTURE

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2135

INPUT

Description: Hum 13-5R. Jane St. & Hwy 7 Pond Outlet Weir x 45 m Drawings by Ander Engineering Ltd. (Dwg No. 85-101-5, 1986 & Figure 1, date/source unknown).

New HEC-RAS coding January 2004 by Acres
included coding of in-line in HEC-RAS.

Distance from Upstream XS = .5
Deck/Roadway Width = .25
Weir Coefficient = 1.72
Weir Embankment Coordinates num = 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
100	202	123	202	123.75	201.95	137.75	201.95	153	201.95
153	200.9	161	200.9	161	201.95	175.3	201.95	189.3	201.95
190	202	207	202						

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 =
Weir crest shape = Broad Crested

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.213

INPUT
Description: Section 46.213 - Jane St. & Hwy 7 Pond Outlet - In-Line Weir - D/S Bounding Section
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	37	202	100	202	122	201	132	200
133	199	134	198	140	196.7	172	196.7	180	198
207	202	273	203	303	204				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	134	.035	180	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
134	180	15	15	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	123	202	F
190	303	202	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.73	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	200.73	Reach Len. (m)	15.00	15.00	15.00
Crit W.S. (m)	197.02	Flow Area (m2)	6.12	176.25	19.89
E.G. Slope (m/m)	0.000002	Area (m2)	6.12	176.25	25.14
Q Total (m3/s)	19.06	Flow (m3/s)	0.13	18.34	0.58

Top Width (m)	73.71	Top Width (m)	9.29	46.00	18.42
Vel Total (m/s)	0.09	Avg. Vel. (m/s)	0.02	0.10	0.03
Max Chl Dpth (m)	4.03	Hydr. Depth (m)	0.66	3.83	1.99
Conv. Total (m3/s)	12764.2	Conv. (m3/s)	87.3	12286.7	390.2
Length Wtd. (m)	15.00	Wetted Per. (m)	10.16	46.24	10.11
Min Ch El (m)	196.70	Shear (N/m2)	0.01	0.08	0.04
Alpha	1.18	Stream Power (N/m s)	0.00	0.01	0.00
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	49.85	88.50	41.36
C & E Loss (m)	0.00	Cum SA (1000 m2)	62.69	28.41	56.61

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.33	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	202.32	Reach Len. (m)	15.00	15.00	15.00
Crit W.S. (m)	197.69	Flow Area (m2)	65.09	249.49	66.09
E.G. Slope (m/m)	0.000021	Area (m2)	65.09	249.49	66.09
Q Total (m3/s)	108.10	Flow (m3/s)	4.16	99.34	4.60
Top Width (m)	203.12	Top Width (m)	108.90	46.00	48.22
Vel Total (m/s)	0.28	Avg. Vel. (m/s)	0.06	0.40	0.07
Max Chl Dpth (m)	5.62	Hydr. Depth (m)	0.60	5.42	1.37
Conv. Total (m3/s)	23861.5	Conv. (m3/s)	918.7	21927.6	1015.2
Length Wtd. (m)	15.00	Wetted Per. (m)	109.80	46.24	48.52
Min Ch El (m)	196.70	Shear (N/m2)	0.12	1.09	0.27
Alpha	1.81	Stream Power (N/m s)	0.01	0.43	0.02
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	190.50	211.77	211.68
C & E Loss (m)	0.00	Cum SA (1000 m2)	135.66	28.41	139.47

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: RIVER-1
REACH: Reach-1 RS: 46.212

INPUT
Description: Section 46.212 - Jane St. & Hwy 7 Pond Outlet - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	37	202	100	202	122	201	132	200
133	199	134	198	140	196.6	172	196.6	180	198
207	199	252	199.5	273	203	303	204		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	133	.035	207	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
133	207	55	45	10	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	149.5	202	F
160.5	303	202	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.73	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.035	
W.S. Elev (m)	200.72	Reach Len. (m)	55.00	45.00	10.00
Crit W.S. (m)	197.27	Flow Area (m2)		45.30	
E.G. Slope (m/m)	0.000033	Area (m2)	3.80	241.75	70.52
Q Total (m3/s)	19.06	Flow (m3/s)		19.06	
Top Width (m)	134.49	Top Width (m)	8.18	74.00	52.31
Vel Total (m/s)	0.42	Avg. Vel. (m/s)		0.42	
Max Chl Dpth (m)	4.12	Hydr. Depth (m)		4.12	
Conv. Total (m3/s)	3325.3	Conv. (m3/s)		3325.3	
Length Wtd. (m)	45.00	Wetted Per. (m)		11.00	
Min Ch El (m)	196.60	Shear (N/m2)		1.33	
Alpha	1.00	Stream Power (N/m s)		0.56	
Frctn Loss (m)		Cum Volume (1000 m3)	49.78	85.36	40.64

C & E Loss (m)		Cum SA (1000 m2)	62.56	27.51 56.07

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	202.33	Element	Left OB	Channel Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035 0.080
W.S. Elev (m)	202.32	Reach Len. (m)	55.00	45.00 10.00
Crit W.S. (m)	198.74	Flow Area (m2)	61.49	360.55 162.22
E.G. Slope (m/m)	0.000010	Area (m2)	61.49	360.55 162.22
Q Total (m3/s)	108.10	Flow (m3/s)	2.67	93.24 12.18
Top Width (m)	243.91	Top Width (m)	107.97	74.00 61.94
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.04	0.26 0.08
Max Chl Dpth (m)	5.72	Hydr. Depth (m)	0.57	4.87 2.62
Conv. Total (m3/s)	34102.2	Conv. (m3/s)	842.4	29416.7 3843.1
Length Wtd. (m)	45.00	Wetted Per. (m)	108.46	74.72 62.18
Min Ch El (m)	196.60	Shear (N/m2)	0.06	0.48 0.26
Alpha	1.71	Stream Power (N/m s)	0.00	0.12 0.02
Frctn Loss (m)		Cum Volume (1000 m3)	189.55	207.19 209.97
C & E Loss (m)		Cum SA (1000 m2)	134.03	27.51 138.64

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2115

INPUT
Description: Hum 13-5R. Jane St & Hwy 7 Pond Outlet Culverts - Triple Cell - 3.0 m W x 1.5 m H x 23.2 m L Concrete Box Culverts. No drawings available (some info on Ander Eng Ltd Dwg 85-101-5, 1986) and York Regional Municipal Culvert Sheet.

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.
Distance from Upstream XS = 10

Deck/Roadway Width = 23.2
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	202	303	202

Upstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	37	202	100	202	122	201	132	200
133	199	134	198	140	196.6	172	196.6	180	198
207	199	252	199.5	273	203	303	204		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	133	.035	207	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
133	207	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	149.5	202	F
160.5	303	202	F

Downstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	202	303	202

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	47	201	103	200	150	200	152	199
160	198	162	197	163	196.4	175	196.4	178	197
181	200	185	201	201	201	261	202	306	203

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	162	.035	178	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
162	178	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	163	200.6	F
175	306	200.6	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	Box	1.5	3

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
	10	23.2	.015	.015	0	.9	1

Number of Barrels = 3
Upstream Elevation = 196.6
Centerline Stations
Sta. Sta. Sta.
151.5 154.85 158.5
Downstream Elevation = 196.4
Centerline Stations
Sta. Sta. Sta.
165.5 168.85 172.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	19.06	Culv Full Len (m)	23.20
# Barrels	3	Culv Vel US (m/s)	1.41
Q Barrel (m3/s)	6.35	Culv Vel DS (m/s)	1.41
E.G. US. (m)	200.73	Culv Inv El Up (m)	196.60
W.S. US. (m)	200.72	Culv Inv El Dn (m)	196.40
E.G. DS (m)	200.52	Culv Frctn Ls (m)	0.03
W.S. DS (m)	200.51	Culv Exit Loss (m)	0.09
Delta EG (m)	0.21	Culv Entr Loss (m)	0.09
Delta WS (m)	0.21	Q Weir (m3/s)	
E.G. IC (m)	197.94	Weir Sta Lft (m)	
E.G. OC (m)	200.73	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	198.10	Weir Max Depth (m)	
Culv WS Outlet (m)	197.90	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	0.77	Min El Weir Flow (m)	202.00

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	43.23	Culv Full Len (m)	23.20
# Barrels	3	Culv Vel US (m/s)	3.20
Q Barrel (m3/s)	14.41	Culv Vel DS (m/s)	3.20
E.G. US. (m)	202.33	Culv Inv El Up (m)	196.60
W.S. US. (m)	202.32	Culv Inv El Dn (m)	196.40
E.G. DS (m)	201.23	Culv Frctn Ls (m)	0.13
W.S. DS (m)	201.20	Culv Exit Loss (m)	0.49
Delta EG (m)	1.09	Culv Entr Loss (m)	0.47
Delta WS (m)	1.13	Q Weir (m3/s)	64.87
E.G. IC (m)	202.20	Weir Sta Lft (m)	24.70
E.G. OC (m)	202.33	Weir Sta Rgt (m)	268.99
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	198.10	Weir Max Depth (m)	0.33
Culv WS Outlet (m)	197.90	Weir Avg Depth (m)	0.32
Culv Nml Depth (m)		Weir Flow Area (m2)	78.79
Culv Crt Depth (m)	1.33	Min El Weir Flow (m)	202.00

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.211

INPUT
Description: Section 46.211 - Jane St. & Hwy 7 Pond Outlet - D/S Bounding
Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	47	201	103	200	150	200	152	199
160	198	162	197	163	196.4	175	196.4	178	197
181	200	185	201	201	201	261	202	306	203

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	162	.035	178	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
162	178	10	10	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	163	200.6	F
175	306	200.6	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.52	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.035	
W.S. Elev (m)	200.51	Reach Len. (m)	10.00	10.00	10.00
Crit W.S. (m)	197.04	Flow Area (m2)		49.29	
E.G. Slope (m/m)	0.000028	Area (m2)	55.19	64.53	6.54
Q Total (m3/s)	19.06	Flow (m3/s)		19.06	
Top Width (m)	108.47	Top Width (m)	87.44	16.00	5.03
Vel Total (m/s)	0.39	Avg. Vel. (m/s)		0.39	
Max Chl Dpth (m)	4.11	Hydr. Depth (m)		4.11	
Conv. Total (m3/s)	3612.6	Conv. (m3/s)		3612.6	
Length Wtd. (m)	10.00	Wetted Per. (m)		12.00	
Min Ch El (m)	196.40	Shear (N/m2)		1.12	
Alpha	1.00	Stream Power (N/m s)		0.43	
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	49.78	82.05	40.64
C & E Loss (m)	0.00	Cum SA (1000 m2)	59.93	25.48	55.79

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.23	Element	Left OB	Channel

Right OB					
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.080
W.S. Elev (m)	201.20	Reach Len. (m)	10.00	10.00	10.00
Crit W.S. (m)	198.42	Flow Area (m2)	128.26	75.57	15.24
E.G. Slope (m/m)	0.000151	Area (m2)	128.26	75.57	15.24
Q Total (m3/s)	108.10	Flow (m3/s)	32.87	73.91	1.31
Top Width (m)	170.55	Top Width (m)	119.66	16.00	34.89
Vel Total (m/s)	0.49	Avg. Vel. (m/s)	0.26	0.98	0.09
Max Chl Dpth (m)	4.80	Hydr. Depth (m)	1.07	4.72	0.44
Conv. Total (m3/s)	8807.5	Conv. (m3/s)	2678.6	6022.0	106.9
Length Wtd. (m)	10.00	Wetted Per. (m)	120.21	16.23	36.26
Min Ch El (m)	196.40	Shear (N/m2)	1.58	6.88	0.62
Alpha	2.77	Stream Power (N/m s)	0.40	6.73	0.05
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	189.55	198.58	209.97
C & E Loss (m)	0.01	Cum SA (1000 m2)	127.77	25.48	138.15

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: RIVER-1
REACH: Reach-1 RS: 46.21

INPUT
Description: Section 46.21 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203	0	201	40	200	76	200	82	199
91	197	91.5	196.3	92.5	196.3	93	197	97	198
108	201	124	202	186	202	230	203		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	91	.035	93	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
91	93	30	30	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.51	Element	Left OB	Channel

Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	200.51	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)		Flow Area (m2)	52.06	8.07	23.56
E.G. Slope (m/m)	0.000106	Area (m2)	52.06	8.07	23.56
Q Total (m3/s)	20.59	Flow (m3/s)	8.69	4.91	7.00
Top Width (m)	86.51	Top Width (m)	71.32	2.00	13.20
Vel Total (m/s)	0.25	Avg. Vel. (m/s)	0.17	0.61	0.30
Max Chl Dpth (m)	4.21	Hydr. Depth (m)	0.73	4.03	1.79
Conv. Total (m3/s)	1995.5	Conv. (m3/s)	841.8	475.7	678.0
Length Wtd. (m)	30.00	Wetted Per. (m)	71.62	2.72	13.65
Min Ch El (m)	196.30	Shear (N/m2)	0.76	3.10	1.80
Alpha	2.15	Stream Power (N/m s)	0.13	1.88	0.53
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	49.24	81.69	40.49
C & E Loss (m)	0.00	Cum SA (1000 m2)	59.14	25.39	55.70

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.22	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.17	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)		Flow Area (m2)	107.13	9.38	33.22
E.G. Slope (m/m)	0.000946	Area (m2)	107.13	9.38	33.22
Q Total (m3/s)	122.56	Flow (m3/s)	73.21	18.82	30.52
Top Width (m)	110.66	Top Width (m)	91.00	2.00	17.66
Vel Total (m/s)	0.82	Avg. Vel. (m/s)	0.68	2.01	0.92
Max Chl Dpth (m)	4.87	Hydr. Depth (m)	1.18	4.69	1.88
Conv. Total (m3/s)	3985.0	Conv. (m3/s)	2380.5	612.0	992.5
Length Wtd. (m)	30.00	Wetted Per. (m)	91.48	2.72	18.19
Min Ch El (m)	196.30	Shear (N/m2)	10.86	32.00	16.94

Alpha	1.65	Stream Power (N/m s)	7.42	64.19 15.57
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	188.38	198.16 209.72
C & E Loss (m)	0.00	Cum SA (1000 m2)	126.72	25.39 137.89

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: RIVER-1
REACH: Reach-1 RS: 46.202

INPUT
Description: Section 46.202 - Highway 7 - U/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	50	200	111	200	113	199	115.5	197
116	196	123	196	123.5	197	129	200	227	202
272	203								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	115.5	.035	123.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
115.5	123.5	70	70	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116	200.23	F
123	272	200.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	200.51	Element	Left OB	Channel Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035 0.050
W.S. Elev (m)	200.51	Reach Len. (m)	70.00	70.00 70.00
Crit W.S. (m)	196.96	Flow Area (m2)	45.47	35.54 17.28
E.G. Slope (m/m)	0.000039	Area (m2)	45.47	35.54 17.28
Q Total (m3/s)	20.59	Flow (m3/s)	3.56	15.57 1.46
Top Width (m)	129.01	Top Width (m)	90.76	8.00 30.25
Vel Total (m/s)	0.21	Avg. Vel. (m/s)	0.08	0.44 0.08
Max Chl Dpth (m)	4.51	Hydr. Depth (m)	0.50	4.44 0.57
Conv. Total (m3/s)	3297.3	Conv. (m3/s)	569.7	2493.6 234.0
Length Wtd. (m)	70.00	Wetted Per. (m)	91.70	9.24

31.02					
Min Ch El (m)	196.00	Shear (N/m2)	0.19	1.47	
0.21					
Alpha	3.34	Stream Power (N/m s)	0.01	0.64	
0.02					
Frctn Loss (m)		Cum Volume (1000 m3)	47.78	81.04	
39.88					
C & E Loss (m)		Cum SA (1000 m2)	56.71	25.24	
55.05					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.20	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.07	Wt. n-Val.	0.050	0.035	
0.050					
W.S. Elev (m)	201.14	Reach Len. (m)	70.00	70.00	
70.00					
Crit W.S. (m)	199.15	Flow Area (m2)	112.34	40.60	
46.19					
E.G. Slope (m/m)	0.000409	Area (m2)	112.34	40.60	
46.19					
Q Total (m3/s)	122.56	Flow (m3/s)	44.31	62.91	
15.34					
Top Width (m)	184.72	Top Width (m)	115.50	8.00	
61.22					
Vel Total (m/s)	0.62	Avg. Vel. (m/s)	0.39	1.55	
0.33					
Max Chl Dpth (m)	5.14	Hydr. Depth (m)	0.97	5.07	
0.75					
Conv. Total (m3/s)	6063.7	Conv. (m3/s)	2192.0	3112.5	
759.1					
Length Wtd. (m)	70.00	Wetted Per. (m)	116.58	9.24	
62.00					
Min Ch El (m)	196.00	Shear (N/m2)	3.86	17.61	
2.98					
Alpha	3.44	Stream Power (N/m s)	1.52	27.29	
0.99					
Frctn Loss (m)		Cum Volume (1000 m3)	185.08	197.41	
208.53					
C & E Loss (m)		Cum SA (1000 m2)	123.62	25.24	
136.71					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.2015

INPUT
Description: Hum 13-4RR. Highway 7 Culvert - 3.7 m W x 1.5 m H x 64 m L
Concrete Box Culvert. Based on drawings. July 2010

New HEC-RAS
coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 64
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201		50	200.45		95	200.23	
168	201		216	202		227	202.5	
272	203.5							

Upstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	50	200	111	200	113	199	115.5	197
116	196	123	196	123.5	197	129	200	227	202
272	203								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	115.5	.035	123.5	.05

Bank Sta: Left Right Coeff Contr. Expan.
115.5 123.5 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116	200.23	F
123	272	200.5	F

Downstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201		50	200.45		95	200.23	
168	201		216	202		227	202.5	
272	203.5							

Downstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	50	200	111	200	113	199	115.5	197
116	196	123	196	123.5	197	129	200	227	202
272	203								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	115.5	.035	123.5	.05

Bank Sta: Left Right Coeff Contr. Expan.
115.5 123.5 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116	199	F
123	272	199	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	Box	1.52	3.66

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
	5	64	.015	.015	0	.5	1

Upstream Elevation = 196
Centerline Station = 119.5
Downstream Elevation = 196
Centerline Station = 119.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	14.09	Culv Full Len (m)	64.00
# Barrels	1	Culv Vel US (m/s)	2.53
Q Barrel (m3/s)	14.09	Culv Vel DS (m/s)	2.53
E.G. US. (m)	200.51	Culv Inv El Up (m)	196.00
W.S. US. (m)	200.51	Culv Inv El Dn (m)	196.00
E.G. DS (m)	199.83	Culv Frctn Ls (m)	0.21
W.S. DS (m)	199.81	Culv Exit Loss (m)	0.31
Delta EG (m)	0.69	Culv Entr Loss (m)	0.16
Delta WS (m)	0.69	Q Weir (m3/s)	6.50
E.G. IC (m)	199.01	Weir Sta Lft (m)	44.67
E.G. OC (m)	200.51	Weir Sta Rgt (m)	121.40
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	197.52	Weir Max Depth (m)	0.28
Culv WS Outlet (m)	197.52	Weir Avg Depth (m)	0.15
Culv Nml Depth (m)		Weir Flow Area (m2)	11.41
Culv Crt Depth (m)	1.15	Min El Weir Flow (m)	200.23

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	2.55	Culv Full Len (m)	64.00
# Barrels	1	Culv Vel US (m/s)	0.46
Q Barrel (m3/s)	2.55	Culv Vel DS (m/s)	0.46
E.G. US. (m)	201.20	Culv Inv El Up (m)	196.00
W.S. US. (m)	201.14	Culv Inv El Dn (m)	196.00
E.G. DS (m)	201.19	Culv Frctn Ls (m)	0.01
W.S. DS (m)	201.12	Culv Exit Loss (m)	0.00
Delta EG (m)	0.01	Culv Entr Loss (m)	0.01
Delta WS (m)	0.01	Q Weir (m3/s)	120.02
E.G. IC (m)	201.19	Weir Sta Lft (m)	0.00
E.G. OC (m)	201.20	Weir Sta Rgt (m)	178.47
Culvert Control	Outlet	Weir Submerg	0.87
Culv WS Inlet (m)	197.52	Weir Max Depth (m)	0.99
Culv WS Outlet (m)	197.52	Weir Avg Depth (m)	0.61
Culv Nml Depth (m)		Weir Flow Area (m2)	109.34
Culv Crt Depth (m)	0.37	Min El Weir Flow (m)	200.23

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.201

INPUT
Description: Section 46.201 - Highway 7 - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	50	200	111	200	113	199	115.5	197
116	196	123	196	123.5	197	129	200	227	202
272	203								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	115.5	.035	123.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
115.5	123.5	20	25	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116	199	F
123	272	199	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.83	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.81	Reach Len. (m)	20.00	25.00	30.00
Crit W.S. (m)	196.96	Flow Area (m2)	5.18	29.98	7.24
E.G. Slope (m/m)	0.000092	Area (m2)	5.18	29.98	7.24
Q Total (m3/s)	20.59	Flow (m3/s)	1.01	17.98	1.59
Top Width (m)	17.27	Top Width (m)	4.12	8.00	5.15
Vel Total (m/s)	0.49	Avg. Vel. (m/s)	0.20	0.60	0.22
Max Chl Dpth (m)	3.81	Hydr. Depth (m)	1.26	3.75	1.41
Conv. Total (m3/s)	2150.8	Conv. (m3/s)	106.0	1878.2	166.6
Length Wtd. (m)	25.07	Wetted Per. (m)	5.01	9.24	5.87
Min Ch El (m)	196.00	Shear (N/m2)	0.93	2.92	1.11
Alpha	1.36	Stream Power (N/m s)	0.18	1.75	0.24
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	47.78	79.37	39.88
C & E Loss (m)	0.00	Cum SA (1000 m2)	53.39	24.68	53.81

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.19	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.12	Reach Len. (m)	20.00	25.00	30.00
Crit W.S. (m)	199.00	Flow Area (m2)	110.67	40.48	45.31
E.G. Slope (m/m)	0.000421	Area (m2)	110.67	40.48	45.31
Q Total (m3/s)	122.56	Flow (m3/s)	43.85	63.52	15.19
Top Width (m)	184.01	Top Width (m)	115.50	8.00	60.51
Vel Total (m/s)	0.62	Avg. Vel. (m/s)	0.40	1.57	0.34
Max Chl Dpth (m)	5.12	Hydr. Depth (m)	0.96	5.06	0.75
Conv. Total (m3/s)	5976.8	Conv. (m3/s)	2138.2	3097.8	740.8
Length Wtd. (m)	23.94	Wetted Per. (m)	116.57	9.24	61.29
Min Ch El (m)	196.00	Shear (N/m2)	3.92	18.08	3.05
Alpha	3.46	Stream Power (N/m s)	1.55	28.36	1.02
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	185.08	188.48	208.53
C & E Loss (m)	0.02	Cum SA (1000 m2)	115.54	24.68	132.45

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.192

INPUT
Description: Section 46.192 - Private Driveway - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	5	200	30	199	56	199	60	197
61.5	195.9	65.5	195.9	67	197	85	200	95	200
95	203	135	203						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	60	.035	67	.05

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
60 67 25 25 25 .3 .5
Ineffective Flow num= 2
Sta L Sta R Elev Permanent
0 61.5 199 F
65.5 135 199.3 F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.82	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.81	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)	197.29	Flow Area (m2)	36.67	25.75	23.75
E.G. Slope (m/m)	0.000053	Area (m2)	36.67	25.75	23.75
Q Total (m3/s)	20.59	Flow (m3/s)	4.30	11.98	4.31
Top Width (m)	74.22	Top Width (m)	50.34	7.00	16.88
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.12	0.47	0.18
Max Chl Dpth (m)	3.91	Hydr. Depth (m)	0.73	3.68	1.41
Conv. Total (m3/s)	2822.8	Conv. (m3/s)	590.1	1641.9	590.9
Length Wtd. (m)	25.00	Wetted Per. (m)	50.82	7.72	17.11
Min Ch El (m)	195.90	Shear (N/m2)	0.38	1.74	0.72
Alpha	2.38	Stream Power (N/m s)	0.04	0.81	0.13
Frctn Loss (m)		Cum Volume (1000 m3)	47.36	78.68	39.41
C & E Loss (m)		Cum SA (1000 m2)	52.84	24.49	53.48

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.17	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.13	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)	199.36	Flow Area (m2)	112.00	34.98	58.73
E.G. Slope (m/m)	0.000236	Area (m2)	112.00	34.98	58.73
Q Total (m3/s)	122.56	Flow (m3/s)	51.81	42.09	28.66
Top Width (m)	95.00	Top Width (m)	60.00	7.00	

28.00					
Vel Total (m/s)	0.60	Avg. Vel. (m/s)	0.46	1.20	0.49
Max Chl Dpth (m)	5.23	Hydr. Depth (m)	1.87	5.00	2.10
Conv. Total (m3/s)	7969.8	Conv. (m3/s)	3368.7	2737.1	1864.0
Length Wtd. (m)	25.00	Wetted Per. (m)	60.72	7.72	29.38
Min Ch El (m)	195.90	Shear (N/m2)	4.28	10.51	4.64
Alpha	1.81	Stream Power (N/m s)	1.98	12.64	2.26
Frctn Loss (m)		Cum Volume (1000 m3)	182.86	187.54	206.97
C & E Loss (m)		Cum SA (1000 m2)	113.78	24.49	131.12

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1915

INPUT
Description: Hum-MM. Private Driveway Culvert - 3.75m x 1.5m Box culvert - sizes determined from Site visit - July 2010

New HEC-RAS coding
January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 4
Deck/Roadway Width = 17
Weir Coefficient = 1.44

Upstream Deck/Roadway Coordinates
num= 3

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
30	199	56	199	85	200

Upstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	5	200	30	199	56	199	60	197
61.5	195.9	65.5	195.9	67	197	85	200	95	200
95	203	135	203						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	60	.035	67	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
60	67	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	61.5	199	F
65.5	135	199.3	F

Downstream Deck/Roadway Coordinates
num= 3

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
30	199	56	199	85	200

Downstream Bridge Cross Section Data
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	5	200	30	199	56	199	60	197
61.5	195.9	65.5	195.9	67	197	85	200	95	200
95	203	135	203						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	60	.035	67	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
60	67	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	61.5	198.5	F
65.5	135	198.5	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	Box	1.5	3.75

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
	4	17	.013	.024	0	.5	1

Upstream Elevation = 195.9
Centerline Station = 63.5
Downstream Elevation = 195.9
Centerline Station = 63.5

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	2.16	Culv Full Len (m)	17.00
# Barrels	1	Culv Vel US (m/s)	0.38
Q Barrel (m3/s)	2.16	Culv Vel DS (m/s)	0.38
E.G. US. (m)	199.82	Culv Inv El Up (m)	195.90
W.S. US. (m)	199.81	Culv Inv El Dn (m)	195.90
E.G. DS (m)	199.81	Culv Frctn Ls (m)	0.00
W.S. DS (m)	199.81	Culv Exit Loss (m)	0.00
Delta EG (m)	0.01	Culv Entr Loss (m)	0.00
Delta WS (m)	0.01	Q Weir (m3/s)	18.43
E.G. IC (m)	198.86	Weir Sta Lft (m)	9.51
E.G. OC (m)	199.82	Weir Sta Rgt (m)	79.76
Culvert Control	Outlet	Weir Submerg	0.99
Culv WS Inlet (m)	197.40	Weir Max Depth (m)	0.82
Culv WS Outlet (m)	197.40	Weir Avg Depth (m)	0.56

Culv Nml Depth (m)		Weir Flow Area (m2)	39.44
Culv Crt Depth (m)	0.32	Min El Weir Flow (m)	199.00

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	1.13	Culv Full Len (m)	17.00
# Barrels	1	Culv Vel US (m/s)	0.20
Q Barrel (m3/s)	1.13	Culv Vel DS (m/s)	0.20
E.G. US. (m)	201.17	Culv Inv El Up (m)	195.90
W.S. US. (m)	201.13	Culv Inv El Dn (m)	195.90
E.G. DS (m)	201.17	Culv Frctn Ls (m)	0.00
W.S. DS (m)	201.13	Culv Exit Loss (m)	0.00
Delta EG (m)	0.00	Culv Entr Loss (m)	0.00
Delta WS (m)	0.00	Q Weir (m3/s)	121.43
E.G. IC (m)	201.17	Weir Sta Lft (m)	0.00
E.G. OC (m)	201.17	Weir Sta Rgt (m)	95.00
Culvert Control	Outlet	Weir Submerg	0.99
Culv WS Inlet (m)	197.40	Weir Max Depth (m)	2.18
Culv WS Outlet (m)	197.40	Weir Avg Depth (m)	1.71
Culv Nml Depth (m)		Weir Flow Area (m2)	162.42
Culv Crt Depth (m)	0.21	Min El Weir Flow (m)	199.00

Warning: The weir over culvert is submerged.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.191

INPUT
Description: Section 46.191 - Private Driveway - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201	5	200	30	199	56	199	60	197
61.5	195.9	65.5	195.9	67	197	85	200	95	200
95	203	135	203						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	60	.035	67	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
60	67	50	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	61.5	198.5	F
65.5	135	198.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.81	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	

0.050					
W.S. Elev (m)	199.81	Reach Len. (m)	50.00	50.00	
50.00					
Crit W.S. (m)	197.29	Flow Area (m2)	36.37	25.70	
23.64					
E.G. Slope (m/m)	0.000054	Area (m2)	36.37	25.70	
23.64					
Q Total (m3/s)	20.59	Flow (m3/s)	4.28	12.01	
4.31					
Top Width (m)	74.03	Top Width (m)	50.18	7.00	
16.84					
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.12	0.47	
0.18					
Max Chl Dpth (m)	3.91	Hydr. Depth (m)	0.72	3.67	
1.40					
Conv. Total (m3/s)	2807.9	Conv. (m3/s)	583.1	1637.3	
587.5					
Length Wtd. (m)	50.00	Wetted Per. (m)	50.67	7.72	
17.08					
Min Ch El (m)	195.90	Shear (N/m2)	0.38	1.76	
0.73					
Alpha	2.38	Stream Power (N/m s)	0.04	0.82	
0.13					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	47.36	77.39	
39.41					
C & E Loss (m)	0.00	Cum SA (1000 m2)	51.59	24.32	
53.05					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.17	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	
0.050					
W.S. Elev (m)	201.13	Reach Len. (m)	50.00	50.00	
50.00					
Crit W.S. (m)	199.36	Flow Area (m2)	111.98	34.98	
58.72					
E.G. Slope (m/m)	0.000237	Area (m2)	111.98	34.98	
58.72					
Q Total (m3/s)	122.56	Flow (m3/s)	51.80	42.10	
28.66					
Top Width (m)	95.00	Top Width (m)	60.00	7.00	
28.00					
Vel Total (m/s)	0.60	Avg. Vel. (m/s)	0.46	1.20	
0.49					
Max Chl Dpth (m)	5.23	Hydr. Depth (m)	1.87	5.00	
2.10					
Conv. Total (m3/s)	7968.1	Conv. (m3/s)	3367.7	2736.8	
1863.5					
Length Wtd. (m)	50.00	Wetted Per. (m)	60.72	7.72	
29.38					
Min Ch El (m)	195.90	Shear (N/m2)	4.28	10.51	
4.64					
Alpha	1.81	Stream Power (N/m s)	1.98	12.65	
2.26					
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	182.86	183.19	

206.97
C & E Loss (m) 0.01 Cum SA (1000 m2) 112.28 24.32
130.42

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.19

INPUT
Description: Section 46.19 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204	0	201	8	201	50	201	58	200
63	199	94	199	104	196.5	105	195.5	106	195.5
107	196.5	114	198	119	198.7	143	198.7	143	203
169	203								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	8	.025	50	.05	104	.035	107	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
104	107	45	45	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.81	Element	Left OB	Channel
Right OB				
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (m)	199.81	Reach Len. (m)	45.00	45.00
45.00				
Crit W.S. (m)		Flow Area (m2)	47.20	11.92
51.74				
E.G. Slope (m/m)	0.000048	Area (m2)	47.20	11.92
51.74				
Q Total (m3/s)	20.59	Flow (m3/s)	6.69	5.01
8.89				
Top Width (m)	84.03	Top Width (m)	45.03	3.00
36.00				
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.14	0.42
0.17				
Max Chl Dpth (m)	4.31	Hydr. Depth (m)	1.05	3.97
1.44				
Conv. Total (m3/s)	2981.7	Conv. (m3/s)	968.6	726.2
1286.8				
Length Wtd. (m)	45.00	Wetted Per. (m)	45.42	3.83
37.31				
Min Ch El (m)	195.50	Shear (N/m2)	0.49	1.46
0.65				
Alpha	1.81	Stream Power (N/m s)	0.07	0.61
0.11				
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	45.27	76.45
37.53				
C & E Loss (m)	0.00	Cum SA (1000 m2)	49.21	24.07

51.73

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.15	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.13	Reach Len. (m)	45.00	45.00	45.00
Crit W.S. (m)		Flow Area (m2)	119.45	15.89	99.36
E.G. Slope (m/m)	0.000201	Area (m2)	119.45	15.89	99.36
Q Total (m3/s)	122.56	Flow (m3/s)	53.01	16.63	52.92
Top Width (m)	143.00	Top Width (m)	104.00	3.00	36.00
Vel Total (m/s)	0.52	Avg. Vel. (m/s)	0.44	1.05	0.53
Max Chl Dpth (m)	5.63	Hydr. Depth (m)	1.15	5.30	2.76
Conv. Total (m3/s)	8638.4	Conv. (m3/s)	3736.2	1172.4	3729.8
Length Wtd. (m)	45.00	Wetted Per. (m)	104.60	3.83	38.64
Min Ch El (m)	195.50	Shear (N/m2)	2.25	8.19	5.08
Alpha	1.31	Stream Power (N/m s)	1.00	8.58	2.70
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	177.07	181.92	203.02
C & E Loss (m)	0.00	Cum SA (1000 m2)	108.18	24.07	128.82

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.182

INPUT
Description: Section 46.182 - Private Driveway - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 47

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.972	.42	201.961	.55	201.96	1.85	201.935	8.17	201.804
21.62	201.526	31.13	201.301	35.82	201.196	38.11	201.147	43.98	201
47.21	201	54.76	201	59.23	201.022	59.93	201.025	61.24	201.019
63.83	201.008	65.54	201	67.48	200.312	68.6	200	69.51	199.67
71.2	199	80.47	198.706	97.37	198.231	101.25	198.152	103.18	198.11
108.63	198	109.89	197.509	111.25	197	113.61	196.424	114.44	196
115	195.5	117	195.5	119.57	196.761	120.39	197	120.93	197.262
122.38	198	123.56	198.575	124.53	199	125.86	199.005	126.15	199.005
126.32	199.005	128.81	199.016	129.09	199.016	133.53	199.074	152.28	199.311
155.51	199.353	179.8	199.659						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	43.98	.025	65.54	.05	111.25	.035	120.39	.05

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
111.25 120.39 30 30 30 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	114	197.8	F
118	179.8	198.1	F

Left Levee Station= 59.93 Elevation= 201.025
Blocked Obstructions num= 1

Sta L	Sta R	Elev
143.39	178.45	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.81	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.80	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)	197.06	Flow Area (m2)	57.30	33.00	21.18
E.G. Slope (m/m)	0.000028	Area (m2)	57.30	33.00	21.18
Q Total (m3/s)	20.59	Flow (m3/s)	7.39	11.17	2.03
Top Width (m)	75.60	Top Width (m)	42.11	9.14	24.35
Vel Total (m/s)	0.18	Avg. Vel. (m/s)	0.13	0.34	0.10
Max Chl Dpth (m)	4.30	Hydr. Depth (m)	1.36	3.61	0.87
Conv. Total (m3/s)	3897.4	Conv. (m3/s)	1399.5	2114.3	383.6
Length Wtd. (m)	30.00	Wetted Per. (m)	42.46	9.83	25.73
Min Ch El (m)	195.50	Shear (N/m2)	0.37	0.92	0.23
Alpha	2.02	Stream Power (N/m s)	0.05	0.31	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	42.92	75.43	35.89
C & E Loss (m)		Cum SA (1000 m2)	47.24	23.79	50.38

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.14	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.11	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)	198.95	Flow Area (m2)	117.48	44.95	

53.01					
E.G. Slope (m/m)	0.000169	Area (m2)	117.48	44.95	
53.01					
Q Total (m3/s)	122.56	Flow (m3/s)	55.11	46.00	
21.45					
Top Width (m)	105.23	Top Width (m)	71.74	9.14	
24.35					
Vel Total (m/s)	0.57	Avg. Vel. (m/s)	0.47	1.02	
0.40					
Max Chl Dpth (m)	5.61	Hydr. Depth (m)	1.64	4.92	
2.18					
Conv. Total (m3/s)	9427.7	Conv. (m3/s)	4239.3	3538.4	
1650.0					
Length Wtd. (m)	30.00	Wetted Per. (m)	72.29	9.83	
29.65					
Min Ch El (m)	195.50	Shear (N/m2)	2.69	7.58	
2.96					
Alpha	1.61	Stream Power (N/m s)	1.26	7.76	
1.20					
Frctn Loss (m)		Cum Volume (1000 m3)	171.74	180.55	
199.59					
C & E Loss (m)		Cum SA (1000 m2)	104.23	23.79	
127.46					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1815

INPUT
Description: Hum-LL - Private Driveway Culvert - 3.23 m W x 2.1 m H x 20 m L Corrugated Metal Pipe Arch Culvert. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004
by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 20
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 68

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.814		8.43	201.594		9.83	201.579	
23.38	201.318		38.06	201.013		38.92	201.052	
39.19	201.044		39.55	201.046		40.67	201.053	
44.98	201.024		45.55	201		48.21	201	
51.41	201		53.82	201		57.05	201.013	
59.14	201.02		61.55	201.011		63.08	201.006	
64.24	201		66.61	200.06		66.78	200	
66.95	199.933		69.25	199		73.56	198.862	
78.46	198.707		78.57	198.703		91.01	198.328	
92.38	198.309		94.38	198.276		94.4	198.275	
94.48	198.274		104.2	198.082		107.92	198.006	
108.02	198.006		108.27	198.006		108.69	198.005	
109.45	198.005		110.23	198.004		110.59	198.004	
111.09	198.004		112.19	198.004		112.58	198.004	

113.44	198.003	114.64	198.003	115.23	198.003
115.68	198.003	116.18	198.002	116.54	198.038
119.63	198.468	121.93	198.762	122.56	198.775
123.93	198.92	125.6	198.914	126.73	198.921
128.12	198.95	128.92	198.942	130.41	198.978
130.95	199	130.96	199	131.04	199
131.13	199	131.47	199.005	131.56	199.007
133.71	199.023	134.52	199.03	136.57	199.051
136.8	199.053	177.16	199.555		

Upstream Bridge Cross Section Data

Station Elevation Data num= 47

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.972	.42	201.961	.55	201.96	1.85	201.935	8.17	201.804
21.62	201.526	31.13	201.301	35.82	201.196	38.11	201.147	43.98	201
47.21	201	54.76	201	59.23	201.022	59.93	201.025	61.24	201.019
63.83	201.008	65.54	201	67.48	200.312	68.6	200	69.51	199.67
71.2	199	80.47	198.706	97.37	198.231	101.25	198.152	103.18	198.11
108.63	198	109.89	197.509	111.25	197	113.61	196.424	114.44	196
115	195.5	117	195.5	119.57	196.761	120.39	197	120.93	197.262
122.38	198	123.56	198.575	124.53	199	125.86	199.005	126.15	199.005
126.32	199.005	128.81	199.016	129.09	199.016	133.53	199.074	152.28	199.311
155.51	199.353	179.8	199.659						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	43.98	.025	65.54	.05	111.25	.035	120.39	.05

Bank Sta: Left Right Coeff Contr. Expan.

111.25 120.39 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	114	197.8	F
118	179.8	198.1	F

Left Levee Station= 59.93 Elevation= 201.025

Blocked Obstructions num= 1

Sta L	Sta R	Elev
143.39	178.45	204

Downstream Deck/Roadway Coordinates

num= 68

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.814		8.43	201.594		9.83	201.579	
23.38	201.318		38.06	201.013		38.92	201.052	
39.19	201.044		39.55	201.046		40.67	201.053	
44.98	201.024		45.55	201		48.21	201	
51.41	201		53.82	201		57.05	201.013	
59.14	201.02		61.55	201.011		63.08	201.006	
64.24	201		66.61	200.06		66.78	200	
66.95	199.933		69.25	199		73.56	198.862	
78.46	198.707		78.57	198.703		91.01	198.328	
92.38	198.309		94.38	198.276		94.4	198.275	
94.48	198.274		104.2	198.082		107.92	198.006	
108.02	198.006		108.27	198.006		108.69	198.005	
109.45	198.005		110.23	198.004		110.59	198.004	
111.09	198.004		112.19	198.004		112.58	198.004	
113.44	198.003		114.64	198.003		115.23	198.003	
115.68	198.003		116.18	198.002		116.54	198.038	
119.63	198.468		121.93	198.762		122.56	198.775	
123.93	198.92		125.6	198.914		126.73	198.921	
128.12	198.95		128.92	198.942		130.41	198.978	
130.95	199		130.96	199		131.04	199	
131.13	199		131.47	199.005		131.56	199.007	

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  133.71 199.023          134.52  199.03          136.57 199.051
   136.8 199.053          177.16 199.555

Downstream Bridge Cross Section Data
Station Elevation Data    num=      63
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 201.672   10.15 201.391   16.44 201.227   19.11 201.198   28.76 201.012
   29.08 201.003   29.75 201.003   30.18 201.003   33.16 201.006   34.09 201.007
   34.71 201.007   38.11 201.008   40.91 201.007   42.47 201.009   46.32  201.01
   49.08  201.01   50.09  201.01   52.79 201.011   53.95 201.011   55.33  201.01
   55.52  201.01   57.16 201.007    59.2 201.008   61.08 201.003   61.53 201.002
   62.11     201   63.74 200.449   63.89 200.402   64.96     200   67.14 199.213
   67.66     199   85.51 198.472   98.03 198.095  102.22 198.037  104.14 198.005
  104.83     198  107.05 197.336  108.45     197   109.6 196.471  110.03 196.349
   110.3 196.132  110.55   195.7  111.55  195.42  112.65  195.42  113.45   195.7
  113.65 196.153  114.19 196.347  114.96 196.478  115.28 196.495  115.54 196.648
  115.97     197  117.96 197.685   118.9     198  119.49 198.157  122.24     199
  123.93 199.013  125.15 199.031  128.94  199.07  130.34 199.094  131.13 199.106
  131.15 199.106  139.61 199.169  174.54 199.456

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   28.76    .025   62.11     .05  108.45    .035  115.97     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
        108.45  115.97            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     110   197.8       F
     114  174.54   197.8       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
  139.13  174.54     204

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     Pipe Arch     2.1    3.23
FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                 5      20     .024     .024        0                    .9
      1
Upstream   Elevation =  195.5
           Centerline Station =  116
Downstream Elevation =  195.42
           Centerline Station =  112

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       1.13    Culv Full Len (m)        20.00
  # Barrels                    1    Culv Vel US (m/s)         0.22
  Q Barrel (m3/s)           1.13    Culv Vel DS (m/s)         0.22
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E.G. US. (m)	199.81	Culv Inv El Up (m)	195.50
W.S. US. (m)	199.80	Culv Inv El Dn (m)	195.42
E.G. DS (m)	199.81	Culv Frctn Ls (m)	0.00
W.S. DS (m)	199.80	Culv Exit Loss (m)	0.00
Delta EG (m)	0.00	Culv Entr Loss (m)	0.00
Delta WS (m)	0.00	Q Weir (m3/s)	19.46
E.G. IC (m)	199.19	Weir Sta Lft (m)	69.13
E.G. OC (m)	199.81	Weir Sta Rgt (m)	179.80
Culvert Control	Outlet	Weir Submerg	1.00
Culv WS Inlet (m)	197.60	Weir Max Depth (m)	1.81
Culv WS Outlet (m)	197.52	Weir Avg Depth (m)	1.18
Culv Nml Depth (m)		Weir Flow Area (m2)	89.52
Culv Crt Depth (m)	0.31	Min El Weir Flow (m)	198.01

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	3.10	Culv Full Len (m)	20.00
# Barrels	1	Culv Vel US (m/s)	0.59
Q Barrel (m3/s)	3.10	Culv Vel DS (m/s)	0.59
E.G. US. (m)	201.14	Culv Inv El Up (m)	195.50
W.S. US. (m)	201.11	Culv Inv El Dn (m)	195.42
E.G. DS (m)	201.11	Culv Frctn Ls (m)	0.01
W.S. DS (m)	201.09	Culv Exit Loss (m)	0.00
Delta EG (m)	0.02	Culv Entr Loss (m)	0.02
Delta WS (m)	0.03	Q Weir (m3/s)	119.46
E.G. IC (m)	201.12	Weir Sta Lft (m)	39.13
E.G. OC (m)	201.14	Weir Sta Rgt (m)	179.80
Culvert Control	Outlet	Weir Submerg	0.99
Culv WS Inlet (m)	197.60	Weir Max Depth (m)	3.12
Culv WS Outlet (m)	197.52	Weir Avg Depth (m)	1.84
Culv Nml Depth (m)		Weir Flow Area (m2)	194.21
Culv Crt Depth (m)	0.55	Min El Weir Flow (m)	198.01

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.181

INPUT
Description: Section 46.181 - Private Driveway - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 63

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.672	10.15	201.391	16.44	201.227	19.11	201.198	28.76	201.012
29.08	201.003	29.75	201.003	30.18	201.003	33.16	201.006	34.09	201.007
34.71	201.007	38.11	201.008	40.91	201.007	42.47	201.009	46.32	201.01
49.08	201.01	50.09	201.01	52.79	201.011	53.95	201.011	55.33	201.01
55.52	201.01	57.16	201.007	59.2	201.008	61.08	201.003	61.53	201.002
62.11	201	63.74	200.449	63.89	200.402	64.96	200	67.14	199.213
67.66	199	85.51	198.472	98.03	198.095	102.22	198.037	104.14	198.005

```
  104.83     198  107.05 197.336  108.45     197   109.6 196.471  110.03 196.349
   110.3 196.132  110.55   195.7  111.55  195.42  112.65  195.42  113.45   195.7
  113.65 196.153  114.19 196.347  114.96 196.478  115.28 196.495  115.54 196.648
  115.97     197  117.96 197.685   118.9     198  119.49 198.157  122.24     199
  123.93 199.013  125.15 199.031  128.94  199.07  130.34 199.094  131.13 199.106
  131.15 199.106  139.61 199.169  174.54 199.456

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   28.76    .025   62.11     .05  108.45    .035  115.97     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        108.45  115.97               10      10      10             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     110   197.8       F
     114  174.54   197.8       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
  139.13  174.54     204

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           199.81    Element                Left OB    Channel
Right OB
  Vel Head (m)              0.00    Wt. n-Val.              0.050      0.035
0.050
  W.S. Elev (m)           199.80    Reach Len. (m)          10.00      10.00
10.00
  Crit W.S. (m)           197.07    Flow Area (m2)          59.22      27.86
23.15
  E.G. Slope (m/m)      0.000032    Area (m2)               59.22      27.86
23.15
  Q Total (m3/s)            20.59   Flow (m3/s)              8.22       9.83
2.54
  Top Width (m)             73.62   Top Width (m)           42.94       7.52
23.16
  Vel Total (m/s)           0.19    Avg. Vel. (m/s)          0.14       0.35
0.11
  Max Chl Dpth (m)          4.38    Hydr. Depth (m)          1.38       3.70
1.00
  Conv. Total (m3/s)      3657.4    Conv. (m3/s)            1460.9     1746.0
450.5
  Length Wtd. (m)           10.00   Wetted Per. (m)          43.24       8.57
24.11
  Min Ch El (m)           195.42    Shear (N/m2)             0.43       1.01
0.30
  Alpha                     1.97    Stream Power (N/m s)     0.06       0.36
0.03
  Frctn Loss (m)            0.00    Cum Volume (1000 m3)    42.92      72.51
35.89
  C & E Loss (m)            0.00    Cum SA (1000 m2)        45.97      23.54
49.66



Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #Regional w red'n
```

E.G. Elev (m)	201.11	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.09	Reach Len. (m)	10.00	10.00	10.00
Crit W.S. (m)	199.00	Flow Area (m2)	119.37	37.51	52.88
E.G. Slope (m/m)	0.000190	Area (m2)	119.37	37.51	52.88
Q Total (m3/s)	122.56	Flow (m3/s)	59.30	39.50	23.76
Top Width (m)	114.19	Top Width (m)	83.51	7.52	23.16
Vel Total (m/s)	0.58	Avg. Vel. (m/s)	0.50	1.05	0.45
Max Chl Dpth (m)	5.67	Hydr. Depth (m)	1.43	4.99	2.28
Conv. Total (m3/s)	8896.6	Conv. (m3/s)	4304.8	2867.1	1724.7
Length Wtd. (m)	10.00	Wetted Per. (m)	84.01	8.57	25.39
Min Ch El (m)	195.42	Shear (N/m2)	2.64	8.14	3.88
Alpha	1.51	Stream Power (N/m s)	1.31	8.58	1.74
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	171.74	174.48	199.59
C & E Loss (m)	0.00	Cum SA (1000 m2)	101.90	23.54	126.75

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.18

INPUT
Description: Section 46.18 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 36

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.977	11.8	201.517	19.72	201.217	24.63	201.027	25.49	201
25.73	200.891	27.72	200	72.09	200	72.38	200.049	72.68	200
73.08	199.878	75.33	199	90.41	198.582	110.99	198	113.81	197.148
114.16	197	114.84	196.777	115.23	196.607	117.24	196	118.92	195.419
119.01	195.418	119.32	195.43	120.38	195.971	120.82	196	123.44	196.968
123.53	197	123.87	197.147	125.89	198	126.38	198.193	128.56	199
130.21	199.025	143.32	199.109	146.37	199.102	152.23	199.148	160.44	199.206
181.15	199.373								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	117.24	.035	120.82	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
117.24	120.82	25	25	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
146.08	181.15	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.80	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)		Flow Area (m2)	64.59	14.65	30.67
E.G. Slope (m/m)	0.000038	Area (m2)	64.59	14.65	30.67
Q Total (m3/s)	20.59	Flow (m3/s)	10.15	6.30	4.14
Top Width (m)	72.80	Top Width (m)	43.96	3.58	25.26
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.16	0.43	0.14
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.47	4.09	1.21
Conv. Total (m3/s)	3360.8	Conv. (m3/s)	1657.3	1027.6	676.0
Length Wtd. (m)	25.00	Wetted Per. (m)	44.44	3.81	26.52
Min Ch El (m)	195.42	Shear (N/m2)	0.53	1.42	0.43
Alpha	2.06	Stream Power (N/m s)	0.08	0.61	0.06
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	42.30	72.30	35.62
C & E Loss (m)	0.00	Cum SA (1000 m2)	45.53	23.49	49.42

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.11	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.09	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)		Flow Area (m2)	172.08	19.25	63.15
E.G. Slope (m/m)	0.000189	Area (m2)	172.08	19.25	63.15
Q Total (m3/s)	122.56	Flow (m3/s)	70.32	22.26	29.98
Top Width (m)	122.99	Top Width (m)	94.15	3.58	25.26
Vel Total (m/s)	0.48	Avg. Vel. (m/s)	0.41	1.16	0.47
Max Chl Dpth (m)	5.67	Hydr. Depth (m)	1.83	5.38	2.50
Conv. Total (m3/s)	8920.1	Conv. (m3/s)	5117.8	1620.2	2182.2
Length Wtd. (m)	25.00	Wetted Per. (m)	94.89	3.81	27.81
Min Ch El (m)	195.42	Shear (N/m2)	3.36	9.36	4.20
Alpha	1.70	Stream Power (N/m s)	1.37	10.82	

2.00
  Frctn Loss (m) 0.00 Cum Volume (1000 m3) 170.28 174.20 199.01
  C & E Loss (m) 0.00 Cum SA (1000 m2) 101.01 23.49 126.51

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: RIVER-1
REACH: Reach-1 RS: 46.172

INPUT
Description: Section 46.172 - Doughton Road - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 112

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.734	12.56	201.239	18.71	201	19.16	200.796	20.83	200
22.76	199.053	22.87	199	62.25	199	63.17	199.011	64.63	199.022
66.94	199.001	66.98	199	67.01	199	68.2	198.967	103.48	198
104.09	197.739	105.82	197	106.27	196.833	107.29	196.474	107.64	196.354
108.58	196	109	195.6	109.6	195.423	111	195.423	111.7	195.6
112.13	196	114.2	196.671	115.34	197	118.55	197.877	118.99	198
121.05	198.574	123.33	199	123.42	199.001	123.5	199.001	123.54	199.001
123.9	199.003	124.23	199.004	124.61	199.005	126.14	199.011	127.45	199.01
127.51	199.01	130.18	199.02	131.13	199.023	131.75	199.022	131.93	199.022
136.67	199.034	138.19	199.034	142.37	199.028	144.48	199.031	146.18	199.033
147.98	199.03	151.4	199.025	152.23	199.024	153.19	199.023	162.26	199.102
168.85	199.106	176.2	199.054	176.37	199.053	179.61	199.282	179.92	199.303
181.07	199.326	182.68	199.444	185.09	199.554	185.23	199.561	190.14	200
190.33	200.08	192.14	200.106	194.32	200.348	197.51	200.575	198.87	200.608
201.34	200.55	205.59	200.325	205.97	200.323	207.47	200.186	208.18	200.159
208.63	200.138	208.84	200.128	209.03	200.12	209.29	200.117	209.54	200.119
210.38	200.139	210.98	200.174	211.81	200.246	213.46	200.375	218.29	200.752
218.48	200.763	218.67	200.765	219.17	200.789	219.59	200.805	220.25	200.786
223.9	200.72	227.49	200.773	227.81	200.78	230.24	200.911	230.52	200.931
231.19	201	231.74	201.005	232.08	201.007	242.92	201.282	250.3	201.41
251.76	201.387	251.9	201.386	253.2	201.371	255.13	201.441	255.57	201.457
256.04	201.474	256.2	201.479	256.73	201.495	258.39	201.529	263.36	201.693
264.27	201.707	264.32	201.707						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	108.58	.035	112.13	.05

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
108.58 112.13 40 40 40 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	108.23	197.78	F
112.38	264.32	197.78	F

Right Levee Station= 198.87 Elevation= 200.608

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m) 199.80 Element Left OB Channel

Right OB					
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.80	Reach Len. (m)	40.00	40.00	40.00
Crit W.S. (m)	197.01	Flow Area (m2)	97.96	15.11	68.87
E.G. Slope (m/m)	0.000021	Area (m2)	97.96	15.11	68.87
Q Total (m3/s)	20.59	Flow (m3/s)	9.73	4.91	5.95
Top Width (m)	166.69	Top Width (m)	87.35	3.55	75.79
Vel Total (m/s)	0.11	Avg. Vel. (m/s)	0.10	0.32	0.09
Max Chl Dpth (m)	4.38	Hydr. Depth (m)	1.12	4.26	0.91
Conv. Total (m3/s)	4455.0	Conv. (m3/s)	2105.7	1062.1	1287.3
Length Wtd. (m)	40.00	Wetted Per. (m)	87.93	3.92	76.22
Min Ch El (m)	195.42	Shear (N/m2)	0.23	0.81	0.19
Alpha	2.50	Stream Power (N/m s)	0.02	0.26	0.02
Frctn Loss (m)		Cum Volume (1000 m3)	40.27	71.92	34.37
C & E Loss (m)		Cum SA (1000 m2)	43.89	23.40	48.16

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.10	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.09	Reach Len. (m)	40.00	40.00	40.00
Crit W.S. (m)	199.38	Flow Area (m2)	212.63	19.69	193.70
E.G. Slope (m/m)	0.000074	Area (m2)	212.63	19.69	193.70
Q Total (m3/s)	122.56	Flow (m3/s)	63.45	14.21	44.90
Top Width (m)	219.18	Top Width (m)	92.27	3.55	123.35
Vel Total (m/s)	0.29	Avg. Vel. (m/s)	0.30	0.72	0.23
Max Chl Dpth (m)	5.67	Hydr. Depth (m)	2.30	5.55	1.57
Conv. Total (m3/s)	14244.4	Conv. (m3/s)	7373.8	1652.0	5218.7
Length Wtd. (m)	40.00	Wetted Per. (m)	93.13	3.92	123.88
Min Ch El (m)	195.42	Shear (N/m2)	1.66	3.65	1.14
Alpha	1.52	Stream Power (N/m s)	0.49	2.64	

0.26
  Frctn Loss (m) Cum Volume (1000 m3) 165.48 173.71 195.80
  C & E Loss (m) Cum SA (1000 m2) 98.68 23.40 124.65

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1715

INPUT
Description: Hum 13-4R. Doughton Road Culvert - 3.54 m W x 2.27 m H x 30 m L Corrugated Metal Pipe Arch Culvert. Drawing by Paul Theil (Dwg No. 8036P-A-17, February 1998) used to code culvert in HEC-RAS format..

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 30
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 146

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.659		17.1	201		18.56	200.215	
19.04	200		20.71	199.079		20.88	199	
58.5	199		58.75	199.001		59.61	199.002	
59.67	199.002		60.49	199.079		61.88	199.001	
62.77	199		62.78	198.999		62.87	198.999	
64.51	198.988		77.88	198.499		79.03	198.456	
80.45	198.394		80.53	198.393		80.55	198.393	
82.71	198.354		101.77	198.004		101.87	198.004	
102.35	198.004		102.49	198.003		103.08	198.003	
103.88	198.003		104.94	198.002		105.2	198.001	
105.36	198.001		105.37	198.001		105.48	198.001	
105.59	198.001		106.17	198		111.07	197.984	
112.06	197.981		112.22	197.981		112.33	197.981	
112.33	197.981		114.49	197.978		114.57	197.978	
114.65	197.978		115.8	197.978		118.45	197.973	
118.88	197.972		119.32	197.973		119.67	197.973	
120.76	197.97		121.29	197.971		125.31	197.974	
128.81	197.969		129.56	197.969		129.66	197.969	
131.93	197.969		135.28	197.977		135.33	197.977	
135.42	197.977		135.86	197.977		136.49	197.98	
136.85	197.98		138.97	197.983		140.58	197.983	
142.91	197.985		143.34	197.986		144	197.987	
148.3	197.988		148.81	197.988		150.8	197.989	
151.39	197.989		151.44	197.989		151.49	197.989	
152.06	197.99		152.7	197.99		156.88	197.993	
158.94	197.995		160.16	197.995		160.52	197.995	
163.7	197.998		163.89	197.998		166.05	198	
171.66	198.147		174	198.212		174.94	198.277	
175.14	198.281		175.27	198.285		175.43	198.29	

175.45	198.29	175.57	198.292	181.56	199
181.89	199	188.35	199	188.45	199
189.17	199	189.18	199	189.3	199
189.37	199	189.43	199	190.46	199
190.69	199	196.39	199	199.89	199
200.58	199	201.89	199	202.2	199
202.34	199	205.71	199	205.77	199
206.03	199	207.51	199	207.73	199
208.17	199	209.97	199	211.96	199.213
212.01	199.214	213.13	199.214	220.85	199.754
223.57	199.952	224.34	199.955	224.39	199.955
224.45	199.955	225.21	199.96	227.97	199.964
228.07	199.964	229.26	199.965	230.05	199.967
232.33	199.971	235.53	199.979	235.78	199.979
238.51	199.989	241.24	199.999	241.32	199.999
241.46	199.999	241.56	200	242.02	200.028
242.12	200.031	255.22	200.891	257.31	200.902
257.33	200.902	259.53	200.742	259.59	200.74
260.02	200.761	260.61	200.75	262.62	200.866
263.38	200.931	263.45	200.931		

Upstream Bridge Cross Section Data
Station Elevation Data num= 112

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.734	12.56	201.239	18.71	201	19.16	200.796	20.83	200
22.76	199.053	22.87	199	62.25	199	63.17	199.011	64.63	199.022
66.94	199.001	66.98	199	67.01	199	68.2	198.967	103.48	198
104.09	197.739	105.82	197	106.27	196.833	107.29	196.474	107.64	196.354
108.58	196	109	195.6	109.6	195.423	111	195.423	111.7	195.6
112.13	196	114.2	196.671	115.34	197	118.55	197.877	118.99	198
121.05	198.574	123.33	199	123.42	199.001	123.5	199.001	123.54	199.001
123.9	199.003	124.23	199.004	124.61	199.005	126.14	199.011	127.45	199.01
127.51	199.01	130.18	199.02	131.13	199.023	131.75	199.022	131.93	199.022
136.67	199.034	138.19	199.034	142.37	199.028	144.48	199.031	146.18	199.033
147.98	199.03	151.4	199.025	152.23	199.024	153.19	199.023	162.26	199.102
168.85	199.106	176.2	199.054	176.37	199.053	179.61	199.282	179.92	199.303
181.07	199.326	182.68	199.444	185.09	199.554	185.23	199.561	190.14	200
190.33	200.08	192.14	200.106	194.32	200.348	197.51	200.575	198.87	200.608
201.34	200.55	205.59	200.325	205.97	200.323	207.47	200.186	208.18	200.159
208.63	200.138	208.84	200.128	209.03	200.12	209.29	200.117	209.54	200.119
210.38	200.139	210.98	200.174	211.81	200.246	213.46	200.375	218.29	200.752
218.48	200.763	218.67	200.765	219.17	200.789	219.59	200.805	220.25	200.786
223.9	200.72	227.49	200.773	227.81	200.78	230.24	200.911	230.52	200.931
231.19	201	231.74	201.005	232.08	201.007	242.92	201.282	250.3	201.41
251.76	201.387	251.9	201.386	253.2	201.371	255.13	201.441	255.57	201.457
256.04	201.474	256.2	201.479	256.73	201.495	258.39	201.529	263.36	201.693
264.27	201.707	264.32	201.707						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	108.58	.035	112.13	.05

Bank Sta: Left Right Coeff Contr. Expan.
108.58 112.13 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	108.23	197.78	F
112.38	264.32	197.78	F

Right Levee Station= 198.87 Elevation= 200.608

Downstream Deck/Roadway Coordinates
num= 146
Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord

0	201.659	17.1	201	18.56	200.215		
19.04	200	20.71	199.079	20.88	199		
58.5	199	58.75	199.001	59.61	199.002		
59.67	199.002	60.49	199.079	61.88	199.001		
62.77	199	62.78	198.999	62.87	198.999		
64.51	198.988	77.88	198.499	79.03	198.456		
80.45	198.394	80.53	198.393	80.55	198.393		
82.71	198.354	101.77	198.004	101.87	198.004		
102.35	198.004	102.49	198.003	103.08	198.003		
103.88	198.003	104.94	198.002	105.2	198.001		
105.36	198.001	105.37	198.001	105.48	198.001		
105.59	198.001	106.17	198	111.07	197.984		
112.06	197.981	112.22	197.981	112.33	197.981		
112.33	197.981	114.49	197.978	114.57	197.978		
114.65	197.978	115.8	197.978	118.45	197.973		
118.88	197.972	119.32	197.973	119.67	197.973		
120.76	197.97	121.29	197.971	125.31	197.974		
128.81	197.969	129.56	197.969	129.66	197.969		
131.93	197.969	135.28	197.977	135.33	197.977		
135.42	197.977	135.86	197.977	136.49	197.98		
136.85	197.98	138.97	197.983	140.58	197.983		
142.91	197.985	143.34	197.986	144	197.987		
148.3	197.988	148.81	197.988	150.8	197.989		
151.39	197.989	151.44	197.989	151.49	197.989		
152.06	197.99	152.7	197.99	156.88	197.993		
158.94	197.995	160.16	197.995	160.52	197.995		
163.7	197.998	163.89	197.998	166.05	198		
171.66	198.147	174	198.212	174.94	198.277		
175.14	198.281	175.27	198.285	175.43	198.29		
175.45	198.29	175.57	198.292	181.56	199		
181.89	199	188.35	199	188.45	199		
189.17	199	189.18	199	189.3	199		
189.37	199	189.43	199	190.46	199		
190.69	199	196.39	199	199.89	199		
200.58	199	201.89	199	202.2	199		
202.34	199	205.71	199	205.77	199		
206.03	199	207.51	199	207.73	199		
208.17	199	209.97	199	211.96	199.213		
212.01	199.214	213.13	199.214	220.85	199.754		
223.57	199.952	224.34	199.955	224.39	199.955		
224.45	199.955	225.21	199.96	227.97	199.964		
228.07	199.964	229.26	199.965	230.05	199.967		
232.33	199.971	235.53	199.979	235.78	199.979		
238.51	199.989	241.24	199.999	241.32	199.999		
241.46	199.999	241.56	200	242.02	200.028		
242.12	200.031	255.22	200.891	257.31	200.902		
257.33	200.902	259.53	200.742	259.59	200.74		
260.02	200.761	260.61	200.75	262.62	200.866		
263.38	200.931	263.45	200.931				

Downstream Bridge Cross Section Data
Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.96	4.98	201.796	12.44	201.256	13.15	201.237	13.25	201.233
14.75	201.164	14.84	201.161	15.12	201.157	15.39	201.155	15.62	201.154
15.69	201.151	15.99	201	16.36	200.819	17.96	200	56.42	200
56.75	200.006	57.02	200.008	57.33	200.003	57.62	200	58.14	199.138
58.25	199.189	58.47	199	60.02	198.995	63.55	198.984	63.81	198.985
64	198.985	65.42	198.99	68.25	198.998	68.82	199	72	199.002
72.03	199.002	72.61	199.001	73.78	199.001	75.32	199	75.36	199
80.19	198.767	92.67	198.166	96.3	198	97.51	197.516	98.72	197
99.68	196.606	99.91	196.501	100.61	196.23	100.78	196	101.09	195.65
102	195.4	103	195.4	103.89	195.65	104.2	196	105.92	196.441

```
  106.96 196.581   107.6 196.655   107.9  196.67  111.41     197  111.54 197.014
  111.55 197.013  112.49 197.087  113.31  197.14  116.28 197.185  119.01 197.211
  119.24 197.207  121.22 197.229  124.15 197.307  124.51  197.35  124.99  197.41
  125.11 197.425  127.76  197.44  128.22 197.417  130.42     198  132.06 198.488
  133.88     199  134.14 199.003  134.41 199.003  134.45 199.003  137.25 199.032
  137.75 199.031  141.77 199.052  141.83 199.052  141.86 199.053  148.67 199.216
  150.74 199.224  152.75 199.228  159.58 199.291  160.35 199.297   162.8 199.347
  166.55 199.342   166.7 199.342  167.68 199.362  170.27 199.374  170.75 199.383
  172.18 199.397  173.54 199.408  175.72 199.407  176.75 199.414  180.91  199.49
  186.98 199.604   187.2 199.611  193.04 199.639     200     200  200.45 200.012
  202.09 200.042  206.82 200.085  218.03   200.5  221.19 200.617  221.21 200.618
  221.33 200.618  221.54 200.615  221.57 200.615   229.4 200.491  229.74  200.48
  236.66 200.579  244.75 200.914  250.98 200.952  251.55 200.969  251.75 200.978
  251.93 200.979   253.5     201  255.98 201.045  256.93 201.053  257.81 201.067
  258.72 201.075  258.93 201.079

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05  100.78    .035   104.2     .05  133.88    .025

Bank Sta: Left   Right    Coeff Contr.   Expan.
        100.78   104.2            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0  100.49   197.5       F
  104.45  258.93   197.5       F
Right Levee     Station=  221.19      Elevation=  200.62

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     Pipe Arch    2.27    3.54
FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                 5      30     .024     .024        0                   .9
      1
Upstream   Elevation =  195.423
           Centerline Station =  110.35
Downstream Elevation =  195.4
           Centerline Station =  102.49

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       0.95    Culv Full Len (m)        30.00
  # Barrels                    1    Culv Vel US (m/s)         0.15
  Q Barrel (m3/s)           0.95    Culv Vel DS (m/s)         0.15
  E.G. US. (m)            199.80    Culv Inv El Up (m)      195.42
  W.S. US. (m)            199.80    Culv Inv El Dn (m)      195.40
  E.G. DS (m)             199.80    Culv Frctn Ls (m)         0.00
  W.S. DS (m)             199.80    Culv Exit Loss (m)        0.00
  Delta EG (m)              0.00    Culv Entr Loss (m)        0.00
  Delta WS (m)              0.00    Q Weir (m3/s)            19.64
```

E.G. IC (m)	198.51	Weir Sta Lft (m)	21.23
E.G. OC (m)	199.80	Weir Sta Rgt (m)	187.93
Culvert Control	Outlet	Weir Submerg	1.00
Culv WS Inlet (m)	197.69	Weir Max Depth (m)	1.83
Culv WS Outlet (m)	197.67	Weir Avg Depth (m)	0.97
Culv Nml Depth (m)		Weir Flow Area (m2)	161.62
Culv Crt Depth (m)	0.28	Min El Weir Flow (m)	197.97

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	2.17	Culv Full Len (m)	30.00
# Barrels	1	Culv Vel US (m/s)	0.35
Q Barrel (m3/s)	2.17	Culv Vel DS (m/s)	0.35
E.G. US. (m)	201.10	Culv Inv El Up (m)	195.42
W.S. US. (m)	201.09	Culv Inv El Dn (m)	195.40
E.G. DS (m)	201.09	Culv Frctn Ls (m)	0.00
W.S. DS (m)	201.08	Culv Exit Loss (m)	0.00
Delta EG (m)	0.01	Culv Entr Loss (m)	0.01
Delta WS (m)	0.01	Q Weir (m3/s)	120.40
E.G. IC (m)	201.09	Weir Sta Lft (m)	16.33
E.G. OC (m)	201.10	Weir Sta Rgt (m)	235.46
Culvert Control	Outlet	Weir Submerg	1.00
Culv WS Inlet (m)	197.69	Weir Max Depth (m)	3.12
Culv WS Outlet (m)	197.67	Weir Avg Depth (m)	1.85
Culv Nml Depth (m)		Weir Flow Area (m2)	405.36
Culv Crt Depth (m)	0.43	Min El Weir Flow (m)	197.97

Warning: The weir over culvert is submerged.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.171

INPUT
Description: Section 46.171 - Doughton Road - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.96	4.98	201.796	12.44	201.256	13.15	201.237	13.25	201.233
14.75	201.164	14.84	201.161	15.12	201.157	15.39	201.155	15.62	201.154
15.69	201.151	15.99	201	16.36	200.819	17.96	200	56.42	200
56.75	200.006	57.02	200.008	57.33	200.003	57.62	200	58.14	199.138
58.25	199.189	58.47	199	60.02	198.995	63.55	198.984	63.81	198.985
64	198.985	65.42	198.99	68.25	198.998	68.82	199	72	199.002
72.03	199.002	72.61	199.001	73.78	199.001	75.32	199	75.36	199
80.19	198.767	92.67	198.166	96.3	198	97.51	197.516	98.72	197
99.68	196.606	99.91	196.501	100.61	196.23	100.78	196	101.09	195.65
102	195.4	103	195.4	103.89	195.65	104.2	196	105.92	196.441
106.96	196.581	107.6	196.655	107.9	196.67	111.41	197	111.54	197.014
111.55	197.013	112.49	197.087	113.31	197.14	116.28	197.185	119.01	197.211
119.24	197.207	121.22	197.229	124.15	197.307	124.51	197.35	124.99	197.41
125.11	197.425	127.76	197.44	128.22	197.417	130.42	198	132.06	198.488
133.88	199	134.14	199.003	134.41	199.003	134.45	199.003	137.25	199.032
137.75	199.031	141.77	199.052	141.83	199.052	141.86	199.053	148.67	199.216

150.74	199.224	152.75	199.228	159.58	199.291	160.35	199.297	162.8	199.347
166.55	199.342	166.7	199.342	167.68	199.362	170.27	199.374	170.75	199.383
172.18	199.397	173.54	199.408	175.72	199.407	176.75	199.414	180.91	199.49
186.98	199.604	187.2	199.611	193.04	199.639	200	200	200.45	200.012
202.09	200.042	206.82	200.085	218.03	200.5	221.19	200.617	221.21	200.618
221.33	200.618	221.54	200.615	221.57	200.615	229.4	200.491	229.74	200.48
236.66	200.579	244.75	200.914	250.98	200.952	251.55	200.969	251.75	200.978
251.93	200.979	253.5	201	255.98	201.045	256.93	201.053	257.81	201.067
258.72	201.075	258.93	201.079						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100.78	.035	104.2	.05	133.88	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
100.78	104.2	20	20	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	100.49	197.5	F
104.45	258.93	197.5	F

Right Levee Station= 221.19 Elevation= 200.62

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.045
W.S. Elev (m)	199.80	Reach Len. (m)	20.00	20.00	20.00
Crit W.S. (m)	197.05	Flow Area (m2)	53.47	14.56	103.52
E.G. Slope (m/m)	0.000013	Area (m2)	53.47	14.56	103.52
Q Total (m3/s)	20.59	Flow (m3/s)	4.42	3.69	12.48
Top Width (m)	138.41	Top Width (m)	43.04	3.42	91.95
Vel Total (m/s)	0.12	Avg. Vel. (m/s)	0.08	0.25	0.12
Max Chl Dpth (m)	4.40	Hydr. Depth (m)	1.24	4.26	1.13
Conv. Total (m3/s)	5677.0	Conv. (m3/s)	1218.0	1018.1	3441.0
Length Wtd. (m)	20.00	Wetted Per. (m)	43.98	3.80	92.28
Min Ch El (m)	195.40	Shear (N/m2)	0.16	0.49	0.14
Alpha	1.51	Stream Power (N/m s)	0.01	0.13	0.02
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	40.27	65.14	34.37
C & E Loss (m)	0.00	Cum SA (1000 m2)	41.29	23.26	44.80

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.09	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.037
W.S. Elev (m)	201.08	Reach Len. (m)	20.00	20.00	20.00
Crit W.S. (m)	198.40	Flow Area (m2)	152.90	18.95	256.04
E.G. Slope (m/m)	0.000047	Area (m2)	152.90	18.95	256.04
Q Total (m3/s)	122.56	Flow (m3/s)	30.86	10.88	80.82
Top Width (m)	243.10	Top Width (m)	84.95	3.42	154.73
Vel Total (m/s)	0.29	Avg. Vel. (m/s)	0.20	0.57	0.32
Max Chl Dpth (m)	5.68	Hydr. Depth (m)	1.80	5.54	1.65
Conv. Total (m3/s)	17786.0	Conv. (m3/s)	4478.4	1578.9	11728.6
Length Wtd. (m)	20.00	Wetted Per. (m)	86.27	3.80	155.09
Min Ch El (m)	195.40	Shear (N/m2)	0.83	2.32	0.77
Alpha	1.28	Stream Power (N/m s)	0.17	1.33	0.24
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	165.48	157.18	195.80
C & E Loss (m)	0.00	Cum SA (1000 m2)	95.14	23.26	119.09

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.17

INPUT
Description: Section 46.17 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 116

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.688	1.92	202.495	4.4	202.266	4.48	202.251	4.75	202.184
4.79	202.176	6.6	202	12.45	201.979	17.91	201.166	18.18	201.154
19.37	201.103	21.4	201	23.54	200.628	24.48	200.486	25.02	200.437
25.18	200.42	27.13	200.345	28.69	200.283	51.47	200.233	52.85	200.015
52.9	200.016	53.01	200.016	53.18	200.017	53.5	200.019	53.65	200.018
55.08	200	55.93	199.504	57.96	199	58.81	198.999	60.02	198.998
60.13	198.998	60.21	198.998	60.95	199	66.84	199.005	72.96	199.008
73.69	199.009	73.9	199.009	74.3	199.009	84.33	199.001	84.69	199
87.85	198.724	88.8	198.65	91.93	198.411	92.06	198.399	92.24	198.395
94.4	198.329	97.14	198.228	101.19	198	104.3	197.667	105.19	197.601
106.64	197.457	107.07	197.401	107.61	197.33	109.57	197.016	109.72	197
111.4	196.518	112.75	196.275	112.89	196.246	114	196	115.21	195.596
116.81	195.074	118.88	195.516	119.22	195.58	121	195.98	121.83	196
122.59	196.161	122.66	196.178	126.09	197	126.52	197.207	127.48	197.726
128.12	198	128.84	198.316	128.95	198.391	130.41	199	131.35	199.029
131.66	199.042	131.84	199.047	145.77	199.679	145.82	199.68	148.15	199.686

148.22 199.687 150.32 199.708 150.42 199.708 155.89 199.771 163.77 199.844
166.6 199.87 172.77 199.998 172.98 200 173.86 200 177.76 200.001
180.71 200.001 182.41 200.001 187.06 200 189.66 200 190.48 200
191.66 199.999 192.68 200 193.35 200 195.14 200.052 210.59 200.774
213.61 200.883 216.46 200.997 216.77 200.998 216.8 201 218.28 201.01
220.35 201.021 223.37 201.004 223.38 201.003 223.46 201.003 223.87 201.001
224 201.001 224.1 201.001 224.26 201.001 247.41 201.031 254.26 201.314
261.99 201.319

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	114	.035	121.83	.05	130.41	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
114	121.83	25	25	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
224	254.26	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.050	0.035	0.046
W.S. Elev (m)	199.80	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)		Flow Area (m2)	78.43	33.06	29.72
E.G. Slope (m/m)	0.000016	Area (m2)	78.43	33.06	29.72
Q Total (m3/s)	20.59	Flow (m3/s)	7.48	9.53	3.58
Top Width (m)	103.45	Top Width (m)	58.57	7.83	37.04
Vel Total (m/s)	0.15	Avg. Vel. (m/s)	0.10	0.29	0.12
Max Chl Dpth (m)	4.72	Hydr. Depth (m)	1.34	4.22	0.80
Conv. Total (m3/s)	5225.2	Conv. (m3/s)	1897.9	2417.7	909.5
Length Wtd. (m)	25.00	Wetted Per. (m)	58.93	8.08	37.62
Min Ch El (m)	195.07	Shear (N/m2)	0.20	0.62	0.12
Alpha	2.08	Stream Power (N/m s)	0.02	0.18	0.01
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	38.95	64.66	33.04
C & E Loss (m)	0.00	Cum SA (1000 m2)	40.27	23.15	43.51

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

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.09	Element	Left OB	Channel

Right OB					
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.032
W.S. Elev (m)	201.08	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)		Flow Area (m2)	179.99	43.06	129.50
E.G. Slope (m/m)	0.000069	Area (m2)	179.99	43.06	129.50
Q Total (m3/s)	122.56	Flow (m3/s)	45.88	31.16	45.52
Top Width (m)	204.08	Top Width (m)	94.08	7.83	102.17
Vel Total (m/s)	0.35	Avg. Vel. (m/s)	0.25	0.72	0.35
Max Chl Dpth (m)	6.00	Hydr. Depth (m)	1.91	5.50	1.27
Conv. Total (m3/s)	14769.6	Conv. (m3/s)	5529.1	3754.9	5485.6
Length Wtd. (m)	25.00	Wetted Per. (m)	94.56	8.08	102.85
Min Ch El (m)	195.07	Shear (N/m2)	1.29	3.60	0.85
Alpha	1.68	Stream Power (N/m s)	0.33	2.61	0.30
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	162.15	156.56	191.95
C & E Loss (m)	0.00	Cum SA (1000 m2)	93.35	23.15	116.52

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: RIVER-1
REACH: Reach-1 RS: 46.162

INPUT
Description: Section 46.162 - Private Roadway - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 109

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.192	1.24	201.169	3.79	201.018	4.16	201	4.19	201
4.59	201	4.76	201	7.68	200.999	11.04	200.998	13.8	200.998
16.96	200.999	17.05	200.985	18.41	200.657	20.17	200.244	20.23	200.243
23.96	200	24.33	200	24.56	200	24.59	200	24.88	200
26.07	200.001	26.81	200.001	26.89	200.001	27.42	200.001	28.48	200.001
30.58	200.002	32.04	200.002	32.36	200.002	32.54	200.002	32.61	200.002
32.89	200.003	34.51	199.895	34.73	199.893	44.5	199.802	46.83	199.776
54.07	199.447	58.78	199.43	64.92	199.322	69.2	199.246	76.37	199.103
81.58	199.008	81.84	199	87.1	198.433	90.24	198	91.32	197.577
93.35	197	93.64	196.919	94.7	196.457	95.67	196.041	95.77	196
95.88	195.96	97	195.074	98.92	195.074	100.12	195.765	100.4	196
101.1	196.258	101.63	196.43	103.42	197	104.06	197.319	105.45	198
106.48	198.488	107.42	199	110.59	199.341	122.09	199.985	122.25	199.995
122.4	200	122.41	200	122.46	200	122.47	200	122.58	200
123.04	200	129.01	200	130.19	200	140.85	200	144.86	200
145.37	200	145.55	200	145.59	200	148.08	200	150.4	200

151.72	200.029	154.44	200.045	164.08	200.101	179.01	200.467	180.22	200.507
181.74	200.559	183.87	200.633	184.02	200.638	184.28	200.645	187.85	200.734
192.91	200.868	197.74	201	200.12	201.06	203.17	201.141	203.19	201.141
203.79	201.145	209.64	201.071	209.78	201.07	219.82	201.072	226.92	201.085
234.49	201.039	242.9	201.219	248.47	201.125	248.56	201.126	248.94	201.13
253.08	201.56	254.15	201.702	256.45	201.992	256.6	202		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	95.77	.035	100.4	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
95.77	100.4	30	30	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	96	198.8	F
100	256.6	198.8	F

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
154.44	183.87	204	209.64	248.47	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.80	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	199.79	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)	196.65	Flow Area (m2)	41.88	20.60	20.89
E.G. Slope (m/m)	0.000060	Area (m2)	41.88	20.60	20.89
Q Total (m3/s)	20.59	Flow (m3/s)	5.72	11.40	3.46
Top Width (m)	73.08	Top Width (m)	50.24	4.63	18.21
Vel Total (m/s)	0.25	Avg. Vel. (m/s)	0.14	0.55	0.17
Max Chl Dpth (m)	4.72	Hydr. Depth (m)	0.83	4.45	1.15
Conv. Total (m3/s)	2655.0	Conv. (m3/s)	737.6	1470.6	446.8
Length Wtd. (m)	30.00	Wetted Per. (m)	50.67	5.22	18.88
Min Ch El (m)	195.07	Shear (N/m2)	0.49	2.33	0.65
Alpha	2.94	Stream Power (N/m s)	0.07	1.29	0.11
Frctn Loss (m)		Cum Volume (1000 m3)	37.44	63.99	32.41
C & E Loss (m)		Cum SA (1000 m2)	38.91	22.99	42.82

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.08	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	201.05	Reach Len. (m)	30.00	30.00	30.00
Crit W.S. (m)	198.81	Flow Area (m2)	135.12	26.43	85.01
E.G. Slope (m/m)	0.000245	Area (m2)	135.12	26.43	85.01
Q Total (m3/s)	122.56	Flow (m3/s)	54.28	34.89	33.39
Top Width (m)	167.01	Top Width (m)	92.51	4.63	69.87
Vel Total (m/s)	0.50	Avg. Vel. (m/s)	0.40	1.32	0.39
Max Chl Dpth (m)	5.98	Hydr. Depth (m)	1.46	5.71	1.22
Conv. Total (m3/s)	7825.2	Conv. (m3/s)	3465.7	2227.8	2131.7
Length Wtd. (m)	30.00	Wetted Per. (m)	93.05	5.22	71.97
Min Ch El (m)	195.07	Shear (N/m2)	3.49	12.19	2.84
Alpha	2.47	Stream Power (N/m s)	1.40	16.10	1.12
Frctn Loss (m)		Cum Volume (1000 m3)	158.21	155.69	189.26
C & E Loss (m)		Cum SA (1000 m2)	91.01	22.99	114.37

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1615

INPUT
Description: Hum 13-KK. Paradise Convention Centre Culvert - 3.23 m W x 2.1 m H x 20 m L Corrugated Metal Pipe Arch Culvert. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004 by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 20
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 126

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.017		9.94	201		10.9	201	
11.2	200.998		11.24	200.998		11.49	200.997	
11.55	200.996		11.63	200.996		11.72	200.995	
11.81	200.995		12.69	200.991		13.63	200.995	
13.69	200.995		13.79	200.995		13.91	200.995	
14.12	200.995		14.43	200.995		15.32	200.994	
16.77	200.993		17.25	200.993		17.58	200.992	
17.88	200.988		18.13	200.991		18.74	201	

19.67	201	20.75	201	22.23	201
22.68	201	23	201	25.78	200.523
29.88	200	30.35	200	30.39	200
30.42	200	30.46	200	30.91	200
31.74	200	31.8	200	31.81	200
32.21	199.978	32.38	199.976	37.76	199.901
45.3	199.796	45.48	199.793	46.6	199.774
47.47	199.76	48.2	199.747	48.73	199.737
52.37	199.712	62.24	199.953	80.06	199.792
80.14	199.784	82.52	199.86	83.52	199.767
86.47	199.141	86.75	199.129	86.83	199.126
86.88	199.126	87.13	199.124	87.38	199.123
92.32	199.013	93.07	199.015	93.82	199.013
94.29	199.014	95.15	199.016	97.02	199.018
99.48	199.024	101.85	199.025	101.94	199.025
102.27	199.026	102.57	199.026	108.65	199.546
109.85	199.579	110.34	199.599	111.74	199.692
113.68	199.827	113.8	199.834	114.21	199.865
114.64	199.898	115.6	200	115.65	200
115.87	200	115.88	200	116.22	200
133.27	200.001	141.62	200.001	151.28	200
152.5	200	152.57	200	152.67	200
153.56	200.001	154.38	200	157.21	200.062
161.12	200.085	198.43	201	198.44	201
198.44	201	198.46	201	198.85	201.004
198.89	201.004	199.24	201.005	201.34	201.009
203.5	201.021	204.2	201.024	204.77	201.027
206.84	201.024	207.23	201.023	207.31	201.023
207.75	201.023	208.37	201.022	211.58	201.02
227.39	201.113	228.72	201.124	234.54	201.088
245.86	201	245.92	201	245.93	201
245.97	201	247.18	201	247.71	201
247.87	201	248.82	201.063	250.46	201.201
257.76	202	258.46	202.763	258.74	203

Upstream Bridge Cross Section Data
Station Elevation Data num= 109

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.192	1.24	201.169	3.79	201.018	4.16	201	4.19	201
4.59	201	4.76	201	7.68	200.999	11.04	200.998	13.8	200.998
16.96	200.999	17.05	200.985	18.41	200.657	20.17	200.244	20.23	200.243
23.96	200	24.33	200	24.56	200	24.59	200	24.88	200
26.07	200.001	26.81	200.001	26.89	200.001	27.42	200.001	28.48	200.001
30.58	200.002	32.04	200.002	32.36	200.002	32.54	200.002	32.61	200.002
32.89	200.003	34.51	199.895	34.73	199.893	44.5	199.802	46.83	199.776
54.07	199.447	58.78	199.43	64.92	199.322	69.2	199.246	76.37	199.103
81.58	199.008	81.84	199	87.1	198.433	90.24	198	91.32	197.577
93.35	197	93.64	196.919	94.7	196.457	95.67	196.041	95.77	196
95.88	195.96	97	195.074	98.92	195.074	100.12	195.765	100.4	196
101.1	196.258	101.63	196.43	103.42	197	104.06	197.319	105.45	198
106.48	198.488	107.42	199	110.59	199.341	122.09	199.985	122.25	199.995
122.4	200	122.41	200	122.46	200	122.47	200	122.58	200
123.04	200	129.01	200	130.19	200	140.85	200	144.86	200
145.37	200	145.55	200	145.59	200	148.08	200	150.4	200
151.72	200.029	154.44	200.045	164.08	200.101	179.01	200.467	180.22	200.507
181.74	200.559	183.87	200.633	184.02	200.638	184.28	200.645	187.85	200.734
192.91	200.868	197.74	201	200.12	201.06	203.17	201.141	203.19	201.141
203.79	201.145	209.64	201.071	209.78	201.07	219.82	201.072	226.92	201.085
234.49	201.039	242.9	201.219	248.47	201.125	248.56	201.126	248.94	201.13
253.08	201.56	254.15	201.702	256.45	201.992	256.6	202		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val

0	.05	95.77	.035	100.4	.05

Bank Sta: Left Right Coeff Contr. Expan.

95.77	100.4	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	96	198.8	F
100	256.6	198.8	F

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
154.44	183.87	204	209.64	248.47	204

Downstream Deck/Roadway Coordinates

num= 126

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.017		9.94	201		10.9	201	
11.2	200.998		11.24	200.998		11.49	200.997	
11.55	200.996		11.63	200.996		11.72	200.995	
11.81	200.995		12.69	200.991		13.63	200.995	
13.69	200.995		13.79	200.995		13.91	200.995	
14.12	200.995		14.43	200.995		15.32	200.994	
16.77	200.993		17.25	200.993		17.58	200.992	
17.88	200.988		18.13	200.991		18.74	201	
19.67	201		20.75	201		22.23	201	
22.68	201		23	201		25.78	200.523	
29.88	200		30.35	200		30.39	200	
30.42	200		30.46	200		30.91	200	
31.74	200		31.8	200		31.81	200	
32.21	199.978		32.38	199.976		37.76	199.901	
45.3	199.796		45.48	199.793		46.6	199.774	
47.47	199.76		48.2	199.747		48.73	199.737	
52.37	199.712		62.24	199.953		80.06	199.792	
80.14	199.784		82.52	199.86		83.52	199.767	
86.47	199.141		86.75	199.129		86.83	199.126	
86.88	199.126		87.13	199.124		87.38	199.123	
92.32	199.013		93.07	199.015		93.82	199.013	
94.29	199.014		95.15	199.016		97.02	199.018	
99.48	199.024		101.85	199.025		101.94	199.025	
102.27	199.026		102.57	199.026		108.65	199.546	
109.85	199.579		110.34	199.599		111.74	199.692	
113.68	199.827		113.8	199.834		114.21	199.865	
114.64	199.898		115.6	200		115.65	200	
115.87	200		115.88	200		116.22	200	
133.27	200.001		141.62	200.001		151.28	200	
152.5	200		152.57	200		152.67	200	
153.56	200.001		154.38	200		157.21	200.062	
161.12	200.085		198.43	201		198.44	201	
198.44	201		198.46	201		198.85	201.004	
198.89	201.004		199.24	201.005		201.34	201.009	
203.5	201.021		204.2	201.024		204.77	201.027	
206.84	201.024		207.23	201.023		207.31	201.023	
207.75	201.023		208.37	201.022		211.58	201.02	
227.39	201.113		228.72	201.124		234.54	201.088	
245.86	201		245.92	201		245.93	201	
245.97	201		247.18	201		247.71	201	
247.87	201		248.82	201.063		250.46	201.201	
257.76	202		258.46	202.763		258.74	203	

Downstream Bridge Cross Section Data

Station Elevation Data num= 97

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.234	6.98	201.333	9.75	201.336	9.77	201.336	17.8	201.001
17.86	201.001	18.1	201.001	19.36	201.001	20.8	201.001	25.37	201

```
   25.69     201   26.12     201    29.2     201   35.72 200.103   36.41     200
   36.94  199.99   50.43 199.898   66.47 200.295   73.43 200.347   83.13 199.309
   84.14     199   88.09  198.41   90.41     198   91.93 197.362   92.38 197.153
   92.68     197    92.7 196.996   92.92 196.907   94.09 196.435   94.82 196.155
   94.98 196.097   95.34     196   95.45 195.993    95.5 195.993   95.57  195.99
    95.6  195.99   95.68 195.987   95.95 195.983   96.08 195.977   96.09 195.977
    96.4   195.5    97.3 195.055   98.25 195.055   98.61 195.055   99.49   195.4
  100.35     196  100.36 196.016  100.39 196.018   100.4 196.019  101.12 196.161
  101.26 196.181   101.4 196.224  101.65 196.305  102.38 196.618   102.6 196.702
  103.35     197  103.53 197.076  104.33   197.5  105.15     198   105.7 198.366
  106.74     199  112.96 199.847  113.59 200.124  114.14     200  115.59     200
  121.06     200  128.26 200.001  134.61 200.001  134.71 200.001  134.82 200.001
  140.07 200.001  142.39 200.001  148.34 200.001  158.18 200.001   158.9 200.001
  160.19     200  160.29     200  163.09 200.057  163.77 200.072  188.65 200.623
  188.78 200.626   191.1 200.678  193.84 200.742  203.22 200.935  204.53 200.978
  204.69  200.98  205.35     201  205.36     201  205.87     201  205.94     201
  205.95     201  210.51 200.999  213.45     201  228.33 201.138  239.76 201.423
  255.77 201.644  259.74     202

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   95.34    .035  100.35     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
         95.34  100.35            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0      96   198.8       F
     100  259.74   198.8       F
Left Levee      Station=   73.43      Elevation=  200.35
Blocked Obstructions     num=       2
   Sta L   Sta R    Elev   Sta L   Sta R    Elev
  112.96  193.84     204  213.45  255.77     204

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        =     199
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     Pipe Arch     2.1    3.23
FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                 5      20     .024     .024        0                  .9
      1
Upstream   Elevation =  195.074
           Centerline Station =  98
Downstream Elevation =  195.055
           Centerline Station =  98

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)       3.51    Culv Full Len (m)        20.00
  # Barrels                    1    Culv Vel US (m/s)         0.67
  Q Barrel (m3/s)           3.51    Culv Vel DS (m/s)         0.67
```

E.G. US. (m)	199.80	Culv Inv El Up (m)	195.07
W.S. US. (m)	199.79	Culv Inv El Dn (m)	195.05
E.G. DS (m)	199.76	Culv Frctn Ls (m)	0.01
W.S. DS (m)	199.75	Culv Exit Loss (m)	0.01
Delta EG (m)	0.04	Culv Entr Loss (m)	0.02
Delta WS (m)	0.04	Q Weir (m3/s)	17.08
E.G. IC (m)	198.77	Weir Sta Lft (m)	45.02
E.G. OC (m)	199.80	Weir Sta Rgt (m)	113.29
Culvert Control	Outlet	Weir Submerg	0.91
Culv WS Inlet (m)	197.17	Weir Max Depth (m)	0.79
Culv WS Outlet (m)	197.16	Weir Avg Depth (m)	0.41
Culv Nml Depth (m)		Weir Flow Area (m2)	17.62
Culv Crt Depth (m)	0.59	Min El Weir Flow (m)	199.02

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	1.98	Culv Full Len (m)	20.00
# Barrels	1	Culv Vel US (m/s)	0.38
Q Barrel (m3/s)	1.98	Culv Vel DS (m/s)	0.38
E.G. US. (m)	201.08	Culv Inv El Up (m)	195.07
W.S. US. (m)	201.05	Culv Inv El Dn (m)	195.05
E.G. DS (m)	201.07	Culv Frctn Ls (m)	0.00
W.S. DS (m)	200.99	Culv Exit Loss (m)	0.00
Delta EG (m)	0.01	Culv Entr Loss (m)	0.01
Delta WS (m)	0.06	Q Weir (m3/s)	118.27
E.G. IC (m)	201.07	Weir Sta Lft (m)	2.73
E.G. OC (m)	201.08	Weir Sta Rgt (m)	209.64
Culvert Control	Outlet	Weir Submerg	0.98
Culv WS Inlet (m)	197.17	Weir Max Depth (m)	2.07
Culv WS Outlet (m)	197.16	Weir Avg Depth (m)	1.03
Culv Nml Depth (m)		Weir Flow Area (m2)	175.13
Culv Crt Depth (m)	0.43	Min El Weir Flow (m)	199.02

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.161

INPUT
Description: Section 46.161 - Private Roadway - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 97

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.234	6.98	201.333	9.75	201.336	9.77	201.336	17.8	201.001
17.86	201.001	18.1	201.001	19.36	201.001	20.8	201.001	25.37	201
25.69	201	26.12	201	29.2	201	35.72	200.103	36.41	200
36.94	199.99	50.43	199.898	66.47	200.295	73.43	200.347	83.13	199.309
84.14	199	88.09	198.41	90.41	198	91.93	197.362	92.38	197.153
92.68	197	92.7	196.996	92.92	196.907	94.09	196.435	94.82	196.155
94.98	196.097	95.34	196	95.45	195.993	95.5	195.993	95.57	195.99
95.6	195.99	95.68	195.987	95.95	195.983	96.08	195.977	96.09	195.977

```
    96.4   195.5    97.3 195.055   98.25 195.055   98.61 195.055   99.49   195.4
  100.35     196  100.36 196.016  100.39 196.018   100.4 196.019  101.12 196.161
  101.26 196.181   101.4 196.224  101.65 196.305  102.38 196.618   102.6 196.702
  103.35     197  103.53 197.076  104.33   197.5  105.15     198   105.7 198.366
  106.74     199  112.96 199.847  113.59 200.124  114.14     200  115.59     200
  121.06     200  128.26 200.001  134.61 200.001  134.71 200.001  134.82 200.001
  140.07 200.001  142.39 200.001  148.34 200.001  158.18 200.001   158.9 200.001
  160.19     200  160.29     200  163.09 200.057  163.77 200.072  188.65 200.623
  188.78 200.626   191.1 200.678  193.84 200.742  203.22 200.935  204.53 200.978
  204.69  200.98  205.35     201  205.36     201  205.87     201  205.94     201
  205.95     201  210.51 200.999  213.45     201  228.33 201.138  239.76 201.423
  255.77 201.644  259.74     202

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   95.34    .035  100.35     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         95.34  100.35              115     115     110             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0      96   198.8       F
     100  259.74   198.8       F
Left Levee      Station=   73.43      Elevation=  200.35
Blocked Obstructions     num=       2
   Sta L   Sta R    Elev   Sta L   Sta R    Elev
  112.96  193.84     204  213.45  255.77     204

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           199.76    Element                 Left OB    Channel
Right OB
  Vel Head (m)              0.01    Wt. n-Val.               0.050      0.035
0.050
  W.S. Elev (m)           199.75    Reach Len. (m)          115.00     115.00
110.00
  Crit W.S. (m)           196.68    Flow Area (m2)           22.94      21.69
18.04
  E.G. Slope (m/m)      0.000066    Area (m2)                22.94      21.69
18.04
  Q Total (m3/s)            20.59   Flow (m3/s)               4.56      12.33
3.70
  Top Width (m)             33.18   Top Width (m)            16.30       5.01
11.87
  Vel Total (m/s)           0.33    Avg. Vel. (m/s)           0.20       0.57
0.21
  Max Chl Dpth (m)          4.69    Hydr. Depth (m)           1.41       4.33
1.52
  Conv. Total (m3/s)      2543.9    Conv. (m3/s)             563.8     1523.0
457.0
  Length Wtd. (m)         114.24    Wetted Per. (m)          16.84       5.63
12.65
  Min Ch El (m)           195.05    Shear (N/m2)              0.87       2.48
0.92
  Alpha                     1.94    Stream Power (N/m s)      0.17       1.41
0.19
  Frctn Loss (m)            0.01    Cum Volume (1000 m3)     37.44      63.00
32.41
  C & E Loss (m)            0.00    Cum SA (1000 m2)         37.91      22.85
42.37
```

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.07	Element	Left OB	Channel	Right OB
Vel Head (m)	0.08	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	200.99	Reach Len. (m)	115.00	115.00	110.00
Crit W.S. (m)	198.80	Flow Area (m2)	85.42	27.90	35.07
E.G. Slope (m/m)	0.000494	Area (m2)	85.42	27.90	35.07
Q Total (m3/s)	122.56	Flow (m3/s)	44.76	51.49	26.31
Top Width (m)	94.74	Top Width (m)	66.04	5.01	23.68
Vel Total (m/s)	0.83	Avg. Vel. (m/s)	0.52	1.85	0.75
Max Chl Dpth (m)	5.93	Hydr. Depth (m)	1.29	5.57	1.48
Conv. Total (m3/s)	5517.0	Conv. (m3/s)	2014.8	2317.8	1184.4
Length Wtd. (m)	113.39	Wetted Per. (m)	66.70	5.63	25.86
Min Ch El (m)	195.05	Shear (N/m2)	6.20	24.00	6.56
Alpha	2.42	Stream Power (N/m s)	3.25	44.28	4.92
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	158.21	149.95	189.26
C & E Loss (m)	0.03	Cum SA (1000 m2)	88.64	22.85	112.97

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.15

INPUT
Description: Section 46.15 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 127

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.186	1.5	202.211	3.88	202.172	12.6	202	18.62	201.651
19.7	201.593	24.97	201.562	31.47	201.499	34.76	201.41	37.06	201.349
38.71	201.307	40.01	201.275	46.43	201.234	53.66	201.182	63.04	201.024
64.83	201	71.77	201	81.8	201.001	98.39	201	98.42	201
98.43	201	98.62	201	99	201	99.33	201	102.54	201
105.72	201	107.82	201	116.56	201	116.8	201	116.89	201
117.43	201	120.19	201	129	201.384	129.41	201.366	129.47	201.361
130.32	201.338	132.46	201.25	145.66	201.39	149.94	201.365	150.29	201.371

150.32	201.371	150.34	201.37	165.5	201.241	174.71	201.093	174.73	201.093
178.62	201.002	178.71	201	179.11	200.997	180.09	200.997	180.29	200.997
182.91	200.994	183.59	200.992	187.46	200.99	189.73	200.989	193.41	200.986
196.61	200.981	201.38	200.993	202.28	200.998	202.8	201	202.82	201.001
204.7	201.012	204.87	201.012	207.02	201	215.88	200.597	217.98	200.503
229.1	200	239.57	200	240.14	200	240.35	200	240.69	200
241.46	200.001	244.02	200.003	244.52	200.003	247.88	200	252.68	199.697
253.79	199.631	254.22	199.606	254.25	199.604	254.45	199.589	254.57	199.581
254.58	199.58	257.09	199.519	293.77	199	311.44	198.052	312.46	198
313.91	197.526	315.84	197	316.71	196.647	317.76	196	318.28	195.859
320.41	195.022	323.03	195.56	324.63	196	325.3	196.405	326.37	197
327.54	197.629	328.2	198	330.14	198.631	330.95	199	332.88	199.124
334.89	199.177	336.12	199.217	343.97	199.5	348.81	199.629	349.11	199.635
350.43	199.664	351.55	199.685	352.86	199.711	358.34	199.849	358.57	199.852
363.52	199.98	371.23	199.957	379.73	199.99	380.54	199.992	381.05	199.993
381.68	199.994	381.77	199.994	381.97	199.994	381.98	199.994	382.55	199.994
383.23	199.994	383.28	199.994	383.63	199.994	388.93	199.98	393.62	199.989
395.11	199.992	396.07	199.992						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	293.77	.08	317.76	.035	324.63	.08	330.95	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
317.76	324.63	50	50	.1	.3

Left Levee Station= 145.66 Elevation= 201.39

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
38.64	61.59	204	257.09	293.77	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	199.75	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.061
W.S. Elev (m)	199.74	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	196.48	Flow Area (m2)	37.70	29.14	20.59
E.G. Slope (m/m)	0.000044	Area (m2)	37.70	29.14	20.59
Q Total (m3/s)	20.59	Flow (m3/s)	3.98	14.03	2.58
Top Width (m)	65.42	Top Width (m)	29.11	6.87	29.44
Vel Total (m/s)	0.24	Avg. Vel. (m/s)	0.11	0.48	0.13
Max Chl Dpth (m)	4.72	Hydr. Depth (m)	1.30	4.24	0.70
Conv. Total (m3/s)	3113.9	Conv. (m3/s)	602.0	2122.3	389.5
Length Wtd. (m)	50.00	Wetted Per. (m)	30.50	7.16	30.16
Min Ch El (m)	195.02	Shear (N/m2)	0.53	1.74	0.29
Alpha	2.92	Stream Power (N/m s)	0.06	0.84	0.04
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	33.96	60.08	30.28
C & E Loss (m)	0.00	Cum SA (1000 m2)	35.30	22.16	40.10

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.01	Element	Left OB	Channel	Right OB
Vel Head (m)	0.03	Wt. n-Val.	0.071	0.035	0.032
W.S. Elev (m)	200.99	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	198.74	Flow Area (m2)	107.71	37.69	100.58
E.G. Slope (m/m)	0.000161	Area (m2)	107.71	37.69	100.58
Q Total (m3/s)	122.56	Flow (m3/s)	28.62	41.35	52.59
Top Width (m)	156.70	Top Width (m)	78.39	6.87	71.44
Vel Total (m/s)	0.50	Avg. Vel. (m/s)	0.27	1.10	0.52
Max Chl Dpth (m)	5.96	Hydr. Depth (m)	1.37	5.49	1.41
Conv. Total (m3/s)	9655.4	Conv. (m3/s)	2254.7	3257.8	4142.8
Length Wtd. (m)	50.00	Wetted Per. (m)	82.30	7.16	73.15
Min Ch El (m)	195.02	Shear (N/m2)	2.07	8.32	2.17
Alpha	2.18	Stream Power (N/m s)	0.55	9.12	1.14
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	147.10	146.18	181.80
C & E Loss (m)	0.01	Cum SA (1000 m2)	80.33	22.16	107.73

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.142

INPUT
Description: Section 46.142 - Private Roadway - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 54

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

```
       0 201.236   12.59     201      21 200.671   22.43 200.623   37.81     200
   39.38     200   40.23     200   42.31 200.027   44.55 200.047   44.93 200.051
   45.27 200.048   49.43     200   56.95 199.696   56.96 199.695   56.98 199.695
   85.47 199.453   94.46     199   96.11 198.897  108.79     198  110.82 197.095
  111.08     197  111.27 196.916  113.02     196  115.02  195.28  116.06     195
  116.72  194.83  117.13  194.83  117.19  194.83  117.27  194.83   118.2     195
  120.05   195.7  120.42 195.827     121     196  123.66 196.903  123.94     197
  124.59 197.177  124.93 197.245  126.67     198  128.21 198.693  128.78     199
  131.04 199.231  132.73   199.5  140.22 199.865  142.99     200  146.99 200.195
  153.53   200.5  153.55   200.5  156.96 200.577  157.48 200.588  173.76 200.995
  173.97     201  179.85 201.266  181.95 201.351  185.83   201.5

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   94.46     .08  113.02    .035     121     .08  142.99    .025

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        113.02     121               60      60      60             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0  115.11   199.5       F
  119.14  185.83   199.5       F
Left Levee      Station=   44.93      Elevation= 200.051
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
   56.98   96.11     204

CROSS SECTION OUTPUT  Profile #100-year


  E.G. Elev (m)           199.75    Element                Left OB    Channel
Right OB
  Vel Head (m)              0.01    Wt. n-Val.              0.080      0.035
0.080
  W.S. Elev (m)           199.74    Reach Len. (m)          60.00      60.00
60.00
  Crit W.S. (m)           196.40    Flow Area (m2)          27.82      35.17
21.08
  E.G. Slope (m/m)      0.000037    Area (m2)               27.82      35.17
21.08
  Q Total (m3/s)            20.59   Flow (m3/s)              2.80      15.95
1.83
  Top Width (m)             42.64   Top Width (m)           18.02       7.98
16.65
  Vel Total (m/s)           0.24    Avg. Vel. (m/s)          0.10       0.45
0.09
  Max Chl Dpth (m)          4.91    Hydr. Depth (m)          1.54       4.41
1.27
  Conv. Total (m3/s)      3380.5    Conv. (m3/s)            460.2     2619.3
301.0
  Length Wtd. (m)           60.00   Wetted Per. (m)         19.39       8.35
17.26
  Min Ch El (m)           194.83    Shear (N/m2)             0.52       1.53
0.44
  Alpha                     2.69    Stream Power (N/m s)     0.05       0.69
0.04
  Frctn Loss (m)                    Cum Volume (1000 m3)    32.32      58.47
29.24
  C & E Loss (m)                    Cum SA (1000 m2)        34.12      21.79
38.95
```

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	201.00	Element	Left OB	Channel	Right OB
Vel Head (m)	0.08	Wt. n-Val.	0.071	0.035	0.069
W.S. Elev (m)	200.91	Reach Len. (m)	60.00	60.00	60.00
Crit W.S. (m)	199.50	Flow Area (m2)	76.41	44.53	56.71
E.G. Slope (m/m)	0.000350	Area (m2)	76.41	44.53	56.71
Q Total (m3/s)	122.56	Flow (m3/s)	28.44	72.59	21.53
Top Width (m)	116.53	Top Width (m)	59.07	7.98	49.48
Vel Total (m/s)	0.69	Avg. Vel. (m/s)	0.37	1.63	0.38
Max Chl Dpth (m)	6.08	Hydr. Depth (m)	1.29	5.58	1.15
Conv. Total (m3/s)	6554.2	Conv. (m3/s)	1521.0	3881.9	1151.2
Length Wtd. (m)	60.00	Wetted Per. (m)	62.81	8.35	50.12
Min Ch El (m)	194.83	Shear (N/m2)	4.17	18.28	3.88
Alpha	3.43	Stream Power (N/m s)	1.55	29.80	1.47
Frctn Loss (m)		Cum Volume (1000 m3)	142.50	144.12	177.87
C & E Loss (m)		Cum SA (1000 m2)	76.89	21.79	104.71

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1415

INPUT
Description: Hum 13-JJ. Private Driveway Culvert - 3.23 m W x 2.1 m H x 52 m L Corrugated Metal Pipe Arch Culvert. No drawings available. Size estimated from HEC-2 coding.

New HEC-RAS coding January 2004
by Acres included coding of culvert in HEC-RAS, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 5
Deck/Roadway Width = 52
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 76

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.501		9.03	201.276		10.69	201.235	

11.93	201.205	15.26	201.124	15.65	201.116				
17.33	201.085	18.3	201.067	21.82	201				
22.59	200.991	22.61	200.991	24.72	200.975				
26.52	200.961	27.55	200.966	33.24	200.845				
34.76	200.824	37.08	200.776	39.72	200.726				
44.95	200.557	45.1	200.554	54.53	200.18				
61.95	200	72.68	199.814	72.97	199.813				
73.26	199.813	73.34	199.813	76.99	199.789				
82.12	199.738	84.44	199.737	86.82	199.742				
87.45	199.733	88.14	199.722	88.29	199.72				
94.48	199.736	95.23	199.732	95.99	199.728				
96.52	199.728	97.04	199.728	97.15	199.728				
97.87	199.727	98.58	199.727	100.35	199.739				
106	199.685	107.51	199.675	109.42	199.671				
109.55	199.67	110.18	199.672	116.42	199.732				
116.58	199.736	116.81	199.741	117.04	199.746				
117.21	199.75	120.07	199.82	125.43	199.969				
126.11	199.987	126.2	199.988	126.71	200				
126.77	200.001	127.26	200.002	127.65	200.002				
133.77	200.118	138.89	200.206	139.11	200.209				
140.01	200.216	140.99	200.224	148.28	200.355				
148.4	200.357	153.83	200.495	154.42	200.496				
154.61	200.497	155.83	200.5	162.15	200.643				
176.54	201	177.09	201.017	191.23	201.5				
191.27	201.5								

Upstream Bridge Cross Section Data
Station Elevation Data num= 54

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.236	12.59	201	21	200.671	22.43	200.623	37.81	200
39.38	200	40.23	200	42.31	200.027	44.55	200.047	44.93	200.051
45.27	200.048	49.43	200	56.95	199.696	56.96	199.695	56.98	199.695
85.47	199.453	94.46	199	96.11	198.897	108.79	198	110.82	197.095
111.08	197	111.27	196.916	113.02	196	115.02	195.28	116.06	195
116.72	194.83	117.13	194.83	117.19	194.83	117.27	194.83	118.2	195
120.05	195.7	120.42	195.827	121	196	123.66	196.903	123.94	197
124.59	197.177	124.93	197.245	126.67	198	128.21	198.693	128.78	199
131.04	199.231	132.73	199.5	140.22	199.865	142.99	200	146.99	200.195
153.53	200.5	153.55	200.5	156.96	200.577	157.48	200.588	173.76	200.995
173.97	201	179.85	201.266	181.95	201.351	185.83	201.5		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	94.46	.08	113.02	.035	121	.08	142.99	.025

Bank Sta: Left	Right	Coeff Contr.	Expan.
113.02	121	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	115.11	199.5	F
119.14	185.83	199.5	F

Left Levee Station= 44.93 Elevation= 200.051
Blocked Obstructions num= 1

Sta L	Sta R	Elev
56.98	96.11	204

Downstream Deck/Roadway Coordinates
num= 76

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	201.501		9.03	201.276		10.69	201.235	
11.93	201.205		15.26	201.124		15.65	201.116	
17.33	201.085		18.3	201.067		21.82	201	
22.59	200.991		22.61	200.991		24.72	200.975	

26.52	200.961	27.55	200.966	33.24	200.845						
34.76	200.824	37.08	200.776	39.72	200.726						
44.95	200.557	45.1	200.554	54.53	200.18						
61.95	200	72.68	199.814	72.97	199.813						
73.26	199.813	73.34	199.813	76.99	199.789						
82.12	199.738	84.44	199.737	86.82	199.742						
87.45	199.733	88.14	199.722	88.29	199.72						
94.48	199.736	95.23	199.732	95.99	199.728						
96.52	199.728	97.04	199.728	97.15	199.728						
97.87	199.727	98.58	199.727	100.35	199.739						
106	199.685	107.51	199.675	109.42	199.671						
109.55	199.67	110.18	199.672	116.42	199.732						
116.58	199.736	116.81	199.741	117.04	199.746						
117.21	199.75	120.07	199.82	125.43	199.969						
126.11	199.987	126.2	199.988	126.71	200						
126.77	200.001	127.26	200.002	127.65	200.002						
133.77	200.118	138.89	200.206	139.11	200.209						
140.01	200.216	140.99	200.224	148.28	200.355						
148.4	200.357	153.83	200.495	154.42	200.496						
154.61	200.497	155.83	200.5	162.15	200.643						
176.54	201	177.09	201.017	191.23	201.5						
191.27	201.5										

Downstream Bridge Cross Section Data
Station Elevation Data num= 102

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.964	2.43	201.92	2.94	201.91	3.53	201.894	4.38	201.869
5.84	201.802	10.38	201.593	13.97	201.399	14.53	201.37	16.68	201.262
16.97	201.25	18.86	201.161	21.88	201.012	22.13	201.011	23.05	201.004
26.53	201	27.47	200.995	28.29	200.997	28.76	200.997	28.82	200.997
29.15	200.996	33.62	200.993	33.7	200.993	37.58	200.533	37.75	200.516
37.79	200.514	38.56	200.515	42.31	200.545	48.93	200.615	49.07	200.618
50.33	200.646	50.39	200.649	61.33	200.328	70.12	200.012	72.92	200.006
73.26	200.005	73.27	200.005	73.46	200.005	73.47	200.004	78.8	200.01
78.81	200.01	80.68	200	84.14	199.945	85.98	199.929	88.28	199.936
92.02	199.995	93.24	199.991	94.47	199.996	95.37	200	97.6	200.002
98.34	200.002	99.45	200.003	100.7	200.002	101.57	200.001	102.44	200
103.62	199.631	105.8	199	106.7	198.73	108.53	198.229	108.84	198.134
109.24	198	109.55	197.899	109.76	197.822	111.11	197	111.52	196.37
111.75	196	111.95	195.708	112.46	195	117.89	194.823	120.59	194.823
122.27	194.884	125.1	195	126.97	195.253	128.35	195.435	132.42	195.983
132.63	195.986	132.82	196	134.16	196.531	134.6	196.682	135.45	197
135.58	197.071	137.13	198	137.6	198.204	137.71	198.254	139.23	199
140.32	199.45	141.61	200	146.06	200.194	161.96	200.967	165.01	200.972
168.03	200.99	169.39	200.999	169.49	201	169.5	201.001	169.55	201.001
170.18	201.005	170.26	201.005	170.49	201.006	172.16	201.006	179.97	201.133
180.44	201.14	194	201.345						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	105.8	.08	112.46	.035	125.1	.08	139.23	.025

Bank Sta: Left Right Coeff Contr. Expan.
112.46 125.1 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116.68	197	F
120.7	194	197	F

Left Levee Station= 50.33 Elevation= 200.65

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	Pipe Arch	2.1	3.23

FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	5	52	.024	.024	0	.9	1

Upstream Elevation = 194.88
Centerline Station = 117.13
Downstream Elevation = 194.82
Centerline Station = 118.7

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	20.31	Culv Full Len (m)	52.00
# Barrels	1	Culv Vel US (m/s)	3.87
Q Barrel (m3/s)	20.31	Culv Vel DS (m/s)	3.87
E.G. US. (m)	199.75	Culv Inv El Up (m)	194.88
W.S. US. (m)	199.74	Culv Inv El Dn (m)	194.82
E.G. DS (m)	197.45	Culv Frctn Ls (m)	0.87
W.S. DS (m)	197.43	Culv Exit Loss (m)	0.75
Delta EG (m)	2.30	Culv Entr Loss (m)	0.69
Delta WS (m)	2.31	Q Weir (m3/s)	0.28
E.G. IC (m)	198.58	Weir Sta Lft (m)	96.11
E.G. OC (m)	199.75	Weir Sta Rgt (m)	117.14
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	196.98	Weir Max Depth (m)	0.08
Culv WS Outlet (m)	196.92	Weir Avg Depth (m)	0.04
Culv Nml Depth (m)		Weir Flow Area (m2)	0.88
Culv Crt Depth (m)	1.65	Min El Weir Flow (m)	199.67

Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported
inlet energy grade answer may not be valid.

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	19.10	Culv Full Len (m)	52.00
# Barrels	1	Culv Vel US (m/s)	3.64
Q Barrel (m3/s)	19.10	Culv Vel DS (m/s)	3.64
E.G. US. (m)	200.99	Culv Inv El Up (m)	194.88
W.S. US. (m)	200.91	Culv Inv El Dn (m)	194.82
E.G. DS (m)	199.10	Culv Frctn Ls (m)	0.77
W.S. DS (m)	198.95	Culv Exit Loss (m)	0.52
Delta EG (m)	1.89	Culv Entr Loss (m)	0.61
Delta WS (m)	1.97	Q Weir (m3/s)	103.46
E.G. IC (m)	200.94	Weir Sta Lft (m)	22.23
E.G. OC (m)	200.99	Weir Sta Rgt (m)	173.77
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	196.98	Weir Max Depth (m)	1.33
Culv WS Outlet (m)	196.92	Weir Avg Depth (m)	0.67
Culv Nml Depth (m)		Weir Flow Area (m2)	75.53
Culv Crt Depth (m)	1.57	Min El Weir Flow (m)	199.67

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.141

INPUT
Description: Section 46.141 - Private Roadway - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 102

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.964	2.43	201.92	2.94	201.91	3.53	201.894	4.38	201.869
5.84	201.802	10.38	201.593	13.97	201.399	14.53	201.37	16.68	201.262
16.97	201.25	18.86	201.161	21.88	201.012	22.13	201.011	23.05	201.004
26.53	201	27.47	200.995	28.29	200.997	28.76	200.997	28.82	200.997
29.15	200.996	33.62	200.993	33.7	200.993	37.58	200.533	37.75	200.516
37.79	200.514	38.56	200.515	42.31	200.545	48.93	200.615	49.07	200.618
50.33	200.646	50.39	200.649	61.33	200.328	70.12	200.012	72.92	200.006
73.26	200.005	73.27	200.005	73.46	200.005	73.47	200.004	78.8	200.01
78.81	200.01	80.68	200	84.14	199.945	85.98	199.929	88.28	199.936
92.02	199.995	93.24	199.991	94.47	199.996	95.37	200	97.6	200.002
98.34	200.002	99.45	200.003	100.7	200.002	101.57	200.001	102.44	200
103.62	199.631	105.8	199	106.7	198.73	108.53	198.229	108.84	198.134
109.24	198	109.55	197.899	109.76	197.822	111.11	197	111.52	196.37
111.75	196	111.95	195.708	112.46	195	117.89	194.823	120.59	194.823
122.27	194.884	125.1	195	126.97	195.253	128.35	195.435	132.42	195.983
132.63	195.986	132.82	196	134.16	196.531	134.6	196.682	135.45	197
135.58	197.071	137.13	198	137.6	198.204	137.71	198.254	139.23	199
140.32	199.45	141.61	200	146.06	200.194	161.96	200.967	165.01	200.972
168.03	200.99	169.39	200.999	169.49	201	169.5	201.001	169.55	201.001
170.18	201.005	170.26	201.005	170.49	201.006	172.16	201.006	179.97	201.133
180.44	201.14	194	201.345						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	105.8	.08	112.46	.035	125.1	.08	139.23	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
112.46	125.1	30	25	20	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	116.68	197	F
120.7	194	197	F

Left Levee Station= 50.33 Elevation= 200.65

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	197.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	197.43	Reach Len. (m)	30.00	25.00	20.00
Crit W.S. (m)	196.22	Flow Area (m2)	2.13	32.14	17.40
E.G. Slope (m/m)	0.000104	Area (m2)	2.13	32.14	17.40
Q Total (m3/s)	20.59	Flow (m3/s)	0.20	17.45	2.93
Top Width (m)	25.79	Top Width (m)	2.06	12.64	

11.09					
Vel Total (m/s)	0.40	Avg. Vel. (m/s)	0.10	0.54	
0.17					
Max Chl Dpth (m)	2.61	Hydr. Depth (m)	1.03	2.54	
1.57					
Conv. Total (m3/s)	2017.4	Conv. (m3/s)	20.0	1710.0	
287.3					
Length Wtd. (m)	24.73	Wetted Per. (m)	3.25	12.65	
11.46					
Min Ch El (m)	194.82	Shear (N/m2)	0.67	2.60	
1.55					
Alpha	1.60	Stream Power (N/m s)	0.06	1.41	
0.26					
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	32.32	57.70	
29.24					
C & E Loss (m)	0.00	Cum SA (1000 m2)	33.52	21.17	
38.11					

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	199.10	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.15	Wt. n-Val.	0.080	0.035	
0.080					
W.S. Elev (m)	198.95	Reach Len. (m)	30.00	25.00	
20.00					
Crit W.S. (m)	197.00	Flow Area (m2)	8.15	51.27	
36.30					
E.G. Slope (m/m)	0.000693	Area (m2)	8.15	51.27	
36.30					
Q Total (m3/s)	122.56	Flow (m3/s)	2.73	98.06	
21.77					
Top Width (m)	33.15	Top Width (m)	6.49	12.64	
14.02					
Vel Total (m/s)	1.28	Avg. Vel. (m/s)	0.33	1.91	
0.60					
Max Chl Dpth (m)	4.12	Hydr. Depth (m)	1.26	4.06	
2.59					
Conv. Total (m3/s)	4654.5	Conv. (m3/s)	103.7	3724.1	
826.7					
Length Wtd. (m)	24.71	Wetted Per. (m)	7.94	12.65	
14.76					
Min Ch El (m)	194.82	Shear (N/m2)	6.98	27.57	
16.72					
Alpha	1.83	Stream Power (N/m s)	2.34	52.73	
10.03					
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	142.50	138.63	
177.87					
C & E Loss (m)	0.03	Cum SA (1000 m2)	74.93	21.17	
102.81					

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.14

INPUT
Description: Section 46.14 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 77

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.098	2.06	202	3.77	201.783	3.8	201.785	6.14	201.803
8.42	201.79	12.49	201.689	12.69	201.684	17.83	201.529	20.79	201.459
33.23	201.049	35.11	201.034	39.84	201.001	39.85	201.001	39.89	201.001
39.92	201.001	39.96	201.001	40.1	201	53.76	200.745	58.1	200.647
58.57	200.638	64.09	200.501	64.12	200.501	64.22	200.5	71.26	200.142
74.41	200	75.87	199.864	77.75	199.81	88.67	199.239	90.92	199.19
94.02	199.106	98.67	199.004	98.73	199.004	98.82	199.004	98.97	199.004
104.41	199	106.38	198.532	109.25	198	111.6	197.01	111.62	197
111.64	196.992	113.27	196.326	114.07	196	114.61	195.85	116.18	195.444
117.28	195	120.38	194.954	124.47	194.898	126.14	194.877	129.68	194.823
133.94	194.919	135.82	194.961	137.74	195	138.12	195.172	139.11	196
139.82	196.864	139.93	197	140.61	197.763	140.81	197.95	140.88	198
141	198.098	142.31	199	145.61	199.973	145.72	200	159.64	200.564
168.75	200.894	180.93	200.961	188.25	200.988	188.75	200.981	190	200.965
190.01	200.965	192.12	200.994	192.14	200.994	192.16	200.994	192.55	201
208.35	201.2341	216.71	201.358						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	104.41	.08	117.28	.035	137.74	.08	142.31	.025

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
117.28 137.74 37.5 37.5 37.5 .1 .3
Blocked Obstructions num= 1

Sta L	Sta R	Elev
145.61	208.35	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	197.44	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	197.44	Reach Len. (m)	37.50	37.50	37.50
Crit W.S. (m)		Flow Area (m2)	8.58	51.63	3.58
E.G. Slope (m/m)	0.000050	Area (m2)	8.58	51.63	3.58
Q Total (m3/s)	20.59	Flow (m3/s)	0.86	19.41	0.32
Top Width (m)	29.73	Top Width (m)	6.69	20.46	2.58
Vel Total (m/s)	0.32	Avg. Vel. (m/s)	0.10	0.38	0.09
Max Chl Dpth (m)	2.61	Hydr. Depth (m)	1.28	2.52	1.39
Conv. Total (m3/s)	2899.4	Conv. (m3/s)	121.2	2733.6	44.6
Length Wtd. (m)	37.50	Wetted Per. (m)	7.13	20.46	3.58
Min Ch El (m)	194.82	Shear (N/m2)	0.59	1.25	0.49

Alpha	1.28	Stream Power (N/m s)	0.06	0.47	0.04
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	32.16	56.66	29.03
C & E Loss (m)	0.05	Cum SA (1000 m2)	33.39	20.76	37.98

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	199.06	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	198.97	Reach Len. (m)	37.50	37.50	37.50
Crit W.S. (m)		Flow Area (m2)	22.93	83.00	8.88
E.G. Slope (m/m)	0.000346	Area (m2)	22.93	83.00	8.88
Q Total (m3/s)	122.56	Flow (m3/s)	7.63	112.26	2.66
Top Width (m)	37.73	Top Width (m)	12.74	20.46	4.53
Vel Total (m/s)	1.07	Avg. Vel. (m/s)	0.33	1.35	0.30
Max Chl Dpth (m)	4.15	Hydr. Depth (m)	1.80	4.06	1.96
Conv. Total (m3/s)	6585.2	Conv. (m3/s)	410.2	6031.9	143.1
Length Wtd. (m)	37.50	Wetted Per. (m)	13.40	20.46	6.07
Min Ch El (m)	194.82	Shear (N/m2)	5.81	13.78	4.97
Alpha	1.48	Stream Power (N/m s)	1.94	18.64	1.49
Frctn Loss (m)	0.04	Cum Volume (1000 m3)	142.03	136.95	177.42
C & E Loss (m)	0.05	Cum SA (1000 m2)	74.64	20.76	102.62

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: RIVER-1

REACH: Reach-1 RS: 46.132

INPUT
Description: Section 46.132 - Private Driveway - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 158

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203.031	4.21	203	6.29	202.04	6.39	202	6.47	201.973
9.02	201	11.19	200.218	11.79	200	11.95	199.995	12.11	199.991
13.73	199.942	14.44	199.957	15.58	200	22.02	200.459	23.3	200.5
23.73	200.501	23.84	200.501	23.88	200.501	24.1	200.505	27.21	200.56
39.78	200.546	43.86	200.559	45.36	200.616	45.59	200.618	46.09	200.615
60.3	200.512	60.52	200.5	67.58	200.314	71.78	200.282	75.54	200.281
75.73	200.287	78.77	200	79.96	199.843	80.54	199.765	86.79	199
91.14	198.248	92.76	198	92.82	197.999	92.88	197.999	93.81	197.998
94.59	197.998	95.38	197.998	96.45	197.998	97.49	197.997	103.13	197.995
104.78	197.997	105.78	197.996	106.85	197.997	107.61	198	112.33	198.851
112.89	199	113.63	199	115.71	199.001	116.33	199.001	118.64	199
119.62	198.642	121.42	198	123.03	197.538	125.2	197.319	125.59	197.265
126.04	197.198	126.29	197.179	126.45	197.149	126.85	197.083	127.29	197.085
127.33	197.08	127.37	197.076	127.89	197.013	129.85	197.011	129.95	197.01
130.35	197.01	132.11	197.014	132.3	197.012	133.91	197.011	134.07	197.009
134.24	197.009	134.44	197.009	134.47	197.009	135.58	197.018	136.75	197.007
136.96	197.005	136.98	197.005	137.16	197.005	137.18	197.005	138.6	197.011
138.83	197.009	139.36	197.005	139.64	197.003	139.73	197	140.03	196.913
140.21	196.887	140.28	196.867	140.33	196.854	140.58	196.76	141.61	196.467
141.72	196.455	143.1	196	143.4	195.948	145.84	195	146.14	194.87
146.23	194.823	146.44	194.865	147.11	195	147.76	195.231	149.57	196
150.75	196.979	150.78	197	150.81	197.022	151.68	198	152.7	198.573
153.48	199	153.61	199.01	158.04	199.446	163.24	199.854	164.21	199.935
164.49	199.957	164.51	199.958	165.41	199.996	165.46	199.999	165.53	200
165.55	200.004	165.69	200.013	165.92	200.013	166.1	200.023	167.24	200.039
167.72	200.033	168.11	200.078	168.16	200.077	168.21	200.076	168.33	200.077
170.66	200.113	172.93	200.103	175.92	200.024	175.95	200.023	177.95	200.045
177.96	200.044	177.97	200.043	177.97	200.042	188.98	200.112	192.6	200.049
195.25	200	195.28	200	196.41	200	197.16	200	197.45	200
197.5	200	200.28	200	201.07	200	201.93	200	202.05	200
213.45	200.076	216.09	200.093	218.17	200.105	219.59	200.114	220.81	200.121
221.65	200.128	222.07	200.132	227.76	200.187				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	139.73	.08	145.84	.035	147.11	.08	151.68	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
145.84	147.11	27.5	27.5	.3	.5

Left Levee Station= 118.64 Elevation= 199

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	197.38	Element	Left OB	Channel	Right OB
Vel Head (m)	0.54	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	196.84	Reach Len. (m)	27.50	27.50	27.50
Crit W.S. (m)	196.84	Flow Area (m2)	4.72	2.45	3.76
E.G. Slope (m/m)	0.010373	Area (m2)	4.72	2.45	3.76
Q Total (m3/s)	20.59	Flow (m3/s)	5.25	10.72	4.62

Top Width (m)	10.22	Top Width (m)	5.47	1.27	3.47
Vel Total (m/s)	1.88	Avg. Vel. (m/s)	1.11	4.38	1.23
Max Chl Dpth (m)	2.02	Hydr. Depth (m)	0.86	1.93	1.08
Conv. Total (m3/s)	202.2	Conv. (m3/s)	51.6	105.2	45.4
Length Wtd. (m)	27.50	Wetted Per. (m)	5.78	1.33	3.97
Min Ch El (m)	194.82	Shear (N/m2)	83.04	187.78	96.36
Alpha	3.00	Stream Power (N/m s)	92.33	822.29	118.32
Frctn Loss (m)	0.06	Cum Volume (1000 m3)	31.91	55.64	28.89
C & E Loss (m)	0.24	Cum SA (1000 m2)	33.16	20.35	37.86

Warning: The energy equation could not be 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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.97	Element	Left OB	Channel	Right OB
Vel Head (m)	0.61	Wt. n-Val.	0.061	0.035	0.080
W.S. Elev (m)	198.35	Reach Len. (m)	27.50	27.50	27.50
Crit W.S. (m)	198.35	Flow Area (m2)	36.11	4.37	10.17
E.G. Slope (m/m)	0.009790	Area (m2)	36.11	4.37	10.17
Q Total (m3/s)	122.56	Flow (m3/s)	76.73	27.32	18.52
Top Width (m)	31.87	Top Width (m)	25.40	1.27	5.19
Vel Total (m/s)	2.42	Avg. Vel. (m/s)	2.12	6.26	1.82
Max Chl Dpth (m)	3.53	Hydr. Depth (m)	1.42	3.44	1.96
Conv. Total (m3/s)	1238.7	Conv. (m3/s)	775.5	276.1	

187.1					
Length Wtd. (m)	27.50	Wetted Per. (m)	25.90	1.33	
6.29					
Min Ch El (m)	194.82	Shear (N/m2)	133.89	316.13	
155.28					
Alpha	2.06	Stream Power (N/m s)	284.46	1978.05	
282.66					
Frctn Loss (m)	0.07	Cum Volume (1000 m3)	140.93	135.31	
177.06					
C & E Loss (m)	0.25	Cum SA (1000 m2)	73.92	20.35	
102.44					

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 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: RIVER-1
REACH: Reach-1 RS: 46.13

INPUT
Description: Section 46.13 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 127

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203.03	.53	203	.96	202.775	2.6	202	4.3	201.009
4.31	201	4.46	200.95	7.15	200	9.26	199.922	13.37	199.838
14.21	199.82	16.49	199.886	21.16	199.987	21.18	200	21.39	200.001
21.4	200.001	21.83	200.002	29.6	200.151	34.56	200.228	35.93	200.238
37.21	200.246	37.34	200.247	39.62	200.26	42.15	200.288	44.35	200.296
46.4	200.303	51.59	200.321	52.9	200.324	54.35	200.328	55.76	200.33
57.13	200.323	58.65	200.312	59.48	200.303	60.41	200.293	60.51	200.291
60.64	200.291	60.78	200.29	60.92	200.29	61.05	200.289	62.88	200.27
65.13	200.241	68.92	200.17	71.75	200.101	75.66	200	75.68	200
76.81	199.771	77.55	199.623	80.95	199	83.24	198.448	85.09	198
86.6	197.995	87.61	197.991	98.22	197.954	101.88	197.965	111.06	198
112.99	198.592	115.45	198.783	118.53	198.292	118.71	198.22	118.81	198.215
119.38	198	122.2	197.044	122.33	197	122.49	196.957	126.05	196
126.98	195.7	127.15	195.657	128.79	195.261	129.74	195.021	129.84	195.018
129.93	195.011	129.96	195.01	130.02	195	131.97	194.859	144.15	194
145.77	193.62	148.15	193	148.36	192.929	148.69	192.82	149.6	192.963
149.87	193	150.14	193.206	150.99	194	151.39	194.702	151.52	195
151.69	195.371	152.08	196	152.24	196.027	152.47	196.039	152.56	196.043
152.62	196.045	152.67	196.044	152.68	196.044	152.79	196.042	152.82	196.041

152.98	196.035	154.35	196.467	155.01	196.685	155.45	196.85	155.58	196.893
155.62	196.908	155.76	196.973	155.82	197	155.89	197.042	157.56	198
161.85	198.688	163.59	199	164.11	199.021	168.85	199.177	171.26	199.182
173.88	199.243	176.15	199.295	177.78	199.33	179.26	199.361	183.65	199.389
188.79	199.423	194.86	199.511	194.9	199.511	201.21	199.575	206.07	199.623
222.21	200	223.15	200.01	223.53	200.01	223.62	200.01	223.66	200.01
224.17	200.01	236.77	200.272						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	119.38	.08	148.15	.035	149.87	.08	157.56	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
148.15	149.87	25	25	.1	.3

Left Levee Station= 115.45 Elevation= 198.783

Blocked Obstructions num= 1

Sta L	Sta R	Elev
171	229	204

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	195.74	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	195.67	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)	194.77	Flow Area (m2)	26.30	4.75	3.20
E.G. Slope (m/m)	0.000918	Area (m2)	26.30	4.75	3.20
Q Total (m3/s)	20.59	Flow (m3/s)	11.46	7.97	1.17
Top Width (m)	24.79	Top Width (m)	21.07	1.72	2.01
Vel Total (m/s)	0.60	Avg. Vel. (m/s)	0.44	1.68	0.36
Max Chl Dpth (m)	2.85	Hydr. Depth (m)	1.25	2.76	1.59
Conv. Total (m3/s)	679.6	Conv. (m3/s)	378.2	262.9	38.5
Length Wtd. (m)	25.00	Wetted Per. (m)	21.31	1.76	3.40
Min Ch El (m)	192.82	Shear (N/m2)	11.11	24.26	8.48
Alpha	3.32	Stream Power (N/m s)	4.84	40.67	3.08
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	31.48	55.54	28.80
C & E Loss (m)	0.01	Cum SA (1000 m2)	32.80	20.31	37.79

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.50	Element	Left OB	Channel	Right OB

Vel Head (m)	0.12	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	198.38	Reach Len. (m)	25.00	25.00	25.00
Crit W.S. (m)	196.37	Flow Area (m2)	95.68	9.40	18.58
E.G. Slope (m/m)	0.001047	Area (m2)	95.68	9.40	18.58
Q Total (m3/s)	122.56	Flow (m3/s)	84.80	26.54	11.23
Top Width (m)	41.93	Top Width (m)	30.16	1.72	10.05
Vel Total (m/s)	0.99	Avg. Vel. (m/s)	0.89	2.82	0.60
Max Chl Dpth (m)	5.56	Hydr. Depth (m)	3.17	5.47	1.85
Conv. Total (m3/s)	3787.8	Conv. (m3/s)	2620.7	820.1	347.0
Length Wtd. (m)	25.00	Wetted Per. (m)	30.81	1.76	12.08
Min Ch El (m)	192.82	Shear (N/m2)	31.89	54.76	15.79
Alpha	2.34	Stream Power (N/m s)	28.26	154.56	9.54
Frctn Loss (m)	0.02	Cum Volume (1000 m3)	139.11	135.12	176.67
C & E Loss (m)	0.00	Cum SA (1000 m2)	73.16	20.31	102.23

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.122

INPUT
Description: Section 46.122 - Peelar Road - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 153

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203.853	.23	203.855	.93	203.865	1.01	203.866	2.78	203.939
3.03	203.939	3.37	203.951	3.73	203.964	5.01	203.946	5.31	203.936
5.61	203.945	6.98	204	8.21	203.442	9.46	203	9.88	202.784
11.44	202	13.15	201.154	13.44	201	14.01	200.722	15.52	200
17.01	199.481	18.02	199	20.35	198.365	21.48	198.229	22.2	198.229
22.48	198.242	22.55	198.253	23.36	198.361	25.19	198.587	26.16	198.662
26.31	198.67	26.95	198.656	27.03	198.655	28	198.645	29.49	198.666
32.66	198.758	32.85	198.766	33.38	198.788	36.68	199	43.6	199.165
43.64	199.166	44.06	199.173	44.1	199.174	45.22	199.23	45.29	199.233
49.48	199.327	54.88	199.38	58.89	199.448	59.82	199.441	62.67	199.521
66.36	199.453	67.01	199.441	68.92	199.378	69.47	199.357	72.61	199.214
73.37	199.196	73.56	199.181	74.94	199	75.77	198.822	76.04	198.77
77.37	198.575	78.16	198.426	78.34	198.376	78.46	198.351	79.57	198
79.94	197.998	80.59	197.996	83.89	197.984	85.16	197.985	85.23	197.984
85.29	197.984	86.24	197.981	86.6	197.98	86.93	197.981	86.99	197.981
92.12	197.978	92.67	197.975	93.8	197.973	96.51	197.968	109.87	197.327
112.55	197.295	123.04	197.978	123.43	197.979	124.91	197.982	126.71	197.996
126.79	197.996	127.47	198	130.8	198	132.4	198	133.05	198

133.1	198	133.26	198	134.36	198	135.44	198	135.67	198
136.01	198	136.06	198	136.92	198	136.94	198	138.2	197.725
141.43	197	143.11	196.356	143.45	196.246	143.63	196.196	144.35	196
145.45	195.701	148.42	195	151.6	194.377	153.04	194	154.48	193.345
154.54	193.311	155.34	193	155.73	192.919	157.65	192.63	159.49	192.987
159.52	193	159.55	193.013	161.56	194	162.02	194.215	163.58	195
164.59	195.492	165.53	196	165.88	196.23	167.15	197	169.04	197.525
170.01	198	170.48	198.005	171.29	198.01	171.61	198.012	176.33	198.211
181.2	198.381	185.45	198.603	188.51	198.84	190.44	198.995	190.51	199
192.15	199.001	192.24	199.001	192.28	199.001	192.41	199.001	192.81	199.001
194.2	199.001	195.83	199.001	195.94	199.001	196.05	199.001	200.13	199.042
211.06	199.149	222.84	199.423	229.22	199.464	230.38	199.482	231.47	199.497
235.25	199.523	240.57	199.568	242.89	199.629				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	155.34	.035	159.52	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
155.34	159.52	38	38	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	155.42	196.7	F
159.34	242.89	196.7	F

Left Levee Station= 136.92 Elevation= 198

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	195.70	Element	Left OB	Channel	Right OB
Vel Head (m)	0.19	Wt. n-Val.		0.035	
W.S. Elev (m)	195.50	Reach Len. (m)	38.00	38.00	38.00
Crit W.S. (m)	194.21	Flow Area (m2)		10.61	
E.G. Slope (m/m)	0.001248	Area (m2)	9.67	11.27	6.39
Q Total (m3/s)	20.59	Flow (m3/s)		20.59	
Top Width (m)	18.32	Top Width (m)	9.05	4.18	5.09
Vel Total (m/s)	1.94	Avg. Vel. (m/s)		1.94	
Max Chl Dpth (m)	2.87	Hydr. Depth (m)		2.71	
Conv. Total (m3/s)	582.8	Conv. (m3/s)		582.8	
Length Wtd. (m)	38.00	Wetted Per. (m)		3.98	
Min Ch El (m)	192.63	Shear (N/m2)		32.62	
Alpha	1.00	Stream Power (N/m s)		63.31	
Frctn Loss (m)		Cum Volume (1000 m3)	31.03	55.34	28.68
C & E Loss (m)		Cum SA (1000 m2)	32.42	20.24	37.70

Note: Multiple critical depths were found at this location. The critical depth

with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.47	Element	Left OB	Channel	Right OB
Vel Head (m)	0.16	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	198.31	Reach Len. (m)	38.00	38.00	38.00
Crit W.S. (m)	196.70	Flow Area (m2)	78.09	23.01	30.08
E.G. Slope (m/m)	0.000790	Area (m2)	78.09	23.01	30.08
Q Total (m3/s)	122.56	Flow (m3/s)	44.00	57.01	21.55
Top Width (m)	102.88	Top Width (m)	78.97	4.18	19.73
Vel Total (m/s)	0.93	Avg. Vel. (m/s)	0.56	2.48	0.72
Max Chl Dpth (m)	5.68	Hydr. Depth (m)	0.99	5.50	1.52
Conv. Total (m3/s)	4359.4	Conv. (m3/s)	1564.9	2027.9	766.6
Length Wtd. (m)	38.00	Wetted Per. (m)	79.79	4.25	20.90
Min Ch El (m)	192.63	Shear (N/m2)	7.59	42.00	11.15
Alpha	3.51	Stream Power (N/m s)	4.27	104.06	7.99
Frctn Loss (m)		Cum Volume (1000 m3)	136.94	134.72	176.06
C & E Loss (m)		Cum SA (1000 m2)	71.80	20.24	101.86

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1215

INPUT
Description: Hum 13-3R. Peelar Road Culvert - 3.72 m W x 2.35 m H x 30 m L Corrugated Metal Pipe Arch Culvert. No drawings available. Size estimated from HEC-2 coding.

HEC-2 to HEC-RAS conversion
January 2004 by Acres included recoding of culvert to HEC-RAS format, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 3
Deck/Roadway Width = 30
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 157

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord

0	198.649	1.52	198.401	2.47	198
2.8	198	2.85	198	3.5	198
3.74	198	4.59	198	13.86	198
15.45	198	15.74	198	17.17	198
18.02	197.999	19.18	197.875	22.99	197.861
24.53	197.999	28.09	197.999	28.15	197.999
28.28	197.999	28.43	197.999	28.64	197.999
29.19	197.999	31.03	197.999	31.34	197.999
32.15	197.999	32.89	197.999	34.84	197.999
34.92	197.999	37.18	197.998	37.71	197.998
38.66	197.998	41.94	197.997	43.56	197.997
44.75	197.997	45.96	197.997	46.74	197.997
49.78	197.996	50.07	197.995	52.53	197.995
54.64	197.995	55.11	197.995	55.42	197.995
55.76	197.995	57.94	197.995	59.43	197.994
60.73	197.994	61.45	197.993	62	197.993
64.12	197.992	64.22	197.992	64.28	197.992
65.61	197.989	67.27	197.991	68.33	197.991
71.97	197.999	72.26	198	73.27	198.017
76.65	198.059	77.23	198.092	78.18	198.119
80.03	198.063	81.1	198	81.68	197.998
81.8	197.997	82.79	197.994	83.16	197.992
83.96	197.989	86.33	197.985	91.22	197.968
99.31	197.849	99.61	197.847	100.72	197.846
105.6	197.845	107.24	197.851	115.83	197.928
117.78	197.909	118.71	197.903	119.04	197.903
119.4	197.899	121.59	197.885	122.03	197.885
124.28	197.863	124.74	197.388	125.47	197.26
125.59	197.264	125.6	197.264	127.02	197.214
127.16	197.211	127.78	197.201	139.62	197
140.18	196.992	140.89	196.988	141.46	196.989
142	196.987	142.75	196.987	143.84	196.986
143.94	196.986	150.74	196.962	158.29	196.957
158.39	196.957	160.98	196.955	164.67	196.924
165.88	196.912	167.31	196.935	168.65	196.948
168.79	196.948	168.84	196.949	169.49	196.951
170.16	196.951	171.53	196.952	172.2	196.956
172.58	196.955	172.76	196.956	172.87	196.955
172.93	196.955	174	196.962	174.57	196.956
175.1	196.959	175.75	196.962	178.58	196.956
180.14	196.971	182.32	196.983	182.65	196.984
182.82	196.987	183.42	196.997	183.61	197
186.18	197.165	192.25	197.667	192.7	197.681
193.37	197.689	193.89	197.919	194.46	197.92
195.12	197.925	196.24	197.935	198.9	197.945
202.32	197.938	208.58	197.985	210.37	197.994
210.52	198	211.83	198.115	211.87	198.116
222.47	198.877	223.67	198.88	226.51	198.911
228.79	198.924	230.7	198.93	232.45	198.935
237.16	198.966	237.24	198.966	237.7	198.968
238.12	198.971	239.89	198.978	239.96	198.978
240.04	198.979	240.24	198.978	240.47	198.98
240.87	199				

Upstream Bridge Cross Section Data
Station Elevation Data num= 153

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	203.853	.23	203.855	.93	203.865	1.01	203.866	2.78	203.939
3.03	203.939	3.37	203.951	3.73	203.964	5.01	203.946	5.31	203.936
5.61	203.945	6.98	204	8.21	203.442	9.46	203	9.88	202.784
11.44	202	13.15	201.154	13.44	201	14.01	200.722	15.52	200
17.01	199.481	18.02	199	20.35	198.365	21.48	198.229	22.2	198.229
22.48	198.242	22.55	198.253	23.36	198.361	25.19	198.587	26.16	198.662

26.31	198.67	26.95	198.656	27.03	198.655	28	198.645	29.49	198.666
32.66	198.758	32.85	198.766	33.38	198.788	36.68	199	43.6	199.165
43.64	199.166	44.06	199.173	44.1	199.174	45.22	199.23	45.29	199.233
49.48	199.327	54.88	199.38	58.89	199.448	59.82	199.441	62.67	199.521
66.36	199.453	67.01	199.441	68.92	199.378	69.47	199.357	72.61	199.214
73.37	199.196	73.56	199.181	74.94	199	75.77	198.822	76.04	198.77
77.37	198.575	78.16	198.426	78.34	198.376	78.46	198.351	79.57	198
79.94	197.998	80.59	197.996	83.89	197.984	85.16	197.985	85.23	197.984
85.29	197.984	86.24	197.981	86.6	197.98	86.93	197.981	86.99	197.981
92.12	197.978	92.67	197.975	93.8	197.973	96.51	197.968	109.87	197.327
112.55	197.295	123.04	197.978	123.43	197.979	124.91	197.982	126.71	197.996
126.79	197.996	127.47	198	130.8	198	132.4	198	133.05	198
133.1	198	133.26	198	134.36	198	135.44	198	135.67	198
136.01	198	136.06	198	136.92	198	136.94	198	138.2	197.725
141.43	197	143.11	196.356	143.45	196.246	143.63	196.196	144.35	196
145.45	195.701	148.42	195	151.6	194.377	153.04	194	154.48	193.345
154.54	193.311	155.34	193	155.73	192.919	157.65	192.63	159.49	192.987
159.52	193	159.55	193.013	161.56	194	162.02	194.215	163.58	195
164.59	195.492	165.53	196	165.88	196.23	167.15	197	169.04	197.525
170.01	198	170.48	198.005	171.29	198.01	171.61	198.012	176.33	198.211
181.2	198.381	185.45	198.603	188.51	198.84	190.44	198.995	190.51	199
192.15	199.001	192.24	199.001	192.28	199.001	192.41	199.001	192.81	199.001
194.2	199.001	195.83	199.001	195.94	199.001	196.05	199.001	200.13	199.042
211.06	199.149	222.84	199.423	229.22	199.464	230.38	199.482	231.47	199.497
235.25	199.523	240.57	199.568	242.89	199.629				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	155.34	.035	159.52	.05

Bank Sta: Left Right Coeff Contr. Expan.

155.34	159.52	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	155.42	196.7	F
159.34	242.89	196.7	F

Left Levee Station= 136.92 Elevation= 198

Downstream Deck/Roadway Coordinates

num= 157

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	198.649		1.52	198.401		2.47	198	
2.8	198		2.85	198		3.5	198	
3.74	198		4.59	198		13.86	198	
15.45	198		15.74	198		17.17	198	
18.02	197.999		19.18	197.875		22.99	197.861	
24.53	197.999		28.09	197.999		28.15	197.999	
28.28	197.999		28.43	197.999		28.64	197.999	
29.19	197.999		31.03	197.999		31.34	197.999	
32.15	197.999		32.89	197.999		34.84	197.999	
34.92	197.999		37.18	197.998		37.71	197.998	
38.66	197.998		41.94	197.997		43.56	197.997	
44.75	197.997		45.96	197.997		46.74	197.997	
49.78	197.996		50.07	197.995		52.53	197.995	
54.64	197.995		55.11	197.995		55.42	197.995	
55.76	197.995		57.94	197.995		59.43	197.994	
60.73	197.994		61.45	197.993		62	197.993	
64.12	197.992		64.22	197.992		64.28	197.992	
65.61	197.989		67.27	197.991		68.33	197.991	
71.97	197.999		72.26	198		73.27	198.017	
76.65	198.059		77.23	198.092		78.18	198.119	
80.03	198.063		81.1	198		81.68	197.998	
81.8	197.997		82.79	197.994		83.16	197.992	

83.96	197.989	86.33	197.985	91.22	197.968
99.31	197.849	99.61	197.847	100.72	197.846
105.6	197.845	107.24	197.851	115.83	197.928
117.78	197.909	118.71	197.903	119.04	197.903
119.4	197.899	121.59	197.885	122.03	197.885
124.28	197.863	124.74	197.388	125.47	197.26
125.59	197.264	125.6	197.264	127.02	197.214
127.16	197.211	127.78	197.201	139.62	197
140.18	196.992	140.89	196.988	141.46	196.989
142	196.987	142.75	196.987	143.84	196.986
143.94	196.986	150.74	196.962	158.29	196.957
158.39	196.957	160.98	196.955	164.67	196.924
165.88	196.912	167.31	196.935	168.65	196.948
168.79	196.948	168.84	196.949	169.49	196.951
170.16	196.951	171.53	196.952	172.2	196.956
172.58	196.955	172.76	196.956	172.87	196.955
172.93	196.955	174	196.962	174.57	196.956
175.1	196.959	175.75	196.962	178.58	196.956
180.14	196.971	182.32	196.983	182.65	196.984
182.82	196.987	183.42	196.997	183.61	197
186.18	197.165	192.25	197.667	192.7	197.681
193.37	197.689	193.89	197.919	194.46	197.92
195.12	197.925	196.24	197.935	198.9	197.945
202.32	197.938	208.58	197.985	210.37	197.994
210.52	198	211.83	198.115	211.87	198.116
222.47	198.877	223.67	198.88	226.51	198.911
228.79	198.924	230.7	198.93	232.45	198.935
237.16	198.966	237.24	198.966	237.7	198.968
238.12	198.971	239.89	198.978	239.96	198.978
240.04	198.979	240.24	198.978	240.47	198.98
240.87	199				

Downstream Bridge Cross Section Data

Station Elevation Data num= 193

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.116	.09	201.103	.16	201.086	2.46	201.134	2.97	201
4.37	200.471	4.61	200.366	5.6	200.081	5.84	200	5.96	199.911
5.99	199.908	6.02	199.896	6.07	199.878	6.15	199.835	7.19	199.231
7.68	199	8.13	198.755	8.5	198.631	8.62	198.603	9.26	198.509
9.72	198.47	10.14	198.456	10.23	198.452	10.32	198.448	11.96	198.458
17.93	198.627	18.79	198.683	20.17	198.853	21.45	198.905	21.67	198.908
22.9	198.868	23.49	198.882	23.72	198.871	24.78	198.788	24.93	198.787
28.22	198.487	32.27	198.564	32.41	198.559	32.55	198.553	32.7	198.554
34.55	198.443	36.02	198.405	47.41	198.657	48.15	198.664	48.64	198.668
48.8	198.663	49	198.655	56.83	198.515	56.94	198.515	57.21	198.506
57.47	198.5	59.64	198.564	60.7	198.535	64.04	198.604	69.34	198.85
70.1	198.861	70.3	198.882	70.32	198.882	71.57	199	74.15	199
75.35	199	76.07	199	76.75	199	77.12	199	78.35	199
79.35	199	79.82	199	81.11	199	81.15	199	81.23	199
81.33	199	81.52	199	84.17	199	85.18	199	86.83	199
86.9	199	86.98	199	91.42	199	92.96	199	96.93	199
97.22	199	97.61	199	98.45	199	98.47	199	98.92	199
99.22	199	101.39	199	102.08	199	102.12	199	102.14	199
103.01	199	103.02	199	106.1	198.877	110.03	198.634	110.07	198.631
110.12	198.629	110.16	198.627	112.11	198.13	112.47	198.125	114.53	198.075
115.89	198.061	116.61	198.058	116.85	198.054	117.55	198.032	119.12	198
121.6	197.696	125.61	197.384	130.31	197	130.42	196.977	131.19	196.835
134.73	196.198	135.06	196.126	135.92	196	136.57	195.912	137.53	195.823
137.73	195.805	139.61	195.582	141.72	195.474	142.72	195.431	142.83	195.423
146.3	195	146.85	194.937	146.93	194.922	147.7	194.851	147.91	194.818
150.84	194.094	151.01	194.05	151.08	194.036	151.14	194.027	151.23	194
151.49	193.87	152.54	193.041	152.6	193	152.61	192.999	152.94	192.956
153.08	192.961	153.39	192.841	153.59	192.827	154.01	192	154.29	191.839

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  154.31 191.823  154.36 191.841   154.5 191.889  154.85     192  155.27 192.599
  155.43 192.632  156.55 192.853   157.2 192.963  157.33     193  157.71   193.1
  157.92 193.149  158.07 193.188  158.44 193.273   159.2  193.41  159.73 193.495
  161.66     194  161.73 194.024   162.6 194.305  162.76 194.371   163.8     195
   164.8 195.636  165.37     196  166.09 196.414     167     197  168.71  197.76
  169.29     198   170.4 198.016  170.43 198.017  170.57 198.018  172.02 198.031
  174.94 198.052  176.13  198.07  176.47 198.141  179.95 198.291  191.32 198.853
  196.68     199  198.11 199.013  201.12 199.029  202.88 199.024  217.21 199.414
  218.54 199.448  219.63 199.477  219.66 199.478  219.79 199.484  219.93 199.488
  227.87 199.454  235.99 199.769  237.56 199.797   238.2   199.8  238.42 199.808
  238.61 199.813  239.21 199.826  239.73 199.834

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05   152.6    .035  157.33     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
         152.6  157.33            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   152.9  196.51       F
  156.88  239.73  196.51       F
Left Levee      Station=  103.02      Elevation=     199

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     Pipe Arch    2.35    3.72
FHWA Chart # 34- 18 inch corner radius; Corrugated metal
FHWA Scale # 3 - Projecting
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                 3      30     .024     .024        0                   .9
      1
Upstream   Elevation =  192.63
           Centerline Station =  157.4
Downstream Elevation =  192.37
           Centerline Station =  154.9

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      20.59    Culv Full Len (m)
  # Barrels                   1    Culv Vel US (m/s)         3.64
  Q Barrel (m3/s)          20.59    Culv Vel DS (m/s)         4.09
  E.G. US. (m)            195.70    Culv Inv El Up (m)      192.63
  W.S. US. (m)            195.50    Culv Inv El Dn (m)      192.37
  E.G. DS (m)             194.62    Culv Frctn Ls (m)         0.01
  W.S. DS (m)             193.92    Culv Exit Loss (m)        0.16
  Delta EG (m)              1.08    Culv Entr Loss (m)        0.61
  Delta WS (m)              1.58    Q Weir (m3/s)
  E.G. IC (m)             195.55    Weir Sta Lft (m)
  E.G. OC (m)             195.70    Weir Sta Rgt (m)
  Culvert Control         Outlet    Weir Submerg
  Culv WS Inlet (m)       194.41    Weir Max Depth (m)
```

Culv WS Outlet (m)	193.92	Weir Avg Depth (m)	
Culv Nml Depth (m)	1.90	Weir Flow Area (m2)	
Culv Crt Depth (m)	1.53	Min El Weir Flow (m)	196.92

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	10.85	Culv Full Len (m)	30.00
# Barrels	1	Culv Vel US (m/s)	1.62
Q Barrel (m3/s)	10.85	Culv Vel DS (m/s)	1.62
E.G. US. (m)	198.47	Culv Inv El Up (m)	192.63
W.S. US. (m)	198.31	Culv Inv El Dn (m)	192.37
E.G. DS (m)	198.23	Culv Frctn Ls (m)	0.07
W.S. DS (m)	198.14	Culv Exit Loss (m)	0.04
Delta EG (m)	0.24	Culv Entr Loss (m)	0.12
Delta WS (m)	0.17	Q Weir (m3/s)	111.71
E.G. IC (m)	198.34	Weir Sta Lft (m)	19.96
E.G. OC (m)	198.47	Weir Sta Rgt (m)	182.92
Culvert Control	Outlet	Weir Submerg	0.64
Culv WS Inlet (m)	194.98	Weir Max Depth (m)	1.56
Culv WS Outlet (m)	194.72	Weir Avg Depth (m)	0.74
Culv Nml Depth (m)		Weir Flow Area (m2)	80.97
Culv Crt Depth (m)	1.08	Min El Weir Flow (m)	196.92

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.121

INPUT
Description: Section 46.121 - Peelar Road - D/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 193

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	201.116	.09	201.103	.16	201.086	2.46	201.134	2.97	201
4.37	200.471	4.61	200.366	5.6	200.081	5.84	200	5.96	199.911
5.99	199.908	6.02	199.896	6.07	199.878	6.15	199.835	7.19	199.231
7.68	199	8.13	198.755	8.5	198.631	8.62	198.603	9.26	198.509
9.72	198.47	10.14	198.456	10.23	198.452	10.32	198.448	11.96	198.458
17.93	198.627	18.79	198.683	20.17	198.853	21.45	198.905	21.67	198.908
22.9	198.868	23.49	198.882	23.72	198.871	24.78	198.788	24.93	198.787
28.22	198.487	32.27	198.564	32.41	198.559	32.55	198.553	32.7	198.554
34.55	198.443	36.02	198.405	47.41	198.657	48.15	198.664	48.64	198.668
48.8	198.663	49	198.655	56.83	198.515	56.94	198.515	57.21	198.506
57.47	198.5	59.64	198.564	60.7	198.535	64.04	198.604	69.34	198.85
70.1	198.861	70.3	198.882	70.32	198.882	71.57	199	74.15	199
75.35	199	76.07	199	76.75	199	77.12	199	78.35	199
79.35	199	79.82	199	81.11	199	81.15	199	81.23	199
81.33	199	81.52	199	84.17	199	85.18	199	86.83	199
86.9	199	86.98	199	91.42	199	92.96	199	96.93	199
97.22	199	97.61	199	98.45	199	98.47	199	98.92	199
99.22	199	101.39	199	102.08	199	102.12	199	102.14	199
103.01	199	103.02	199	106.1	198.877	110.03	198.634	110.07	198.631
110.12	198.629	110.16	198.627	112.11	198.13	112.47	198.125	114.53	198.075
115.89	198.061	116.61	198.058	116.85	198.054	117.55	198.032	119.12	198
121.6	197.696	125.61	197.384	130.31	197	130.42	196.977	131.19	196.835
134.73	196.198	135.06	196.126	135.92	196	136.57	195.912	137.53	195.823
137.73	195.805	139.61	195.582	141.72	195.474	142.72	195.431	142.83	195.423
146.3	195	146.85	194.937	146.93	194.922	147.7	194.851	147.91	194.818
150.84	194.094	151.01	194.05	151.08	194.036	151.14	194.027	151.23	194
151.49	193.87	152.54	193.041	152.6	193	152.61	192.999	152.94	192.956

153.08	192.961	153.39	192.841	153.59	192.827	154.01	192	154.29	191.839
154.31	191.823	154.36	191.841	154.5	191.889	154.85	192	155.27	192.599
155.43	192.632	156.55	192.853	157.2	192.963	157.33	193	157.71	193.1
157.92	193.149	158.07	193.188	158.44	193.273	159.2	193.41	159.73	193.495
161.66	194	161.73	194.024	162.6	194.305	162.76	194.371	163.8	195
164.8	195.636	165.37	196	166.09	196.414	167	197	168.71	197.76
169.29	198	170.4	198.016	170.43	198.017	170.57	198.018	172.02	198.031
174.94	198.052	176.13	198.07	176.47	198.141	179.95	198.291	191.32	198.853
196.68	199	198.11	199.013	201.12	199.029	202.88	199.024	217.21	199.414
218.54	199.448	219.63	199.477	219.66	199.478	219.79	199.484	219.93	199.488
227.87	199.454	235.99	199.769	237.56	199.797	238.2	199.8	238.42	199.808
238.61	199.813	239.21	199.826	239.73	199.834				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	152.6	.035	157.33	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
152.6	157.33	20	20	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	152.9	196.51	F
156.88	239.73	196.51	F

Left Levee Station= 103.02 Elevation= 199

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	194.62	Element	Left OB	Channel	Right OB
Vel Head (m)	0.69	Wt. n-Val.		0.035	
W.S. Elev (m)	193.92	Reach Len. (m)	20.00	20.00	20.00
Crit W.S. (m)	193.92	Flow Area (m2)		5.58	
E.G. Slope (m/m)	0.014163	Area (m2)	0.54	6.30	1.90
Q Total (m3/s)	20.59	Flow (m3/s)		20.59	
Top Width (m)	9.97	Top Width (m)	1.21	4.73	4.03
Vel Total (m/s)	3.69	Avg. Vel. (m/s)		3.69	
Max Chl Dpth (m)	2.10	Hydr. Depth (m)		1.40	
Conv. Total (m3/s)	173.0	Conv. (m3/s)		173.0	
Length Wtd. (m)	20.00	Wetted Per. (m)		4.93	
Min Ch El (m)	191.82	Shear (N/m2)		157.14	
Alpha	1.00	Stream Power (N/m s)		580.15	
Frctn Loss (m)	0.24	Cum Volume (1000 m3)	31.03	55.08	28.68
C & E Loss (m)	0.15	Cum SA (1000 m2)	32.22	20.07	37.53

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 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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.23	Element	Left OB	Channel	Right OB
Vel Head (m)	0.09	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	198.14	Reach Len. (m)	20.00	20.00	20.00
Crit W.S. (m)	196.51	Flow Area (m2)	68.57	26.25	37.11
E.G. Slope (m/m)	0.000574	Area (m2)	68.57	26.25	37.11
Q Total (m3/s)	122.56	Flow (m3/s)	46.17	49.79	26.60
Top Width (m)	64.38	Top Width (m)	40.52	4.73	19.13
Vel Total (m/s)	0.93	Avg. Vel. (m/s)	0.67	1.90	0.72
Max Chl Dpth (m)	6.32	Hydr. Depth (m)	1.69	5.55	1.94
Conv. Total (m3/s)	5115.7	Conv. (m3/s)	1927.2	2078.2	1110.4
Length Wtd. (m)	20.00	Wetted Per. (m)	41.16	5.69	20.27
Min Ch El (m)	191.82	Shear (N/m2)	9.38	25.96	10.30
Alpha	2.02	Stream Power (N/m s)	6.31	49.24	7.39
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	136.94	131.43	176.06
C & E Loss (m)	0.03	Cum SA (1000 m2)	69.53	20.07	101.12

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: RIVER-1
REACH: Reach-1 RS: 46.12

INPUT
Description: Section 46.12 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 121

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204.017	.64	204	1.57	203.584	2.88	203	4.16	202.234
4.52	202	5.56	201.407	6.37	201	10.22	201	14.03	201
15.11	201.341	17.03	201.774	17.39	201.08	19.08	201.047	20.72	201
24.05	200.087	24.34	200	25.06	199.958	40.15	199.007	40.26	199.007
42.43	199.003	42.76	199.003	45.21	199.27	45.36	199.272	47	199.255
47.99	199.251	57.78	199.012	58.42	199.012	60	199.011	66.24	199
66.68	199	66.83	199	67.45	199	68.32	199	70.6	199
78.32	199	82.38	198.38	85.31	198	86.68	197.459	88	197
88.9	197	89.01	197	89.06	197	89.47	197	90.05	197
90.13	197	90.19	197	92.58	197	93.92	197	95.28	197
98.06	197	98.16	197	98.96	197	104.19	196.364	106.24	196.391
109.27	196	109.29	195.994	109.82	195.992	109.83	195.992	110.07	195.99
110.19	195.988	111.79	195.978	112.9	195.816	112.97	195.809	116.66	195.626
117.36	195.562	117.5	195.552	118.97	195.46	120.07	195.413	121.94	195.336
125.09	195	127.14	194.798	128.66	194.593	128.86	194.565	129.9	194.436
130.12	194.409	133.39	194	134.46	193.993	134.62	193.992	134.65	193.992
134.67	193.992	136.01	193.914	142.87	193.531	143.04	193.525	143.27	193.512
144.35	193.401	148.02	193	149.07	192.548	150.54	192	150.66	191.955
150.99	191.823	151.13	191.883	151.39	192	153.89	192.96	154.01	193
154.32	193.077	156.61	193.626	157.62	193.852	158.11	194	159.55	194.326
162.27	195	164.16	195.858	164.18	195.863	164.2	195.868	164.23	195.877
164.52	196	165.52	196.466	165.69	196.535	166.77	196.945	166.9	197
167	197.043	168.84	198	179.75	198.43	194.54	199	199.89	199.172
218.12	199.701	222.85	199.836	227.56	199.963	228.52	200	228.56	200
228.84	200								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	148.02	.035	154.01	.05

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
148.02 154.01 35 38 40 .1 .3
Left Levee Station= 45.21 Elevation= 199.27

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	193.92	Element	Left OB	Channel	Right OB
Vel Head (m)	0.40	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	193.51	Reach Len. (m)	35.00	38.00	40.00
Crit W.S. (m)	193.51	Flow Area (m2)	1.22	6.62	0.55
E.G. Slope (m/m)	0.009935	Area (m2)	1.22	6.62	0.55
Q Total (m3/s)	20.59	Flow (m3/s)	0.97	19.19	0.43
Top Width (m)	12.93	Top Width (m)	4.80	5.99	2.14
Vel Total (m/s)	2.46	Avg. Vel. (m/s)	0.80	2.90	0.79
Max Chl Dpth (m)	1.69	Hydr. Depth (m)	0.25	1.10	0.26
Conv. Total (m3/s)	206.6	Conv. (m3/s)	9.7	192.5	4.3
Length Wtd. (m)	37.95	Wetted Per. (m)	4.83	6.44	2.20

Min Ch El (m)	191.82	Shear (N/m2)	24.55	100.14	24.27
Alpha	1.31	Stream Power (N/m s)	19.52	290.43	19.16
Frctn Loss (m)	0.15	Cum Volume (1000 m3)	31.02	54.95	28.65
C & E Loss (m)	0.07	Cum SA (1000 m2)	32.16	19.96	37.46

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 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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.19	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	198.17	Reach Len. (m)	35.00	38.00	40.00
Crit W.S. (m)	194.95	Flow Area (m2)	170.19	34.50	46.06
E.G. Slope (m/m)	0.000121	Area (m2)	170.19	34.50	46.06
Q Total (m3/s)	122.56	Flow (m3/s)	71.65	33.24	17.68
Top Width (m)	89.13	Top Width (m)	64.02	5.99	19.13
Vel Total (m/s)	0.49	Avg. Vel. (m/s)	0.42	0.96	0.38
Max Chl Dpth (m)	6.35	Hydr. Depth (m)	2.66	5.76	2.41
Conv. Total (m3/s)	11128.4	Conv. (m3/s)	6505.3	3018.1	1605.0
Length Wtd. (m)	37.26	Wetted Per. (m)	64.42	6.44	20.03
Min Ch El (m)	191.82	Shear (N/m2)	3.14	6.37	2.74
Alpha	1.58	Stream Power (N/m s)	1.32	6.14	1.05
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	134.55	130.82	175.23
C & E Loss (m)	0.05	Cum SA (1000 m2)	68.48	19.96	100.74

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.11

INPUT
Description: Station 46.11 - Highway 407 - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 157

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204.194	7.42	204	8.35	203.615	9.72	203	10.51	202.654
11.9	202	13.52	201.278	13.79	201.12	14.04	201	14.65	200.732
16.39	200	19.18	199.003	19.19	199	19.21	199	19.73	199
20.17	199	20.27	199	21.54	199.137	21.57	199.136	22.93	199.296
27.45	199.348	31.63	199.351	31.74	199.347	35.8	199.168	40.37	199.056
40.58	199.048	41.65	199	41.8	199	43.05	199	44.74	199
45.85	199	51.4	198.797	51.94	198.785	52.27	198.776	52.69	198.777
53.03	198.784	53.16	198.787	53.2	198.788	53.37	198.79	53.4	198.791
61.25	199	65.25	199	67.89	199	69.57	199	71.3	199
72.99	198.774	81.96	199	82.48	199	82.91	199	87.13	199
87.27	199	89.8	199.348	92.33	199.42	92.43	199.422	92.63	199.428
92.82	199.435	93.33	199.424	96.19	199	96.38	199	96.8	199
96.94	199	97.06	198.997	97.07	198.997	97.08	198.997	97.09	198.997
97.3	198.997	98.11	198.973	108.25	198.335	110.22	198.302	111.36	198.277
114.19	198.195	116.72	198.145	119.02	198.024	119.8	198.022	120.85	198.023
124.59	198.036	124.96	198.033	126.47	198.02	128.17	198.004	128.71	198.001
128.74	198	129.24	197.91	129.28	197.902	129.33	197.895	131.38	197.515
132.26	197.384	132.42	197.378	134.55	197.078	134.78	197.085	136.08	197.005
136.09	197.005	136.2	197	137.94	196.567	140.2	196	140.31	195.965
140.65	195.808	142.27	195.002	142.28	195	142.86	194.747	143.59	194.559
143.95	194.432	145.52	194	147.05	193.476	147.49	193.353	148.41	193
149.22	192.702	149.63	192.585	149.8	192	150	191.725	153.14	191.725
153.57	191.725	156	191.725	156.2	192	156.84	193	157.12	193.11
157.35	193.215	158.69	194	160.15	194.705	160.84	195	161.92	195.417
163.52	196	165.53	196.656	166.54	197	169.15	197.405	171.98	197.769
172.73	197.841	173.74	198	174.74	198.01	174.77	198.01	175.33	198.016
176.17	198.026	176.63	198.028	178.63	198.05	178.89	198.05	193.15	198.522
195.72	198.556	198.31	198.69	202.36	198.883	204.46	199	222.27	199.574
235.58	200	245.55	200.352	249	200.514	250.09	200.573	255.18	200.87
257.13	200.961	257.34	200.963	257.9	200.992	261.45	200.989	261.74	200.99
264.23	200.975	264.53	200.978	266.78	200.994	266.87	201	268.79	201.048
272.01	201.138	283.95	201.338						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	149.8	.035	156.2	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
149.8	156.2	235	235	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	149.5	200.65	F

156.5 283.95 200.5 F
Left Levee Station= 92.82 Elevation= 199.435

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	193.64	Element	Left OB	Channel	Right OB
Vel Head (m)	0.16	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	193.48	Reach Len. (m)	235.00	235.00	235.00
Crit W.S. (m)	192.75	Flow Area (m2)	0.32	11.17	0.37
E.G. Slope (m/m)	0.002016	Area (m2)	1.36	11.17	0.88
Q Total (m3/s)	20.59	Flow (m3/s)	0.16	20.17	0.26
Top Width (m)	10.76	Top Width (m)	2.76	6.40	1.60
Vel Total (m/s)	1.74	Avg. Vel. (m/s)	0.51	1.81	0.69
Max Chl Dpth (m)	1.75	Hydr. Depth (m)	1.05	1.74	1.24
Conv. Total (m3/s)	458.6	Conv. (m3/s)	3.6	449.3	5.7
Length Wtd. (m)	235.00	Wetted Per. (m)	0.74	6.68	0.56
Min Ch El (m)	191.73	Shear (N/m2)	8.37	33.04	13.26
Alpha	1.06	Stream Power (N/m s)	4.24	59.70	9.12
Frctn Loss (m)		Cum Volume (1000 m3)	30.97	54.61	28.63
C & E Loss (m)		Cum SA (1000 m2)	32.03	19.73	37.39

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	198.13	Element	Left OB	Channel	Right OB
Vel Head (m)	0.49	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	197.64	Reach Len. (m)	235.00	235.00	235.00
Crit W.S. (m)	195.01	Flow Area (m2)	1.56	37.83	1.62
E.G. Slope (m/m)	0.001191	Area (m2)	40.24	37.83	28.33
Q Total (m3/s)	122.56	Flow (m3/s)	1.77	118.50	2.29
Top Width (m)	40.33	Top Width (m)	19.12	6.40	14.81
Vel Total (m/s)	2.99	Avg. Vel. (m/s)	1.13	3.13	1.41
Max Chl Dpth (m)	5.92	Hydr. Depth (m)	5.22	5.91	5.41

Conv. Total (m3/s)	3551.8	Conv. (m3/s)	51.4	3434.2	66.3
Length Wtd. (m)	235.00	Wetted Per. (m)	0.74	6.68	0.56
Min Ch El (m)	191.73	Shear (N/m2)	24.55	66.13	34.06
Alpha	1.07	Stream Power (N/m s)	27.80	207.16	47.99
Frctn Loss (m)		Cum Volume (1000 m3)	130.87	129.45	173.74
C & E Loss (m)		Cum SA (1000 m2)	67.03	19.73	100.06

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.1015

INPUT
Description: Hum 13-2R. Highway 407 Culvert - 6.0 m W x 4.3 m H x 215 m L Concrete Box Culvert. Drawings by MTO (WP 140-87-08, Sheet 76, 1993) used to code in new culvert not previously coded in HEC-2.

HEC-2 to HEC-RAS conversion January 2004 by Acres
included coding of culvert to HEC-RAS format, including adjustments to roadway coding and hydraulic loss coefficients.
Distance from Upstream XS = 12
Deck/Roadway Width = 215
Weir Coefficient = 1.44
Upstream Deck/Roadway Coordinates
num= 146

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	204.208		4.75	204.007		4.97	204.007	
5.27	204.006		5.82	204.006		6.46	204.006	
7.86	204.005		8.62	204.005		8.71	204.005	
8.78	204.005		15.85	204.005		16.29	204.005	
17.76	204.004		17.9	204.004		18.19	204.004	
18.94	204.004		19.1	204.004		19.28	204.004	
20.12	204.004		21.34	204.004		21.76	204.004	
23.12	204.003		23.2	204.003		23.24	204.003	
23.33	204.003		23.38	204.003		23.44	204.003	
23.71	204.003		26.02	204.003		26.83	204.003	
28.53	204.003		34.85	204.001		37.83	204	
37.89	204		37.96	204		37.98	204	
38.02	204		43.02	203.56		47.14	203.538	
50.92	203.25		56.58	203.216		56.61	203.216	
56.64	203.216		56.83	203.213		57.93	203.201	
60.55	203.159		62.45	203.15		64.39	203.13	
64.6	203.129		64.76	203.127		69.02	203.102	
72.02	203.093		74.17	203.074		74.23	203.074	
75.29	203.068		75.83	203.062		76.16	203.061	
76.51	203.057		76.78	203.053		83.95	203	
84.95	202.936		85.88	202.932		86.17	202.919	
91.34	202.663		92.19	202.66		93.67	202.607	
93.81	202.601		95.31	202.52		102.69	202.429	
106.82	202.107		109.74	202.092		114.1	202.071	

117.19 202.043	117.24 202.043	117.39 202.042
117.45 202.041	118.91 202.033	121.76 202
126.9 201.626	135.34 201.601	138.96 201.498
146.46 201.017	146.74 201.017	147.02 201.017
147.32 201.017	148.59 201.016	150.04 201.016
150.78 201.016	152 201.015	152.08 201.014
152.54 201.014	153.09 201.014	153.16 201.014
157.65 201.014	158.63 201.014	159.79 201.014
159.86 201.014	159.95 201.014	163.62 201.013
167.46 201.011	171.93 201.294	176.54 201.237
179.73 201.007	180.03 201.007	180.13 201.007
182.08 201.007	183.45 201.007	196.02 201.006
199.93 201.005	200.98 201.005	201.21 201.005
203.84 201.005	219.13 201.005	223.98 201.005
224.97 201.005	225.02 201.005	225.67 201.005
226.17 201.005	226.62 201.005	226.68 201.005
228.24 201.005	228.93 201.005	238.94 201.006
244.81 201.005	246.52 201.005	249.44 201.005
251.75 201.154	255.03 201.173	256.62 201.006
259.78 201.005	260.65 201.005	262.23 201.005
262.29 201.005	262.38 201.005	265.7 201.004
265.92 201.004	266.14 201.004	266.66 201.004
268.21 201.004	270.47 201.004	270.83 201.004
271.72 201.005	271.99 201.005	272.99 201.005
279.13 201.004	279.54 201.004	

Upstream Bridge Cross Section Data
Station Elevation Data num= 157

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	204.194	7.42	204	8.35	203.615	9.72	203	10.51	202.654
11.9	202	13.52	201.278	13.79	201.12	14.04	201	14.65	200.732
16.39	200	19.18	199.003	19.19	199	19.21	199	19.73	199
20.17	199	20.27	199	21.54	199.137	21.57	199.136	22.93	199.296
27.45	199.348	31.63	199.351	31.74	199.347	35.8	199.168	40.37	199.056
40.58	199.048	41.65	199	41.8	199	43.05	199	44.74	199
45.85	199	51.4	198.797	51.94	198.785	52.27	198.776	52.69	198.777
53.03	198.784	53.16	198.787	53.2	198.788	53.37	198.79	53.4	198.791
61.25	199	65.25	199	67.89	199	69.57	199	71.3	199
72.99	198.774	81.96	199	82.48	199	82.91	199	87.13	199
87.27	199	89.8	199.348	92.33	199.42	92.43	199.422	92.63	199.428
92.82	199.435	93.33	199.424	96.19	199	96.38	199	96.8	199
96.94	199	97.06	198.997	97.07	198.997	97.08	198.997	97.09	198.997
97.3	198.997	98.11	198.973	108.25	198.335	110.22	198.302	111.36	198.277
114.19	198.195	116.72	198.145	119.02	198.024	119.8	198.022	120.85	198.023
124.59	198.036	124.96	198.033	126.47	198.02	128.17	198.004	128.71	198.001
128.74	198	129.24	197.91	129.28	197.902	129.33	197.895	131.38	197.515
132.26	197.384	132.42	197.378	134.55	197.078	134.78	197.085	136.08	197.005
136.09	197.005	136.2	197	137.94	196.567	140.2	196	140.31	195.965
140.65	195.808	142.27	195.002	142.28	195	142.86	194.747	143.59	194.559
143.95	194.432	145.52	194	147.05	193.476	147.49	193.353	148.41	193
149.22	192.702	149.63	192.585	149.8	192	150	191.725	153.14	191.725
153.57	191.725	156	191.725	156.2	192	156.84	193	157.12	193.11
157.35	193.215	158.69	194	160.15	194.705	160.84	195	161.92	195.417
163.52	196	165.53	196.656	166.54	197	169.15	197.405	171.98	197.769
172.73	197.841	173.74	198	174.74	198.01	174.77	198.01	175.33	198.016
176.17	198.026	176.63	198.028	178.63	198.05	178.89	198.05	193.15	198.522
195.72	198.556	198.31	198.69	202.36	198.883	204.46	199	222.27	199.574
235.58	200	245.55	200.352	249	200.514	250.09	200.573	255.18	200.87
257.13	200.961	257.34	200.963	257.9	200.992	261.45	200.989	261.74	200.99
264.23	200.975	264.53	200.978	266.78	200.994	266.87	201	268.79	201.048
272.01	201.138	283.95	201.338						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	149.8	.035	156.2	.05

Bank Sta: Left Right Coeff Contr. Expan.
149.8 156.2 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	149.5	200.65	F
156.5	283.95	200.5	F

Left Levee Station= 92.82 Elevation= 199.435

Downstream Deck/Roadway Coordinates
num= 146

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	204.208		4.75	204.007		4.97	204.007	
5.27	204.006		5.82	204.006		6.46	204.006	
7.86	204.005		8.62	204.005		8.71	204.005	
8.78	204.005		15.85	204.005		16.29	204.005	
17.76	204.004		17.9	204.004		18.19	204.004	
18.94	204.004		19.1	204.004		19.28	204.004	
20.12	204.004		21.34	204.004		21.76	204.004	
23.12	204.003		23.2	204.003		23.24	204.003	
23.33	204.003		23.38	204.003		23.44	204.003	
23.71	204.003		26.02	204.003		26.83	204.003	
28.53	204.003		34.85	204.001		37.83	204	
37.89	204		37.96	204		37.98	204	
38.02	204		43.02	203.56		47.14	203.538	
50.92	203.25		56.58	203.216		56.61	203.216	
56.64	203.216		56.83	203.213		57.93	203.201	
60.55	203.159		62.45	203.15		64.39	203.13	
64.6	203.129		64.76	203.127		69.02	203.102	
72.02	203.093		74.17	203.074		74.23	203.074	
75.29	203.068		75.83	203.062		76.16	203.061	
76.51	203.057		76.78	203.053		83.95	203	
84.95	202.936		85.88	202.932		86.17	202.919	
91.34	202.663		92.19	202.66		93.67	202.607	
93.81	202.601		95.31	202.52		102.69	202.429	
106.82	202.107		109.74	202.092		114.1	202.071	
117.19	202.043		117.24	202.043		117.39	202.042	
117.45	202.041		118.91	202.033		121.76	202	
126.9	201.626		135.34	201.601		138.96	201.498	
146.46	201.017		146.74	201.017		147.02	201.017	
147.32	201.017		148.59	201.016		150.04	201.016	
150.78	201.016		152	201.015		152.08	201.014	
152.54	201.014		153.09	201.014		153.16	201.014	
157.65	201.014		158.63	201.014		159.79	201.014	
159.86	201.014		159.95	201.014		163.62	201.013	
167.46	201.011		171.93	201.294		176.54	201.237	
179.73	201.007		180.03	201.007		180.13	201.007	
182.08	201.007		183.45	201.007		196.02	201.006	
199.93	201.005		200.98	201.005		201.21	201.005	
203.84	201.005		219.13	201.005		223.98	201.005	
224.97	201.005		225.02	201.005		225.67	201.005	
226.17	201.005		226.62	201.005		226.68	201.005	
228.24	201.005		228.93	201.005		238.94	201.006	
244.81	201.005		246.52	201.005		249.44	201.005	
251.75	201.154		255.03	201.173		256.62	201.006	
259.78	201.005		260.65	201.005		262.23	201.005	
262.29	201.005		262.38	201.005		265.7	201.004	
265.92	201.004		266.14	201.004		266.66	201.004	
268.21	201.004		270.47	201.004		270.83	201.004	
271.72	201.005		271.99	201.005		272.99	201.005	
279.13	201.004		279.54	201.004				

Downstream Bridge Cross Section Data
Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.016	1.7	202.008	3.31	202	6.36	201.056	6.55	201
9.56	200.072	9.81	200	10.8	199.702	11.4	199.711	13.91	199.257
20.78	199.071	21.41	199.041	21.73	199.035	22.13	199.012	28.32	199.055
30.43	199.043	30.53	199.043	30.61	199	34.33	198.39	36.83	198
38.26	197.761	38.91	197.735	42.59	197.626	45.28	197.715	49.27	197.928
49.51	197.912	49.64	197.913	50.24	198	54.26	198.904	54.69	199
55.54	199.006	55.6	199.007	56.47	199.015	56.56	199.016	58.01	199.028
58.36	199.031	64.08	199.075	66.11	199.058	71.53	199.016	73.74	199
78.09	198.205	79.43	198	80.3	197.717	82.64	197	84.16	196.504
85.78	196	87.38	195.494	88.82	195	90.55	194.411	91.82	194
93.73	193.361	95.06	193	96.61	192.832	96.99	192.821	97.75	192.766
99.02	192.647	104.34	192.001	104.36	192.001	104.39	192	107.5	192
108	191.6	114	191.6	114.5	192	116.67	192	119.53	192.809
120.23	193	120.93	193.226	123.26	194	125.52	194.789	126.17	195
129.05	195.811	130	196	130.82	196.156	134.81	197	136.27	197.006
139.91	197.009	140.26	197.01	149.58	197.28	159.19	197.543	159.78	197.568
160.61	197.581	161.67	197.609	161.81	197.612	162.94	197.638	163.7	197.652
169.85	197.681	172.35	197.776	174.11	197.816	175.39	197.838	176.32	197.837
176.8	197.835	177.83	197.831	178.38	197.827	178.95	197.822	180.79	197.795
184.91	197.765	186.04	197.738	186.65	197.724	187.33	197.708	192.06	197.647
192.56	197.637	195.08	197.575	199.98	197.49	201.37	197.459	203.14	197.409
207.72	197.255	214.28	197.01	214.52	197	219.09	196.443	220.61	196.279
221.92	196.225	229.69	196.45	231.97	196.372	232.71	196.357	233.41	196.345
235.42	196.321	237.27	196.318	238.24	196.334	239.43	196.362	242.98	196.554
248.74	196.965	250.8	197						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	107.5	.035	114.5	.05

Bank Sta: Left Right Coeff Contr. Expan.
107.5 114.5 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	107.5	200	F
114.5	250.8	200	F

Left Levee Station= 64.08 Elevation= 199.075
Right Levee Station= 175.39 Elevation= 197.838

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 4.3 6
FHWA Chart # 58- Rectangular concrete
FHWA Scale # 2 - Side tapered; More favorable edges
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	12	215	.015	.015	0	.5	1

Upstream Elevation = 191.725

Centerline Station = 153
Downstream Elevation = 191.6
Centerline Station = 111

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	20.59	Culv Full Len (m)	
# Barrels	1	Culv Vel US (m/s)	2.24
Q Barrel (m3/s)	20.59	Culv Vel DS (m/s)	3.23
E.G. US. (m)	193.64	Culv Inv El Up (m)	191.73
W.S. US. (m)	193.48	Culv Inv El Dn (m)	191.60
E.G. DS (m)	193.07	Culv Frctn Ls (m)	0.01
W.S. DS (m)	192.59	Culv Exit Loss (m)	0.13
Delta EG (m)	0.57	Culv Entr Loss (m)	0.13
Delta WS (m)	0.89	Q Weir (m3/s)	
E.G. IC (m)	193.62	Weir Sta Lft (m)	
E.G. OC (m)	193.64	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	193.26	Weir Max Depth (m)	
Culv WS Outlet (m)	192.66	Weir Avg Depth (m)	
Culv Nml Depth (m)	1.92	Weir Flow Area (m2)	
Culv Crt Depth (m)	1.06	Min El Weir Flow (m)	201.01

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	122.56	Culv Full Len (m)	119.53
# Barrels	1	Culv Vel US (m/s)	4.75
Q Barrel (m3/s)	122.56	Culv Vel DS (m/s)	5.85
E.G. US. (m)	198.13	Culv Inv El Up (m)	191.73
W.S. US. (m)	197.64	Culv Inv El Dn (m)	191.60
E.G. DS (m)	196.35	Culv Frctn Ls (m)	0.45
W.S. DS (m)	194.78	Culv Exit Loss (m)	0.48
Delta EG (m)	1.78	Culv Entr Loss (m)	0.58
Delta WS (m)	2.86	Q Weir (m3/s)	
E.G. IC (m)	198.26	Weir Sta Lft (m)	
E.G. OC (m)	198.13	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	196.03	Weir Max Depth (m)	
Culv WS Outlet (m)	195.09	Weir Avg Depth (m)	
Culv Nml Depth (m)	4.30	Weir Flow Area (m2)	
Culv Crt Depth (m)	3.49	Min El Weir Flow (m)	201.01

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.
Note: During supercritical analysis, the culvert direct step method went to critical depth. The program then assumed critical depth at the outlet.
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: 46.10

INPUT
Description: Station 46.10 - Highway 407 - D/S Bounding Section - J.D. Barnes
2003 topo mapping
Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	202.016	1.7	202.008	3.31	202	6.36	201.056	6.55	201
9.56	200.072	9.81	200	10.8	199.702	11.4	199.711	13.91	199.257
20.78	199.071	21.41	199.041	21.73	199.035	22.13	199.012	28.32	199.055
30.43	199.043	30.53	199.043	30.61	199	34.33	198.39	36.83	198
38.26	197.761	38.91	197.735	42.59	197.626	45.28	197.715	49.27	197.928
49.51	197.912	49.64	197.913	50.24	198	54.26	198.904	54.69	199
55.54	199.006	55.6	199.007	56.47	199.015	56.56	199.016	58.01	199.028
58.36	199.031	64.08	199.075	66.11	199.058	71.53	199.016	73.74	199
78.09	198.205	79.43	198	80.3	197.717	82.64	197	84.16	196.504
85.78	196	87.38	195.494	88.82	195	90.55	194.411	91.82	194
93.73	193.361	95.06	193	96.61	192.832	96.99	192.821	97.75	192.766
99.02	192.647	104.34	192.001	104.36	192.001	104.39	192	107.5	192
108	191.6	114	191.6	114.5	192	116.67	192	119.53	192.809
120.23	193	120.93	193.226	123.26	194	125.52	194.789	126.17	195
129.05	195.811	130	196	130.82	196.156	134.81	197	136.27	197.006
139.91	197.009	140.26	197.01	149.58	197.28	159.19	197.543	159.78	197.568
160.61	197.581	161.67	197.609	161.81	197.612	162.94	197.638	163.7	197.652
169.85	197.681	172.35	197.776	174.11	197.816	175.39	197.838	176.32	197.837
176.8	197.835	177.83	197.831	178.38	197.827	178.95	197.822	180.79	197.795
184.91	197.765	186.04	197.738	186.65	197.724	187.33	197.708	192.06	197.647
192.56	197.637	195.08	197.575	199.98	197.49	201.37	197.459	203.14	197.409
207.72	197.255	214.28	197.01	214.52	197	219.09	196.443	220.61	196.279
221.92	196.225	229.69	196.45	231.97	196.372	232.71	196.357	233.41	196.345
235.42	196.321	237.27	196.318	238.24	196.334	239.43	196.362	242.98	196.554
248.74	196.965	250.8	197						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	107.5	.035	114.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
107.5	114.5	130	200	160	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	107.5	200	F
114.5	250.8	200	F

Left Levee Station= 64.08 Elevation= 199.075
Right Levee Station= 175.39 Elevation= 197.838

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	193.07	Element	Left OB	Channel	Right OB
Vel Head (m)	0.48	Wt. n-Val.		0.035	
W.S. Elev (m)	192.59	Reach Len. (m)	130.00	200.00	160.00
Crit W.S. (m)	192.59	Flow Area (m2)		6.72	
E.G. Slope (m/m)	0.012821	Area (m2)	3.28	6.72	1.89
Q Total (m3/s)	20.59	Flow (m3/s)		20.59	
Top Width (m)	19.24	Top Width (m)	7.99	7.00	4.25
Vel Total (m/s)	3.07	Avg. Vel. (m/s)		3.07	

Max Chl Dpth (m)	0.99	Hydr. Depth (m)			0.96
Conv. Total (m3/s)	181.8	Conv. (m3/s)			181.8
Length Wtd. (m)	199.34	Wetted Per. (m)			7.28
Min Ch El (m)	191.60	Shear (N/m2)			115.98
Alpha	1.00	Stream Power (N/m s)			355.55
Frctn Loss (m)	1.06	Cum Volume (1000 m3)	30.97	52.54	28.63
C & E Loss (m)	0.13	Cum SA (1000 m2)	30.77	18.15	36.70

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 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, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	196.35	Element	Left OB	Channel	Right OB
Vel Head (m)	1.57	Wt. n-Val.		0.035	
W.S. Elev (m)	194.78	Reach Len. (m)	130.00	200.00	160.00
Crit W.S. (m)	194.78	Flow Area (m2)		22.09	
E.G. Slope (m/m)	0.008591	Area (m2)	34.85	22.09	18.94
Q Total (m3/s)	122.56	Flow (m3/s)		122.56	
Top Width (m)	36.05	Top Width (m)	18.04	7.00	11.00
Vel Total (m/s)	5.55	Avg. Vel. (m/s)		5.55	
Max Chl Dpth (m)	3.18	Hydr. Depth (m)		3.16	
Conv. Total (m3/s)	1322.3	Conv. (m3/s)		1322.3	
Length Wtd. (m)	184.22	Wetted Per. (m)		7.28	
Min Ch El (m)	191.60	Shear (N/m2)		255.57	

Alpha	1.00	Stream Power (N/m s)			1418.26
Frctn Loss (m)	0.11	Cum Volume (1000 m3)	130.87	122.47	173.74
C & E Loss (m)	0.77	Cum SA (1000 m2)	62.66	18.15	97.02

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, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.09

INPUT
Description: Section 46.09 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	199.5	20	198	60	198	92	191	93	190
95	189	99	189	100	190	102	191	146	192
173	194	210	196	255	197				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	93	.035	100	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
93	100	80	95	125	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	191.07	Element	Left OB	Channel	Right OB
Vel Head (m)	0.22	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (m)	190.85	Reach Len. (m)	80.00	95.00	125.00
Crit W.S. (m)		Flow Area (m2)	0.36	11.45	0.72
E.G. Slope (m/m)	0.003188	Area (m2)	0.36	11.45	

0.72					
Q Total (m3/s)	24.80	Flow (m3/s)	0.18	24.18	
0.43					
Top Width (m)	9.55	Top Width (m)	0.85	7.00	
1.70					
Vel Total (m/s)	1.98	Avg. Vel. (m/s)	0.51	2.11	
0.59					
Max Chl Dpth (m)	1.85	Hydr. Depth (m)	0.43	1.64	
0.43					
Conv. Total (m3/s)	439.2	Conv. (m3/s)	3.2	428.3	
7.6					
Length Wtd. (m)	95.20	Wetted Per. (m)	1.20	7.65	
1.90					
Min Ch El (m)	189.00	Shear (N/m2)	9.40	46.80	
11.89					
Alpha	1.11	Stream Power (N/m s)	4.77	98.81	
7.05					
Frctn Loss (m)	0.21	Cum Volume (1000 m3)	30.73	50.72	
28.42					
C & E Loss (m)	0.02	Cum SA (1000 m2)	30.19	16.75	
36.23					

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	194.31	Element	Left OB	Channel	
Right OB					
Vel Head (m)	0.03	Wt. n-Val.	0.050	0.035	
0.050					
W.S. Elev (m)	194.28	Reach Len. (m)	80.00	95.00	
125.00					
Crit W.S. (m)		Flow Area (m2)	28.44	35.49	
165.48					
E.G. Slope (m/m)	0.000218	Area (m2)	28.44	35.49	
165.48					
Q Total (m3/s)	133.76	Flow (m3/s)	11.93	41.61	
80.23					
Top Width (m)	101.27	Top Width (m)	16.01	7.00	
78.25					
Vel Total (m/s)	0.58	Avg. Vel. (m/s)	0.42	1.17	
0.48					
Max Chl Dpth (m)	5.28	Hydr. Depth (m)	1.78	5.07	
2.11					
Conv. Total (m3/s)	9065.7	Conv. (m3/s)	808.3	2820.1	
5437.3					
Length Wtd. (m)	115.54	Wetted Per. (m)	16.78	7.65	
78.58					
Min Ch El (m)	189.00	Shear (N/m2)	3.62	9.90	
4.50					
Alpha	1.72	Stream Power (N/m s)	1.52	11.61	
2.18					
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	126.76	116.71	
158.99					
C & E Loss (m)	0.01	Cum SA (1000 m2)	60.44	16.75	
89.88					

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: RIVER-1
REACH: Reach-1 RS: 46.082

INPUT
Description: Section 46.082 - Jane Steet - U/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	196	50	195	94	194	116	192	122	189
123	188.7	129	188.7	129.5	189	132	189.5	175	190
192	191	220	192	225	193	267	194	300	195

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	122	.035	129.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
122	129.5	75	75	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	122.5	196.5	F
129.5	300	193.5	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	190.84	Element	Left OB	Channel	Right OB
Vel Head (m)	0.17	Wt. n-Val.		0.035	
W.S. Elev (m)	190.68	Reach Len. (m)	75.00	75.00	75.00
Crit W.S. (m)	189.80	Flow Area (m2)		13.72	
E.G. Slope (m/m)	0.001663	Area (m2)	2.81	14.60	47.27
Q Total (m3/s)	24.80	Flow (m3/s)		24.80	
Top Width (m)	67.85	Top Width (m)	3.35	7.50	56.99
Vel Total (m/s)	1.81	Avg. Vel. (m/s)		1.81	
Max Chl Dpth (m)	1.98	Hydr. Depth (m)		1.96	
Conv. Total (m3/s)	607.9	Conv. (m3/s)		607.9	
Length Wtd. (m)	75.00	Wetted Per. (m)		7.11	
Min Ch El (m)	188.70	Shear (N/m2)		31.50	
Alpha	1.00	Stream Power (N/m s)		56.93	
Frctn Loss (m)		Cum Volume (1000 m3)	30.61	49.48	25.42
C & E Loss (m)		Cum SA (1000 m2)	30.03	16.06	32.56

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	194.30	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.		0.035	0.050
W.S. Elev (m)	194.29	Reach Len. (m)	75.00	75.00	75.00
Crit W.S. (m)	192.06	Flow Area (m2)		39.01	393.75
E.G. Slope (m/m)	0.000051	Area (m2)	52.93	41.70	393.75
Q Total (m3/s)	133.76	Flow (m3/s)		24.89	108.87
Top Width (m)	195.26	Top Width (m)	40.72	7.50	147.04
Vel Total (m/s)	0.31	Avg. Vel. (m/s)		0.64	0.28
Max Chl Dpth (m)	5.59	Hydr. Depth (m)		5.57	2.68
Conv. Total (m3/s)	18640.6	Conv. (m3/s)		3469.1	15171.5
Length Wtd. (m)	75.00	Wetted Per. (m)		7.11	147.25
Min Ch El (m)	188.70	Shear (N/m2)		2.77	1.35
Alpha	1.44	Stream Power (N/m s)		1.77	0.37
Frctn Loss (m)		Cum Volume (1000 m3)	123.50	113.05	124.03
C & E Loss (m)		Cum SA (1000 m2)	58.18	16.06	75.80

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.0815

INPUT
Description: Hum 13-1R. Jane Street. 6.0 m W x 4.3 m H x 65 m L Concrete Box Culvert. Previous drawings by Ducan Hopper (1964) are out of date. Culvert modified as part of Highway 407, but no drawings available. Field observations used to update previous HEC-2 coding.

HEC-2 to HEC-RAS conversion January 2004 by Acres
included recoding of culvert to HEC-RAS format, including adjustments to roadway coding and hydraulic loss coefficients.
Distance from Upstream XS = 5
Deck/Roadway Width = 65
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 5

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	200	126	196.5	235	193.5
267	194	300	195		

Upstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	196	50	195	94	194	116	192	122	189
123	188.7	129	188.7	129.5	189	132	189.5	175	190
192	191	220	192	225	193	267	194	300	195

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	122	.035	129.5	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
122	129.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	122.5	196.5	F
129.5	300	193.5	F

Downstream Deck/Roadway Coordinates
num= 5

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	200	126	196.5	235	193.5
267	194	300	195		

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	196	50	195	94	194	116	192	122	189
123	188.7	129	188.7	129.5	189	132	189.5	175	190
192	191	220	192	225	193	267	194	300	195

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	122	.035	129.5	.08	225	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
122	129.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	122.5	196.5	F
129.5	300	191.8	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 = 193.5
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	4.3	6

FHWA Chart # 58- Rectangular concrete
FHWA Scale # 2 - Side tapered; More favorable edges
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef

```
                5      65     .015     .015        0                    .5
      1
Upstream   Elevation =  188.7
           Centerline Station =  126
Downstream Elevation =  188.7
           Centerline Station =  126

CULVERT OUTPUT  Profile #100-year  Culv Group:  Culvert #1

  Q Culv Group (m3/s)      24.80    Culv Full Len (m)
  # Barrels                   1    Culv Vel US (m/s)         2.57
  Q Barrel (m3/s)          24.80    Culv Vel DS (m/s)         3.02
  E.G. US. (m)            190.84    Culv Inv El Up (m)      188.70
  W.S. US. (m)            190.68    Culv Inv El Dn (m)      188.70
  E.G. DS (m)             190.42    Culv Frctn Ls (m)         0.01
  W.S. DS (m)             190.07    Culv Exit Loss (m)        0.12
  Delta EG (m)              0.43    Culv Entr Loss (m)        0.20
  Delta WS (m)              0.61    Q Weir (m3/s)
  E.G. IC (m)             190.84    Weir Sta Lft (m)
  E.G. OC (m)             190.81    Weir Sta Rgt (m)
  Culvert Control          Inlet    Weir Submerg
  Culv WS Inlet (m)       190.31    Weir Max Depth (m)
  Culv WS Outlet (m)      190.07    Weir Avg Depth (m)
  Culv Nml Depth (m)                Weir Flow Area (m2)
  Culv Crt Depth (m)        1.20    Min El Weir Flow (m)    193.50


CULVERT OUTPUT  Profile #Regional w red'n  Culv Group:  Culvert #1

  Q Culv Group (m3/s)     104.27    Culv Full Len (m)
  # Barrels                   1    Culv Vel US (m/s)         4.54
  Q Barrel (m3/s)         104.27    Culv Vel DS (m/s)         5.54
  E.G. US. (m)            194.30    Culv Inv El Up (m)      188.70
  W.S. US. (m)            194.29    Culv Inv El Dn (m)      188.70
  E.G. DS (m)             191.93    Culv Frctn Ls (m)         0.06
  W.S. DS (m)             191.80    Culv Exit Loss (m)        1.47
  Delta EG (m)              2.37    Culv Entr Loss (m)        0.72
  Delta WS (m)              2.49    Q Weir (m3/s)            29.50
  E.G. IC (m)             194.30    Weir Sta Lft (m)        205.90
  E.G. OC (m)             194.25    Weir Sta Rgt (m)        276.93
  Culvert Control          Inlet    Weir Submerg              0.00
  Culv WS Inlet (m)       192.53    Weir Max Depth (m)        0.80
  Culv WS Outlet (m)      191.83    Weir Avg Depth (m)        0.43
  Culv Nml Depth (m)                Weir Flow Area (m2)      30.77
  Culv Crt Depth (m)        3.13    Min El Weir Flow (m)    193.50


CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 46.081

INPUT
Description: Section 46.081 - Jane Steet - D/S Bounding Section - J.D. Barnes
             2003 topo mapping
Station Elevation Data    num=      15
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0     196      50     195      94     194     116     192     122     189
     123   188.7     129   188.7   129.5     189     132   189.5     175     190
     192     191     220     192     225     193     267     194     300     195

Manning's n Values        num=       4
```

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	122	.035	129.5	.08	225	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
122	129.5	185	175	145	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	122.5	196.5	F
129.5	300	191.8	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	190.42	Element	Left OB	Channel	Right OB
Vel Head (m)	0.35	Wt. n-Val.		0.035	
W.S. Elev (m)	190.07	Reach Len. (m)	185.00	175.00	145.00
Crit W.S. (m)	189.80	Flow Area (m2)		9.46	
E.G. Slope (m/m)	0.005752	Area (m2)	1.14	10.03	15.71
Q Total (m3/s)	24.80	Flow (m3/s)		24.80	
Top Width (m)	56.27	Top Width (m)	2.13	7.50	46.64
Vel Total (m/s)	2.62	Avg. Vel. (m/s)		2.62	
Max Chl Dpth (m)	1.37	Hydr. Depth (m)		1.35	
Conv. Total (m3/s)	326.9	Conv. (m3/s)		326.9	
Length Wtd. (m)	166.20	Wetted Per. (m)		7.11	
Min Ch El (m)	188.70	Shear (N/m2)		75.07	
Alpha	1.00	Stream Power (N/m s)		196.84	
Frctn Loss (m)	1.19	Cum Volume (1000 m3)	30.61	48.52	25.42
C & E Loss (m)	0.11	Cum SA (1000 m2)	29.82	15.50	28.67

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.93	Element	Left OB	Channel	Right OB
Vel Head (m)	0.13	Wt. n-Val.		0.035	0.080
W.S. Elev (m)	191.80	Reach Len. (m)	185.00	175.00	

145.00					
Crit W.S. (m)	191.80	Flow Area (m2)			21.59
125.59					
E.G. Slope (m/m)	0.001613	Area (m2)		7.84	23.03
125.59					
Q Total (m3/s)	133.76	Flow (m3/s)			51.97
81.79					
Top Width (m)	98.00	Top Width (m)		5.60	7.50
84.90					
Vel Total (m/s)	0.91	Avg. Vel. (m/s)			2.41
0.65					
Max Chl Dpth (m)	3.10	Hydr. Depth (m)			3.08
1.48					
Conv. Total (m3/s)	3330.5	Conv. (m3/s)			1294.0
2036.5					
Length Wtd. (m)	155.29	Wetted Per. (m)			7.11
85.00					
Min Ch El (m)	188.70	Shear (N/m2)			48.07
23.37					
Alpha	3.04	Stream Power (N/m s)			115.71
15.22					
Frctn Loss (m)	0.24	Cum Volume (1000 m3)		123.50	106.93
124.03					
C & E Loss (m)	0.04	Cum SA (1000 m2)		56.44	15.50
67.10					

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.07

INPUT
Description: Section 46.07 - J.D. Barnes 2003 topo mapping
Section 46.06
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	193	15	190	20	189	24	188	25	188
25	187.7	27	187.7	27	188	30	188	64	189
70	190	102	193	146	193	157	194		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	25	.035	27	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
25	27	95	165	125	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	189.12	Element	Left OB	Channel	Right OB
Vel Head (m)	0.13	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	188.99	Reach Len. (m)	95.00	165.00	125.00
Crit W.S. (m)		Flow Area (m2)	2.93	2.57	19.49
E.G. Slope (m/m)	0.009195	Area (m2)	2.93	2.57	19.49
Q Total (m3/s)	24.80	Flow (m3/s)	2.44	7.00	15.36
Top Width (m)	43.47	Top Width (m)	4.94	2.00	36.52
Vel Total (m/s)	0.99	Avg. Vel. (m/s)	0.83	2.72	0.79
Max Chl Dpth (m)	1.29	Hydr. Depth (m)	0.59	1.29	0.53
Conv. Total (m3/s)	258.6	Conv. (m3/s)	25.4	73.0	160.2
Length Wtd. (m)	133.79	Wetted Per. (m)	5.07	2.60	36.54
Min Ch El (m)	187.70	Shear (N/m2)	52.17	89.20	48.09
Alpha	2.58	Stream Power (N/m s)	43.42	242.64	37.91
Frctn Loss (m)	1.22	Cum Volume (1000 m3)	30.23	47.42	22.87
C & E Loss (m)	0.01	Cum SA (1000 m2)	29.16	14.67	22.64

Warning: The energy loss was 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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.31	Element	Left OB	Channel	Right OB
Vel Head (m)	0.06	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	191.26	Reach Len. (m)	95.00	165.00	125.00
Crit W.S. (m)		Flow Area (m2)	27.00	7.11	122.40
E.G. Slope (m/m)	0.001526	Area (m2)	27.00	7.11	122.40
Q Total (m3/s)	133.76	Flow (m3/s)	18.22	15.53	100.02
Top Width (m)	74.67	Top Width (m)	16.28	2.00	56.39
Vel Total (m/s)	0.85	Avg. Vel. (m/s)	0.67	2.18	0.82
Max Chl Dpth (m)	3.56	Hydr. Depth (m)	1.66	3.56	2.17
Conv. Total (m3/s)	3423.9	Conv. (m3/s)	466.3	397.4	

2560.2					
Length Wtd. (m)	117.48	Wetted Per. (m)	16.62	2.60	56.55
Min Ch El (m)	187.70	Shear (N/m2)	24.31	40.94	32.40
Alpha	1.53	Stream Power (N/m s)	16.40	89.38	26.47
Frctn Loss (m)	0.05	Cum Volume (1000 m3)	120.28	104.29	106.05
C & E Loss (m)	0.01	Cum SA (1000 m2)	54.41	14.67	56.86

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: RIVER-1
REACH: Reach-1 RS: 46.06

INPUT
Description: Section 46.06 - J.D. Barnes 2003 topo mapping
Section 46.06
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	192	25	191	47	190	55	188	114	187
118	186.9	119	186.4	121	186.4	122	186.9	125	187
142	192	187	192	217	192	222	191	255	191
257	192	275	193						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	118	.035	122	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
118	122	130	165	145	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
142	275	192.1	T

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	187.89	Element	Left OB	Channel	Right OB
Vel Head (m)	0.23	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	187.66	Reach Len. (m)	130.00	165.00	145.00
Crit W.S. (m)	187.66	Flow Area (m2)	15.80	4.55	2.88
E.G. Slope (m/m)	0.008997	Area (m2)	15.80	4.55	2.88
Q Total (m3/s)	24.80	Flow (m3/s)	9.60	12.93	2.27
Top Width (m)	52.35	Top Width (m)	43.09	4.00	5.25
Vel Total (m/s)	1.07	Avg. Vel. (m/s)	0.61	2.84	0.79

Max Chl Dpth (m)	1.26	Hydr. Depth (m)	0.37	1.14	0.55
Conv. Total (m3/s)	261.4	Conv. (m3/s)	101.2	136.3	23.9
Length Wtd. (m)	156.17	Wetted Per. (m)	43.10	4.24	5.35
Min Ch El (m)	186.40	Shear (N/m2)	32.35	94.77	47.56
Alpha	3.88	Stream Power (N/m s)	19.65	269.37	37.36
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	29.34	46.83	21.47
C & E Loss (m)	0.07	Cum SA (1000 m2)	26.88	14.17	20.03

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 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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.25	Element	Left OB	Channel	Right OB
Vel Head (m)	0.02	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	191.23	Reach Len. (m)	130.00	165.00	145.00
Crit W.S. (m)		Flow Area (m2)	271.80	18.82	43.27
E.G. Slope (m/m)	0.000217	Area (m2)	271.80	18.82	51.07
Q Total (m3/s)	133.76	Flow (m3/s)	98.07	21.40	14.29
Top Width (m)	154.77	Top Width (m)	98.77	4.00	52.00
Vel Total (m/s)	0.40	Avg. Vel. (m/s)	0.36	1.14	0.33
Max Chl Dpth (m)	4.83	Hydr. Depth (m)	2.75	4.71	2.49
Conv. Total (m3/s)	9083.5	Conv. (m3/s)	6659.4	1453.4	970.7
Length Wtd. (m)	148.83	Wetted Per. (m)	99.05	4.24	18.00
Min Ch El (m)	186.40	Shear (N/m2)	5.84	9.45	5.11
Alpha	1.96	Stream Power (N/m s)	2.11	10.75	

1.69					
Frctn Loss (m)	0.01	Cum Volume (1000 m3)	106.09	102.15	95.21
C & E Loss (m)	0.00	Cum SA (1000 m2)	48.95	14.17	50.09

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.05

INPUT
Description: Section 46.05 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	193	30	192	72	191	90	186	93	185
95	184.8	100	184.5	123	184.5	128	184.8	150	189
170	190	190	191	210	192	217	191	260	190
280	190	292	193						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	95	.035	128	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
95	128	70	70	65	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
210	292	192.1	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	187.52	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	187.52	Reach Len. (m)	70.00	70.00	65.00
Crit W.S. (m)	184.93	Flow Area (m2)	15.47	98.20	19.40
E.G. Slope (m/m)	0.000015	Area (m2)	15.47	98.20	19.40
Q Total (m3/s)	24.80	Flow (m3/s)	0.96	22.69	1.15
Top Width (m)	57.73	Top Width (m)	10.48	33.00	14.25
Vel Total (m/s)	0.19	Avg. Vel. (m/s)	0.06	0.23	0.06
Max Chl Dpth (m)	3.02	Hydr. Depth (m)	1.48	2.98	1.36
Conv. Total (m3/s)	6342.1	Conv. (m3/s)	245.0	5802.9	294.2
Length Wtd. (m)	69.23	Wetted Per. (m)	10.86	33.02	14.51

Min Ch El (m)	184.50	Shear (N/m2)	0.21	0.45	0.20
Alpha	1.42	Stream Power (N/m s)	0.01	0.10	0.01
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	27.31	38.36	19.85
C & E Loss (m)	0.00	Cum SA (1000 m2)	23.40	11.12	18.62

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.24	Element	Left OB	Channel	Right OB
Vel Head (m)	0.01	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	191.23	Reach Len. (m)	70.00	70.00	65.00
Crit W.S. (m)	185.72	Flow Area (m2)	79.98	220.47	144.74
E.G. Slope (m/m)	0.000024	Area (m2)	79.98	220.47	203.68
Q Total (m3/s)	133.76	Flow (m3/s)	8.82	110.04	14.90
Top Width (m)	201.52	Top Width (m)	32.51	33.00	136.02
Vel Total (m/s)	0.30	Avg. Vel. (m/s)	0.11	0.50	0.10
Max Chl Dpth (m)	6.73	Hydr. Depth (m)	2.46	6.68	2.18
Conv. Total (m3/s)	27150.8	Conv. (m3/s)	1790.8	22336.0	3024.0
Length Wtd. (m)	68.38	Wetted Per. (m)	33.36	33.02	66.98
Min Ch El (m)	184.50	Shear (N/m2)	0.57	1.59	0.51
Alpha	2.29	Stream Power (N/m s)	0.06	0.79	0.05
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	83.22	82.41	76.74
C & E Loss (m)	0.00	Cum SA (1000 m2)	40.42	11.12	36.45

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.04

INPUT
Description: Section 46.04 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	192	38	192	65	191	107	190	120	189
126	185	127	184	130	184	131	184.5	135	185
148	189	190	189.5	205	189	220	189	232	192

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	126	.035	131	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
126	131	115	100	70	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
190	232	190	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	187.52	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	187.48	Reach Len. (m)	115.00	100.00	70.00
Crit W.S. (m)	185.46	Flow Area (m2)	4.60	16.64	20.88
E.G. Slope (m/m)	0.000306	Area (m2)	4.60	16.64	20.88
Q Total (m3/s)	24.80	Flow (m3/s)	1.03	17.32	6.44
Top Width (m)	20.77	Top Width (m)	3.72	5.00	12.05
Vel Total (m/s)	0.59	Avg. Vel. (m/s)	0.22	1.04	0.31
Max Chl Dpth (m)	3.48	Hydr. Depth (m)	1.24	3.33	1.73
Conv. Total (m3/s)	1417.3	Conv. (m3/s)	58.7	990.2	368.4
Length Wtd. (m)	98.06	Wetted Per. (m)	4.47	5.53	12.45
Min Ch El (m)	184.00	Shear (N/m2)	3.09	9.03	5.03
Alpha	2.26	Stream Power (N/m s)	0.69	9.40	1.55
Frctn Loss (m)	0.03	Cum Volume (1000 m3)	26.61	34.34	18.54
C & E Loss (m)	0.00	Cum SA (1000 m2)	22.90	9.79	17.76

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.23	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	191.19	Reach Len. (m)	115.00	100.00	70.00
Crit W.S. (m)	187.49	Flow Area (m2)	76.88	35.22	233.69
E.G. Slope (m/m)	0.000190	Area (m2)	76.88	35.22	233.69
Q Total (m3/s)	133.76	Flow (m3/s)	14.46	47.70	71.61
Top Width (m)	169.03	Top Width (m)	66.26	5.00	97.78
Vel Total (m/s)	0.39	Avg. Vel. (m/s)	0.19	1.35	0.31
Max Chl Dpth (m)	7.19	Hydr. Depth (m)	1.16	7.04	2.39
Conv. Total (m3/s)	9694.4	Conv. (m3/s)	1047.8	3457.0	5189.6
Length Wtd. (m)	95.43	Wetted Per. (m)	67.52	5.53	98.69
Min Ch El (m)	184.00	Shear (N/m2)	2.13	11.89	4.42
Alpha	4.73	Stream Power (N/m s)	0.40	16.10	1.35
Frctn Loss (m)	0.00	Cum Volume (1000 m3)	77.73	73.46	62.53
C & E Loss (m)	0.01	Cum SA (1000 m2)	36.96	9.79	28.86

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: RIVER-1
REACH: Reach-1 RS: 46.032

INPUT
Description: Section 46.032 - CNR - U/S Bounding Section - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	191.25	6	191	9.7	190	13.7	189.8	58	189
88.3	188	109.3	185	121.7	184.2	125	184	181.4	182.6
195.4	182.6	209	184	287.6	185	289.7	187	297.1	188
316	189	328	189	334	185.4	350	192		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	125	.035	209	.08

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

```
          125     209              50      50      50             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0   182.9   189.8       F
   193.9     350   191.5       F
```

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	187.49	Element	Left OB	Channel	Right OB
Vel Head (m)	0.08	Wt. n-Val.		0.035	
W.S. Elev (m)	187.41	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	184.15	Flow Area (m2)		52.87	
E.G. Slope (m/m)	0.000242	Area (m2)	65.97	354.71	240.20
Q Total (m3/s)	66.97	Flow (m3/s)		66.97	
Top Width (m)	208.45	Top Width (m)	32.54	84.00	91.91
Vel Total (m/s)	1.27	Avg. Vel. (m/s)		1.27	
Max Chl Dpth (m)	4.81	Hydr. Depth (m)		4.81	
Conv. Total (m3/s)	4301.8	Conv. (m3/s)		4301.8	
Length Wtd. (m)	50.00	Wetted Per. (m)		11.00	
Min Ch El (m)	182.60	Shear (N/m2)		11.42	
Alpha	1.00	Stream Power (N/m s)		14.47	
Frctn Loss (m)		Cum Volume (1000 m3)	22.55	15.77	9.41
C & E Loss (m)		Cum SA (1000 m2)	20.82	5.34	14.12

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	191.22	Element	Left OB	Channel	Right OB
Vel Head (m)	0.00	Wt. n-Val.	0.080	0.035	
W.S. Elev (m)	191.22	Reach Len. (m)	50.00	50.00	50.00
Crit W.S. (m)	185.84	Flow Area (m2)	375.67	554.11	
E.G. Slope (m/m)	0.000007	Area (m2)	375.67	674.68	709.24
Q Total (m3/s)	200.64	Flow (m3/s)	26.82	173.83	
Top Width (m)	347.26	Top Width (m)	124.16	84.00	139.10
Vel Total (m/s)	0.22	Avg. Vel. (m/s)	0.07	0.31	

Max Chl Dpth (m)	8.62	Hydr. Depth (m)	3.03	8.04
Conv. Total (m3/s)	73340.5	Conv. (m3/s)	9801.9	63538.5
Length Wtd. (m)	50.00	Wetted Per. (m)	124.57	68.92
Min Ch El (m)	182.60	Shear (N/m2)	0.22	0.59
Alpha	1.85	Stream Power (N/m s)	0.02	0.19
Frctn Loss (m)		Cum Volume (1000 m3)	51.71	37.97
29.53				
C & E Loss (m)		Cum SA (1000 m2)	26.01	5.34
20.57				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: RIVER-1
REACH: Reach-1 RS: 46.0315

INPUT
Description: Hum 13-1RR. CNR Culvert. Twin 3.0 m W x 3.5 m H x 32 m L
Structural Steel Plate Arch Culverts. No drawings available.
Size estimated from HEC-2 coding.

HEC-2 to HEC-RAS conversion
January 2004 by Acres included recoding of culvert to HEC-RAS format, including adjustments to roadway coding and hydraulic loss coefficients.

Distance from Upstream XS = 13
Deck/Roadway Width = 32
Weir Coefficient = 1.4
Upstream Deck/Roadway Coordinates
num= 10

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	191.2		5	191		8.7	190	
12.7	189.8		16.6	190		25	190.3	
115.5	191		274.1	192		335	192.5	
350	192.65							

Upstream Bridge Cross Section Data
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	191.25	6	191	9.7	190	13.7	189.8	58	189
88.3	188	109.3	185	121.7	184.2	125	184	181.4	182.6
195.4	182.6	209	184	287.6	185	289.7	187	297.1	188
316	189	328	189	334	185.4	350	192		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	125	.035	209	.08

Bank Sta: Left Right Coeff Contr. Expan.
125 209 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent

0	182.9	189.8	F
193.9	350	191.5	F

Downstream Deck/Roadway Coordinates
num= 10

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	191.2		5	191		8.7	190	
12.7	189.8		16.6	190		25	190.3	
115.5	191		274.1	192		335	192.5	
350	192.65							

Downstream Bridge Cross Section Data
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	191.2	6	191	9.7	190	13.7	189.8	58	189
88.3	188	109.3	185	121.7	184.2	125	184	170	183.2
171	182.6	180	182.6	181	183.2	195	184	310	190

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	170	.035	181	.08

Bank Sta: Left	Right	Coeff Contr.	Expan.
170	181	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	170	187	F
181	310	187	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 = 190.5
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	Ellipse	3.5	3

FHWA Chart # 30- Vertical Ellipse; Concrete
FHWA Scale # 1 - Square edge with headwall
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	13	32	.024	.024	0	.7	1

Number of Barrels = 2
Upstream Elevation = 182.6
Centerline Stations

Sta.	Sta.
185.4	191.4

Downstream Elevation = 182.6
Centerline Stations

Sta.	Sta.
172	178

CULVERT OUTPUT Profile #100-year Culv Group: Culvert #1

Q Culv Group (m3/s)	66.97	Culv Full Len (m)	
# Barrels	2	Culv Vel US (m/s)	4.07
Q Barrel (m3/s)	33.49	Culv Vel DS (m/s)	5.02

E.G. US. (m)	187.49	Culv Inv El Up (m)	182.60
W.S. US. (m)	187.41	Culv Inv El Dn (m)	182.60
E.G. DS (m)	184.99	Culv Frctn Ls (m)	0.01
W.S. DS (m)	184.22	Culv Exit Loss (m)	1.53
Delta EG (m)	2.50	Culv Entr Loss (m)	0.59
Delta WS (m)	3.19	Q Weir (m3/s)	
E.G. IC (m)	187.09	Weir Sta Lft (m)	
E.G. OC (m)	187.49	Weir Sta Rgt (m)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (m)	186.05	Weir Max Depth (m)	
Culv WS Outlet (m)	185.24	Weir Avg Depth (m)	
Culv Nml Depth (m)		Weir Flow Area (m2)	
Culv Crt Depth (m)	2.64	Min El Weir Flow (m)	190.50

CULVERT OUTPUT Profile #Regional w red'n Culv Group: Culvert #1

Q Culv Group (m3/s)	112.90	Culv Full Len (m)	29.43
# Barrels	2	Culv Vel US (m/s)	6.84
Q Barrel (m3/s)	56.45	Culv Vel DS (m/s)	7.01
E.G. US. (m)	191.22	Culv Inv El Up (m)	182.60
W.S. US. (m)	191.22	Culv Inv El Dn (m)	182.60
E.G. DS (m)	187.51	Culv Frctn Ls (m)	1.06
W.S. DS (m)	185.89	Culv Exit Loss (m)	0.89
Delta EG (m)	3.71	Culv Entr Loss (m)	1.67
Delta WS (m)	5.32	Q Weir (m3/s)	87.74
E.G. IC (m)	191.21	Weir Sta Lft (m)	0.68
E.G. OC (m)	191.22	Weir Sta Rgt (m)	150.71
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (m)	186.10	Weir Max Depth (m)	1.40
Culv WS Outlet (m)	185.89	Weir Avg Depth (m)	0.51
Culv Nml Depth (m)		Weir Flow Area (m2)	76.97
Culv Crt Depth (m)	3.25	Min El Weir Flow (m)	190.50

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.031

INPUT
Description: Section 46.031 - CNR - D/S Bounding Section - J.D. Barnes 2003 topo mapping

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	191.2	6	191	9.7	190	13.7	189.8	58	189
88.3	188	109.3	185	121.7	184.2	125	184	170	183.2
171	182.6	180	182.6	181	183.2	195	184	310	190

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	170	.035	181	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
170	181	90	110	75	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	170	187	F
181	310	187	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	184.99	Element	Left OB	Channel	Right OB
Vel Head (m)	0.77	Wt. n-Val.		0.035	
W.S. Elev (m)	184.22	Reach Len. (m)	90.00	110.00	75.00
Crit W.S. (m)	184.22	Flow Area (m2)		17.18	
E.G. Slope (m/m)	0.010691	Area (m2)	28.11	17.18	9.07
Q Total (m3/s)	66.97	Flow (m3/s)		66.97	
Top Width (m)	77.69	Top Width (m)	48.55	11.00	18.14
Vel Total (m/s)	3.90	Avg. Vel. (m/s)		3.90	
Max Chl Dpth (m)	1.62	Hydr. Depth (m)		1.56	
Conv. Total (m3/s)	647.7	Conv. (m3/s)		647.7	
Length Wtd. (m)	102.88	Wetted Per. (m)		11.33	
Min Ch El (m)	182.60	Shear (N/m2)		158.94	
Alpha	1.00	Stream Power (N/m s)		619.61	
Frctn Loss (m)	0.24	Cum Volume (1000 m3)	22.55	6.82	9.41
C & E Loss (m)	0.37	Cum SA (1000 m2)	18.79	2.97	11.37

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 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, water surface was used.

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	187.51	Element	Left OB	Channel	Right OB
Vel Head (m)	1.62	Wt. n-Val.		0.035	
W.S. Elev (m)	185.89	Reach Len. (m)	90.00	110.00	75.00

Crit W.S. (m)	185.89	Flow Area (m2)		35.64	
E.G. Slope (m/m)	0.008428	Area (m2)	128.00	35.64	66.50
Q Total (m3/s)	200.64	Flow (m3/s)		200.64	
Top Width (m)	128.26	Top Width (m)	66.96	11.00	50.30
Vel Total (m/s)	5.63	Avg. Vel. (m/s)		5.63	
Max Chl Dpth (m)	3.29	Hydr. Depth (m)		3.24	
Conv. Total (m3/s)	2185.5	Conv. (m3/s)		2185.5	
Length Wtd. (m)	101.96	Wetted Per. (m)		11.33	
Min Ch El (m)	182.60	Shear (N/m2)		259.91	
Alpha	1.00	Stream Power (N/m s)		1463.36	
Frctn Loss (m)	0.23	Cum Volume (1000 m3)	51.71	11.26	29.53
C & E Loss (m)	0.78	Cum SA (1000 m2)	21.23	2.97	15.83

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 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, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.03

INPUT
Description: Section 46.03 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	189	17	183	34	182.3	35	182	39	182
40	182.3	43	183	88	182.5	89	181.5	93	181.5
94	182.5	96	183	100	184	103	185	138	187
187	188								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	88	.035	94	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
88	94	185	205	150	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	43	183.1	F

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	184.04	Element	Left OB	Channel	Right OB
Vel Head (m)	0.04	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	184.00	Reach Len. (m)	185.00	205.00	150.00
Crit W.S. (m)	183.28	Flow Area (m2)	96.30	14.00	4.49
E.G. Slope (m/m)	0.000995	Area (m2)	96.30	14.00	4.49
Q Total (m3/s)	66.97	Flow (m3/s)	45.19	20.35	1.43
Top Width (m)	85.83	Top Width (m)	73.83	6.00	6.00
Vel Total (m/s)	0.58	Avg. Vel. (m/s)	0.47	1.45	0.32
Max Chl Dpth (m)	2.50	Hydr. Depth (m)	1.30	2.33	0.75
Conv. Total (m3/s)	2122.9	Conv. (m3/s)	1432.3	645.2	45.4
Length Wtd. (m)	184.84	Wetted Per. (m)	74.19	6.83	6.18
Min Ch El (m)	181.50	Shear (N/m2)	12.67	20.00	7.10
Alpha	2.33	Stream Power (N/m s)	5.94	29.09	2.26
Frctn Loss (m)	0.32	Cum Volume (1000 m3)	16.95	5.11	8.90
C & E Loss (m)	0.01	Cum SA (1000 m2)	13.29	2.03	10.47

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	185.45	Element	Left OB	Channel	Right OB
Vel Head (m)	0.07	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	185.39	Reach Len. (m)	185.00	205.00	150.00
Crit W.S. (m)	183.85	Flow Area (m2)	201.48	22.32	16.79

E.G. Slope (m/m)	0.000999	Area (m2)	201.48	22.32	16.79
Q Total (m3/s)	200.64	Flow (m3/s)	149.42	44.40	6.81
Top Width (m)	99.53	Top Width (m)	77.76	6.00	15.77
Vel Total (m/s)	0.83	Avg. Vel. (m/s)	0.74	1.99	0.41
Max Chl Dpth (m)	3.89	Hydr. Depth (m)	2.59	3.72	1.06
Conv. Total (m3/s)	6347.1	Conv. (m3/s)	4726.9	1404.7	215.6
Length Wtd. (m)	181.78	Wetted Per. (m)	78.36	6.83	16.13
Min Ch El (m)	181.50	Shear (N/m2)	25.20	32.03	10.20
Alpha	1.86	Stream Power (N/m s)	18.69	63.72	4.14
Frctn Loss (m)	0.29	Cum Volume (1000 m3)	36.88	8.07	26.40
C & E Loss (m)	0.01	Cum SA (1000 m2)	14.72	2.03	13.35

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: RIVER-1
REACH: Reach-1 RS: 46.02

INPUT
Description: Section 46.02 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	189	18	183	41	182	44	181.7	44	181
46	181	47	181.7	50	182	70	183	78	185
90	186	120	187	150	188				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	44	.035	47	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
44	47	110	120	110	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	183.71	Element	Left OB	Channel	Right OB
Vel Head (m)	0.13	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	183.57	Reach Len. (m)	110.00	120.00	110.00
Crit W.S. (m)		Flow Area (m2)	30.30	7.36	27.25
E.G. Slope (m/m)	0.003860	Area (m2)	30.30	7.36	27.25

Q Total (m3/s)	66.97	Flow (m3/s)	24.89	19.90	22.18
Top Width (m)	56.00	Top Width (m)	27.71	3.00	25.29
Vel Total (m/s)	1.03	Avg. Vel. (m/s)	0.82	2.70	0.81
Max Chl Dpth (m)	2.57	Hydr. Depth (m)	1.09	2.45	1.08
Conv. Total (m3/s)	1077.9	Conv. (m3/s)	400.7	320.3	356.9
Length Wtd. (m)	113.76	Wetted Per. (m)	27.84	3.92	25.40
Min Ch El (m)	181.00	Shear (N/m2)	41.19	71.11	40.62
Alpha	2.48	Stream Power (N/m s)	33.85	192.16	33.06
Frctn Loss (m)	0.34	Cum Volume (1000 m3)	5.24	2.92	6.52
C & E Loss (m)	0.00	Cum SA (1000 m2)	3.89	1.11	8.12

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 OUTPUT Profile #Regional w red'n

E.G. Elev (m)	185.15	Element	Left OB	Channel	Right OB
Vel Head (m)	0.16	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	184.99	Reach Len. (m)	110.00	120.00	110.00
Crit W.S. (m)		Flow Area (m2)	72.73	11.63	67.24
E.G. Slope (m/m)	0.003026	Area (m2)	72.73	11.63	67.24
Q Total (m3/s)	200.64	Flow (m3/s)	85.86	37.73	77.05
Top Width (m)	65.95	Top Width (m)	31.98	3.00	30.97
Vel Total (m/s)	1.32	Avg. Vel. (m/s)	1.18	3.24	1.15
Max Chl Dpth (m)	3.99	Hydr. Depth (m)	2.27	3.88	2.17
Conv. Total (m3/s)	3647.3	Conv. (m3/s)	1560.7	685.9	1400.7
Length Wtd. (m)	112.32	Wetted Per. (m)	32.34	3.92	31.26
Min Ch El (m)	181.00	Shear (N/m2)	66.75	88.03	63.84
Alpha	1.76	Stream Power (N/m s)	78.79	285.62	73.15
Frctn Loss (m)	0.25	Cum Volume (1000 m3)	11.52	4.59	20.10
C & E Loss (m)	0.01	Cum SA (1000 m2)	4.57	1.11	9.85

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.01

INPUT
Description: Section 46.01 - J.D. Barnes 2003 topo mapping
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	189	14	188	20	182	33	181	34	180.4
37	180.4	38	182	87	183	98	185	106	186
126	187	180	188						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	33	.035	38	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
33	38	95	105	95	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	183.36	Element	Left OB	Channel	Right OB
Vel Head (m)	0.14	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	183.22	Reach Len. (m)	95.00	105.00	95.00
Crit W.S. (m)		Flow Area (m2)	23.16	13.02	35.59
E.G. Slope (m/m)	0.002412	Area (m2)	23.16	13.02	35.59
Q Total (m3/s)	66.97	Flow (m3/s)	19.18	30.43	17.36
Top Width (m)	69.45	Top Width (m)	14.22	5.00	50.23
Vel Total (m/s)	0.93	Avg. Vel. (m/s)	0.83	2.34	0.49
Max Chl Dpth (m)	2.82	Hydr. Depth (m)	1.63	2.60	0.71
Conv. Total (m3/s)	1363.7	Conv. (m3/s)	390.6	619.7	353.4
Length Wtd. (m)	100.25	Wetted Per. (m)	14.77	6.05	50.26
Min Ch El (m)	180.40	Shear (N/m2)	37.08	50.86	16.75
Alpha	3.15	Stream Power (N/m s)	30.72	118.91	8.17
Frctn Loss (m)	0.19	Cum Volume (1000 m3)	2.30	1.70	3.06
C & E Loss (m)	0.00	Cum SA (1000 m2)	1.59	0.63	3.97

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	184.89	Element	Left OB	Channel	Right OB
Vel Head (m)	0.13	Wt. n-Val.	0.080	0.035	

0.080					
W.S. Elev (m)	184.76	Reach Len. (m)	95.00	105.00	95.00
Crit W.S. (m)		Flow Area (m2)	46.23	20.71	119.40
E.G. Slope (m/m)	0.001702	Area (m2)	46.23	20.71	119.40
Q Total (m3/s)	200.64	Flow (m3/s)	46.54	55.43	98.67
Top Width (m)	79.46	Top Width (m)	15.76	5.00	58.69
Vel Total (m/s)	1.08	Avg. Vel. (m/s)	1.01	2.68	0.83
Max Chl Dpth (m)	4.36	Hydr. Depth (m)	2.93	4.14	2.03
Conv. Total (m3/s)	4863.7	Conv. (m3/s)	1128.2	1343.8	2391.7
Length Wtd. (m)	98.47	Wetted Per. (m)	16.95	6.05	58.86
Min Ch El (m)	180.40	Shear (N/m2)	45.53	57.11	33.85
Alpha	2.20	Stream Power (N/m s)	45.84	152.85	27.97
Frctn Loss (m)	0.16	Cum Volume (1000 m3)	4.97	2.65	9.84
C & E Loss (m)	0.01	Cum SA (1000 m2)	1.94	0.63	4.92

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.00

INPUT
Description: Section 46.00 - J.D. Barnes 2003 topo mapping (This section location corresponds to D/S HEC-RAS model section 475.53)

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	188	20	187	40	182	55	181	57	180
60	180	62	181	73	182	95	183	103	184
110	185	123	187	180	187				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	55	.035	62	.08

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
55	62	0	0	.1	.3

CROSS SECTION OUTPUT Profile #100-year

E.G. Elev (m)	183.18	Element	Left OB	Channel	Right OB
Vel Head (m)	0.14	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	183.04	Reach Len. (m)			
Crit W.S. (m)	182.26	Flow Area (m2)	25.26	19.28	28.83

E.G. Slope (m/m)	0.001480	Area (m2)	25.26	19.28	28.83
Q Total (m3/s)	66.97	Flow (m3/s)	14.53	39.87	12.57
Top Width (m)	59.48	Top Width (m)	19.16	7.00	33.32
Vel Total (m/s)	0.91	Avg. Vel. (m/s)	0.58	2.07	0.44
Max Chl Dpth (m)	3.04	Hydr. Depth (m)	1.32	2.75	0.87
Conv. Total (m3/s)	1740.6	Conv. (m3/s)	377.6	1036.3	326.7
Length Wtd. (m)		Wetted Per. (m)	19.32	7.47	33.39
Min Ch El (m)	180.00	Shear (N/m2)	18.98	37.46	12.53
Alpha	3.19	Stream Power (N/m s)	10.92	77.47	5.47
Frctn Loss (m)		Cum Volume (1000 m3)			
C & E Loss (m)		Cum SA (1000 m2)			

CROSS SECTION OUTPUT Profile #Regional w red'n

E.G. Elev (m)	184.73	Element	Left OB	Channel	Right OB
Vel Head (m)	0.19	Wt. n-Val.	0.080	0.035	0.080
W.S. Elev (m)	184.54	Reach Len. (m)			
Crit W.S. (m)	183.38	Flow Area (m2)	58.50	29.78	87.66
E.G. Slope (m/m)	0.001535	Area (m2)	58.50	29.78	87.66
Q Total (m3/s)	200.64	Flow (m3/s)	49.83	83.80	67.01
Top Width (m)	76.94	Top Width (m)	25.16	7.00	44.78
Vel Total (m/s)	1.14	Avg. Vel. (m/s)	0.85	2.81	0.76
Max Chl Dpth (m)	4.54	Hydr. Depth (m)	2.33	4.25	1.96
Conv. Total (m3/s)	5120.9	Conv. (m3/s)	1271.8	2138.8	1710.3
Length Wtd. (m)		Wetted Per. (m)	25.51	7.47	44.95
Min Ch El (m)	180.00	Shear (N/m2)	34.53	60.00	29.36
Alpha	2.83	Stream Power (N/m s)	29.41	168.84	22.44
Frctn Loss (m)		Cum Volume (1000 m3)			
C & E Loss (m)		Cum SA (1000 m2)			

SUMMARY OF MANNING'S N VALUES

River:RIVER-1

Reach	River Sta.	n1	n2	n3	n4	n5	n6	n7
Reach-1	46.45	.05	.035	.08				
Reach-1	46.44	.05	.035	.05				
Reach-1	46.43	.05	.08	.035	.08	.05		
Reach-1	46.42	.05	.08	.035	.08	.05		
Reach-1	46.413	.05	.08	.035	.08	.05		
Reach-1	46.4125	Inl Struct						
Reach-1	46.412	.05	.08	.035	.08	.05		
Reach-1	46.4115	Culvert						
Reach-1	46.411	.05	.08	.035	.08	.05		
Reach-1	46.41	.05	.08	.035	.08	.035	.08	.05
Reach-1	46.402	.05	.08	.035	.08	.05		
Reach-1	46.4015	Culvert						
Reach-1	46.401	.05	.08	.035	.08	.05		
Reach-1	46.392	.05	.025	.05	.08	.035	.08	.05
Reach-1	46.3915	Mult Open						
Reach-1	46.391	.05	.025	.05	.08	.05		
Reach-1	46.39	.05	.025	.05	.08	.035	.08	.05
Reach-1	46.382	.025	.08	.035	.08	.05		
Reach-1	46.3815	Culvert						
Reach-1	46.381	.025	.05	.08	.035	.08	.05	
Reach-1	46.36	.025	.05	.08	.035	.08	.05	
Reach-1	46.35	.025	.05	.08	.035	.08	.05	
Reach-1	46.34	.025	.05	.08	.035	.08	.05	
Reach-1	46.33	.05	.08	.035	.08	.05		
Reach-1	46.322	.05	.08	.035	.08	.05		
Reach-1	46.3215	Culvert						
Reach-1	46.321	.05	.08	.035	.08	.05		

Reach-1	46.32		.05	.08	.035	.08	.05
Reach-1	46.312		.05	.08	.035	.08	.05
Reach-1	46.3115	Culvert					
Reach-1	46.311		.05	.08	.035	.08	.05
Reach-1	46.31		.05	.08	.035	.08	.05
Reach-1	46.30		.05	.08	.035	.08	.025
.05							
Reach-1	46.292		.05	.08	.035	.08	.05
Reach-1	46.2915	Culvert					
Reach-1	46.291		.05	.08	.035	.08	.05
Reach-1	46.29		.05	.08	.035	.08	.05
Reach-1	46.282		.05	.08	.035	.08	.05
.025	.05						
Reach-1	46.2815	Culvert					
Reach-1	46.281		.05	.08	.035	.08	.05
.025	.05						
Reach-1	46.28		.05	.08	.035	.08	.05
.025	.05						
Reach-1	46.274		.05	.08	.035	.08	.05
Reach-1	46.2735	Bridge					
Reach-1	46.273		.05	.08	.035	.08	.05
Reach-1	46.272		.05	.08	.035	.08	.05
Reach-1	46.2715	Culvert					
Reach-1	46.271		.05	.05	.08	.035	.08
.05							
Reach-1	46.27		.08	.035	.08		
Reach-1	46.26		.05	.08	.035	.08	.05
Reach-1	46.25		.05	.08	.035	.08	.05
Reach-1	46.24		.05	.08	.035	.08	.05
Reach-1	46.2375		.05	.08	.035	.08	.05
Reach-1	46.235	Culvert					
Reach-1	46.2325		.05	.08	.035	.08	.05
Reach-1	46.23		.05	.08	.035	.08	.05
Reach-1	46.22		.08	.035	.08	.035	.05
Reach-1	46.214		.05	.035	.08		
Reach-1	46.2135	Inl Struct					
Reach-1	46.213		.05	.035	.08		

Reach-1	46.212	.05	.035	.08		
Reach-1	46.2115	Culvert				
Reach-1	46.211	.05	.035	.08		
Reach-1	46.21	.05	.035	.05		
Reach-1	46.202	.05	.035	.05		
Reach-1	46.2015	Culvert				
Reach-1	46.201	.05	.035	.05		
Reach-1	46.192	.05	.035	.05		
Reach-1	46.1915	Culvert				
Reach-1	46.191	.05	.035	.05		
Reach-1	46.19	.05	.025	.05	.035	.05
Reach-1	46.182	.05	.025	.05	.035	.05
Reach-1	46.1815	Culvert				
Reach-1	46.181	.05	.025	.05	.035	.05
Reach-1	46.18	.05	.035	.05		
Reach-1	46.172	.05	.035	.05		
Reach-1	46.1715	Culvert				
Reach-1	46.171	.05	.035	.05	.025	
Reach-1	46.17	.05	.035	.05	.025	
Reach-1	46.162	.05	.035	.05		
Reach-1	46.1615	Culvert				
Reach-1	46.161	.05	.035	.05		
Reach-1	46.15	.05	.08	.035	.08	.025
Reach-1	46.142	.05	.08	.035	.08	.025
Reach-1	46.1415	Culvert				
Reach-1	46.141	.05	.08	.035	.08	.025
Reach-1	46.14	.05	.08	.035	.08	.025
Reach-1	46.132	.05	.08	.035	.08	.05
Reach-1	46.13	.05	.08	.035	.08	.05
Reach-1	46.122	.05	.035	.05		
Reach-1	46.1215	Culvert				

Reach-1	46.121	.05	.035	.05	
Reach-1	46.12	.05	.035	.05	
Reach-1	46.11	.05	.035	.05	
Reach-1	46.1015	Culvert			
Reach-1	46.10	.05	.035	.05	
Reach-1	46.09	.05	.035	.05	
Reach-1	46.082	.05	.035	.05	
Reach-1	46.0815	Culvert			
Reach-1	46.081	.08	.035	.08	.05
Reach-1	46.07	.08	.035	.08	
Reach-1	46.06	.08	.035	.08	
Reach-1	46.05	.08	.035	.08	
Reach-1	46.04	.08	.035	.08	
Reach-1	46.032	.08	.035	.08	
Reach-1	46.0315	Culvert			
Reach-1	46.031	.08	.035	.08	
Reach-1	46.03	.08	.035	.08	
Reach-1	46.02	.08	.035	.08	
Reach-1	46.01	.08	.035	.08	
Reach-1	46.00	.08	.035	.08	

SUMMARY OF REACH LENGTHS

River: RIVER-1

Reach	River Sta.	Left	Channel	Right
Reach-1	46.45	180	180	170
Reach-1	46.44	130	130	125
Reach-1	46.43	100	100	95
Reach-1	46.42	295	240	190
Reach-1	46.413	5	5	5
Reach-1	46.4125	Inl Struct		
Reach-1	46.412	45	45	45
Reach-1	46.4115	Culvert		
Reach-1	46.411	80	80	90
Reach-1	46.41	140	140	120
Reach-1	46.402	100	100	100
Reach-1	46.4015	Culvert		

Reach-1	46.401		80	95	100
Reach-1	46.392		70	70	70
Reach-1	46.3915	Mult Open			
Reach-1	46.391		45	35	25
Reach-1	46.39		50	35	25
Reach-1	46.382		45	45	45
Reach-1	46.3815	Culvert			
Reach-1	46.381		260	275	290
Reach-1	46.36		150	150	150
Reach-1	46.35		120	120	120
Reach-1	46.34		225	205	190
Reach-1	46.33		130	130	130
Reach-1	46.322		50	50	50
Reach-1	46.3215	Culvert			
Reach-1	46.321		50	50	50
Reach-1	46.32		110	110	110
Reach-1	46.312		60	60	60
Reach-1	46.3115	Culvert			
Reach-1	46.311		150	150	150
Reach-1	46.31		150	150	150
Reach-1	46.30		110	110	110
Reach-1	46.292		55	55	55
Reach-1	46.2915	Culvert			
Reach-1	46.291		145	150	155
Reach-1	46.29		135	145	150
Reach-1	46.282		50	50	50
Reach-1	46.2815	Culvert			
Reach-1	46.281		40	40	40
Reach-1	46.28		50	50	50
Reach-1	46.274		1	1	1
Reach-1	46.2735	Bridge			
Reach-1	46.273		4	4	4
Reach-1	46.272		100	80	60
Reach-1	46.2715	Culvert			
Reach-1	46.271		55	60	70
Reach-1	46.27		100	110	120
Reach-1	46.26		115	120	120
Reach-1	46.25		140	130	125
Reach-1	46.24		54	51	45
Reach-1	46.2375		30	30	30
Reach-1	46.235	Culvert			
Reach-1	46.2325		94	94	94
Reach-1	46.23		101	95	89
Reach-1	46.22		125	140	115
Reach-1	46.214		1	1	1
Reach-1	46.2135	Inl Struct			
Reach-1	46.213		15	15	15
Reach-1	46.212		55	45	10
Reach-1	46.2115	Culvert			
Reach-1	46.211		10	10	10
Reach-1	46.21		30	30	30
Reach-1	46.202		70	70	70
Reach-1	46.2015	Culvert			
Reach-1	46.201		20	25	30
Reach-1	46.192		25	25	25
Reach-1	46.1915	Culvert			
Reach-1	46.191		50	50	50
Reach-1	46.19		45	45	45
Reach-1	46.182		30	30	30
Reach-1	46.1815	Culvert			
Reach-1	46.181		10	10	10
Reach-1	46.18		25	25	25
Reach-1	46.172		40	40	40

Reach-1	46.1715	Culvert		
Reach-1	46.171	20	20	20
Reach-1	46.17	25	25	25
Reach-1	46.162	30	30	30
Reach-1	46.1615	Culvert		
Reach-1	46.161	115	115	110
Reach-1	46.15	50	50	50
Reach-1	46.142	60	60	60
Reach-1	46.1415	Culvert		
Reach-1	46.141	30	25	20
Reach-1	46.14	37.5	37.5	37.5
Reach-1	46.132	27.5	27.5	27.5
Reach-1	46.13	25	25	25
Reach-1	46.122	38	38	38
Reach-1	46.1215	Culvert		
Reach-1	46.121	20	20	20
Reach-1	46.12	35	38	40
Reach-1	46.11	235	235	235
Reach-1	46.1015	Culvert		
Reach-1	46.10	130	200	160
Reach-1	46.09	80	95	125
Reach-1	46.082	75	75	75
Reach-1	46.0815	Culvert		
Reach-1	46.081	185	175	145
Reach-1	46.07	95	165	125
Reach-1	46.06	130	165	145
Reach-1	46.05	70	70	65
Reach-1	46.04	115	100	70
Reach-1	46.032	50	50	50
Reach-1	46.0315	Culvert		
Reach-1	46.031	90	110	75
Reach-1	46.03	185	205	150
Reach-1	46.02	110	120	110
Reach-1	46.01	95	105	95
Reach-1	46.00	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: RIVER-1

Reach	River Sta.	Contr.	Expan.
Reach-1	46.45	.1	.3
Reach-1	46.44	.1	.3
Reach-1	46.43	.1	.3
Reach-1	46.42	.1	.3
Reach-1	46.413	.3	.5
Reach-1	46.4125	Inl Struct	
Reach-1	46.412	.3	.5
Reach-1	46.4115	Culvert	
Reach-1	46.411	.3	.5
Reach-1	46.41	.1	.3
Reach-1	46.402	.3	.5
Reach-1	46.4015	Culvert	
Reach-1	46.401	.3	.5
Reach-1	46.392	.3	.5
Reach-1	46.3915	Mult Open	
Reach-1	46.391	.3	.5
Reach-1	46.39	.1	.3
Reach-1	46.382	.3	.5

Reach-1	46.3815	Culvert		
Reach-1	46.381		.3	.5
Reach-1	46.36		.1	.3
Reach-1	46.35		.1	.3
Reach-1	46.34		.1	.3
Reach-1	46.33		.1	.3
Reach-1	46.322		.3	.5
Reach-1	46.3215	Culvert		
Reach-1	46.321		.3	.5
Reach-1	46.32		.1	.3
Reach-1	46.312		.3	.5
Reach-1	46.3115	Culvert		
Reach-1	46.311		.3	.5
Reach-1	46.31		.1	.3
Reach-1	46.30		.1	.3
Reach-1	46.292		.3	.5
Reach-1	46.2915	Culvert		
Reach-1	46.291		.3	.5
Reach-1	46.29		.1	.3
Reach-1	46.282		.3	.5
Reach-1	46.2815	Culvert		
Reach-1	46.281		.3	.5
Reach-1	46.28		.1	.3
Reach-1	46.274		.3	.5
Reach-1	46.2735	Bridge		
Reach-1	46.273		.3	.5
Reach-1	46.272		.3	.5
Reach-1	46.2715	Culvert		
Reach-1	46.271		.3	.5
Reach-1	46.27		.1	.3
Reach-1	46.26		.1	.3
Reach-1	46.25		.1	.3
Reach-1	46.24		.1	.3
Reach-1	46.2375		.3	.5
Reach-1	46.235	Culvert		
Reach-1	46.2325		.3	.5
Reach-1	46.23		.1	.3
Reach-1	46.22		.1	.3
Reach-1	46.214		.3	.5
Reach-1	46.2135	Inl Struct		
Reach-1	46.213		.3	.5
Reach-1	46.212		.3	.5
Reach-1	46.2115	Culvert		
Reach-1	46.211		.3	.5
Reach-1	46.21		.1	.3
Reach-1	46.202		.3	.5
Reach-1	46.2015	Culvert		
Reach-1	46.201		.3	.5
Reach-1	46.192		.3	.5
Reach-1	46.1915	Culvert		
Reach-1	46.191		.3	.5
Reach-1	46.19		.1	.3
Reach-1	46.182		.3	.5
Reach-1	46.1815	Culvert		
Reach-1	46.181		.3	.5
Reach-1	46.18		.1	.3
Reach-1	46.172		.3	.5
Reach-1	46.1715	Culvert		
Reach-1	46.171		.3	.5
Reach-1	46.17		.1	.3
Reach-1	46.162		.3	.5
Reach-1	46.1615	Culvert		
Reach-1	46.161		.3	.5

Reach-1	46.15	.1	.3
Reach-1	46.142	.3	.5
Reach-1	46.1415	Culvert	
Reach-1	46.141	.3	.5
Reach-1	46.14	.1	.3
Reach-1	46.132	.3	.5
Reach-1	46.13	.1	.3
Reach-1	46.122	.3	.5
Reach-1	46.1215	Culvert	
Reach-1	46.121	.3	.5
Reach-1	46.12	.1	.3
Reach-1	46.11	.3	.5
Reach-1	46.1015	Culvert	
Reach-1	46.10	.3	.5
Reach-1	46.09	.1	.3
Reach-1	46.082	.3	.5
Reach-1	46.0815	Culvert	
Reach-1	46.081	.3	.5
Reach-1	46.07	.1	.3
Reach-1	46.06	.1	.3
Reach-1	46.05	.1	.3
Reach-1	46.04	.1	.3
Reach-1	46.032	.3	.5
Reach-1	46.0315	Culvert	
Reach-1	46.031	.3	.5
Reach-1	46.03	.1	.3
Reach-1	46.02	.1	.3
Reach-1	46.01	.1	.3
Reach-1	46.00	.1	.3

APPENDIX B

Storm Sewer Design Sheet

Storm Sewer Design Sheet

Location		Drainage Area				Runoff				Pipe Selection								
From CB/MH No.	To CB/MH No.	A ha	C	Cumul. A ha	Adjusted C	T_i min.	Cumul. Tc min.	I (Vaughan, 5yr) mm/hr	Q m^3/s	Dia. m	So m/m	Pipe Length m	Rough Coeff. n	Velocity (full) m/s	Actual Capacity (full) m^3/s	Time of Flow min.	Percent Full Flow	Actual Velocity m/s
101	102	0.3980	0.75	0.3980	0.75	7	7.00	137.17	**0.1137**	**0.450**	**0.002**	91.0	0.013	**0.80**	**0.1275**	1.89	89%	0.82
102	103			0.3980	0.75		8.89	120.86	**0.1002**	**0.450**	**0.002**	93.0	0.013	**0.80**	**0.1275**	1.93	79%	0.79
103	104	0.6530	0.75	1.0510	0.75		10.83	108.10	**0.2367**	**0.600**	**0.003**	127.0	0.013	**1.19**	**0.3363**	1.78	70%	1.13
104	105	0.2440	0.75	1.2950	0.75		12.60	98.75	**0.2664**	**0.600**	**0.003**	110.0	0.013	**1.19**	**0.3363**	1.54	79%	1.17
105	106	0.2250	0.75	1.5200	0.75		14.15	92.00	**0.2913**	**0.600**	**0.003**	98.0	0.013	**1.19**	**0.3363**	1.37	87%	1.20
106	107	0.3860	0.75	1.9060	0.75		15.52	86.80	**0.3447**	**0.675**	**0.003**	68.0	0.013	**1.29**	**0.4604**	0.88	75%	1.25
107	108			1.9060	0.75		16.40	83.79	**0.3327**	**0.675**	**0.003**	68.0	0.013	**1.29**	**0.4604**	0.88	72%	1.24
108	109	0.3590	0.75	2.2650	0.75		17.28	81.01	**0.3823**	**0.675**	**0.004**	74.0	0.013	**1.49**	**0.5316**	0.83	72%	1.43
109	STC			2.2650	0.75		18.11	78.58	**0.3708**	**0.675**	**0.004**	69.0	0.013	**1.49**	**0.5316**	0.77	70%	1.41
STC	Outlet			2.2650	0.75		18.89	76.45	**0.3607**	**0.675**	**0.004**	6.0	0.013	**1.49**	**0.5316**	0.07	68%	1.40
111	110	0.3230	0.75	0.3230	0.75	7	7.00	137.17	**0.0923**	**0.300**	**0.015**	100.0	0.013	**1.68**	**0.1184**	0.99	78%	1.64
110	STC	0.6670	0.75	0.9900	0.75		7.99	128.02	**0.2640**	**0.450**	**0.015**	10.0	0.013	**2.20**	**0.3492**	0.08	76%	2.13
STC	Outlet			0.9900	0.75		8.07	127.37	**0.2627**	**0.450**	**0.015**	7.0	0.013	**2.20**	**0.3492**	0.05	75%	2.13
112	Creditstone	0.3050	0.75	0.3050	0.75	7	7.00	137.17	**0.0872**	**0.300**	**0.015**	25.0	0.013	**1.68**	**0.1184**	0.25	74%	1.63

APPENDIX C

Stormceptor Sizing Reports

Detailed Stormceptor Sizing Report – Portage Extension

Project Information & Location			
Project Name	Portage	**Project Number**	1522372
City	Vaughan	**State/ Province**	Ontario
Country	Canada	**Date**	5/18/2016
Designer Information		**EOR Information (optional)**	
Name	Scott Taylor	**Name**	
Company	Golder Associates Ltd.	**Company**	
Phone #	613-592-9600	**Phone #**	
Email	staylor@golder.com	**Email**	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	Portage Extension
Recommended Stormceptor Model	STC 4000
Target TSS Removal (%)	80.0
TSS Removal (%) Provided	83
PSD	City of Toronto PSD
Rainfall Station	TORONTO CENTRAL

The recommended Stormceptor model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	**% TSS Removal Provided**
STC 300	61
STC 750	72
STC 1000	73
STC 1500	74
STC 2000	78
STC 3000	79
STC 4000	83
STC 5000	84
STC 6000	86
STC 9000	90
STC 10000	90
STC 14000	92
Stormceptor MAX	Custom

Stormceptor

The Stormceptor oil and sediment separator is sized to treat stormwater runoff by removing pollutants through gravity separation and flotation. Stormceptor's patented design generates positive TSS removal for each rainfall event, including large storms. Significant levels of pollutants such as heavy metals, free oils and nutrients are prevented from entering natural water resources and the re-suspension of previously captured sediment (scour) does not occur.
Stormceptor provides a high level of TSS removal for small frequent storm events that represent the majority of annual rainfall volume and pollutant load. Positive treatment continues for large infrequent events, however, such events have little impact on the average annual TSS removal as they represent a small percentage of the total runoff volume and pollutant load.

Design Methodology

Stormceptor is sized using PCSWMM for Stormceptor, a continuous simulation model based on US EPA SWMM. The program calculates hydrology using local historical rainfall data and specified site parameters. With US EPA SWMM's precision, every Stormceptor unit is designed to achieve a defined water quality objective. The TSS removal data presented follows US EPA guidelines to reduce the average annual TSS load. The Stormceptor's unit process for TSS removal is settling. The settling model calculates TSS removal by analyzing:

- Site parameters
- Continuous historical rainfall data, including duration, distribution, peaks & inter-event dry periods
- Particle size distribution, and associated settling velocities (Stokes Law, corrected for drag)
- TSS load
- Detention time of the system

Hydrology Analysis
PCSWMM for Stormceptor calculates annual hydrology with the US EPA SWMM and local continuous historical rainfall data. Performance calculations of Stormceptor are based on the average annual removal of TSS for the selected site parameters. The Stormceptor is engineered to capture sediment particles by treating the required average annual runoff volume, ensuring positive removal efficiency is maintained during each rainfall event, and preventing negative removal efficiency (scour). Smaller recurring storms account for the majority of rainfall events and average annual runoff volume, as observed in the historical rainfall data analyses presented in this section.

Rainfall Station			
State/Province	Ontario	**Total Number of Rainfall Events**	2719
Rainfall Station Name	TORONTO CENTRAL	**Total Rainfall (mm)**	13185.4
Station ID #	0100	**Average Annual Rainfall (mm)**	732.5
Coordinates	45°30'N, 90°30'W	**Total Evaporation (mm)**	1075.7
Elevation (ft)	328	**Total Infiltration (mm)**	2625.1
Years of Rainfall Data	18	**Total Rainfall that is Runoff**	9484.6

Notes
• Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules. • Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed. • For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

Drainage Area	
Total Area (ha)	0.99
Imperviousness %	80.0

Up Stream Storage	
Storage (ha-m)	Discharge (cms)
0.000	0.000

Water Quality Objective	
TSS Removal (%)	80.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (L)	
Peak Conveyed Flow Rate (L/s)	
Water Quality Flow Rate (L/s)	

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cms)	

Design Details	
Stormceptor Inlet Invert Elev (m)	199.20
Stormceptor Outlet Invert Elev (m)	199.20
Stormceptor Rim Elev (m)	201.50
Normal Water Level Elevation (m)	199.00
Pipe Diameter (mm)	450
Pipe Material	RCP - concrete
Multiple Inlets (Y/N)	No
Grate Inlet (Y/N)	No

Particle Size Distribution (PSD)

Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor design.

City of Toronto PSD		
Particle Diameter (microns)	Distribution %	Specific Gravity
10.0	20.0	2.65
30.0	10.0	2.65
50.0	10.0	2.65
95.0	20.0	2.65
265.0	20.0	2.65
1000.0	20.0	2.65

Site Name	Portage Extension

Site Details

Drainage Area

Total Area (ha)	0.99
Imperviousness %	80.0

Surface Characteristics

Width (m)	199.00
Slope %	2
Impervious Depression Storage (mm)	0.508
Pervious Depression Storage (mm)	5.08
Impervious Manning's n	0.015
Pervious Manning's n	0.25

Maintenance Frequency

Maintenance Frequency (months) >	12

Infiltration Parameters

Horton's equation is used to estimate infiltration

Max. Infiltration Rate (mm/hr)	61.98
Min. Infiltration Rate (mm/hr)	10.16
Decay Rate (1/sec)	0.00055
Regeneration Rate (1/sec)	0.01

Evaporation

Daily Evaporation Rate (mm/day)	2.54

Dry Weather Flow

Dry Weather Flow (lps)	0

Winter Months

Winter Infiltration	0

TSS Loading Parameters

TSS Loading Function	

Buildup/Wash-off Parameters

Target Event Mean Conc. (EMC) mg/L	
Exponential Buildup Power	
Exponential Washoff Exponent	

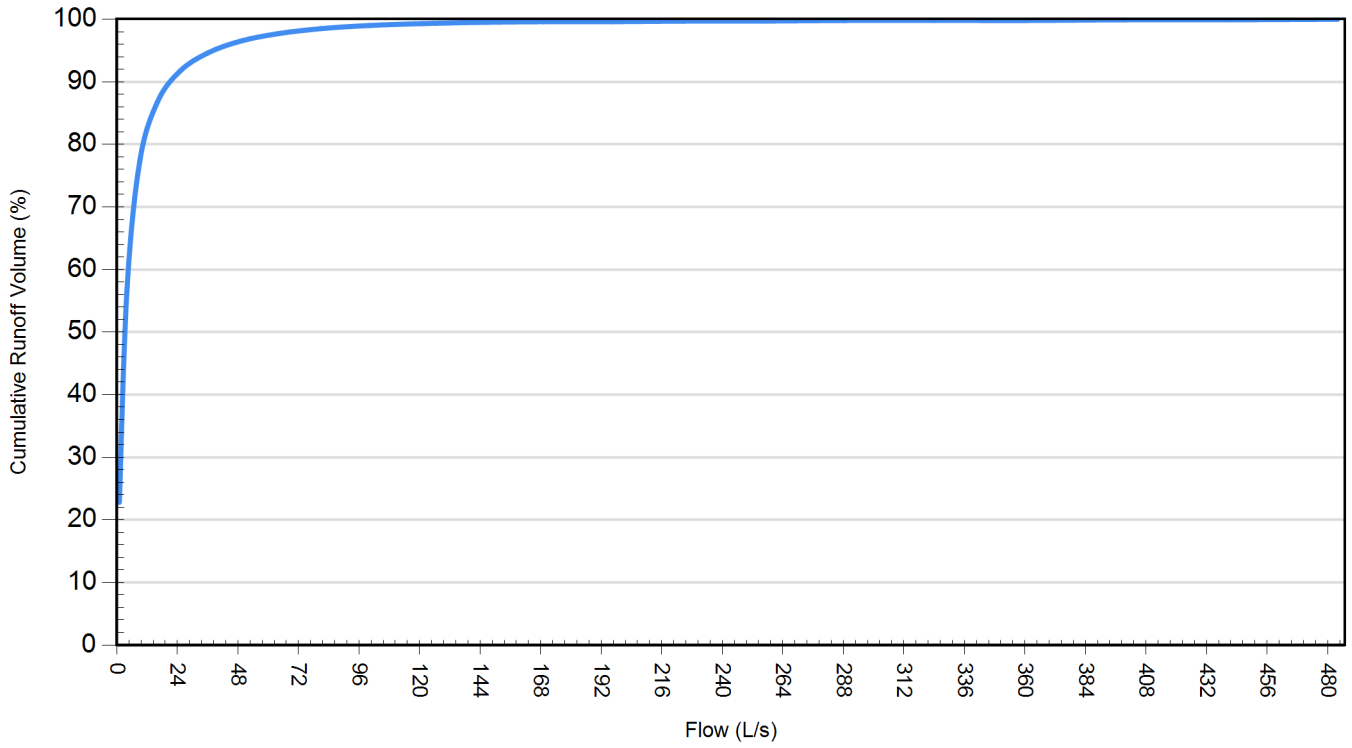
TSS Availability Parameters

Availability Constant A	
Availability Factor B	
Availability Exponent C	
Min. Particle Size Affected by Availability (micron)	

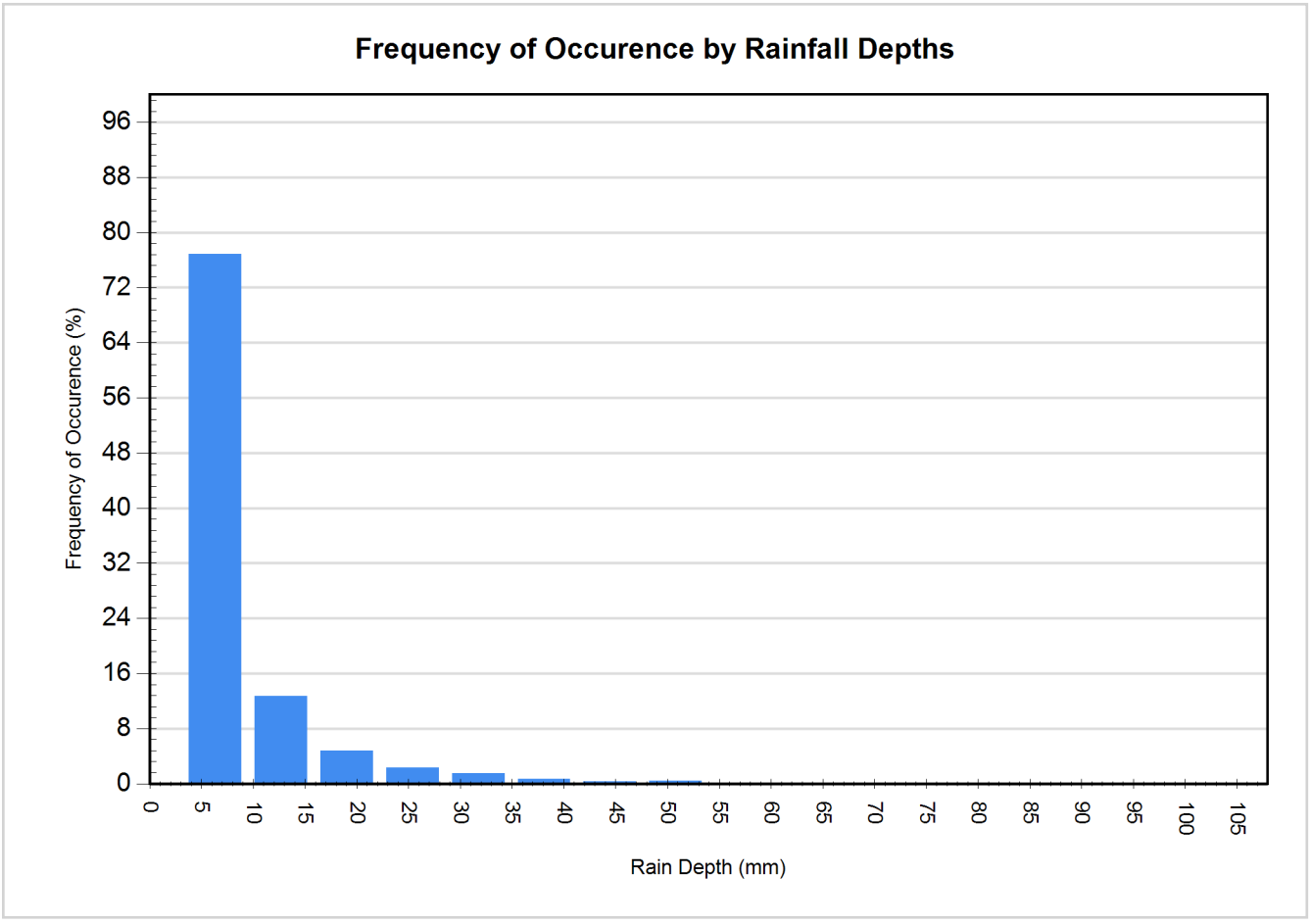
Cumulative Runoff Volume by Runoff Rate			
Runoff Rate (L/s)	**Runoff Volume (m^3)**	**Volume Over (m^3)**	**Cumulative Runoff Volume (%)**
1	21.562	73.037	22.8
4	53.554	41.044	56.6
9	72.949	21.651	77.1
16	82.054	12.543	86.7
25	86.763	7.834	91.7
36	89.495	5.101	94.6
49	91.255	3.342	96.5
64	92.403	2.193	97.7
81	93.142	1.454	98.5
100	93.636	0.96	99.0
121	93.957	0.639	99.3
144	94.118	0.478	99.5
169	94.201	0.395	99.6
196	94.252	0.344	99.6
225	94.301	0.295	99.7
256	94.345	0.251	99.7
289	94.377	0.219	99.8
324	94.408	0.188	99.8
361	94.441	0.155	99.8
400	94.476	0.12	99.9
441	94.513	0.083	99.9
484	94.55	0.046	100.0

Cumulative Runoff Volume by Runoff Rate

For area: 0.99(ha), imperviousness: 80.0%, rainfall station: TORONTO CENTRAL



Rainfall Event Analysis				
Rainfall Depth (mm)	**No. of Events**	**Percentage of Total Events (%)**	**Total Volume (mm)**	**Percentage of Annual Volume (%)**
6.35	2091	76.9	3344	25.4
12.70	345	12.7	3201	24.3
19.05	131	4.8	2062	15.6
25.40	63	2.3	1358	10.3
31.75	42	1.5	1185	9.0
38.10	20	0.7	678	5.1
44.45	9	0.3	377	2.9
50.80	11	0.4	521	4.0
57.15	3	0.1	159	1.2
63.50	1	0.0	61	0.5
69.85	0	0.0	0	0.0
76.20	1	0.0	73	0.6
82.55	1	0.0	80	0.6
88.90	1	0.0	85	0.6
95.25	0	0.0	0	0.0
101.60	0	0.0	0	0.0



For Stormceptor Specifications and Drawings Please Visit:
http://www.imbriumsystems.com/technical-specifications

Detailed Stormceptor Sizing Report – Portage

Project Information & Location			
Project Name	Portage	**Project Number**	1522372
City	Vaughan	**State/ Province**	Ontario
Country	Canada	**Date**	5/18/2016
Designer Information		**EOR Information (optional)**	
Name	Scott Taylor	**Name**	
Company	Golder Associates Ltd.	**Company**	
Phone #	613-592-9600	**Phone #**	
Email	staylor@golder.com	**Email**	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	Portage
Recommended Stormceptor Model	STC 9000
Target TSS Removal (%)	80.0
TSS Removal (%) Provided	83
PSD	City of Toronto PSD
Rainfall Station	TORONTO CENTRAL

The recommended Stormceptor model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	**% TSS Removal Provided**
STC 300	49
STC 750	62
STC 1000	63
STC 1500	64
STC 2000	68
STC 3000	70
STC 4000	75
STC 5000	76
STC 6000	78
STC 9000	83
STC 10000	83
STC 14000	86
Stormceptor MAX	Custom

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- Site parameters
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Rainfall Station

State/Province	Ontario	**Total Number of Rainfall Events**	2719
Rainfall Station Name	TORONTO CENTRAL	**Total Rainfall (mm)**	13185.4
Station ID #	0100	**Average Annual Rainfall (mm)**	732.5
Coordinates	45°30'N, 90°30'W	**Total Evaporation (mm)**	1120.4
Elevation (ft)	328	**Total Infiltration (mm)**	2626.6
Years of Rainfall Data	18	**Total Rainfall that is Runoff**	9438.4

Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
- For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

Drainage Area	
Total Area (ha)	2.27
Imperviousness %	80.0

Up Stream Storage	
Storage (ha-m)	Discharge (cms)
0.000	0.000

Water Quality Objective	
TSS Removal (%)	80.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (L)	
Peak Conveyed Flow Rate (L/s)	
Water Quality Flow Rate (L/s)	

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cms)	

Design Details	
Stormceptor Inlet Invert Elev (m)	199.20
Stormceptor Outlet Invert Elev (m)	199.20
Stormceptor Rim Elev (m)	201.50
Normal Water Level Elevation (m)	199.00
Pipe Diameter (mm)	675
Pipe Material	RCP - concrete
Multiple Inlets (Y/N)	No
Grate Inlet (Y/N)	No

Particle Size Distribution (PSD)

Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor design.

City of Toronto PSD		
Particle Diameter (microns)	Distribution %	Specific Gravity
10.0	20.0	2.65
30.0	10.0	2.65
50.0	10.0	2.65
95.0	20.0	2.65
265.0	20.0	2.65
1000.0	20.0	2.65

Site Name	Portage

Site Details

Drainage Area

Total Area (ha)	2.27
Imperviousness %	80.0

Surface Characteristics

Width (m)	301.00
Slope %	2
Impervious Depression Storage (mm)	0.508
Pervious Depression Storage (mm)	5.08
Impervious Manning's n	0.015
Pervious Manning's n	0.25

Maintenance Frequency

Maintenance Frequency (months) >	12

Infiltration Parameters

Horton's equation is used to estimate infiltration

Max. Infiltration Rate (mm/hr)	61.98
Min. Infiltration Rate (mm/hr)	10.16
Decay Rate (1/sec)	0.00055
Regeneration Rate (1/sec)	0.01

Evaporation

Daily Evaporation Rate (mm/day)	2.54

Dry Weather Flow

Dry Weather Flow (lps)	0

Winter Months

Winter Infiltration	0

TSS Loading Parameters

TSS Loading Function	

Buildup/Wash-off Parameters

Target Event Mean Conc. (EMC) mg/L	
Exponential Buildup Power	
Exponential Washoff Exponent	

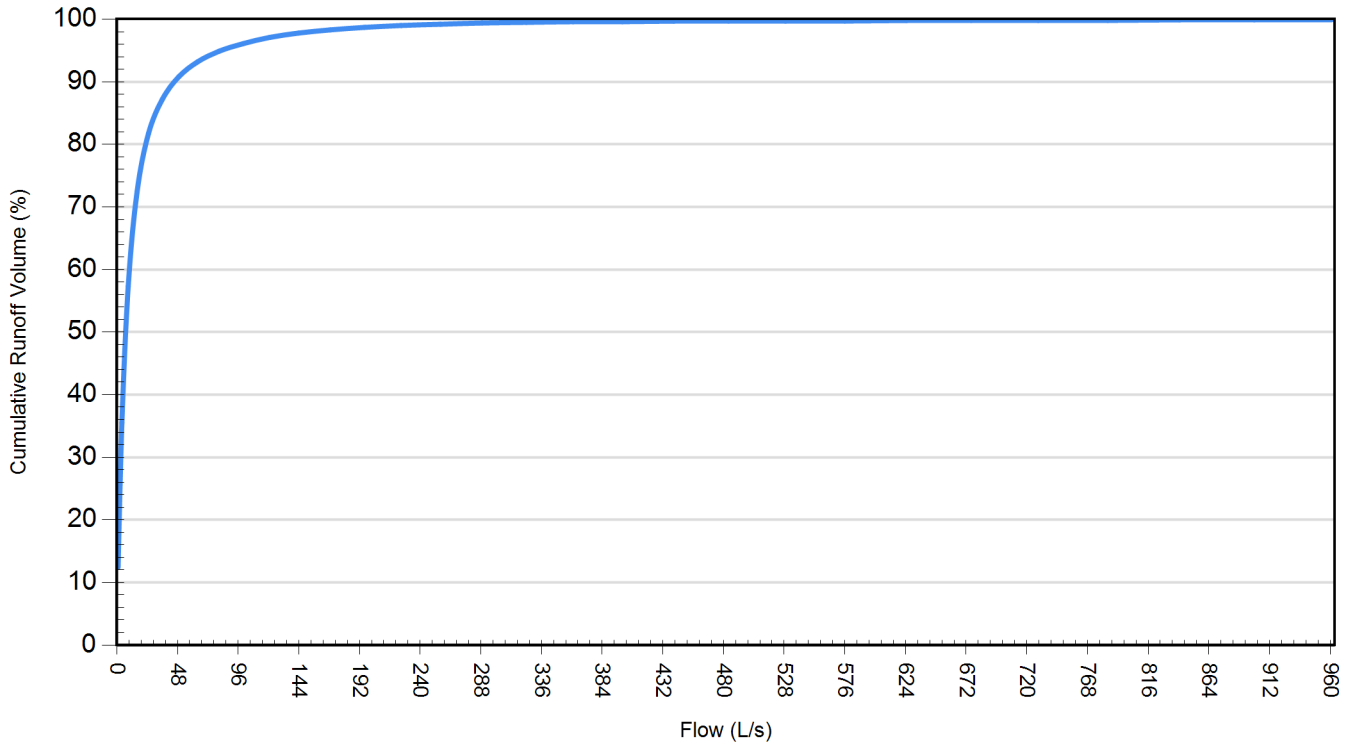
TSS Availability Parameters

Availability Constant A	
Availability Factor B	
Availability Exponent C	
Min. Particle Size Affected by Availability (micron)	

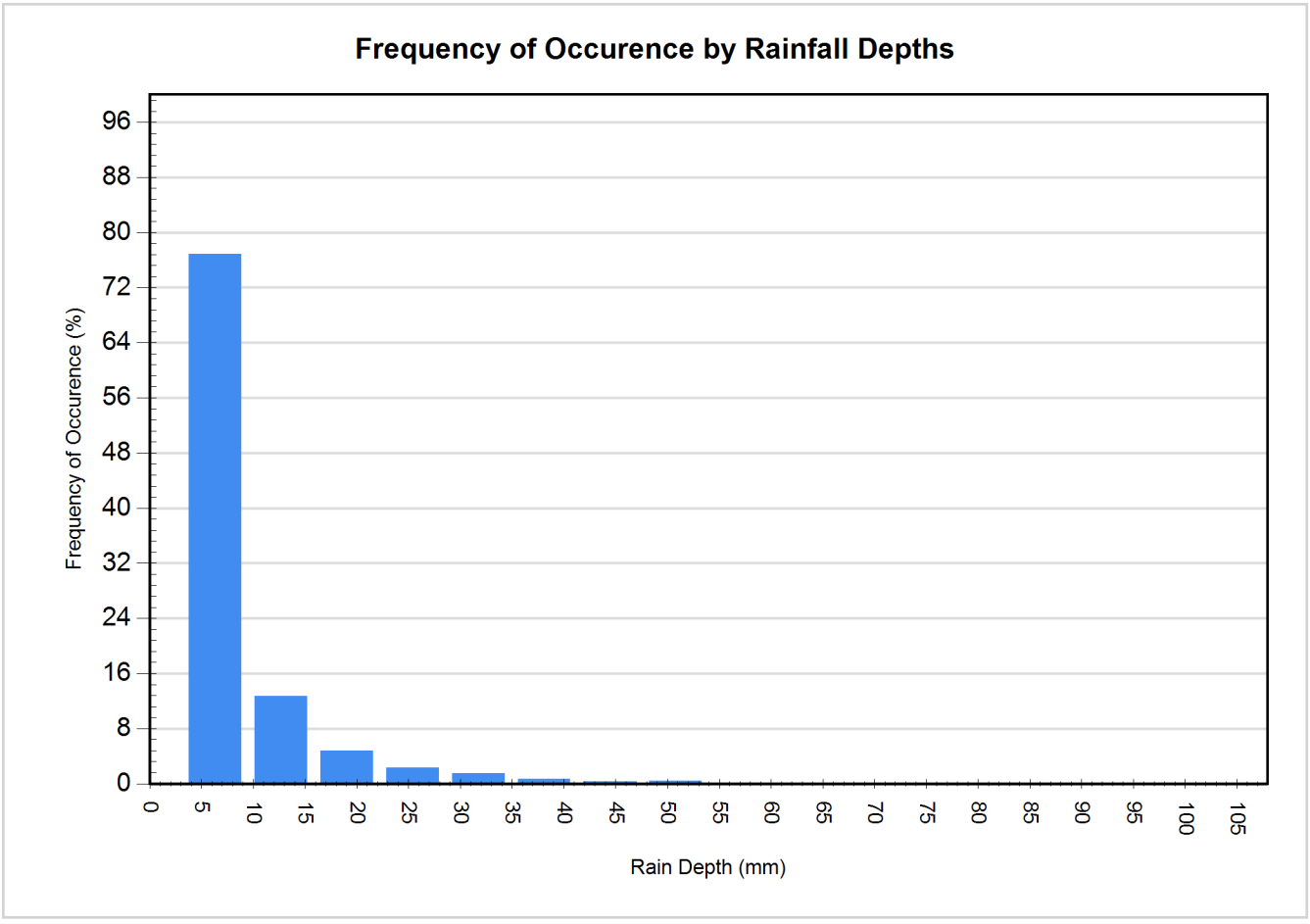
Cumulative Runoff Volume by Runoff Rate			
Runoff Rate (L/s)	**Runoff Volume (m^3)**	**Volume Over (m^3)**	**Cumulative Runoff Volume (%)**
1	26.742	188.942	12.4
4	76.459	139.22	35.5
9	123.528	92.188	57.3
16	156.14	59.536	72.4
25	176.205	39.482	81.7
36	188.071	27.604	87.2
49	195.792	19.887	90.8
64	200.912	14.764	93.2
81	204.589	11.088	94.9
100	207.313	8.363	96.1
121	209.363	6.314	97.1
144	210.882	4.794	97.8
169	212.027	3.649	98.3
196	212.905	2.77	98.7
225	213.554	2.121	99.0
256	214.046	1.63	99.2
289	214.413	1.263	99.4
324	214.614	1.061	99.5
361	214.742	0.933	99.6
400	214.85	0.826	99.6
441	214.925	0.751	99.7
484	214.994	0.682	99.7
529	215.061	0.614	99.7
576	215.124	0.551	99.7
625	215.173	0.503	99.8
676	215.218	0.457	99.8
729	215.266	0.409	99.8
784	215.316	0.36	99.8
841	215.367	0.309	99.9
900	215.42	0.256	99.9
961	215.475	0.201	99.9

Cumulative Runoff Volume by Runoff Rate

For area: 2.27(ha), imperviousness: 80.0%, rainfall station: TORONTO CENTRAL



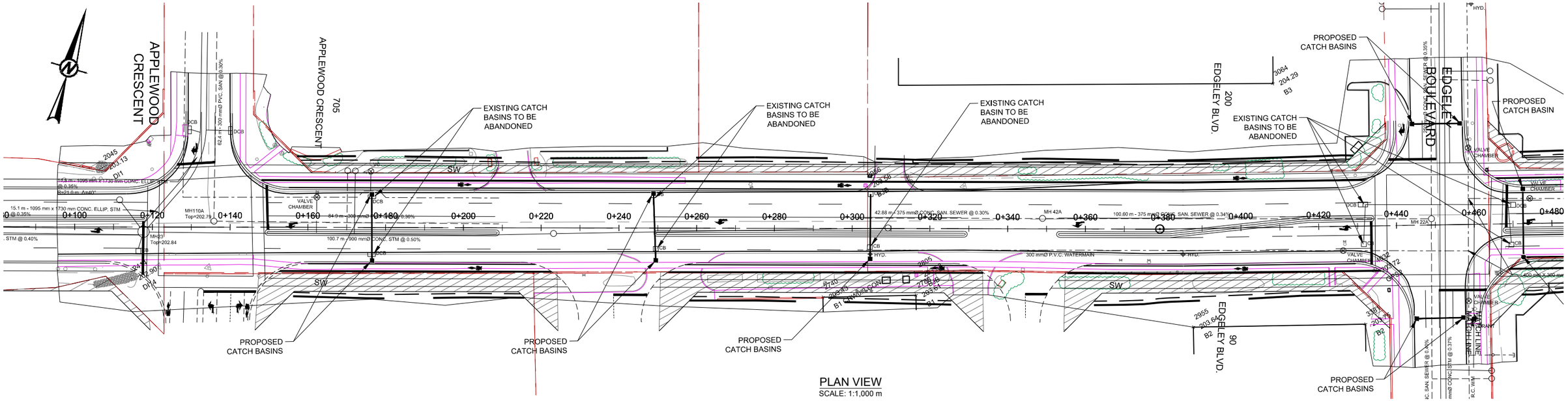
Rainfall Event Analysis				
Rainfall Depth (mm)	**No. of Events**	**Percentage of Total Events (%)**	**Total Volume (mm)**	**Percentage of Annual Volume (%)**
6.35	2091	76.9	3344	25.4
12.70	345	12.7	3201	24.3
19.05	131	4.8	2062	15.6
25.40	63	2.3	1358	10.3
31.75	42	1.5	1185	9.0
38.10	20	0.7	678	5.1
44.45	9	0.3	377	2.9
50.80	11	0.4	521	4.0
57.15	3	0.1	159	1.2
63.50	1	0.0	61	0.5
69.85	0	0.0	0	0.0
76.20	1	0.0	73	0.6
82.55	1	0.0	80	0.6
88.90	1	0.0	85	0.6
95.25	0	0.0	0	0.0
101.60	0	0.0	0	0.0



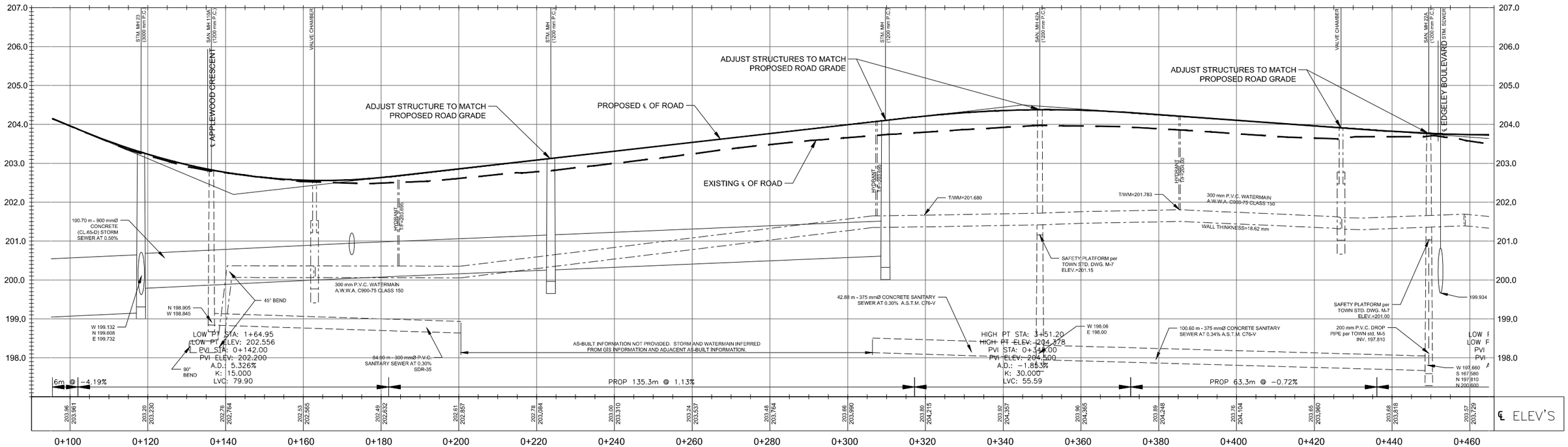
For Stormceptor Specifications and Drawings Please Visit:
http://www.imbriumsystems.com/technical-specifications

APPENDIX D

Plan and Profile Drawings



PLAN VIEW
SCALE: 1:1,000 m



HORZ. SCALE: 1:1,000 m
VERT. SCALE: 1:100 m

P1 PROFILE VIEW FROM STATION 0+100 TO 0+460

NOT FOR CONSTRUCTION

0 2.5 5
1:100 METRES

0 25 50
1:1,000 METRES

CLIENT
CIMA+

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-06-29
DESIGNED	SWT
PREPARED	MLF/JM
REVIEWED	SWT
APPROVED	DVK

PROJECT
STORMWATER MANAGEMENT
PORTAGE PARKWAY

TITLE
PLAN AND PROFILE FROM STATION 0+100 TO 0+460

PROJECT NO.	PHASE	REV.	DRAWING
1522372	2000	A	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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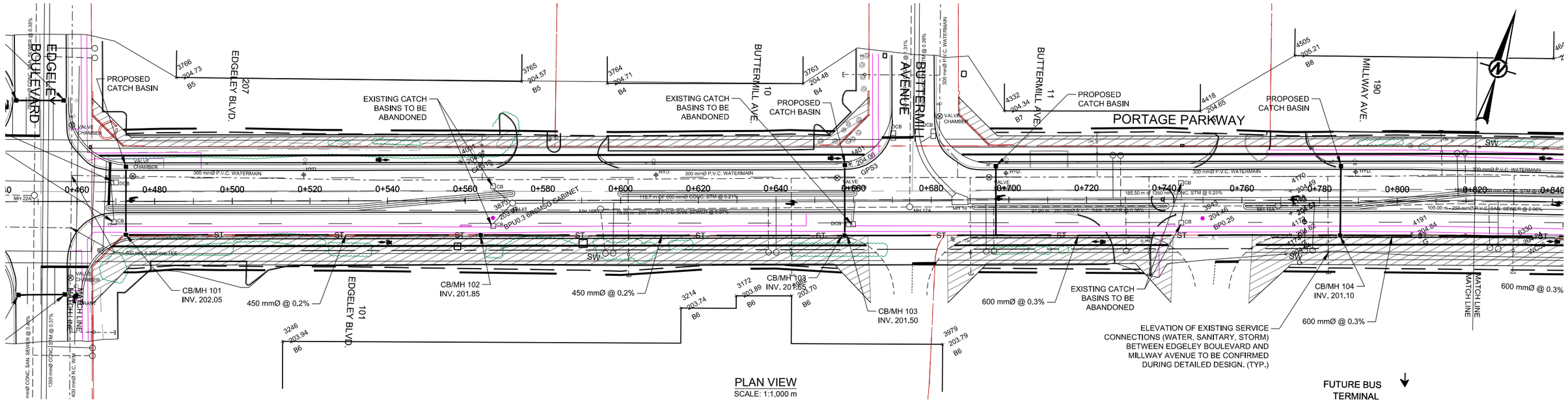

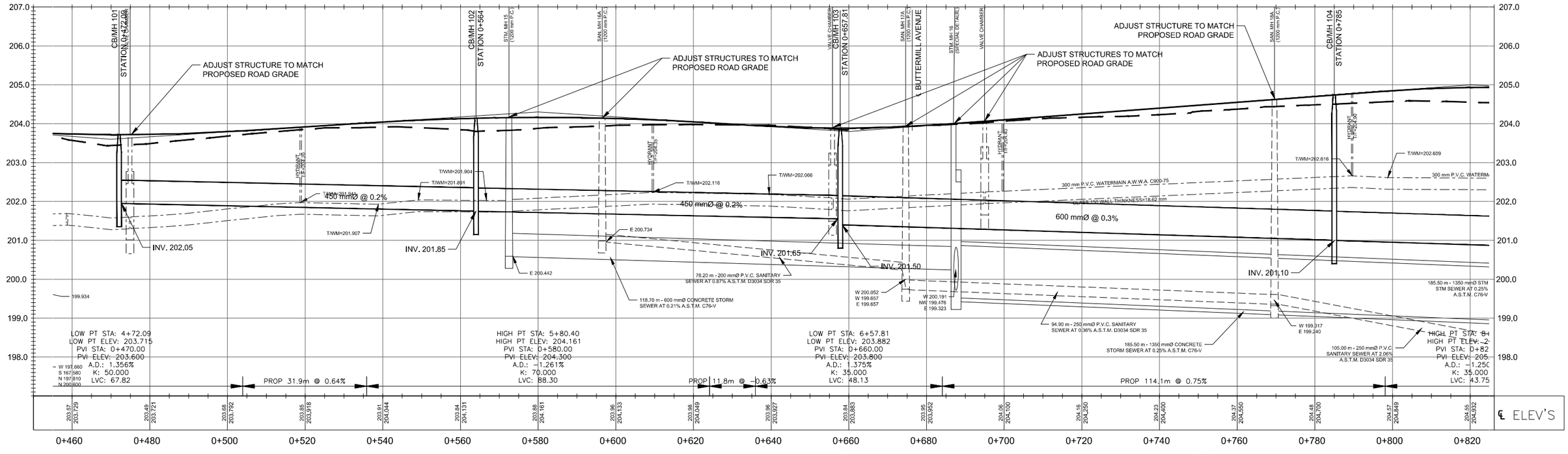

HORZ. SCALE: 1:1,000 m
VERT. SCALE: 1:100 m

P2 PROFILE VIEW FROM STATION 0+460 TO 0+820

NOT FOR CONSTRUCTION

0 2.5 5
1:100 METRES

0 25 50
1:1,000 METRES

CLIENT
CIMA+

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PREPARED	MLF/JM
REVIEWED	SWT
APPROVED	DVK

PROJECT
STORMWATER MANAGEMENT
PORTAGE PARKWAY

TITLE
PLAN AND PROFILE FROM STATION 0+460 TO 0+820

PROJECT NO.	PHASE	REV.	DRAWING
1522372	2000	A	2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25 mm

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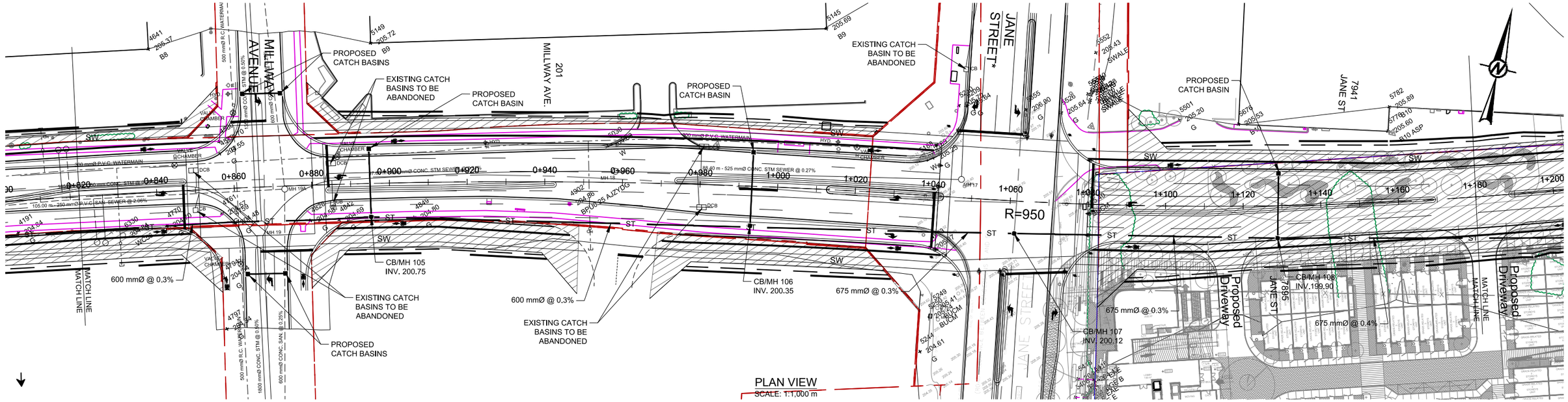

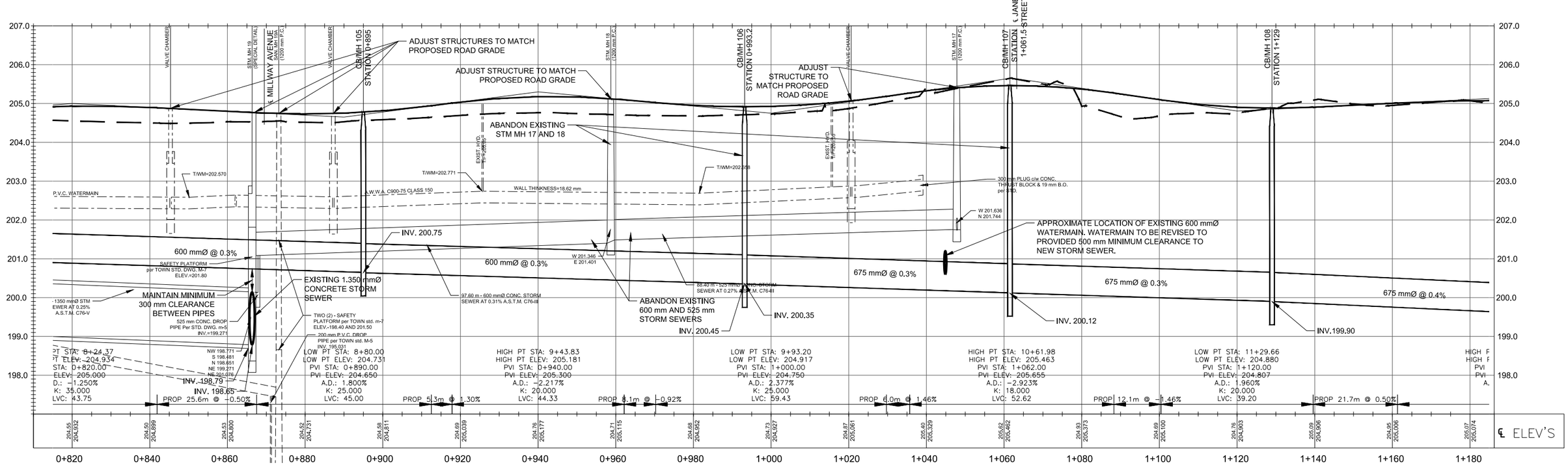

HORZ. SCALE: 1:1,000 m
VERT. SCALE: 1:100 m

P3 PROFILE VIEW FROM STATION 0.820 TO 1+180

NOT FOR CONSTRUCTION

0 2.5 5
1:100 METRES

0 25 50
1:1,000 METRES

CLIENT
CIMA+

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PREPARED	MLF/JM
REVIEWED	SWT
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PROJECT
STORMWATER MANAGEMENT
PORTAGE PARKWAY

TITLE
PLAN AND PROFILE FROM STATION 0+820 TO 1+180

PROJECT NO.	PHASE	REV.	DRAWING
1522372	2000	B	3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25 mm

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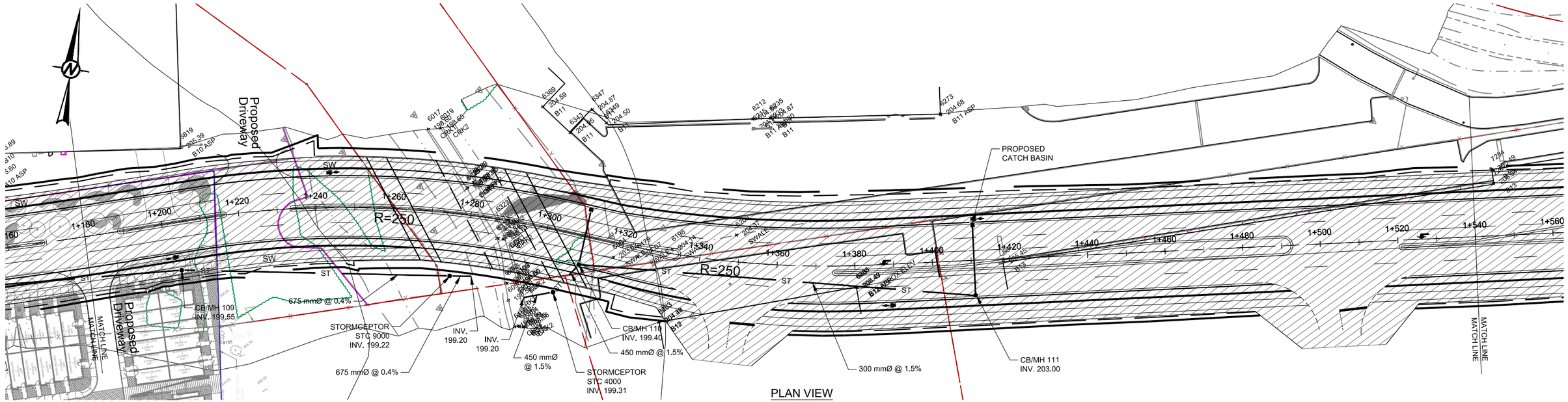

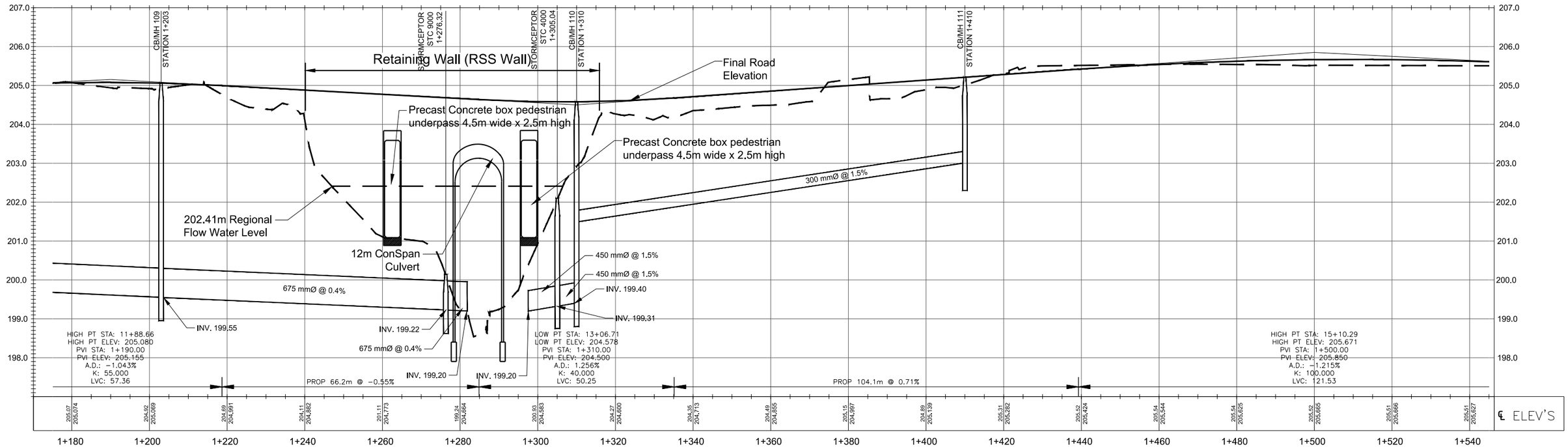

HORZ. SCALE: 1:1,000 m
VERT. SCALE: 1:100 m
P4
PROFILE VIEW FROM STATION 1+180 TO 1+540

NOT FOR CONSTRUCTION

0 2.5 5
1:100 METRES

0 25 50
1:1,000 METRES

CLIENT
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PROJECT
STORMWATER MANAGEMENT
PORTAGE PARKWAY

TITLE
PLAN AND PROFILE FROM STATION 1+180 TO 1+540

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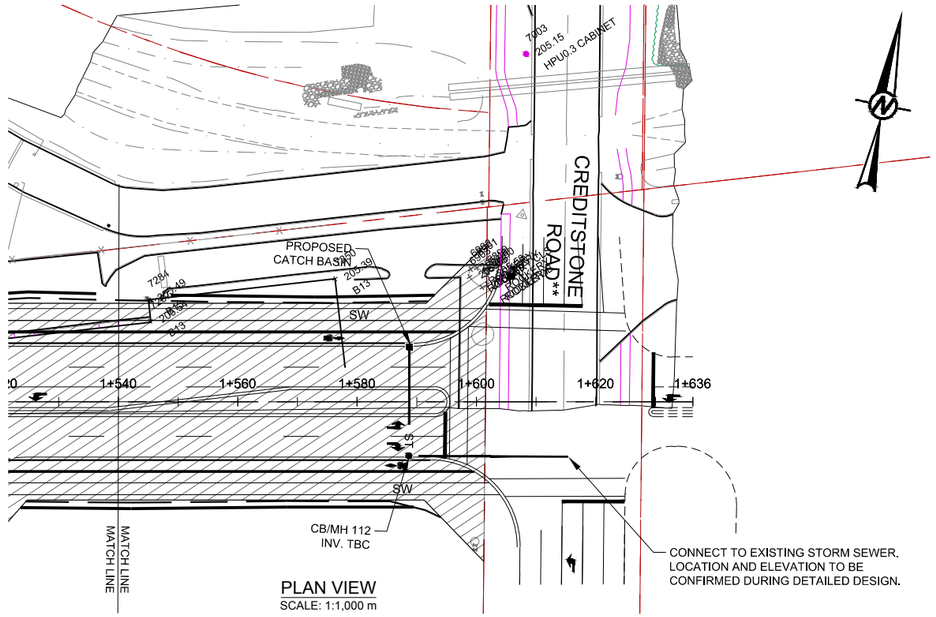
PROJECT NO.	PHASE	REV.	DRAWING
1522372	2000	B	4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

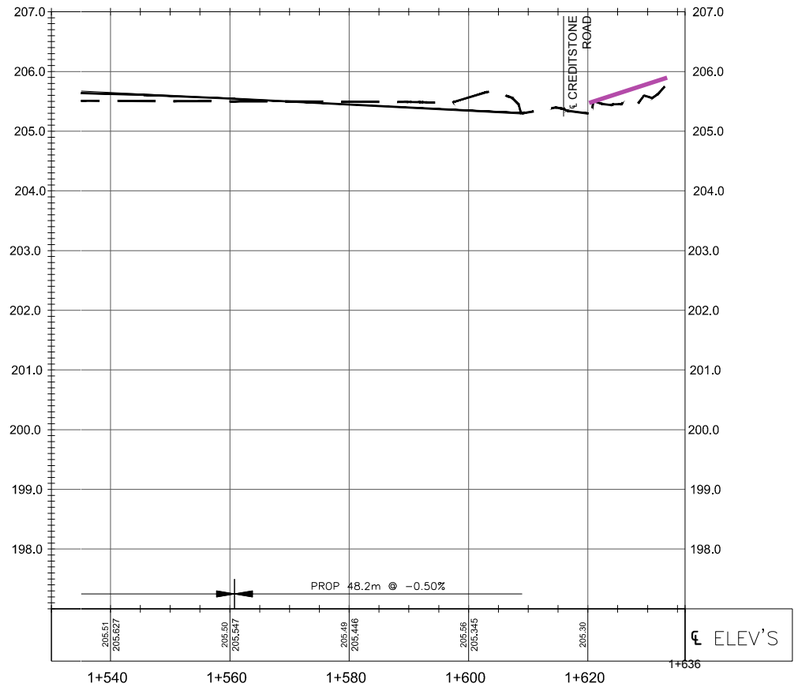
25 mm

0

Path: \\golder.gds\gal\ottawa\Active\Spatial_IM\CIMA+\EA_PortageParkway_ON\99_PROJ\1522372_CIMA\40_PROD\Phase_2002_Stormwater\ | File Name: 1522372-2002-CN-0001.dwg



PLAN VIEW
SCALE: 1:1,000 m



HORZ. SCALE: 1:1,000 m
VERT. SCALE: 1:100 m
P5
PROFILE VIEW FROM STATION 1+540 TO 1+636

0 2.5 5
1:100 METRES

0 25 50
1:1,000 METRES

NOT FOR CONSTRUCTION

CLIENT
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REVIEWED	SWT
APPROVED	DVK

PROJECT
STORMWATER MANAGEMENT
PORTAGE PARKWAY

TITLE
PLAN AND PROFILE FROM STATION 1+540 TO 1+636

PROJECT NO.	PHASE	REV.	DRAWING
1522372	2000	A	5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25 mm

0

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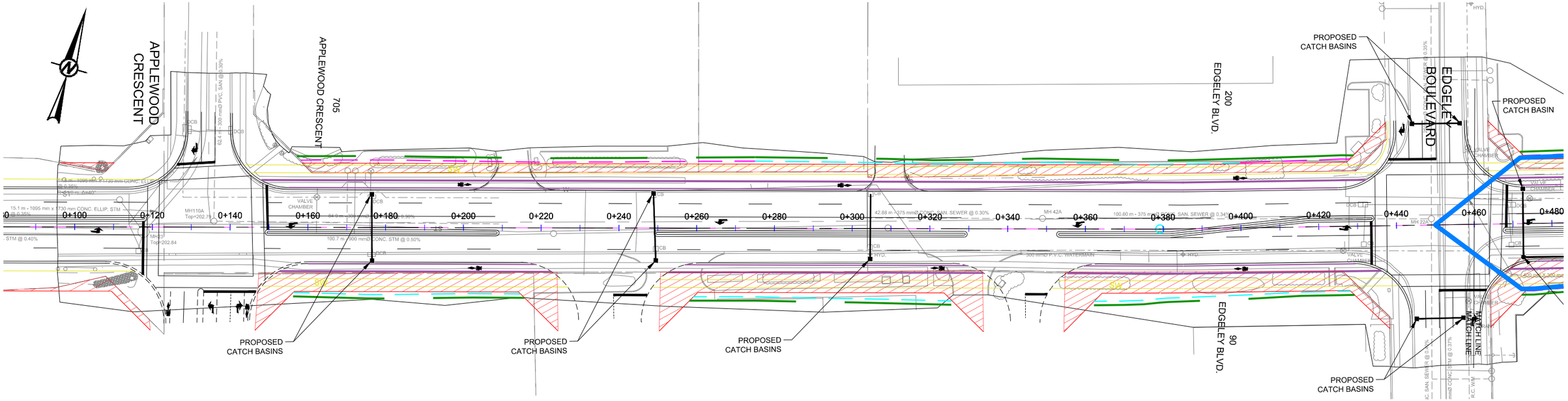
APPENDIX E

Drainage Area Plans



PLAN VIEW
SCALE: 1:1,000 m

NOT FOR CONSTRUCTION

0 2.5 5
1:100 METRES

0 25 50
1:1,000 METRES

CLIENT
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REVIEWED	SWT
APPROVED	DVK

PROJECT
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PORTAGE PARKWAY

TITLE
DRAINAGE AREA PLAN, STATION 0+100 TO 0+460

PROJECT NO.	PHASE	REV.	DRAWING
1522372	2000	A	6

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25 mm

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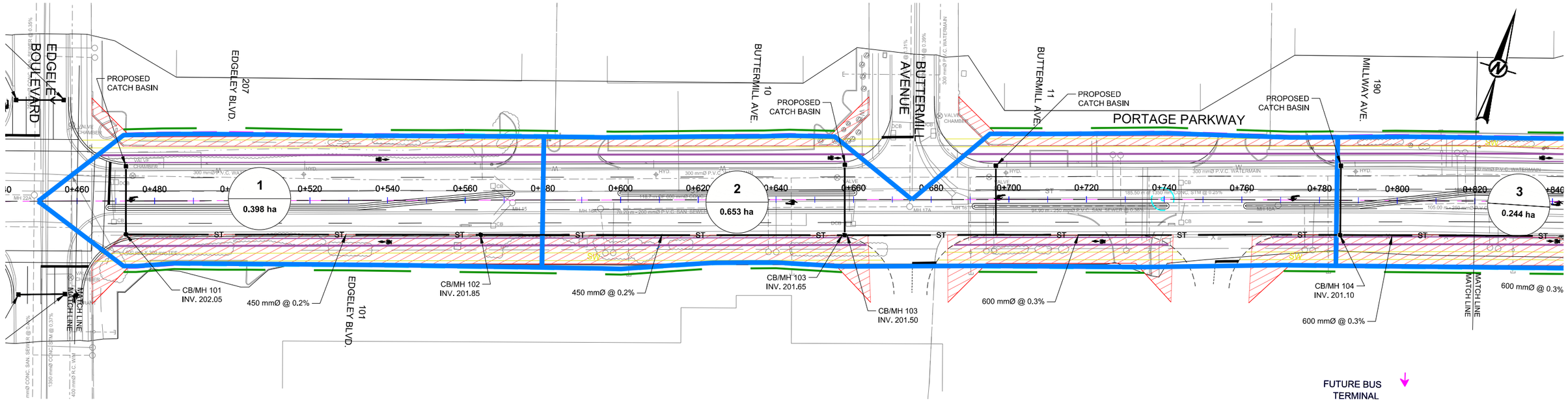

PLAN VIEW
SCALE: 1:1,000 m

NOT FOR CONSTRUCTION

0 2.5 5
1:100 METRES

0 25 50
1:1,000 METRES

CLIENT
CIMA+

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REVIEWED	SWT
APPROVED	DVK

PROJECT
STORMWATER MANAGEMENT
PORTAGE PARKWAY

TITLE
DRAINAGE AREA PLAN, STATION 0+460 TO 0+820

PROJECT NO.	PHASE	REV.	DRAWING
1522372	2000	A	7

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25 mm 0

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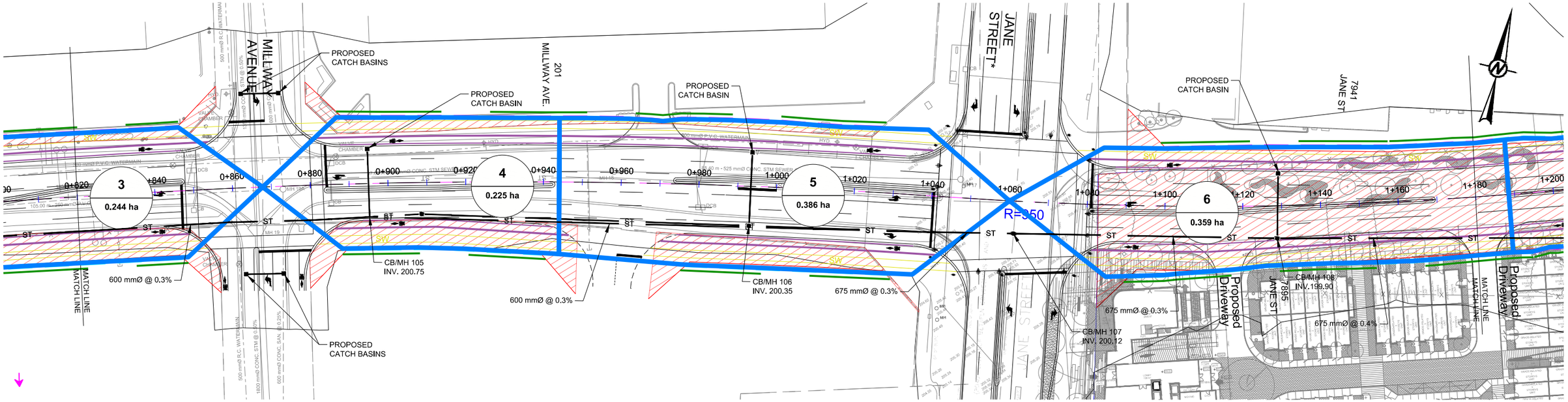

PLAN VIEW
SCALE: 1:1,000 m

NOT FOR CONSTRUCTION

0 2.5 5
1:100 METRES

0 25 50
1:1,000 METRES

CLIENT
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PROJECT
STORMWATER MANAGEMENT
PORTAGE PARKWAY

TITLE
DRAINAGE AREA PLAN, STATION 0+820 TO 1+180

PROJECT NO.	PHASE	REV.	DRAWING
1522372	2000	A	8

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25 mm
0

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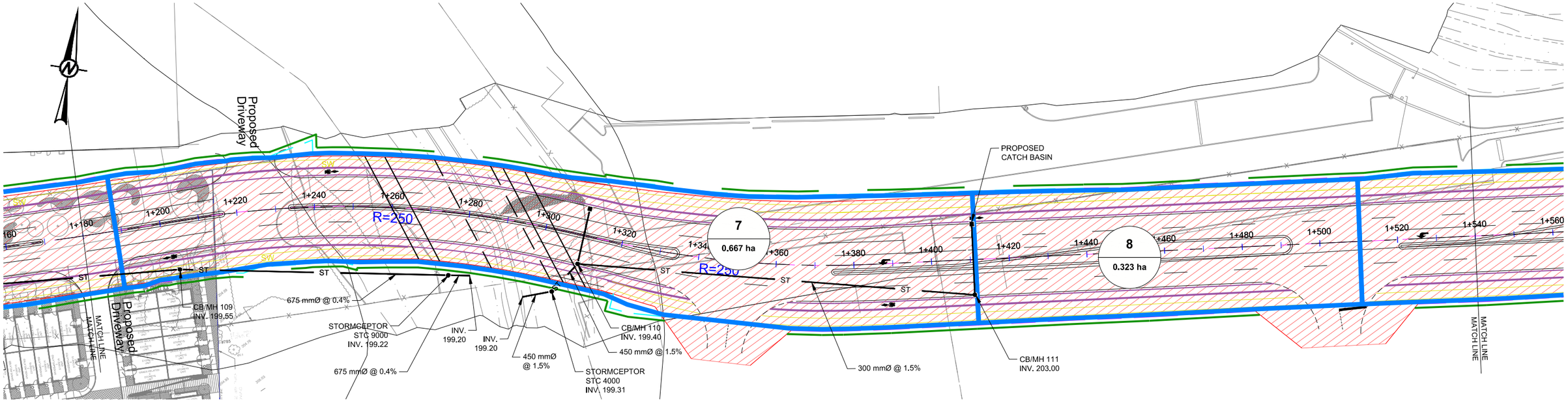

PLAN VIEW
SCALE: 1:1,000 m

NOT FOR CONSTRUCTION

0 2.5 5
1:100 METRES

0 25 50
1:1,000 METRES

CLIENT
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YYYY-MM-DD	2016-06-28
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PROJECT
STORMWATER MANAGEMENT
PORTAGE PARKWAY

TITLE
DRAINAGE AREA PLAN, STATION 1+180 TO 1+540

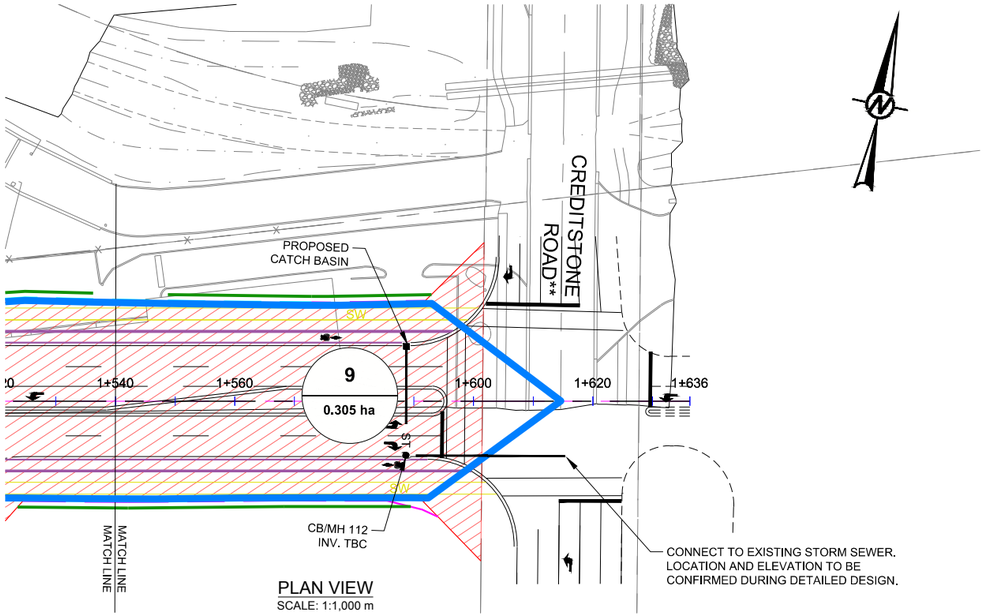
PROJECT NO.	PHASE	REV.	DRAWING
1522372	2000	A	9

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25 mm

0

Path: \\golder.gds\gal\ottawa\Active\Spatial_IM\CIMA+\EA_PortageParkway_ON\99_PRO\1522372_CIMA40_PROD\Phase_2001_Stormwater\ | File Name: 1522372-2001-CN-0001.dwg



PLAN VIEW
SCALE: 1:1,000 m

0 2.5 5
1:100 METRES

0 25 50
1:1,000 METRES

NOT FOR CONSTRUCTION

CLIENT
CIMA+

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YYYY-MM-DD	2016-06-28
DESIGNED	SWT
PREPARED	MLF/JM
REVIEWED	SWT
APPROVED	DVK

PROJECT
STORMWATER MANAGEMENT
PORTAGE PARKWAY

TITLE
DRAINAGE AREA PLAN, STATION 1+540 TO 1+636

PROJECT NO.	PHASE	REV.	DRAWING
1522372	2000	A	10

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25 mm

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