See B-70-244 for additional Info.

WisDOT HYDRAULIC BRIDGE DESIGN

West Frontage Rd USH 45

BRIDGE NUMBER: B-70-307
QUAD MAP #: Oshkosh NW R-89

HYDRAULICS BY: NK
DATE: 3-9-2010
FHA X (Y) _____ (N)
Zone A

HYDROLOGY

Q100= 3000 cfs
Q2= 960 cfs
DRAINAGE AREA= 26.8 sq mi

BY: NK
DATE: 5-4-05

METHOD: Regression Equations & Drainage Comparison (See B-70-244 for Calculations)

HYDRAULICS

METHOD: (WSPRO, HEC-2, HY8, OTHER: HEC-RAS)

ENERGY SLOPE: SSR= 0.00009 ft/ft
USGS= _____
KNOWN TAILWATER= FIS x-section T ~ 200' d/s – Elev 756.5

MANNING "N" LEFT: 0.07 CHANNEL: 0.04 RIGHT: 0.07
LEFT: _____ CHANNEL: _____ RIGHT: _____

COMMENTS:

EXISTING CONDITIONS **********

QBR = 3000 cfs
QRD= _____
A (br)= _____
VEL = 3.79 ft/sec
FLOW Type= low flow

No existing Bridge

HW-100 = 757.42 Sec 9
NATURAL= _____
BACKWTR= _____
EXIT= 756.5

PROPOSED CONDITIONS **********

QBR = 3000 cfs
QRD = 0
A (br)= 757 sq ft
VEL = 3.96
FLOW Type= low flow

HW2= 752.5

SCOUR CODE 8

757.54 n/s this bridge

HW-100 = 757.73 Sec 9
NATURAL= _____
BACKWTR= _____
EXIT= 756.5

PROPOSED STRUCTURE: Single-Span, 45W" PSG, 96' span (Future) COST: $ 300,000

EXTENT OF BACKWATER REACH (N/A IF NO INCREASE IN BACKWATER): ~ 14,600 ft

COMMENTS: Combined Backwater due to USH 45 & Frontage Rds ~0.35' @ Sec 9 – Property owners were notified at the time of USH 45 Construction –

NK 3-9-10

HEC-RAS Version 3.1.3 May 2005
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

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

Proposed Condition

B-70-307 & B-70-308

PROJECT DATA
Project Title: USH 45 & frontage Rds over Arrowhead R.
Project File : B70_307.prj
Run Date and Time: 3/9/2010 11:38:53 AM

Project in English units

Project Description:
Starting Condition based on WINNEBAGO CO. WIS- FIS 5-30-78 revised 2003

ARROWHEAD RIVER JN2000
Updated by NK of WisDOT on 3-8-2010 to reflect final
sizing of the USH 45 frontage Roads (B-70-307 and B-70-308)

PLAN DATA

Plan Title: 45" PSG alternative
Plan File : C:\users\projects\B-70-244\B70_307.p04

Geometry Title: 45" PSG alternative
Geometry File : C:\users\projects\B-70-244\B70_307.g04

Flow Title : 100 YR & 2 YR
Flow File : C:\users\projects\B-70-244\B70_307.f01

Plan Description:
Includes future frontage roads. Assumed all proposed structures are
single-span, A5 abutments, 8-ft tall

Plan Summary Information:

Number of:	Cross Sections	= 17	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 5	Lateral Structures	=	0

Computational Information

Water surface calculation tolerance	= 0.01
Critical depth calculation tolerance	= 0.01
Maximum number of iterations	= 20
Maximum difference tolerance	= 0.3
Flow tolerance factor	= 0.001

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

FLOW DATA

Flow Title: 100 YR & 2 YR
Flow File : C:\users\projects\B-70-244\B70_307.f01

Flow Data (cfs)

River	Reach	RS	2 yr	100 yr
RIVER-1	Reach-1	20	760	3000
RIVER-1	Reach-1	10	760	3000
RIVER-1	Reach-1	1	830	4000

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
RIVER-1	Reach-1	2 yr		Known WS = 752.5
RIVER-1	Reach-1	100 yr		Known WS = 756.52

GEOMETRY DATA

Geometry Title: 45" PSG alternative
Geometry File : C:\users\projects\B-70-244\B70_307.g04

CROSS SECTION
RIVER: RIVER-1
REACH: Reach-1 RS: 20

INPUT
Description: Repeat section-- Based on USGS quad map
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1700	760	2980	750	2984	747	3000	745	3016	747
3020	750	4650	760						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1700	.06	2980	.04	3020	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
2980	3020	5300	5300	.1	.3

CROSS SECTION OUTPUT Profile #100 yr

		Element	Left OB	Channel	Right OB
E.G. Elev (ft)	758.81	Wt. n-Val.	0.060	0.040	0.060
Vel Head (ft)	0.00	Reach Len. (ft)	5300.00	5300.00	5300.00
W.S. Elev (ft)	758.81	Flow Area (sq ft)	4969.70	492.48	6328.60
Crit W.S. (ft)		Area (sq ft)	4969.70	492.48	6328.60
E.G. Slope (ft/ft)	0.000013	Flow (cfs)	1172.89	333.50	1493.61
Q Total (cfs)	3000.00	Top Width (ft)	1127.94	40.00	1436.36
Top Width (ft)	2604.30	Avg. Vel. (ft/s)	0.24	0.68	0.24
Vel Total (ft/s)	0.25	Hydr. Depth (ft)	4.41	12.31	4.41
Max Chl Dpth (ft)	13.81	Conv. (cfs)	330771.9	94052.9	421220.6
Conv. Total (cfs)	846045.4	Wetted Per. (ft)	1127.97	42.25	1436.39
Length Wtd. (ft)	5300.00	Shear (lb/sq ft)	0.00	0.01	0.00
Min Ch El (ft)	745.00	Stream Power (lb/ft s)	0.00	0.01	0.00
Alpha	1.55	Cum Volume (acre-ft)	1239.95	124.97	1111.82
Frctn Loss (ft)	0.05	Cum SA (acres)	283.07	9.85	283.64
C & E Loss (ft)	0.00				

CROSS SECTION
RIVER: RIVER-1
REACH: Reach-1 RS: 18

INPUT
Description: Repeat section-- Based on USGS quad map
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
600	760	2980	750	2984	746.6	2992	744.8	3000	744.7
3008	745	3016	746	3020	750	3350	753	5450	760

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
600	.06	2980	.04	3020	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
2980	3020	1650	1650	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
600	1100		F
4700	5450		F

CROSS SECTION OUTPUT Profile #100 yr

		Element	Left OB	Channel	Right OB
E.G. Elev (ft)	758.77	Wt. n-Val.	0.060	0.040	0.060
Vel Head (ft)	0.00	Reach Len. (ft)	1650.00	1650.00	1650.00
W.S. Elev (ft)	758.77	Flow Area (sq ft)	9057.25	519.09	7146.52
Crit W.S. (ft)		Area (sq ft)	9146.93	519.09	7387.42
E.G. Slope (ft/ft)	0.000006	Flow (cfs)	1592.04	251.81	1156.15
Q Total (cfs)	3000.00	Top Width (ft)	2086.61	40.00	2060.18
Top Width (ft)	4186.79	Avg. Vel. (ft/s)	0.18	0.49	0.16
Vel Total (ft/s)	0.18	Hydr. Depth (ft)	4.82	12.98	4.25
Max Chl Dpth (ft)	14.07	Conv. (cfs)	639828.7	101201.1	464648.9
Conv. Total (cfs)	1205679.0	Wetted Per. (ft)	1880.02	43.18	1680.02
Length Wtd. (ft)	1650.00	Shear (lb/sq ft)	0.00	0.00	0.00
Min Ch El (ft)	744.70	Stream Power (lb/ft s)	0.00	0.00	0.00
Alpha	1.44	Cum Volume (acre-ft)	381.15	63.43	277.39
Frctn Loss (ft)	0.02	Cum SA (acres)	87.51	4.98	70.93
C & E Loss (ft)	0.00				

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

CROSS SECTION
RIVER: RIVER-1
REACH: Reach-1 RS: 16

INPUT
Description: Repeat section-- Based on USGS quad map
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
150	760	980	750	984	746.6	992	744.8	1000	744.7
1008	744.9	1016	746	1020	750	1550	760		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
150	.08	980	.04	1020	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
980	1020	2600	2500	2100	.1	.3

CROSS SECTION OUTPUT Profile #100 yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	758.74	Element			
Vel Head (ft)	0.01	Wt. n-Val.	0.080	0.040	0.060
W.S. Elev (ft)	758.73	Reach Len. (ft)	2600.00	2500.00	2100.00
Crit W.S. (ft)		Flow Area (sq ft)	3164.64	518.50	2020.79
E.G. Slope (ft/ft)	0.000059	Area (sq ft)	3164.64	518.50	2020.79
Q Total (cfs)	3000.00	Flow (cfs)	1202.62	773.53	1023.85
Top Width (ft)	1227.62	Top Width (ft)	724.80	40.00	462.82
Vel Total (ft/s)	0.53	Avg. Vel. (ft/s)	0.38	1.49	0.51
Max Chl Dpth (ft)	14.03	Hydr. Depth (ft)	4.37	12.96	4.37
Conv. Total (cfs)	391685.9	Conv. (cfs)	157016.8	100993.5	133675.6
Length Wtd. (ft)	2397.95	Wetted Per. (ft)	724.85	43.19	462.90
Min Ch El (ft)	744.70	Shear (lb/sq ft)	0.02	0.04	0.02
Alpha	2.60	Stream Power (lb/ft s)	0.01	0.07	0.01
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)	147.98	43.78	99.21
C & E Loss (ft)	0.01	Cum SA (acres)	34.27	3.47	23.14

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.

CROSS SECTION
RIVER: RIVER-1
REACH: Reach-1 RS: 14

INPUT
Description: Repeat section-- Based on USGS quad map
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
750	760	980	750	984	746.6	992	744.6	1000	744.5
1008	744.9	1016	746	1020	750	1300	760		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
750	.08	980	.04	1020	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
980	1020	50	50	50	.3	.5

CROSS SECTION OUTPUT Profile #100 yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	758.49	Element			
Vel Head (ft)	0.07	Wt. n-Val.	0.080	0.040	0.060
W.S. Elev (ft)	758.42	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)		Flow Area (sq ft)	816.25	509.39	993.70
E.G. Slope (ft/ft)	0.000221	Area (sq ft)	816.25	509.39	993.70
Q Total (cfs)	3000.00	Flow (cfs)	587.93	1457.56	954.52
Top Width (ft)	469.67	Top Width (ft)	193.77	40.00	235.90
Vel Total (ft/s)	1.29	Avg. Vel. (ft/s)	0.72	2.86	0.96
Max Chl Dpth (ft)	13.92	Hydr. Depth (ft)	4.21	12.73	4.21
Conv. Total (cfs)	201654.1	Conv. (cfs)	39519.5	97974.0	64160.6
Length Wtd. (ft)	50.00	Wetted Per. (ft)	193.96	43.24	236.05
Min Ch El (ft)	744.50	Shear (lb/sq ft)	0.06	0.16	0.06
Alpha	2.61	Stream Power (lb/ft s)	0.04	0.47	0.06
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	29.18	14.28	26.54
C & E Loss (ft)	0.00	Cum SA (acres)	6.85	1.17	6.30

CROSS SECTION
RIVER: RIVER-1
REACH: Reach-1 RS: 12

INPUT
Description: U/s face of upstream bridge -- private field entrance
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
750	760	980	750	984	746.6	992	744.6	1000	744.5
1008	744.9	1016	746	1020	750	1300	760		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
750	.08	984	.04	1016	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
984	1016	20	20	20	.3	.5

CROSS SECTION OUTPUT Profile #100 yr

E.G. Elev (ft)	758.48	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.	0.080	0.040	0.060
W.S. Elev (ft)	758.40	Reach Len. (ft)	1.00	1.00	1.00
Crit W.S. (ft)	752.22	Flow Area (sq ft)	852.39	426.49	1030.10
E.G. Slope (ft/ft)	0.000231	Area (sq ft)	852.39	426.49	1030.10
Q Total (cfs)	3000.00	Flow (cfs)	635.18	1344.06	1020.76
Top Width (ft)	468.54	Top Width (ft)	197.26	32.00	239.28
Vel Total (ft/s)	1.30	Avg. Vel. (ft/s)	0.75	3.15	0.99
Max Chl Dpth (ft)	13.90	Hydr. Depth (ft)	4.32	13.33	4.31
Conv. Total (cfs)	197422.1	Conv. (cfs)	41799.7	88448.8	67173.6
Length Wtd. (ft)	1.00	Wetted Per. (ft)	198.70	32.33	241.08
Min Ch El (ft)	744.50	Shear (lb/sq ft)	0.06	0.19	0.06
Alpha	2.90	Stream Power (lb/ft s)	0.05	0.60	0.06
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	28.22	13.75	25.38
C & E Loss (ft)	0.10	Cum SA (acres)	6.63	1.13	6.03

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.

BRIDGE
RIVER: RIVER-1
REACH: Reach-1 RS: 11

INPUT
Description: Field Entrance Bridge
Distance from Upstream XS = 1
Deck/Roadway Width = 18
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 6

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
750	760	984	755	984	755
1016	755	752	1016	755	1300

Sta Hi Cord	Lo Cord
752	
760	

Upstream Bridge Cross Section Data
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
750	760	980	750	984	746.6	992	744.6	1000	744.5
1008	744.9	1016	746	1020	750	1300	760		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
750	.08	984	.04	1016	.06

Bank Sta: Left Right Coeff Contr. Expan.
984 1016 .3 .5

Downstream Deck/Roadway Coordinates
num= 6

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
750	760	984	755	984	755
1016	755	752	1016	755	1300

Sta Hi Cord	Lo Cord
752	
760	

Downstream Bridge Cross Section Data
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
750	760	980	750	984	746.6	992	744.6	1000	744.5
1008	744.9	1016	746	1020	750	1300	760		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
750	.08	984	.04	1016	.06

Bank Sta: Left Right Coeff Contr. Expan.
984 1016 .3 .5

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 yr

			Inside BR US	Inside BR DS
E.G. US. (ft)	758.48	Element		
W.S. US. (ft)	758.40	E.G. Elev (ft)	758.38	758.21
Q Total (cfs)	3000.00	W.S. Elev (ft)	757.96	757.67
Q Bridge (cfs)	1362.37	Crit W.S. (ft)	751.57	751.57
Q Weir (cfs)		Max Chl Dpth (ft)	13.46	13.17
Weir Sta Lft (ft)		Vel Total (ft/s)	3.89	4.44
Weir Sta Rgt (ft)		Flow Area (sq ft)	771.09	676.26
Weir Submerg		Froude # Chl	0.19	0.22
Weir Max Depth (ft)		Specif Force (cu ft)	3133.25	2986.89
Min El Weir Flow (ft)	755.01	Hydr Depth (ft)	2.28	2.19
Min El Prs (ft)	752.00	W.P. Total (ft)	414.73	384.38
Delta EG (ft)	0.49	Conv. Total (cfs)	37084.0	32759.6
Delta WS (ft)	0.51	Top Width (ft)	338.94	308.59
BR Open Area (sq ft)	221.60	Frctn Loss (ft)	0.13	0.00
BR Open Vel (ft/s)	6.15	C & E Loss (ft)	0.04	0.22
Coef of Q		Shear Total (lb/sq ft)	0.76	0.92
Br Sel Method	Energy only	Power Total (lb/ft s)	2.96	4.09

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

CROSS SECTION
RIVER: RIVER-1
REACH: Reach-1 RS: 10

INPUT
Description: D/s face of upstream bridge -- private field entrance
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
750	760	980	750	984	746.6	992	744.6	1000	744.5
1008	744.9	1016	746	1020	750	1300	760		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
750	.08	984	.04	1016	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
984	1016	700	700	.3	.5

CROSS SECTION OUTPUT Profile #100 yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	757.99	Element			
Vel Head (ft)	0.10	Wt. n-Val.	0.080	0.040	0.060
W.S. Elev (ft)	757.89	Reach Len. (ft)	700.00	700.00	700.00
Crit W.S. (ft)		Flow Area (sq ft)	754.17	410.06	910.98
E.G. Slope (ft/ft)	0.000293	Area (sq ft)	754.17	410.06	910.98
Q Total (cfs)	3000.00	Flow (cfs)	607.39	1417.16	975.45
Top Width (ft)	442.37	Top Width (ft)	185.46	32.00	224.91
Vel Total (ft/s)	1.45	Avg. Vel. (ft/s)	0.81	3.46	1.07
Max Chl Dpth (ft)	13.39	Hydr. Depth (ft)	4.07	12.81	4.05
Conv. Total (cfs)	175375.6	Conv. (cfs)	35506.9	82845.1	57023.6
Length Wtd. (ft)	700.00	Wetted Per. (ft)	186.88	32.33	226.70
Min Ch El (ft)	744.50	Shear (lb/sq ft)	0.07	0.23	0.07
Alpha	2.94	Stream Power (lb/ft s)	0.06	0.80	0.08
Frctn Loss (ft)	0.17	Cum Volume (acre-ft)	28.12	13.60	25.26
C & E Loss (ft)	0.02	Cum SA (acres)	6.57	1.12	5.95

CROSS SECTION
RIVER: RIVER-1
REACH: Reach-1 RS: 9

INPUT
Description: X-section based on DTM
Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
550	760	610	759	755	758	782	757	808	756
840	754	880	753	905	752	970	751	975	750
982	746.5	1000	744.6	1018	746.5	1030	750	1035	751
1088	752	1110	753	1140	754	1160	755	1200	758
1220	759	1224	762						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
550	.06	982	.04	1018	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
982	1018	300	300	.1	.3

CROSS SECTION OUTPUT Profile #100 yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	757.79	Element			
Vel Head (ft)	0.06	Wt. n-Val.	0.060	0.040	0.060
W.S. Elev (ft)	757.73	Reach Len. (ft)	300.00	300.00	300.00
Crit W.S. (ft)		Flow Area (sq ft)	934.18	438.52	836.54
E.G. Slope (ft/ft)	0.000216	Area (sq ft)	934.18	438.52	836.54
Q Total (cfs)	3000.00	Flow (cfs)	888.64	1261.65	849.71
Top Width (ft)	434.15	Top Width (ft)	219.74	36.00	178.41
Vel Total (ft/s)	1.36	Avg. Vel. (ft/s)	0.95	2.88	1.02
Max Chl Dpth (ft)	13.13	Hydr. Depth (ft)	4.25	12.18	4.69
Conv. Total (cfs)	204311.9	Conv. (cfs)	60519.7	85923.2	57868.9
Length Wtd. (ft)	300.00	Wetted Per. (ft)	220.80	36.20	179.19
Min Ch El (ft)	744.60	Shear (lb/sq ft)	0.06	0.16	0.06
Alpha	2.19	Stream Power (lb/ft s)	0.05	0.47	0.06
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	14.55	6.78	11.22
C & E Loss (ft)	0.01	Cum SA (acres)	3.31	0.57	2.71

CROSS SECTION
RIVER: RIVER-1
REACH: Reach-1 RS: 8

INPUT
Description: About 120 ft u/s proposed B-70-244-
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
740	756	770	755	798	754	850	753	880	752
925	751	975	750	982	746.3	1000	744.5	1015	746.3
1030	750	1035	751	1070	751	1095	752	1130	753
1175	755	1210	757	1220	758	1232	758	1245	757

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
740	.06	982	.04	1015	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
982	1015	15	25	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
740	950	760	F
1093	1245	758	F

CROSS SECTION OUTPUT Profile #100 yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	757.70	Element			
Vel Head (ft)	0.15	Wt. n-Val.	0.060	0.040	0.060
W.S. Elev (ft)	757.55	Reach Len. (ft)	15.00	25.00	35.00
Crit W.S. (ft)	752.12	Flow Area (sq ft)	248.44	401.10	545.92
E.G. Slope (ft/ft)	0.000393	Area (sq ft)	1200.63	401.10	951.90
Q Total (cfs)	3000.00	Flow (cfs)	469.19	1555.03	975.78
Top Width (ft)	482.75	Top Width (ft)	242.00	33.00	207.75
Vel Total (ft/s)	2.51	Avg. Vel. (ft/s)	1.89	3.88	1.79
Max Chl Dpth (ft)	13.05	Hydr. Depth (ft)	7.76	12.15	7.00
Conv. Total (cfs)	151355.0	Conv. (cfs)	23671.3	78453.9	49229.8
Length Wtd. (ft)	26.21	Wetted Per. (ft)	32.92	33.20	78.57
Min Ch El (ft)	744.50	Shear (lb/sq ft)	0.19	0.30	0.17
Alpha	1.49	Stream Power (lb/ft s)	0.35	1.15	0.30
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	7.20	3.89	5.06
C & E Loss (ft)	0.04	Cum SA (acres)	1.72	0.33	1.38

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION
RIVER: RIVER-1
REACH: Reach-1 RS: 7.79

INPUT
Description: U/s East Frontage Rd
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
81.568	753	163.135	752	226.577	751	232.921	750	239.265	746.3
258.298	744.3	271.892	746.3	282.768	750	339.865	751	371.586	752
394.244	753								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
81.568	.05	239.265	.04	271.892	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
239.265	271.892	50	50	.3	.5

```
Ineffective Flow      num=       2
   Sta L   Sta R    Elev  Permanent
  81.568     216   763.3        F
     301 394.244   763.3        F
Skew Angle = 25

CROSS SECTION OUTPUT  Profile #100 yr

  E.G. Elev (ft)             757.65    Element                  Left OB    Channel   Right OB
  Vel Head (ft)                0.27    Wt. n-Val.                0.050      0.040      0.050
  W.S. Elev (ft)             757.38    Reach Len. (ft)            2.00       2.00       2.00
  Crit W.S. (ft)             751.83    Flow Area (sq ft)        168.87     394.22     232.11
  E.G. Slope (ft/ft)       0.000603    Area (sq ft)             873.72     394.22     790.64
  Q Total (cfs)              3000.00    Flow (cfs)               448.38    1884.65     666.97
  Top Width (ft)             312.68    Top Width (ft)           157.70      32.63     122.35
  Vel Total (ft/s)             3.77    Avg. Vel. (ft/s)           2.66       4.78       2.87
  Max Chl Dpth (ft)           13.08    Hydr. Depth (ft)           7.26      12.08       7.97
  Conv. Total (cfs)         122121.9    Conv. (cfs)            18252.5    76719.0    27150.4
  Length Wtd. (ft)             2.00    Wetted Per. (ft)          24.34      32.88      29.72
  Min Ch El (ft)             744.30    Shear (lb/sq ft)           0.26       0.45       0.29
  Alpha                        1.21    Stream Power (lb/ft s)     0.69       2.16       0.85
  Frctn Loss (ft)              0.00    Cum Volume (acre-ft)       6.84       3.66       4.36
  C & E Loss (ft)              0.01    Cum SA (acres)             1.65       0.31       1.25


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,
         energy was used.

BRIDGE
RIVER: RIVER-1
REACH: Reach-1            RS: 7.75

INPUT
Description: Proposed East Frontage Rd B-70-308
Distance from Upstream XS =       2
Deck/Roadway Width        =      35
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       6
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
  81.568   763.3             216   763.3             216   763.3   758.5
   300.8   763.3   758.2   300.8   763.3         394.244   763.3

Upstream Bridge Cross Section Data
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  81.568     753 163.135     752 226.577     751 232.921     750 239.265   746.3
 258.298   744.3 271.892   746.3 282.768     750 339.865     751 371.586     752
 394.244     753

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
  81.568     .05 239.265     .04 271.892     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
        239.265 271.892            .3       .5
Ineffective Flow      num=       2
   Sta L   Sta R    Elev  Permanent
  81.568     216   763.3        F
     301 394.244   763.3        F
Skew Angle = 25

Downstream  Deck/Roadway Coordinates
    num=       6
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
  81.568   763.3             216   763.3             216   763.3   758.5
   300.8   763.3   758.2   300.8   763.3         394.244   763.3

Downstream Bridge Cross Section Data
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  81.568     753 163.135     752 226.577     751 232.921     750 239.265   746.3
 258.298   744.3 271.892   746.3 282.768     750 339.865     751 371.586     752
 394.244     753

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
  81.568     .05 239.265     .04 271.892     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
        239.265 271.892            .3       .5
Ineffective Flow      num=       2
   Sta L   Sta R    Elev  Permanent
  81.568     216   763.3        F
     301 394.244   763.3        F
Skew Angle = 25
```

```
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         =   763.3
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Abutments =  2

Abutment Data
Upstream     num=       3
     Sta    Elev     Sta    Elev     Sta    Elev
     216     753   218.5     753   230.5     745
Downstream     num=       3
     Sta    Elev     Sta    Elev     Sta    Elev
     216     753   218.5     753   230.5     745

Abutment Data
Upstream     num=       3
     Sta    Elev     Sta    Elev     Sta    Elev
   286.8     745   298.3   752.7   300.8   752.7
Downstream     num=       3
     Sta    Elev     Sta    Elev     Sta    Elev
   286.8     745   298.3   752.7   300.8   752.7

Number of Bridge Coefficient Sets =  1

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

High Flow Method
       Pressure and Weir flow
           Submerged Inlet Cd          =
           Submerged Inlet + Outlet Cd =      .8
           Max Low Cord                =

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 yr

  E.G. US. (ft)                757.65    Element                 Inside BR US  Inside BR DS
  W.S. US. (ft)                757.38    E.G. Elev (ft)               757.64        757.61
  Q Total (cfs)               3000.00    W.S. Elev (ft)               757.32        757.30
  Q Bridge (cfs)              3000.00    Crit W.S. (ft)               751.74        751.74
  Q Weir (cfs)                           Max Chl Dpth (ft)             13.02         13.00
  Weir Sta Lft (ft)                      Vel Total (ft/s)               3.89          3.90
  Weir Sta Rgt (ft)                      Flow Area (sq ft)            770.96        768.68
  Weir Submerg                           Froude # Chl                   0.26          0.26
  Weir Max Depth (ft)                    Specif Force (cu ft)         4215.10       4195.60
  Min El Weir Flow (ft)        763.31    Hydr Depth (ft)                9.09          9.06
  Min El Prs (ft)              758.50    W.P. Total (ft)               97.03         96.98
  Delta EG (ft)                  0.07    Conv. Total (cfs)           112941.6      112451.2
  Delta WS (ft)                  0.07    Top Width (ft)                84.80         84.80
  BR Open Area (sq ft)         857.95    Frctn Loss (ft)                0.02          0.01
  BR Open Vel (ft/s)             3.90    C & E Loss (ft)                0.00          0.02
  Coef of Q                              Shear Total (lb/sq ft)         0.35          0.35
  Br Sel Method          Energy only     Power Total (lb/ft s)          1.36          1.37


Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid,
         energy was used.
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: 7.5

INPUT
Description: D/s East frontage Rd
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  81.568     753 163.135     752 226.577     751 232.921     750 239.265   746.3
 258.298   744.3 271.892   746.3 282.768     750 339.865     751 371.586     752
 394.244     753

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
  81.568     .05 239.265     .04 271.892     .05

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

```
      239.265 271.892                45       45       45              .3       .5
Ineffective Flow      num=        2
   Sta L    Sta R     Elev  Permanent
  81.568      216    763.3        F
     301 394.244    763.3        F
Skew Angle = 25

CROSS SECTION OUTPUT  Profile #100 yr

  E.G. Elev (ft)             757.58    Element                 Left OB    Channel   Right OB
  Vel Head (ft)                0.27    Wt. n-Val.                0.050      0.040      0.050
  W.S. Elev (ft)             757.31    Reach Len. (ft)           45.00      45.00      45.00
  Crit W.S. (ft)             751.83    Flow Area (sq ft)        167.15     391.82     229.96
  E.G. Slope (ft/ft)       0.000619    Area (sq ft)             862.11     391.82     781.63
  Q Total (cfs)              3000.00    Flow (cfs)               446.32    1888.77     664.91
  Top Width (ft)              312.68    Top Width (ft)           157.70      32.63     122.35
  Vel Total (ft/s)              3.80    Avg. Vel. (ft/s)           2.67       4.82       2.89
  Max Chl Dpth (ft)            13.01    Hydr. Depth (ft)           7.18      12.01       7.90
  Conv. Total (cfs)         120620.6    Conv. (cfs)             17945.0    75941.6    26734.0
  Length Wtd. (ft)             45.00    Wetted Per. (ft)          24.34      32.88      29.72
  Min Ch El (ft)              744.30    Shear (lb/sq ft)           0.27       0.46       0.30
  Alpha                         1.21    Stream Power (lb/ft s)     0.71       2.22       0.86
  Frctn Loss (ft)               0.03    Cum Volume (acre-ft)       6.54       3.21       4.01
  C & E Loss (ft)               0.00    Cum SA (acres)             1.60       0.28       1.20


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,
         energy was used.

CROSS SECTION
RIVER: RIVER-1
REACH: Reach-1            RS: 7

INPUT
Description: U/s bridge face -- proposed B-70-244
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  81.568     753 163.135     752 226.577     751 232.921     750 239.265   746.3
 258.298   744.3 271.892   746.3 282.768     750 339.865     751 371.586     752
 394.244     753

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
  81.568     .05 239.265     .04 271.892     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       239.265 271.892                45       45       45              .3       .5
Ineffective Flow      num=        2
   Sta L    Sta R     Elev  Permanent
  81.568      206     760        F
     292 394.244     760        F
Skew Angle = 25

CROSS SECTION OUTPUT  Profile #100 yr

  E.G. Elev (ft)             757.55    Element                 Left OB    Channel   Right OB
  Vel Head (ft)                0.28    Wt. n-Val.                0.050      0.040      0.050
  W.S. Elev (ft)             757.27    Reach Len. (ft)           0.50       0.50       0.50
  Crit W.S. (ft)             751.88    Flow Area (sq ft)        226.56     390.61     165.60
  E.G. Slope (ft/ft)       0.000637    Area (sq ft)             856.27     390.61     777.10
  Q Total (cfs)              3000.00    Flow (cfs)               597.48    1906.19     496.33
  Top Width (ft)              312.68    Top Width (ft)           157.70      32.63     122.35
  Vel Total (ft/s)              3.83    Avg. Vel. (ft/s)           2.64       4.88       3.00
  Max Chl Dpth (ft)            12.97    Hydr. Depth (ft)           6.81      11.97       8.24
  Conv. Total (cfs)         118904.8    Conv. (cfs)             23681.1    75551.5    19672.1
  Length Wtd. (ft)              0.50    Wetted Per. (ft)          34.35      32.88      20.72
  Min Ch El (ft)              744.30    Shear (lb/sq ft)           0.26       0.47       0.32
  Alpha                         1.23    Stream Power (lb/ft s)     0.69       2.30       0.95
  Frctn Loss (ft)               0.00    Cum Volume (acre-ft)       5.65       2.81       3.21
  C & E Loss (ft)               0.01    Cum SA (acres)             1.44       0.24       1.07


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,
         energy was used.

BRIDGE
RIVER: RIVER-1
REACH: Reach-1            RS: 6.5

INPUT
Description: Proposed Bridge B-70-244
Distance from Upstream XS =       .5
Deck/Roadway Width        =      42
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=        6
```

```
     Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord
   81.56   760.2           206.4   760.2           206.4   760.2   757.2
   291.3   760.2   757.2   291.3   760.2          394.25   760.2

Upstream Bridge Cross Section Data
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  81.568     753 163.135     752 226.577     751 232.921     750 239.265   746.3
 258.298   744.3 271.892   746.3 282.768     750 339.865     751 371.586     752
 394.244     753

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
  81.568     .05 239.265     .04 271.892     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
       239.265 271.892            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
  81.568     206     760        F
     292 394.244     760        F
Skew Angle = 25

Downstream  Deck/Roadway Coordinates
    num=       6
     Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord
   81.56   760.2           206.4   760.2           206.4   760.2   757.2
   291.3   760.2   757.2   291.3   760.2          394.25   760.2

Downstream Bridge Cross Section Data
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  81.568     753 163.135     752 226.577     751 232.921     750 239.265   746.3
 258.298   744.3 271.892   746.3 282.768     750 339.865     751 371.586     752
 394.244     753

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
  81.568     .05 239.265     .04 271.892     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
       239.265 271.892            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
  81.568     206     760        F
     292 394.244     760        F
Skew Angle = 25

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 Abutments =  2

Abutment Data
Upstream     num=       3
     Sta    Elev     Sta    Elev     Sta    Elev
   206.4   751.7   208.9   751.7     219     746
Downstream     num=       3
     Sta    Elev     Sta    Elev     Sta    Elev
   206.4   751.7   208.9   751.7     219     746

Abutment Data
Upstream     num=       3
     Sta    Elev     Sta    Elev     Sta    Elev
     278     746   288.8   752.7   291.3   752.7
Downstream     num=       3
     Sta    Elev     Sta    Elev     Sta    Elev
     278     746   288.8   752.7   291.3   752.7

Number of Bridge Coefficient Sets =  1

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

High Flow Method
       Pressure and Weir flow
           Submerged Inlet Cd          =
           Submerged Inlet + Outlet Cd =      .8
           Max Low Cord                =

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 water surface

BRIDGE OUTPUT Profile #100 yr

			Inside BR US	Inside BR DS
E.G. US. (ft)	757.55	Element		
W.S. US. (ft)	757.27	E.G. Elev (ft)	757.54	757.51
Q Total (cfs)	3000.00	W.S. Elev (ft)	757.21	757.18
Q Bridge (cfs)	3000.00	Crit W.S. (ft)	751.86	751.86
Q Weir (cfs)		Max Chl Dpth (ft)	12.91	12.88
Weir Sta Lft (ft)		Vel Total (ft/s)	3.96	3.98
Weir Sta Rgt (ft)		Flow Area (sq ft)	756.96	754.03
Weir Submerg		Froude # Chl	0.27	0.27
Weir Max Depth (ft)		Specif Force (cu ft)	4098.33	4073.94
Min El Weir Flow (ft)	760.21	Hydr Depth (ft)	8.92	8.88
Min El Prs (ft)	757.20	W.P. Total (ft)	97.72	97.67
Delta EG (ft)	0.07	Conv. Total (cfs)	109762.7	109135.6
Delta WS (ft)	0.08	Top Width (ft)	84.90	84.90
BR Open Area (sq ft)	756.11	Frctn Loss (ft)	0.03	0.00
BR Open Vel (ft/s)	3.98	C & E Loss (ft)	0.00	0.02
Coef of Q		Shear Total (lb/sq ft)	0.36	0.36
Br Sel Method	Energy only	Power Total (lb/ft s)	1.43	1.45

Warning: The sluice gate calculations did not converge during the pressure flow only calculation.
Note: The downstream water surface is below the minimum elevation for pressure flow. The sluice gate equations were used for pressure flow.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
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: 6

INPUT
Description: D/s bridge face -- proposed B-70-244
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
81.568	753	163.135	752	226.577	751	232.921	750	239.265	746.3
258.298	744.3	271.892	746.3	282.768	750	339.865	751	371.586	752
394.244	753								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
81.568	.05	239.265	.04	271.892	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
239.265	271.892	38	38	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
81.568	206	760	F
292	394.244	760	F

Skew Angle = 25

CROSS SECTION OUTPUT Profile #100 yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	757.48	Element			
Vel Head (ft)	0.28	Wt. n-Val.	0.050	0.040	0.050
W.S. Elev (ft)	757.20	Reach Len. (ft)	38.00	38.00	38.00
Crit W.S. (ft)	751.88	Flow Area (sq ft)	224.02	388.13	164.07
E.G. Slope (ft/ft)	0.000653	Area (sq ft)	844.27	388.13	767.79
Q Total (cfs)	3000.00	Flow (cfs)	594.09	1910.78	495.13
Top Width (ft)	312.68	Top Width (ft)	157.70	32.63	122.35
Vel Total (ft/s)	3.86	Avg. Vel. (ft/s)	2.65	4.92	3.02
Max Chl Dpth (ft)	12.90	Hydr. Depth (ft)	6.73	11.90	8.16
Conv. Total (cfs)	117364.5	Conv. (cfs)	23241.7	74752.7	19370.1
Length Wtd. (ft)	38.00	Wetted Per. (ft)	34.35	32.88	20.72
Min Ch El (ft)	744.30	Shear (lb/sq ft)	0.27	0.48	0.32
Alpha	1.23	Stream Power (lb/ft s)	0.71	2.37	0.97
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	5.40	2.41	3.04
C & E Loss (ft)	0.14	Cum SA (acres)	1.40	0.21	1.05

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: 4

INPUT

Description: U/s face bridge B-70-139
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
267.92	756.17	268.34	752.95	276	750.98	283	746.55	290	744.98
297	744.9	304	744.94	311	746.48	318	750.52	325.63	753.34
326	756.17								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
267.92	.05	283	.04	311	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
283	311	50	50	50	.3	.5

CROSS SECTION OUTPUT Profile #100 yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	757.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.74	Wt. n-Val.	0.050	0.040	0.050
W.S. Elev (ft)	756.56	Reach Len. (ft)	2.00	2.00	2.00
Crit W.S. (ft)	752.24	Flow Area (sq ft)	90.67	314.47	92.49
E.G. Slope (ft/ft)	0.001675	Area (sq ft)	90.67	314.47	92.49
Q Total (cfs)	3000.00	Flow (cfs)	303.76	2378.33	317.91
Top Width (ft)	58.08	Top Width (ft)	15.08	28.00	15.00
Vel Total (ft/s)	6.03	Avg. Vel. (ft/s)	3.35	7.56	3.44
Max Chl Dpth (ft)	11.66	Hydr. Depth (ft)	6.01	11.23	6.17
Conv. Total (cfs)	73303.2	Conv. (cfs)	7422.2	58113.1	7767.9
Length Wtd. (ft)	2.00	Wetted Per. (ft)	19.84	28.34	19.47
Min Ch El (ft)	744.90	Shear (lb/sq ft)	0.48	1.16	0.50
Alpha	1.31	Stream Power (lb/ft s)	1.60	8.77	1.71
Frctn Loss (ft)		Cum Volume (acre-ft)	5.00	2.10	2.66
C & E Loss (ft)		Cum SA (acres)	1.33	0.18	0.99

BRIDGE
RIVER: RIVER-1
REACH: Reach-1 RS: 3.5

INPUT
Description: Existing bridge B-70-139
Distance from Upstream XS = 2
Deck/Roadway Width = 46
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 4

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
267.92	760.4		267.92	760.4	756.17	326	760.4	756.17
326	760.4							

Upstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
267.92	756.17	268.34	752.95	276	750.98	283	746.55	290	744.98
297	744.9	304	744.94	311	746.48	318	750.52	325.63	753.34
326	756.17								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
267.92	.05	283	.04	311	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
283	311	.3	.5

Downstream Deck/Roadway Coordinates
num= 4

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
267.92	760.4		267.92	760.4	756.17	326	760.4	756.17
326	760.4							

Downstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
267.92	756.17	268.34	752.95	276	750.98	283	746.55	290	744.98
297	744.9	304	744.94	311	746.48	318	750.52	325.63	753.34
326	756.17								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
267.92	.05	283	.04	311	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
283	311	.3	.5

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
Pressure and Weir flow
Submerged Inlet Cd =
Submerged Inlet + Outlet Cd = .8
Max Low Cord =

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 water surface

BRIDGE OUTPUT Profile #100 yr

			Inside BR US	Inside BR DS
E.G. US. (ft)	757.31	Element		
W.S. US. (ft)	756.56	E.G. Elev (ft)	757.31	757.12
Q Total (cfs)	3000.00	W.S. Elev (ft)	756.17	756.17
Q Bridge (cfs)	3000.00	Crit W.S. (ft)	752.28	752.28
Q Weir (cfs)		Max Chl Dpth (ft)	11.27	11.27
Weir Sta Lft (ft)		Vel Total (ft/s)	6.32	6.32
Weir Sta Rgt (ft)		Flow Area (sq ft)	474.70	474.70
Weir Submerg		Froude # Chl	0.42	0.42
Weir Max Depth (ft)		Specif Force (cu ft)	2851.29	2851.29
Min El Weir Flow (ft)	760.41	Hydr Depth (ft)	8.17	8.17
Min El Prs (ft)	756.17	W.P. Total (ft)	66.85	66.85
Delta EG (ft)	0.19	Conv. Total (cfs)	68519.1	68519.1
Delta WS (ft)	0.23	Top Width (ft)	58.08	58.08
BR Open Area (sq ft)	474.70	Frctn Loss (ft)		
BR Open Vel (ft/s)	6.32	C & E Loss (ft)		
Coef of Q		Shear Total (lb/sq ft)	0.85	0.85
Br Sel Method	Press Only	Power Total (lb/ft s)	5.37	5.37

Note: The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.

CROSS SECTION
RIVER: RIVER-1
REACH: Reach-1 RS: 3

INPUT
Description: D/s face bridge B-70-139
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
267.92	756.17	268.34	752.95	276	750.98	283	746.55	290	744.98
297	744.9	304	744.94	311	746.48	318	750.52	325.63	753.34
326	756.17								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
267.92	.05	283	.04	311	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
283	311	30	30	.3	.5

CROSS SECTION OUTPUT Profile #100 yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	757.12	Element			
Vel Head (ft)	0.78	Wt. n-Val.	0.050	0.040	0.050
W.S. Elev (ft)	756.34	Reach Len. (ft)	30.00	30.00	30.00
Crit W.S. (ft)		Flow Area (sq ft)	87.26	308.13	89.09
E.G. Slope (ft/ft)	0.001808	Area (sq ft)	87.26	308.13	89.09
Q Total (cfs)	3000.00	Flow (cfs)	298.36	2388.85	312.80
Top Width (ft)	58.08	Top Width (ft)	15.08	28.00	15.00
Vel Total (ft/s)	6.19	Avg. Vel. (ft/s)	3.42	7.75	3.51
Max Chl Dpth (ft)	11.44	Hydr. Depth (ft)	5.79	11.00	5.94
Conv. Total (cfs)	70545.3	Conv. (cfs)	7015.9	56173.9	7355.5
Length Wtd. (ft)	30.00	Wetted Per. (ft)	19.61	28.34	19.24
Min Ch El (ft)	744.90	Shear (lb/sq ft)	0.50	1.23	0.52
Alpha	1.31	Stream Power (lb/ft s)	1.72	9.52	1.84
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	4.90	1.75	2.56
C & E Loss (ft)	0.24	Cum SA (acres)	1.31	0.15	0.97

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 2.5

INPUT
Description: Just U/s West Frontage Rd-- based on DTM
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
610	756	645	755	682	754	785	753	860	752
950	751	978	750	984	746	1000	744.3	1015	746
1028	750	1032	752	1045	752	1050	751	1090	751
1105	752	1130	753	1160	754	1175	755	1186	756

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
610	.05	984	.04	1015	.05

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
984 1015 70 70 70 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
610	945	760	F
1038	1186	760	F

CROSS SECTION OUTPUT Profile #100 yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	756.85	Element			
Vel Head (ft)	0.31	Wt. n-Val.	0.050	0.040	0.050
W.S. Elev (ft)	756.54	Reach Len. (ft)	20.00	20.00	20.00
Crit W.S. (ft)	751.78	Flow Area (sq ft)	247.96	353.12	160.44
E.G. Slope (ft/ft)	0.000774	Area (sq ft)	1402.34	353.12	749.01
Q Total (cfs)	3000.00	Flow (cfs)	689.37	1840.71	469.91
Top Width (ft)	576.00	Top Width (ft)	374.00	31.00	171.00
Vel Total (ft/s)	3.94	Avg. Vel. (ft/s)	2.78	5.21	2.93
Max Chl Dpth (ft)	12.24	Hydr. Depth (ft)	6.36	11.39	6.98
Conv. Total (cfs)	107804.4	Conv. (cfs)	24772.4	66145.7	16886.3
Length Wtd. (ft)	20.00	Wetted Per. (ft)	40.23	31.19	24.07
Min Ch El (ft)	744.30	Shear (lb/sq ft)	0.30	0.55	0.32
Alpha	1.28	Stream Power (lb/ft s)	0.83	2.85	0.94
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	4.39	1.52	2.27
C & E Loss (ft)	0.00	Cum SA (acres)	1.17	0.13	0.91

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, energy was used.

BRIDGE
RIVER: RIVER-1
REACH: Reach-1 RS: 2.25

INPUT
Description: Proposed West Frontage Rd B-70-307
Distance from Upstream XS = 20
Deck/Roadway Width = 35
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 6

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
610 761.6		945 761.6		945 761.6	757.4
1038 761.5	757.3	1038 761.5		1186 761.5	

Upstream Bridge Cross Section Data
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
610	756	645	755	682	754	785	753	860	752
950	751	978	750	984	746	1000	744.3	1015	746
1028	750	1032	752	1045	752	1050	751	1090	751
1105	752	1130	753	1160	754	1175	755	1186	756

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
610	.05	984	.04	1015	.05

Bank Sta: Left Right Coeff Contr. Expan.
984 1015 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
610	945	760	F
1038	1186	760	F

Downstream Deck/Roadway Coordinates
num= 6

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
610 761.6		945 761.6		945 761.6	757.4
1038 761.5	757.3	1038 761.5		1186 761.5	

Downstream Bridge Cross Section Data
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
610	756	645	755	682	754	785	753	860	752
950	751	978	750	984	746	1000	744.3	1015	746
1028	750	1032	752	1045	752	1050	751	1090	751
1105	752	1130	753	1160	754	1175	755	1186	756

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
610	.05	984	.04	1015	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
984	1015	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
610	945	760	F
1038	1186	760	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 Abutments = 2

Abutment Data
Upstream num= 3

Sta	Elev	Sta	Elev	Sta	Elev
945	751.2	947.5	751.2	956.8	746

Downstream num= 3

Sta	Elev	Sta	Elev	Sta	Elev
945	751.2	947.5	751.2	956.8	746

Abutment Data
Upstream num= 3

Sta	Elev	Sta	Elev	Sta	Elev
1026.2	746	1035.5	751.2	1038	751.2

Downstream num= 3

Sta	Elev	Sta	Elev	Sta	Elev
1026.2	746	1035.5	751.2	1038	751.2

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

artificially Right : 756.6 to 756.7 LC

BRIDGE OUTPUT Profile #100 yr

		Element	Inside BR US	Inside BR DS
E.G. US. (ft)	756.85	E.G. Elev (ft)	756.83	756.80
W.S. US. (ft)	756.54	W.S. Elev (ft)	756.51	756.48
Q Total (cfs)	3000.00	Crit W.S. (ft)	751.79	751.79
Q Bridge (cfs)	3000.00	Max Chl Dpth (ft)	12.21	12.18
Q Weir (cfs)		Vel Total (ft/s)	3.96	3.97
Weir Sta Lft (ft)		Flow Area (sq ft)	757.93	754.97
Weir Sta Rgt (ft)		Froude # Chl	0.24	0.25
Weir Submerg		Specif Force (cu ft)	3812.44	3790.04
Weir Max Depth (ft)		Hydr Depth (ft)	8.15	8.12
Min El Weir Flow (ft)	761.51	W.P. Total (ft)	100.84	100.81
Min El Prs (ft)	757.40	Conv. Total (cfs)	105089.8	104475.7
Delta EG (ft)	0.07	Top Width (ft)	93.00	93.00
Delta WS (ft)	0.07	Frctn Loss (ft)	0.03	0.01
BR Open Area (sq ft)	836.34	C & E Loss (ft)	0.00	0.01
BR Open Vel (ft/s)	3.97	Shear Total (lb/sq ft)	0.38	0.39
Coef of Q		Power Total (lb/ft s)	1.51	1.53
Br Sel Method	Energy only			

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
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: 2

INPUT
Description: About 100 d/s B-70-139-- based on DTM-- D/s West frontage Rd
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
610	756	645	755	682	754	785	753	860	752
950	751	978	750	984	746	1000	744.3	1015	746
1028	750	1032	752	1045	752	1050	751	1090	751
1105	752	1130	753	1160	754	1175	755	1186	756

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
610	.05	984	.04	1015	.05

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
984 1015 100 100 100 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
610	945	760	F
1038	1186	760	F

CROSS SECTION OUTPUT Profile #100 yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	756.78	Element			
Vel Head (ft)	0.31	Wt. n-Val.	0.050	0.040	0.050
W.S. Elev (ft)	756.47	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	751.78	Flow Area (sq ft)	245.13	350.87	158.77
E.G. Slope (ft/ft)	0.000796	Area (sq ft)	1375.18	350.87	736.59
Q Total (cfs)	3000.00	Flow (cfs)	685.60	1846.26	468.14
Top Width (ft)	576.00	Top Width (ft)	374.00	31.00	171.00
Vel Total (ft/s)	3.97	Avg. Vel. (ft/s)	2.80	5.26	2.95
Max Chl Dpth (ft)	12.17	Hydr. Depth (ft)	6.29	11.32	6.90
Conv. Total (cfs)	106341.1	Conv. (cfs)	24302.6	65444.3	16594.3
Length Wtd. (ft)	100.00	Wetted Per. (ft)	40.23	31.19	24.07
Min Ch El (ft)	744.30	Shear (lb/sq ft)	0.30	0.56	0.33
Alpha	1.28	Stream Power (lb/ft s)	0.85	2.94	0.97
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	3.53	0.96	1.78
C & E Loss (ft)	0.11	Cum SA (acres)	0.98	0.08	0.81

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: 1

INPUT
Description: CRANE SECTION 9-- FIS X-section I (section 2.86 in HEC-2)
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	760.8	1530	753.9	1800	748.9	1806	746	1810	743.5
1825	743.5	1840	743.5	1844	746	1850	751	2080	756.2
2380	756.2								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.07	1806	.045	1844	.07

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
1806 1844 2800 2800 2800 .1 .3

CROSS SECTION OUTPUT Profile #100 yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	756.62	Element			
Vel Head (ft)	0.10	Wt. n-Val.	0.070	0.045	0.070
W.S. Elev (ft)	756.52	Reach Len. (ft)			
Crit W.S. (ft)	751.56	Flow Area (sq ft)	1700.45	484.76	815.73
E.G. Slope (ft/ft)	0.000433	Area (sq ft)	1700.45	484.76	815.73
Q Total (cfs)	4000.00	Flow (cfs)	1750.42	1774.15	475.43
Top Width (ft)	1051.25	Top Width (ft)	477.25	38.00	536.00
Vel Total (ft/s)	1.33	Avg. Vel. (ft/s)	1.03	3.66	0.58
Max Chl Dpth (ft)	13.02	Hydr. Depth (ft)	3.56	12.76	1.52
Conv. Total (cfs)	192228.8	Conv. (cfs)	84120.4	85260.5	22848.0
Length Wtd. (ft)		Wetted Per. (ft)	477.97	39.43	538.19
Min Ch El (ft)	743.50	Shear (lb/sq ft)	0.10	0.33	0.04
Alpha	3.63	Stream Power (lb/ft s)	0.10	1.22	0.02
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

HEC-RAS Version 3.1.3 May 2005
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

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

Existing Conditions

PROJECT DATA
Project Title: USH 45 & frontage Rds over Arrowhead R.
Project File : B70_307.prj
Run Date and Time: 9/28/2005 10:37:02 AM

B-70-307 &

Project in English units

Project Description:
Starting Condition based on WINNEBAGO CO. WIS- FIS 5-30-78 revised 2003

ARROWHEAD RIVER JN2000
Updated by NK of WisDOT on 3-8-2010 to reflect final
sizing of the USH 45 frontage Roads (B-70-307 and B-70-308)

B-70-308

PLAN DATA

Plan Title: Existing Conditions
Plan File : C:\users\projects\B-70-244\B70_307.p01

Geometry Title: Existing Conditions
Geometry File : C:\users\projects\B-70-244\B70_307.g01

Flow Title : 100 YR & 2 YR
Flow File : C:\users\projects\B-70-244\B70_307.f01

Plan Summary Information:
Number of: Cross Sections = 14 Multiple Openings = 0
Culverts = 0 Inline Structures = 0
Bridges = 2 Lateral Structures = 0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

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

FLOW DATA

Flow Title: 100 YR & 2 YR
Flow File : C:\users\projects\B-70-244\B70_307.f01

Flow Data (cfs)

River	Reach	RS	2 yr	100 yr
RIVER-1	Reach-1	20	760	3000
RIVER-1	Reach-1	10	760	3000
RIVER-1	Reach-1	1	830	4000

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
RIVER-1	Reach-1	2 yr		Known WS = 752.5
RIVER-1	Reach-1	100 yr		Known WS = 756.52

GEOMETRY DATA

Geometry Title: Existing Conditions
Geometry File : C:\users\projects\B-70-244\B70_307.g01

CROSS SECTION
RIVER: RIVER-1
REACH: Reach-1 RS: 20

INPUT
Description: Repeat section-- Based on USGS quad map
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1700	760	2980	750	2984	747	3000	745	3016	747
3020	750	4650	760						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1700	.06	2980	.04	3020	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
2980	3020	5300	5300	5300 .1	.3

CROSS SECTION OUTPUT Profile #100 yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	758.75	Element			
Vel Head (ft)	0.00	Wt. n-Val.	0.060	0.040	0.060
W.S. Elev (ft)	758.75	Reach Len. (ft)	5300.00	5300.00	5300.00
Crit W.S. (ft)		Flow Area (sq ft)	4900.00	490.00	6239.84
E.G. Slope (ft/ft)	0.000013	Area (sq ft)	4900.00	490.00	6239.84
Q Total (cfs)	3000.00	Flow (cfs)	1171.52	336.60	1491.87
Top Width (ft)	2586.25	Top Width (ft)	1120.00	40.00	1426.25
Vel Total (ft/s)	0.26	Avg. Vel. (ft/s)	0.24	0.69	0.24
Max Chl Dpth (ft)	13.75	Hydr. Depth (ft)	4.38	12.25	4.38
Conv. Total (cfs)	831228.1	Conv. (cfs)	324601.0	93264.7	413362.3
Length Wtd. (ft)	5300.00	Wetted Per. (ft)	1120.03	42.25	1426.28
Min Ch El (ft)	745.00	Shear (lb/sq ft)	0.00	0.01	0.00
Alpha	1.56	Stream Power (lb/ft s)	0.00	0.01	0.00
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	1222.96	124.13	1094.78
C & E Loss (ft)	0.00	Cum SA (acres)	281.37	9.85	281.57

CROSS SECTION
RIVER: RIVER-1
REACH: Reach-1 RS: 18

INPUT
Description: Repeat section-- Based on USGS quad map
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
600	760	2980	750	2984	746.6	2992	744.8	3000	744.7
3008	745	3016	746	3020	750	3350	753	5450	760

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
600	.06	2980	.04	3020	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
2980	3020	1650	1650	1650 .1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
600	1100		F
4700	5450		F

CROSS SECTION OUTPUT Profile #100 yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	758.70	Element			
Vel Head (ft)	0.00	Wt. n-Val.	0.060	0.040	0.060
W.S. Elev (ft)	758.70	Reach Len. (ft)	1650.00	1650.00	1650.00
Crit W.S. (ft)		Flow Area (sq ft)	8937.11	516.53	7039.16
E.G. Slope (ft/ft)	0.000006	Area (sq ft)	9014.08	516.53	7256.38
Q Total (cfs)	3000.00	Flow (cfs)	1591.97	255.36	1152.67
Top Width (ft)	4152.41	Top Width (ft)	2071.40	40.00	2041.01
Vel Total (ft/s)	0.18	Avg. Vel. (ft/s)	0.18	0.49	0.16
Max Chl Dpth (ft)	14.00	Hydr. Depth (ft)	4.75	12.91	4.19
Conv. Total (cfs)	1179192.0	Conv. (cfs)	625746.3	100371.9	453073.7
Length Wtd. (ft)	1650.00	Wetted Per. (ft)	1880.02	43.18	1680.02
Min Ch El (ft)	744.70	Shear (lb/sq ft)	0.00	0.00	0.00
Alpha	1.45	Stream Power (lb/ft s)	0.00	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	376.48	62.90	273.73
C & E Loss (ft)	0.00	Cum SA (acres)	87.22	4.98	70.63

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
RIVER: RIVER-1
REACH: Reach-1 RS: 16

INPUT
Description: Repeat section-- Based on USGS quad map

Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
150	760	980	750	984	746.6	992	744.8	1000	744.7
1008	744.9	1016	746	1020	750	1550	760		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
150	.08	980	.04	1020	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
980	1020	2600	2500	2100	.1	.3

CROSS SECTION OUTPUT Profile #100 yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	758.68	Element			
Vel Head (ft)	0.01	Wt. n-Val.	0.080	0.040	0.060
W.S. Elev (ft)	758.67	Reach Len. (ft)	2600.00	2500.00	2100.00
Crit W.S. (ft)		Flow Area (sq ft)	3117.52	515.89	1990.71
E.G. Slope (ft/ft)	0.000061	Area (sq ft)	3117.52	515.89	1990.71
Q Total (cfs)	3000.00	Flow (cfs)	1199.02	780.20	1020.78
Top Width (ft)	1218.74	Top Width (ft)	719.38	40.00	459.36
Vel Total (ft/s)	0.53	Avg. Vel. (ft/s)	0.38	1.51	0.51
Max Chl Dpth (ft)	13.97	Hydr. Depth (ft)	4.33	12.90	4.33
Conv. Total (cfs)	385084.2	Conv. (cfs)	153907.8	100147.6	131028.8
Length Wtd. (ft)	2398.47	Wetted Per. (ft)	719.43	43.19	459.45
Min Ch El (ft)	744.70	Shear (lb/sq ft)	0.02	0.05	0.02
Alpha	2.61	Stream Power (lb/ft s)	0.01	0.07	0.01
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)	146.72	43.35	98.59
C & E Loss (ft)	0.01	Cum SA (acres)	34.36	3.47	23.28

Warning: The conveyance ratio (upstream 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: 14

INPUT
Description: Repeat section-- Based on USGS quad map
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
750	760	980	750	984	746.6	992	744.6	1000	744.5
1008	744.9	1016	746	1020	750	1300	760		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
750	.08	980	.04	1020	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
980	1020	50	50	50	.3	.5

CROSS SECTION OUTPUT Profile #100 yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	758.42	Element			
Vel Head (ft)	0.07	Wt. n-Val.	0.080	0.040	0.060
W.S. Elev (ft)	758.35	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)		Flow Area (sq ft)	801.62	506.36	975.88
E.G. Slope (ft/ft)	0.000229	Area (sq ft)	801.62	506.36	975.88
Q Total (cfs)	3000.00	Flow (cfs)	583.88	1468.17	947.95
Top Width (ft)	465.80	Top Width (ft)	192.03	40.00	233.77
Vel Total (ft/s)	1.31	Avg. Vel. (ft/s)	0.73	2.90	0.97
Max Chl Dpth (ft)	13.85	Hydr. Depth (ft)	4.17	12.66	4.17
Conv. Total (cfs)	198212.1	Conv. (cfs)	38577.6	97003.1	62631.5
Length Wtd. (ft)	50.00	Wetted Per. (ft)	192.21	43.24	233.92
Min Ch El (ft)	744.50	Shear (lb/sq ft)	0.06	0.17	0.06
Alpha	2.62	Stream Power (lb/ft s)	0.04	0.49	0.06
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	29.76	14.01	27.09
C & E Loss (ft)	0.00	Cum SA (acres)	7.16	1.17	6.57

CROSS SECTION
RIVER: RIVER-1
REACH: Reach-1 RS: 12

INPUT
Description: U/s face of upstream brige -- private field entrance
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
750	760	980	750	984	746.6	992	744.6	1000	744.5
1008	744.9	1016	746	1020	750	1300	760		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
750	.08	984	.04	1016	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
984	1016	20	20	20	.3	.5

CROSS SECTION OUTPUT Profile #100 yr

E.G. Elev (ft)	758.40	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.	0.080	0.040	0.060
W.S. Elev (ft)	758.33	Reach Len. (ft)	1.00	1.00	1.00
Crit W.S. (ft)	752.22	Flow Area (sq ft)	837.32	424.03	1011.83
E.G. Slope (ft/ft)	0.000239	Area (sq ft)	837.32	424.03	1011.83
Q Total (cfs)	3000.00	Flow (cfs)	631.17	1354.60	1014.22
Top Width (ft)	464.63	Top Width (ft)	195.50	32.00	237.13
Vel Total (ft/s)	1.32	Avg. Vel. (ft/s)	0.75	3.19	1.00
Max Chl Dpth (ft)	13.83	Hydr. Depth (ft)	4.28	13.25	4.27
Conv. Total (cfs)	194009.3	Conv. (cfs)	40817.8	87601.8	65589.6
Length Wtd. (ft)	1.00	Wetted Per. (ft)	196.93	32.33	238.93
Min Ch El (ft)	744.50	Shear (lb/sq ft)	0.06	0.20	0.06
Alpha	2.91	Stream Power (lb/ft s)	0.05	0.63	0.06
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	28.82	13.48	25.94
C & E Loss (ft)	0.12	Cum SA (acres)	6.94	1.13	6.30

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.

BRIDGE
RIVER: RIVER-1
REACH: Reach-1 RS: 11

INPUT
Description: Field Entrance Bridge
Distance from Upstream XS = 1
Deck/Roadway Width = 18
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 6

Sta Hi Cord	Lo Cord		Sta Hi Cord	Lo Cord		Sta Hi Cord	Lo Cord	
750	760		984	755		984	755	752
1016	755	752	1016	755		1300	760	

Upstream Bridge Cross Section Data
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
750	760	980	750	984	746.6	992	744.6	1000	744.5
1008	744.9	1016	746	1020	750	1300	760		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
750	.08	984	.04	1016	.06

Bank Sta: Left	Right	Coeff Contr.	Expan.
984	1016	.3	.5

Downstream Deck/Roadway Coordinates
num= 6

Sta Hi Cord	Lo Cord		Sta Hi Cord	Lo Cord		Sta Hi Cord	Lo Cord	
750	760		984	755		984	755	752
1016	755	752	1016	755		1300	760	

Downstream Bridge Cross Section Data
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
750	760	980	750	984	746.6	992	744.6	1000	744.5
1008	744.9	1016	746	1020	750	1300	760		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
750	.08	984	.04	1016	.06

Bank Sta: Left	Right	Coeff Contr.	Expan.
984	1016	.3	.5

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 yr

		Element	Inside BR US	Inside BR DS
E.G. US. (ft)	758.40	E.G. Elev (ft)	758.29	758.04
W.S. US. (ft)	758.33	W.S. Elev (ft)	757.81	757.29
Q Total (cfs)	3000.00	Crit W.S. (ft)	751.57	751.57
Q Bridge (cfs)	1452.38	Max Chl Dpth (ft)	13.31	12.79
Q Weir (cfs)		Vel Total (ft/s)	4.16	5.31
Weir Sta Lft (ft)		Flow Area (sq ft)	721.05	565.24
Weir Sta Rgt (ft)		Froude # Chl	0.21	0.27
Weir Submerg		Specif Force (cu ft)	3053.12	2848.64
Weir Max Depth (ft)		Hydr Depth (ft)	2.23	2.10
Min El Weir Flow (ft)	755.01	W.P. Total (ft)	399.07	344.53
Min El Prs (ft)	752.00	Conv. Total (cfs)	34781.9	27910.3
Delta EG (ft)	0.69	Top Width (ft)	323.28	268.75
Delta WS (ft)	0.72	Frctn Loss (ft)	0.16	0.00
BR Open Area (sq ft)	221.60	C & E Loss (ft)	0.08	0.32
BR Open Vel (ft/s)	6.55	Shear Total (lb/sq ft)	0.84	1.18
Coef of Q		Power Total (lb/ft s)	3.49	6.28
Br Sel Method	Energy only			

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
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: 10

INPUT
Description: D/s face of upstream brige -- private field entrance
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
750	760	980	750	984	746.6	992	744.6	1000	744.5
1008	744.9	1016	746	1020	750	1300	760		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
750	.08	984	.04	1016	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
984	1016	700	700	.3	.5

CROSS SECTION OUTPUT Profile #100 yr

		Element	Left OB	Channel	Right OB
E.G. Elev (ft)	757.71	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.	0.080	0.040	0.060
W.S. Elev (ft)	757.60	Reach Len. (ft)	700.00	700.00	700.00
Crit W.S. (ft)		Flow Area (sq ft)	702.22	400.94	847.99
E.G. Slope (ft/ft)	0.000335	Area (sq ft)	702.22	400.94	847.99
Q Total (cfs)	3000.00	Flow (cfs)	590.91	1460.47	948.61
Top Width (ft)	427.82	Top Width (ft)	178.90	32.00	216.92
Vel Total (ft/s)	1.54	Avg. Vel. (ft/s)	0.84	3.64	1.12
Max Chl Dpth (ft)	13.10	Hydr. Depth (ft)	3.93	12.53	3.91
Conv. Total (cfs)	163910.1	Conv. (cfs)	32285.4	79795.5	51829.2
Length Wtd. (ft)	700.00	Wetted Per. (ft)	180.32	32.33	218.72
Min Ch El (ft)	744.50	Shear (lb/sq ft)	0.08	0.26	0.08
Alpha	2.96	Stream Power (lb/ft s)	0.07	0.94	0.09
Frctn Loss (ft)	0.20	Cum Volume (acre-ft)	28.73	13.34	25.84
C & E Loss (ft)	0.02	Cum SA (acres)	6.88	1.11	6.23

CROSS SECTION
RIVER: RIVER-1
REACH: Reach-1 RS: 9

INPUT
Description: X-section based on DTM
Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
550	760	610	759	755	758	782	757	808	756
840	754	880	753	905	752	970	751	975	750
982	746.5	1000	744.6	1018	746.5	1030	750	1035	751
1088	752	1110	753	1140	754	1160	755	1200	758
1220	759	1224	762						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
550	.06	982	.04	1018	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
982	1018	300	300	.1	.3

CROSS SECTION OUTPUT Profile #100 yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	757.49	Element			
Vel Head (ft)	0.07	Wt. n-Val.	0.060	0.040	0.060
W.S. Elev (ft)	757.42	Reach Len. (ft)	300.00	300.00	300.00
Crit W.S. (ft)		Flow Area (sq ft)	867.36	427.36	781.87
E.G. Slope (ft/ft)	0.000250	Area (sq ft)	867.36	427.36	781.87
Q Total (cfs)	3000.00	Flow (cfs)	867.81	1301.67	830.52
Top Width (ft)	421.65	Top Width (ft)	211.37	36.00	174.28
Vel Total (ft/s)	1.44	Avg. Vel. (ft/s)	1.00	3.05	1.06
Max Chl Dpth (ft)	12.82	Hydr. Depth (ft)	4.10	11.87	4.49
Conv. Total (cfs)	189702.1	Conv. (cfs)	54874.9	82309.8	52517.4
Length Wtd. (ft)	300.00	Wetted Per. (ft)	212.42	36.20	175.04
Min Ch El (ft)	744.60	Shear (lb/sq ft)	0.06	0.18	0.07
Alpha	2.22	Stream Power (lb/ft s)	0.06	0.56	0.07
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	16.12	6.68	12.75
C & E Loss (ft)	0.00	Cum SA (acres)	3.75	0.57	3.09

CROSS SECTION
RIVER: RIVER-1
REACH: Reach-1 RS: 8

INPUT
Description: About 120 ft u/s proposed B-70-244
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
740	756	770	755	798	754	850	753	880	752
925	751	975	750	982	746.3	1000	744.5	1015	746.3
1030	750	1035	751	1070	751	1095	752	1130	753
1175	755	1210	757	1220	758	1232	758	1245	757

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
740	.06	982	.04	1015	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
982	1015	110	120	150	.1 .3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
740	855	760	F
1220	1245	758	F

CROSS SECTION OUTPUT Profile #100 yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	757.42	Element			
Vel Head (ft)	0.06	Wt. n-Val.	0.060	0.040	0.060
W.S. Elev (ft)	757.36	Reach Len. (ft)	110.00	120.00	150.00
Crit W.S. (ft)	752.18	Flow Area (sq ft)	794.89	394.72	911.31
E.G. Slope (ft/ft)	0.000214	Area (sq ft)	1153.83	394.72	912.16
Q Total (cfs)	3000.00	Flow (cfs)	973.15	1117.37	909.47
Top Width (ft)	478.30	Top Width (ft)	242.00	33.00	203.30
Vel Total (ft/s)	1.43	Avg. Vel. (ft/s)	1.22	2.83	1.00
Max Chl Dpth (ft)	12.86	Hydr. Depth (ft)	6.26	11.96	4.59
Conv. Total (cfs)	205083.3	Conv. (cfs)	66525.9	76384.8	62172.7
Length Wtd. (ft)	127.58	Wetted Per. (ft)	127.95	33.20	199.31
Min Ch El (ft)	744.50	Shear (lb/sq ft)	0.08	0.16	0.06
Alpha	1.85	Stream Power (lb/ft s)	0.10	0.45	0.06
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	9.16	3.85	6.91
C & E Loss (ft)	0.01	Cum SA (acres)	2.18	0.33	1.79

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION
RIVER: RIVER-1
REACH: Reach-1 RS: 7

INPUT
Description: U/s bridge face -- proposed B-70-244
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
81.568	753	163.135	752	226.577	751	232.921	750	239.265	746.3
258.298	744.3	271.892	746.3	282.768	750	339.865	751	371.586	752
394.244	753								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
81.568	.05	239.265	.04	271.892	.05

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Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
      239.265 271.892               45      45      45             .1        .3
Ineffective Flow      num=        2
   Sta L   Sta R    Elev  Permanent
  81.568     200     760       F
     350 394.244     760       F
Skew Angle = 25

CROSS SECTION OUTPUT  Profile #100 yr

  E.G. Elev (ft)             757.38    Element                 Left OB    Channel   Right OB
  Vel Head (ft)                0.13    Wt. n-Val.                0.050      0.040      0.050
  W.S. Elev (ft)             757.25    Reach Len. (ft)           45.00      45.00      45.00
  Crit W.S. (ft)             752.10    Flow Area (sq ft)        261.20     389.98     546.31
  E.G. Slope (ft/ft)       0.000346    Area (sq ft)             853.21     389.98     774.73
  Q Total (cfs)              3000.00    Flow (cfs)               501.25    1400.74    1098.01
  Top Width (ft)              312.68    Top Width (ft)           157.70      32.63     122.35
  Vel Total (ft/s)              2.51    Avg. Vel. (ft/s)           1.92       3.59       2.01
  Max Chl Dpth (ft)            12.95    Hydr. Depth (ft)           6.65      11.95       6.99
  Conv. Total (cfs)         161373.6    Conv. (cfs)              26962.9    75347.5    59063.2
  Length Wtd. (ft)            45.00    Wetted Per. (ft)           40.35      32.88      78.73
  Min Ch El (ft)              744.30    Shear (lb/sq ft)           0.14       0.26       0.15
  Alpha                         1.29    Stream Power (lb/ft s)     0.27       0.92       0.30
  Frctn Loss (ft)               0.02    Cum Volume (acre-ft)       6.63       2.77       4.01
  C & E Loss (ft)               0.02    Cum SA (acres)             1.68       0.24       1.23


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,
         water surface was used.

CROSS SECTION
RIVER: RIVER-1
REACH: Reach-1            RS: 6

INPUT
Description: D/s bridge face -- proposed B-70-244
Station Elevation Data    num=      11
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
  81.568      753 163.135      752 226.577      751 232.921      750 239.265   746.3
 258.298    744.3 271.892    746.3 282.768      750 339.865      751 371.586     752
 394.244      753

Manning's n Values        num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
  81.568     .05 239.265     .04 271.892     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
      239.265 271.892               38      38      38             .1        .3
Ineffective Flow      num=        2
   Sta L   Sta R    Elev  Permanent
  81.568     220     760       F
     300 394.244     760       F
Skew Angle = 25

CROSS SECTION OUTPUT  Profile #100 yr

  E.G. Elev (ft)             757.34    Element                 Left OB    Channel   Right OB
  Vel Head (ft)                0.31    Wt. n-Val.                0.050      0.040      0.050
  W.S. Elev (ft)             757.03    Reach Len. (ft)           38.00      38.00      38.00
  Crit W.S. (ft)             751.77    Flow Area (sq ft)        137.01     382.59     215.01
  E.G. Slope (ft/ft)       0.000718    Area (sq ft)             817.49     382.59     747.01
  Q Total (cfs)              3000.00    Flow (cfs)               389.08    1955.69     655.23
  Top Width (ft)              312.68    Top Width (ft)           157.70      32.63     122.35
  Vel Total (ft/s)              4.08    Avg. Vel. (ft/s)           2.84       5.11       3.05
  Max Chl Dpth (ft)            12.73    Hydr. Depth (ft)           7.11      11.73       7.65
  Conv. Total (cfs)         111954.6    Conv. (cfs)              14519.8    72982.9    24451.9
  Length Wtd. (ft)            38.00    Wetted Per. (ft)           20.34      32.88      28.72
  Min Ch El (ft)              744.30    Shear (lb/sq ft)           0.30       0.52       0.34
  Alpha                         1.21    Stream Power (lb/ft s)     0.86       2.67       1.02
  Frctn Loss (ft)               0.04    Cum Volume (acre-ft)       5.76       2.37       3.22
  C & E Loss (ft)               0.04    Cum SA (acres)             1.52       0.21       1.10


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,
         water surface was used.

CROSS SECTION
RIVER: RIVER-1
REACH: Reach-1            RS: 4

INPUT
```

Description: U/s face bridge B-70-139
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
267.92	756.17	268.34	752.95	276	750.98	283	746.55	290	744.98
297	744.9	304	744.94	311	746.48	318	750.52	325.63	753.34
326	756.17								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
267.92	.05	283	.04	311	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
283	311	50	50	.3	.5

CROSS SECTION OUTPUT Profile #100 yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	757.26	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.75	Wt. n-Val.	0.050	0.040	0.050
W.S. Elev (ft)	756.50	Reach Len. (ft)	2.00	2.00	2.00
Crit W.S. (ft)	752.24	Flow Area (sq ft)	89.73	312.72	91.55
E.G. Slope (ft/ft)	0.001710	Area (sq ft)	89.73	312.72	91.55
Q Total (cfs)	3000.00	Flow (cfs)	302.30	2381.17	316.53
Top Width (ft)	58.08	Top Width (ft)	15.08	28.00	15.00
Vel Total (ft/s)	6.07	Avg. Vel. (ft/s)	3.37	7.61	3.46
Max Chl Dpth (ft)	11.60	Hydr. Depth (ft)	5.95	11.17	6.10
Conv. Total (cfs)	72538.7	Conv. (cfs)	7309.6	57575.6	7653.6
Length Wtd. (ft)	2.00	Wetted Per. (ft)	19.77	28.34	19.40
Min Ch El (ft)	744.90	Shear (lb/sq ft)	0.48	1.18	0.50
Alpha	1.31	Stream Power (lb/ft s)	1.63	8.97	1.74
Prctn Loss (ft)		Cum Volume (acre-ft)	5.37	2.07	2.86
C & E Loss (ft)		Cum SA (acres)	1.44	0.18	1.04

BRIDGE
RIVER: RIVER-1
REACH: Reach-1 RS: 3.5

INPUT
Description: Existing bridge B-70-139
Distance from Upstream XS = 2
Deck/Roadway Width = 46
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 4

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
267.92	760.4		267.92	760.4	756.17	326	760.4	756.17
326	760.4							

Upstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
267.92	756.17	268.34	752.95	276	750.98	283	746.55	290	744.98
297	744.9	304	744.94	311	746.48	318	750.52	325.63	753.34
326	756.17								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
267.92	.05	283	.04	311	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
283	311	.3	.5

Downstream Deck/Roadway Coordinates
num= 4

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
267.92	760.4		267.92	760.4	756.17	326	760.4	756.17
326	760.4							

Downstream Bridge Cross Section Data
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
267.92	756.17	268.34	752.95	276	750.98	283	746.55	290	744.98
297	744.9	304	744.94	311	746.48	318	750.52	325.63	753.34
326	756.17								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
267.92	.05	283	.04	311	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
283	311	.3	.5

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
Pressure and Weir flow
Submerged Inlet Cd =
Submerged Inlet + Outlet Cd = .8
Max Low Cord =

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 yr

			Inside BR US	Inside BR DS
E.G. US. (ft)	757.26	Element		
W.S. US. (ft)	756.50	E.G. Elev (ft)	757.25	757.08
Q Total (cfs)	3000.00	W.S. Elev (ft)	756.17	756.17
Q Bridge (cfs)	3000.00	Crit W.S. (ft)	752.28	752.28
Q Weir (cfs)		Max Chl Dpth (ft)	11.27	11.27
Weir Sta Lft (ft)		Vel Total (ft/s)	6.32	6.32
Weir Sta Rgt (ft)		Flow Area (sq ft)	474.70	474.70
Weir Submerg		Froude # Chl	0.42	0.42
Weir Max Depth (ft)		Specif Force (cu ft)	2851.29	2851.29
Min El Weir Flow (ft)	760.41	Hydr Depth (ft)	8.17	8.17
Min El Prs (ft)	756.17	W.P. Total (ft)	66.85	66.85
Delta EG (ft)	0.18	Conv. Total (cfs)	68519.1	68519.1
Delta WS (ft)	0.22	Top Width (ft)	58.08	58.08
BR Open Area (sq ft)	474.70	Frctn Loss (ft)		
BR Open Vel (ft/s)	6.32	C & E Loss (ft)		
Coef of Q		Shear Total (lb/sq ft)	0.85	0.85
Br Sel Method	Press Only	Power Total (lb/ft s)	5.37	5.37

Note: The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.

CROSS SECTION
RIVER: RIVER-1
REACH: Reach-1 RS: 3

INPUT
Description: D/s face bridge B-70-139
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
267.92	756.17	268.34	752.95	276	750.98	283	746.55	290	744.98
297	744.9	304	744.94	311	746.48	318	750.52	325.63	753.34
326	756.17								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
267.92	.05	283	.04	311	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
283	311	100	100	.3	.5

CROSS SECTION OUTPUT Profile #100 yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	757.08	Element			
Vel Head (ft)	0.79	Wt. n-Val.	0.050	0.040	0.050
W.S. Elev (ft)	756.29	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	86.48	306.68	88.32
E.G. Slope (ft/ft)	0.001841	Area (sq ft)	86.48	306.68	88.32
Q Total (cfs)	3000.00	Flow (cfs)	297.08	2391.33	311.59
Top Width (ft)	58.08	Top Width (ft)	15.08	28.00	15.00
Vel Total (ft/s)	6.23	Avg. Vel. (ft/s)	3.44	7.80	3.53
Max Chl Dpth (ft)	11.39	Hydr. Depth (ft)	5.73	10.95	5.89
Conv. Total (cfs)	69922.3	Conv. (cfs)	6924.1	55735.8	7262.3
Length Wtd. (ft)	100.00	Wetted Per. (ft)	19.56	28.34	19.19
Min Ch El (ft)	744.90	Shear (lb/sq ft)	0.51	1.24	0.53
Alpha	1.31	Stream Power (lb/ft s)	1.75	9.70	1.87
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)	5.27	1.72	2.76
C & E Loss (ft)	0.33	Cum SA (acres)	1.42	0.15	1.03

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

HEC-RAS River: RIVER-1 Reach: Reach-1

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	1	2 yr	45" psg	830.00	743.50	752.50	746.21	752.54	0.000196	1.91	785.97	310.74	0.11
Reach-1	1	2 yr	Existing	830.00	743.50	752.50	746.21	752.54	0.000196	1.91	785.97	310.74	0.11
Reach-1	1	100 yr	45" psg	4000.00	743.50	756.52	751.56	756.62	0.000433	3.66	3000.94	1051.25	0.18
Reach-1	1	100 yr	Existing	4000.00	743.50	756.52	751.56	756.62	0.000433	3.66	3000.94	1051.25	0.18
Reach-1	2	2 yr	45" psg	760.00	744.30	752.50	747.81	752.59	0.000352	2.62	386.05	295.37	0.17
Reach-1	2	2 yr	Existing	760.00	744.30	752.50	747.81	752.58	0.000309	2.46	490.91	295.48	0.16
Reach-1	2	100 yr	45" psg	3000.00	744.30	756.47	751.78	756.78	0.000796	5.26	754.77	576.00	0.28
Reach-1	2	100 yr	Existing	3000.00	744.30	756.54	752.38	756.67	0.000410	3.79	1217.32	576.00	0.20
Reach-1	2.25			Bridge									
Reach-1	2.5	2 yr	45" psg	760.00	744.30	752.53	747.81	752.62	0.000346	2.61	388.50	298.00	0.17
Reach-1	2.5	100 yr	45" psg	3000.00	744.30	756.54	751.78	756.85	0.000774	5.21	761.53	576.00	0.27
Reach-1	3	2 yr	45" psg	760.00	744.90	752.51		752.67	0.000608	3.38	264.93	53.31	0.22
Reach-1	3	2 yr	Existing	760.00	744.90	752.50		752.66	0.000609	3.38	264.72	53.28	0.22
Reach-1	3	100 yr	45" psg	3000.00	744.90	756.34		757.12	0.001808	7.75	484.48	58.08	0.41
Reach-1	3	100 yr	Existing	3000.00	744.90	756.29		757.08	0.001841	7.80	481.48	58.08	0.42
Reach-1	3.5			Bridge									
Reach-1	4	2 yr	45" psg	760.00	744.90	752.54	748.18	752.70	0.000598	3.36	266.66	53.52	0.22
Reach-1	4	2 yr	Existing	760.00	744.90	752.53	748.18	752.69	0.000599	3.36	266.45	53.50	0.22
Reach-1	4	100 yr	45" psg	3000.00	744.90	756.56	752.24	757.31	0.001675	7.56	497.63	58.08	0.40
Reach-1	4	100 yr	Existing	3000.00	744.90	756.50	752.24	757.26	0.001710	7.61	494.00	58.08	0.40
Reach-1	6	2 yr	45" psg	760.00	744.30	752.65	747.89	752.74	0.000326	2.52	385.68	276.69	0.16
Reach-1	6	2 yr	Existing	760.00	744.30	752.64	747.89	752.72	0.000324	2.51	383.46	274.83	0.16
Reach-1	6	100 yr	45" psg	3000.00	744.30	757.20	751.88	757.48	0.000653	4.92	776.23	312.68	0.25
Reach-1	6	100 yr	Existing	3000.00	744.30	757.03	751.77	757.34	0.000718	5.11	734.61	312.68	0.26
Reach-1	6.5			Bridge									
Reach-1	7	2 yr	45" psg	760.00	744.30	752.68	747.89	752.76	0.000321	2.51	387.62	279.04	0.16
Reach-1	7	2 yr	Existing	760.00	744.30	752.68	747.89	752.73	0.000255	2.24	510.88	278.83	0.15
Reach-1	7	100 yr	45" psg	3000.00	744.30	757.27	751.88	757.55	0.000637	4.88	782.77	312.68	0.25
Reach-1	7	100 yr	Existing	3000.00	744.30	757.25	752.10	757.38	0.000346	3.59	1197.49	312.68	0.18
Reach-1	7.5	2 yr	45" psg	760.00	744.30	752.70	747.88	752.77	0.000308	2.46	396.87	281.05	0.16
Reach-1	7.5	100 yr	45" psg	3000.00	744.30	757.31	751.83	757.58	0.000619	4.82	788.94	312.68	0.25
Reach-1	7.75			Bridge									
Reach-1	7.79	2 yr	45" psg	760.00	744.30	752.72	747.88	752.80	0.000304	2.45	398.79	283.41	0.16

HEC-RAS River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	7.79	100 yr	45" psg	3000.00	744.30	757.38	751.83	757.65	0.000603	4.78	795.20	312.68	0.24
Reach-1	8	2 yr	45" psg	760.00	744.50	752.74	747.95	752.81	0.000277	2.33	507.35	263.26	0.15
Reach-1	8	2 yr	Existing	760.00	744.50	752.71	747.95	752.77	0.000263	2.26	623.32	260.97	0.15
Reach-1	8	100 yr	45" psg	3000.00	744.50	757.55	752.12	757.70	0.000393	3.88	1195.46	482.75	0.20
Reach-1	8	100 yr	Existing	3000.00	744.50	757.36	752.18	757.42	0.000214	2.83	2100.92	478.30	0.14
Reach-1	9	2 yr	45" psg	760.00	744.60	752.82		752.89	0.000278	2.32	544.14	221.72	0.15
Reach-1	9	2 yr	Existing	760.00	744.60	752.78		752.85	0.000287	2.34	534.86	219.74	0.15
Reach-1	9	100 yr	45" psg	3000.00	744.60	757.73		757.79	0.000216	2.88	2209.24	434.15	0.15
Reach-1	9	100 yr	Existing	3000.00	744.60	757.42		757.49	0.000250	3.05	2076.59	421.65	0.16
Reach-1	10	2 yr	45" psg	760.00	744.50	753.01		753.09	0.000278	2.45	524.48	193.68	0.15
Reach-1	10	2 yr	Existing	760.00	744.50	752.98		753.06	0.000285	2.47	517.51	191.84	0.15
Reach-1	10	100 yr	45" psg	3000.00	744.50	757.89		757.99	0.000293	3.46	2075.22	442.37	0.17
Reach-1	10	100 yr	Existing	3000.00	744.50	757.60		757.71	0.000335	3.64	1951.15	427.82	0.18
Reach-1	11			Bridge									
Reach-1	12	2 yr	45" psg	760.00	744.50	753.14	747.67	753.21	0.000257	2.38	549.96	200.28	0.15
Reach-1	12	2 yr	Existing	760.00	744.50	753.11	747.67	753.18	0.000263	2.40	542.52	198.37	0.15
Reach-1	12	100 yr	45" psg	3000.00	744.50	758.40	752.22	758.48	0.000231	3.15	2308.98	468.54	0.15
Reach-1	12	100 yr	Existing	3000.00	744.50	758.33	752.22	758.40	0.000239	3.19	2273.18	464.63	0.15
Reach-1	14	2 yr	45" psg	760.00	744.50	753.17		753.23	0.000251	2.14	555.53	201.69	0.14
Reach-1	14	2 yr	Existing	760.00	744.50	753.13		753.20	0.000256	2.15	548.17	199.82	0.14
Reach-1	14	100 yr	45" psg	3000.00	744.50	758.42		758.49	0.000221	2.86	2319.34	469.67	0.14
Reach-1	14	100 yr	Existing	3000.00	744.50	758.35		758.42	0.000229	2.90	2283.86	465.80	0.14
Reach-1	16	2 yr	45" psg	760.00	744.70	753.61		753.63	0.000114	1.49	1200.62	531.17	0.09
Reach-1	16	2 yr	Existing	760.00	744.70	753.59		753.61	0.000116	1.50	1186.56	527.56	0.09
Reach-1	16	100 yr	45" psg	3000.00	744.70	758.73		758.74	0.000059	1.49	5703.93	1227.62	0.07
Reach-1	16	100 yr	Existing	3000.00	744.70	758.67		758.68	0.000061	1.51	5624.12	1218.74	0.07
Reach-1	18	2 yr	45" psg	760.00	744.70	753.72		753.73	0.000033	0.81	2778.69	1472.95	0.05
Reach-1	18	2 yr	Existing	760.00	744.70	753.70		753.70	0.000034	0.81	2743.78	1460.15	0.05
Reach-1	18	100 yr	45" psg	3000.00	744.70	758.77		758.77	0.000006	0.49	16722.86	4186.79	0.02
Reach-1	18	100 yr	Existing	3000.00	744.70	758.70		758.70	0.000006	0.49	16492.81	4152.41	0.02
Reach-1	20	2 yr	45" psg	760.00	745.00	753.91		753.91	0.000036	0.82	2515.90	1176.59	0.05
Reach-1	20	2 yr	Existing	760.00	745.00	753.89		753.89	0.000037	0.83	2493.12	1170.95	0.05
Reach-1	20	100 yr	45" psg	3000.00	745.00	758.81		758.81	0.000013	0.68	11790.78	2604.30	0.03
Reach-1	20	100 yr	Existing	3000.00	745.00	758.75		758.75	0.000013	0.69	11629.84	2586.25	0.03