

APPENDIX D – RIPRAP DESIGN

CHANNEL PRO CALCULATIONS

Riprap Sizing for Blue River Channel

HEC-RAS Cross-section 10.646

Station 115+55: 10.646 Invert							
PROGRAM OUTPUT FOR A TRAPEZOIDAL CHANNEL INVERT, STRAIGHT REACH STRAIGHT REACH IS > 5 WS WIDTHS DS OF ANYTHING CAUSING A FLOW IMBALANCE							
INPUT PARAMETERS							
SPECIFIC WEIGHT OF STONE,PCF		160.0					
LOCAL FLOW DEPTH,FT		35.3					
CHANNEL SIDE SLOPE,1 VER: 4.00 HORZ							
AVERAGE CHANNEL VELOCITY,FPS		9.52					
COMPUTED LOCAL DEPTH AVG VEL,FPS		10.95					
(LOCAL VELOCITY)/(AVG CHANNEL VEL)		1.15					
BOTTOM WIDTH,FT TRAP SECT		24.00					
MAXIMUM FLOW DEPTH,FT TRAP SECT		35.31					
SIDE SLOPE CORRECTION FACTOR K1		1.00					
CORRECTION FOR VELOCITY PROFILE IN BEND		1.00					
RIPRAP DESIGN SAFETY FACTOR		1.10					
SELECTED STABLE GRADATIONS ALTERNATE GRADATION							
NAME THICKNESS	COMPUTED	D30(MIN)	D100(MAX)	D85/D15	N=THICKNESS/	CT	
	D30 FT	FT	IN		D100(MAX)		IN
R2200	.40	1.90	35.70	2.80	1.00	1.00	35.7

Station 115+55: 10.646 Side Slope							
PROGRAM OUTPUT FOR A TRAPEZOIDAL CHANNEL SIDE SLOPE, STRAIGHT REACH STRAIGHT REACH IS > 5 WS WIDTHS DS OF ANYTHING CAUSING A FLOW IMBALANCE							
INPUT PARAMETERS							
SPECIFIC WEIGHT OF STONE,PCF		160.0					
LOCAL FLOW DEPTH,FT		28.3					
CHANNEL SIDE SLOPE,1 VER: 3.00 HORZ							
AVERAGE CHANNEL VELOCITY,FPS		6.49					
COMPUTED LOCAL DEPTH AVG VEL,FPS		4.81					
(LOCAL VELOCITY)/(AVG CHANNEL VEL)		.74					
BOTTOM WIDTH,FT TRAP SECT		24.00					
MAXIMUM FLOW DEPTH,FT TRAP SECT		28.25					
SIDE SLOPE CORRECTION FACTOR K1		.99					
CORRECTION FOR VELOCITY PROFILE IN BEND		1.00					
RIPRAP DESIGN SAFETY FACTOR		1.10					
SELECTED STABLE GRADATIONS ALTERNATE GRADATION							
NAME THICKNESS	COMPUTED	D30(MIN)	D100(MAX)	D85/D15	N=THICKNESS/	CT	
	D30 FT	FT	IN		D100(MAX)		IN
R2200	.06	1.90	35.70	2.80	1.00	1.00	35.7

HEC-RAS Cross-section 10.808

10.808 Invert

PROGRAM OUTPUT FOR A TRAPEZOIDAL CHANNEL INVERT, STRAIGHT REACH
 STRAIGHT REACH IS > 5 WS WIDTHS DS OF ANYTHING CAUSING A FLOW IMBALANCE

INPUT PARAMETERS

SPECIFIC WEIGHT OF STONE,PCF 160.0
 LOCAL FLOW DEPTH,FT 32.7
 CHANNEL SIDE SLOPE,1 VER: 4.00 HORZ
 AVERAGE CHANNEL VELOCITY,FPS 11.56
 COMPUTED LOCAL DEPTH AVG VEL,FPS 13.29
 (LOCAL VELOCITY)/(AVG CHANNEL VEL) 1.15
 BOTTOM WIDTH,FT TRAP SECT 24.00
 MAXIMUM FLOW DEPTH,FT TRAP SECT 32.67
 SIDE SLOPE CORRECTION FACTOR K1 1.00
 CORRECTION FOR VELOCITY PROFILE IN BEND 1.00
 RIPRAP DESIGN SAFETY FACTOR 1.10

SELECTED STABLE GRADATIONS
 ALTERNATE GRADATION

NAME	COMPUTED	D30(MIN)	D100(MAX)	D85/D15	N=THICKNESS/	CT
THICKNESS	D30 FT	FT	IN		D100(MAX)	IN
R2200	.66	1.90	35.70	2.80	1.00	1.00 35.7

10.808 side slope

PROGRAM OUTPUT FOR A TRAPEZOIDAL CHANNEL SIDE SLOPE, STRAIGHT REACH
 STRAIGHT REACH IS > 5 WS WIDTHS DS OF ANYTHING CAUSING A FLOW IMBALANCE

INPUT PARAMETERS

SPECIFIC WEIGHT OF STONE,PCF 160.0
 LOCAL FLOW DEPTH,FT 26.1
 CHANNEL SIDE SLOPE,1 VER: 3.00 HORZ
 AVERAGE CHANNEL VELOCITY,FPS 11.29
 COMPUTED LOCAL DEPTH AVG VEL,FPS 8.07
 (LOCAL VELOCITY)/(AVG CHANNEL VEL) .72
 BOTTOM WIDTH,FT TRAP SECT 24.00
 MAXIMUM FLOW DEPTH,FT TRAP SECT 26.14
 SIDE SLOPE CORRECTION FACTOR K1 .99
 CORRECTION FOR VELOCITY PROFILE IN BEND 1.00
 RIPRAP DESIGN SAFETY FACTOR 1.10

SELECTED STABLE GRADATIONS
 ALTERNATE GRADATION

NAME	COMPUTED	D30(MIN)	D100(MAX)	D85/D15	N=THICKNESS/	CT
THICKNESS	D30 FT	FT	IN		D100(MAX)	IN
R2200	.21	1.90	35.70	2.80	1.00	1.00 35.7

HEC-RAS Cross-section 10.817

10.817 Invert

PROGRAM OUTPUT FOR A TRAPEZOIDAL CHANNEL INVERT, STRAIGHT REACH
 STRAIGHT REACH IS > 5 WS WIDTHS DS OF ANYTHING CAUSING A FLOW IMBALANCE

INPUT PARAMETERS

SPECIFIC WEIGHT OF STONE,PCF 160.0
 LOCAL FLOW DEPTH,FT 35.4
 CHANNEL SIDE SLOPE,1 VER: 4.00 HORZ
 AVERAGE CHANNEL VELOCITY,FPS 8.20
 COMPUTED LOCAL DEPTH AVG VEL,FPS 9.43
 (LOCAL VELOCITY)/(AVG CHANNEL VEL) 1.15
 BOTTOM WIDTH,FT TRAP SECT 24.00
 MAXIMUM FLOW DEPTH,FT TRAP SECT 35.43
 SIDE SLOPE CORRECTION FACTOR K1 1.00
 CORRECTION FOR VELOCITY PROFILE IN BEND 1.00
 RIPRAP DESIGN SAFETY FACTOR 1.10

SELECTED STABLE GRADATIONS
 ALTERNATE GRADATION

NAME THICKNESS	COMPUTED D30(MIN)		D100(MAX)	D85/D15	N=THICKNESS/ D100(MAX)	CT	IN
	D30 FT	FT	IN				
R2200	.28	1.90	35.70	2.80	1.00	1.00	35.7

10.817 side slope

PROGRAM OUTPUT FOR A TRAPEZOIDAL CHANNEL INVERT, STRAIGHT REACH
 STRAIGHT REACH IS > 5 WS WIDTHS DS OF ANYTHING CAUSING A FLOW IMBALANCE

INPUT PARAMETERS

SPECIFIC WEIGHT OF STONE,PCF 160.0
 LOCAL FLOW DEPTH,FT 28.3
 CHANNEL SIDE SLOPE,1 VER: 3.00 HORZ
 AVERAGE CHANNEL VELOCITY,FPS 6.52
 COMPUTED LOCAL DEPTH AVG VEL,FPS 7.50
 (LOCAL VELOCITY)/(AVG CHANNEL VEL) 1.15
 BOTTOM WIDTH,FT TRAP SECT 24.00
 MAXIMUM FLOW DEPTH,FT TRAP SECT 28.34
 SIDE SLOPE CORRECTION FACTOR K1 1.00
 CORRECTION FOR VELOCITY PROFILE IN BEND 1.00
 RIPRAP DESIGN SAFETY FACTOR 1.10

SELECTED STABLE GRADATIONS
 ALTERNATE GRADATION

NAME THICKNESS	COMPUTED D30(MIN)		D100(MAX)	D85/D15	N=THICKNESS/ D100(MAX)	CT	IN
	D30 FT	FT	IN				
R2200	.16	1.90	35.70	2.80	1.00	1.00	35.7

HEC-RAS Cross-section 11.117

Station 90+00: 11.117 Invert							
PROGRAM OUTPUT FOR A TRAPEZOIDAL CHANNEL INVERT, STRAIGHT REACH STRAIGHT REACH IS > 5 WS WIDTHS DS OF ANYTHING CAUSING A FLOW IMBALANCE							
INPUT PARAMETERS							
SPECIFIC WEIGHT OF STONE,PCF				160.0			
LOCAL FLOW DEPTH,FT				35.3			
CHANNEL SIDE SLOPE,1 VER: 4.00 HORZ							
AVERAGE CHANNEL VELOCITY,FPS				9.63			
COMPUTED LOCAL DEPTH AVG VEL,FPS				11.07			
(LOCAL VELOCITY)/(AVG CHANNEL VEL)				1.15			
BOTTOM WIDTH,FT TRAP SECT				24.00			
MAXIMUM FLOW DEPTH,FT TRAP SECT				35.29			
SIDE SLOPE CORRECTION FACTOR K1				1.00			
CORRECTION FOR VELOCITY PROFILE IN BEND				1.00			
RIPRAP DESIGN SAFETY FACTOR				1.10			
SELECTED STABLE GRADATIONS ALTERNATE GRADATION							
NAME THICKNESS	COMPUTED D30 FT	D30(MIN) FT	D100(MAX) IN	D85/D15	N=THICKNESS/ D100(MAX)	CT	
R2200	.41	1.90	35.70	2.80	1.00	1.00	IN 35.7

Station 90+00: 11.117 side slope							
PROGRAM OUTPUT FOR A TRAPEZOIDAL CHANNEL SIDE SLOPE, STRAIGHT REACH STRAIGHT REACH IS > 5 WS WIDTHS DS OF ANYTHING CAUSING A FLOW IMBALANCE							
INPUT PARAMETERS							
SPECIFIC WEIGHT OF STONE,PCF				160.0			
LOCAL FLOW DEPTH,FT				28.2			
CHANNEL SIDE SLOPE,1 VER: 3.00 HORZ							
AVERAGE CHANNEL VELOCITY,FPS				6.57			
COMPUTED LOCAL DEPTH AVG VEL,FPS				4.87			
(LOCAL VELOCITY)/(AVG CHANNEL VEL)				.74			
BOTTOM WIDTH,FT TRAP SECT				24.00			
MAXIMUM FLOW DEPTH,FT TRAP SECT				28.23			
SIDE SLOPE CORRECTION FACTOR K1				.99			
CORRECTION FOR VELOCITY PROFILE IN BEND				1.00			
RIPRAP DESIGN SAFETY FACTOR				1.10			
SELECTED STABLE GRADATIONS ALTERNATE GRADATION							
NAME THICKNESS	COMPUTED D30 FT	D30(MIN) FT	D100(MAX) IN	D85/D15	N=THICKNESS/ D100(MAX)	CT	
R2200	.06	1.90	35.70	2.80	1.00	1.00	IN 35.7

Riprap Sizing for Temporary Grade Control Structure

HEC-RAS Cross-section 11.184

Station 86+00: 11.184 Invert

PROGRAM OUTPUT FOR A TRAPEZOIDAL CHANNEL INVERT, STRAIGHT REACH
STRAIGHT REACH IS > 5 WS WIDTHS DS OF ANYTHING CAUSING A FLOW IMBALANCE

INPUT PARAMETERS

SPECIFIC WEIGHT OF STONE,PCF	160.0
LOCAL FLOW DEPTH,FT	34.7
CHANNEL SIDE SLOPE,1 VER: 4.00 HORZ	
AVERAGE CHANNEL VELOCITY,FPS	12.86
COMPUTED LOCAL DEPTH AVG VEL,FPS	14.79
(LOCAL VELOCITY)/(AVG CHANNEL VEL)	1.15
BOTTOM WIDTH,FT TRAP SECT	39.00
MAXIMUM FLOW DEPTH,FT TRAP SECT	34.69
SIDE SLOPE CORRECTION FACTOR K1	1.00
CORRECTION FOR VELOCITY PROFILE IN BEND	1.00
RIPRAP DESIGN SAFETY FACTOR	1.10

SELECTED STABLE GRADATIONS ALTERNATE GRADATION

NAME THICKNESS	COMPUTED D30(MIN)	D100(MAX)	D85/D15	N=THICKNESS/	CT		
	D30 FT	FT	IN	D100(MAX)	IN		
R2200	.85	1.90	35.70	2.80	1.00	1.00	35.7

Station 86+00: 11.184 Side Slope

PROGRAM OUTPUT FOR A TRAPEZOIDAL CHANNEL SIDE SLOPE, STRAIGHT REACH
STRAIGHT REACH IS > 5 WS WIDTHS DS OF ANYTHING CAUSING A FLOW IMBALANCE

INPUT PARAMETERS

SPECIFIC WEIGHT OF STONE,PCF	160.0
LOCAL FLOW DEPTH,FT	27.8
CHANNEL SIDE SLOPE,1 VER: 3.00 HORZ	
AVERAGE CHANNEL VELOCITY,FPS	10.06
COMPUTED LOCAL DEPTH AVG VEL,FPS	5.34
(LOCAL VELOCITY)/(AVG CHANNEL VEL)	.53
BOTTOM WIDTH,FT TRAP SECT	39.00
MAXIMUM FLOW DEPTH,FT TRAP SECT	27.75
SIDE SLOPE CORRECTION FACTOR K1	.99
CORRECTION FOR VELOCITY PROFILE IN BEND	1.00
RIPRAP DESIGN SAFETY FACTOR	1.10

SELECTED STABLE GRADATIONS ALTERNATE GRADATION

NAME THICKNESS	COMPUTED D30(MIN)	D100(MAX)	D85/D15	N=THICKNESS/	CT		
	D30 FT	FT	IN	D100(MAX)	IN		
R2200	.07	1.90	35.70	2.80	1.00	1.00	35.7

Riprap Sizing for Riprap Gutters

Riprap Gutter at Channel Station 88+04

88+04 Invert							
PROGRAM OUTPUT FOR A TRAPEZOIDAL CHANNEL INVERT, STRAIGHT REACH STRAIGHT REACH IS < = 5 WS WIDTHS DS OF ANYTHING CAUSING A FLOW IMBALANCE							
INPUT PARAMETERS							
SPECIFIC WEIGHT OF STONE,PCF		160.0					
LOCAL FLOW DEPTH,FT		.8					
CHANNEL SIDE SLOPE,1 VER: 4.00 HORZ							
AVERAGE CHANNEL VELOCITY,FPS		10.63					
COMPUTED LOCAL DEPTH AVG VEL,FPS		12.22					
(LOCAL VELOCITY)/(AVG CHANNEL VEL)		1.15					
BOTTOM WIDTH,FT TRAP SECT		5.00					
MAXIMUM FLOW DEPTH,FT TRAP SECT		.78					
SIDE SLOPE CORRECTION FACTOR K1		1.00					
CORRECTION FOR VELOCITY PROFILE IN BEND		1.00					
RIPRAP DESIGN SAFETY FACTOR		1.10					
SELECTED STABLE GRADATIONS ALTERNATE GRADATION							
NAME THICKNESS	COMPUTED D30(MIN)		D100(MAX)	D85/D15	N=THICKNESS/	CT	
	D30 FT	FT	IN		D100(MAX)	IN	
R2200	1.37	1.90	35.70	2.80	1.00	1.00	35.7

88+04 side slope							
PROGRAM OUTPUT FOR A TRAPEZOIDAL CHANNEL SIDE SLOPE, STRAIGHT REACH STRAIGHT REACH IS < = 5 WS WIDTHS DS OF ANYTHING CAUSING A FLOW IMBALANCE							
INPUT PARAMETERS							
SPECIFIC WEIGHT OF STONE,PCF		160.0					
LOCAL FLOW DEPTH,FT		.6					
CHANNEL SIDE SLOPE,1 VER: 2.00 HORZ							
AVERAGE CHANNEL VELOCITY,FPS		10.63					
COMPUTED LOCAL DEPTH AVG VEL,FPS		10.63					
(LOCAL VELOCITY)/(AVG CHANNEL VEL)		1.00					
BOTTOM WIDTH,FT TRAP SECT		5.00					
MAXIMUM FLOW DEPTH,FT TRAP SECT		.62					
SIDE SLOPE CORRECTION FACTOR K1		.88					
CORRECTION FOR VELOCITY PROFILE IN BEND		1.00					
RIPRAP DESIGN SAFETY FACTOR		1.10					
SELECTED STABLE GRADATIONS ALTERNATE GRADATION							
NAME THICKNESS	COMPUTED D30(MIN)		D100(MAX)	D85/D15	N=THICKNESS/	CT	
	D30 FT	FT	IN		D100(MAX)	IN	
R2200	1.21	1.90	35.70	2.80	1.00	1.00	35.7

Riprap Gutter at Channel Station 90+65

90+65 Invert							
PROGRAM OUTPUT FOR A TRAPEZOIDAL CHANNEL INVERT, STRAIGHT REACH STRAIGHT REACH IS < = 5 WS WIDTHS DS OF ANYTHING CAUSING A FLOW IMBALANCE							
INPUT PARAMETERS							
SPECIFIC WEIGHT OF STONE,PCF				160.0			
LOCAL FLOW DEPTH,FT				1.1			
CHANNEL SIDE SLOPE,1 VER: 4.00 HORZ							
AVERAGE CHANNEL VELOCITY,FPS				13.52			
COMPUTED LOCAL DEPTH AVG VEL,FPS				15.55			
(LOCAL VELOCITY)/(AVG CHANNEL VEL)				1.15			
BOTTOM WIDTH,FT TRAP SECT				10.00			
MAXIMUM FLOW DEPTH,FT TRAP SECT				1.12			
SIDE SLOPE CORRECTION FACTOR K1				1.00			
CORRECTION FOR VELOCITY PROFILE IN BEND				1.00			
RIPRAP DESIGN SAFETY FACTOR				1.10			
SELECTED STABLE GRADATIONS ALTERNATE GRADATION							
NAME THICKNESS	COMPUTED	D30(MIN)	D100(MAX)	D85/D15	N=THICKNESS/ D100(MAX)	CT	
	D30 FT	FT	IN				IN
R2200	1.90	1.90	35.70	2.80	1.50	.83	53.5

90+65 side slope							
PROGRAM OUTPUT FOR A TRAPEZOIDAL CHANNEL SIDE SLOPE, STRAIGHT REACH STRAIGHT REACH IS < = 5 WS WIDTHS DS OF ANYTHING CAUSING A FLOW IMBALANCE							
INPUT PARAMETERS							
SPECIFIC WEIGHT OF STONE,PCF				160.0			
LOCAL FLOW DEPTH,FT				.9			
CHANNEL SIDE SLOPE,1 VER: 2.00 HORZ							
AVERAGE CHANNEL VELOCITY,FPS				13.52			
COMPUTED LOCAL DEPTH AVG VEL,FPS				13.52			
(LOCAL VELOCITY)/(AVG CHANNEL VEL)				1.00			
BOTTOM WIDTH,FT TRAP SECT				10.00			
MAXIMUM FLOW DEPTH,FT TRAP SECT				.90			
SIDE SLOPE CORRECTION FACTOR K1				.88			
CORRECTION FOR VELOCITY PROFILE IN BEND				1.00			
RIPRAP DESIGN SAFETY FACTOR				1.10			
SELECTED STABLE GRADATIONS ALTERNATE GRADATION							
NAME THICKNESS	COMPUTED	D30(MIN)	D100(MAX)	D85/D15	N=THICKNESS/ D100(MAX)	CT	
	D30 FT	FT	IN				IN
R2200	1.90	1.90	35.70	2.80	1.15	.95	41.2

Riprap Gutter at Channel Station 93+00

93+00 Invert							
PROGRAM OUTPUT FOR A TRAPEZOIDAL CHANNEL INVERT, STRAIGHT REACH STRAIGHT REACH IS < = 5 WS WIDTHS DS OF ANYTHING CAUSING A FLOW IMBALANCE							
INPUT PARAMETERS							
SPECIFIC WEIGHT OF STONE,PCF				160.0			
LOCAL FLOW DEPTH,FT				.7			
CHANNEL SIDE SLOPE,1 VER: 4.00 HORZ							
AVERAGE CHANNEL VELOCITY,FPS				9.72			
COMPUTED LOCAL DEPTH AVG VEL,FPS				11.18			
(LOCAL VELOCITY)/(AVG CHANNEL VEL)				1.15			
BOTTOM WIDTH,FT TRAP SECT				5.00			
MAXIMUM FLOW DEPTH,FT TRAP SECT				.71			
SIDE SLOPE CORRECTION FACTOR K1				1.00			
CORRECTION FOR VELOCITY PROFILE IN BEND				1.00			
RIPRAP DESIGN SAFETY FACTOR				1.10			
SELECTED STABLE GRADATIONS ALTERNATE GRADATION							
NAME THICKNESS	COMPUTED	D30(MIN)	D100(MAX)	D85/D15	N=THICKNESS/ D100(MAX)	CT	
	D30 FT	FT	IN				IN
R2200	1.12	1.90	35.70	2.80	1.00	1.00	35.7

93+00 side slope							
PROGRAM OUTPUT FOR A TRAPEZOIDAL CHANNEL SIDE SLOPE, STRAIGHT REACH STRAIGHT REACH IS < = 5 WS WIDTHS DS OF ANYTHING CAUSING A FLOW IMBALANCE							
INPUT PARAMETERS							
SPECIFIC WEIGHT OF STONE,PCF				160.0			
LOCAL FLOW DEPTH,FT				.6			
CHANNEL SIDE SLOPE,1 VER: 2.00 HORZ							
AVERAGE CHANNEL VELOCITY,FPS				9.72			
COMPUTED LOCAL DEPTH AVG VEL,FPS				9.72			
(LOCAL VELOCITY)/(AVG CHANNEL VEL)				1.00			
BOTTOM WIDTH,FT TRAP SECT				5.00			
MAXIMUM FLOW DEPTH,FT TRAP SECT				.57			
SIDE SLOPE CORRECTION FACTOR K1				.88			
CORRECTION FOR VELOCITY PROFILE IN BEND				1.00			
RIPRAP DESIGN SAFETY FACTOR				1.10			
SELECTED STABLE GRADATIONS ALTERNATE GRADATION							
NAME THICKNESS	COMPUTED	D30(MIN)	D100(MAX)	D85/D15	N=THICKNESS/ D100(MAX)	CT	
	D30 FT	FT	IN				IN
R2200	.99	1.90	35.70	2.80	1.00	1.00	35.7

Riprap Gutter at Channel Station 104+60

104+60 Invert							
PROGRAM OUTPUT FOR A TRAPEZOIDAL CHANNEL INVERT, STRAIGHT REACH STRAIGHT REACH IS < = 5 WS WIDTHS DS OF ANYTHING CAUSING A FLOW IMBALANCE							
INPUT PARAMETERS							
SPECIFIC WEIGHT OF STONE,PCF							160.0
LOCAL FLOW DEPTH,FT							.3
CHANNEL SIDE SLOPE,1 VER: 4.00 HORZ							
AVERAGE CHANNEL VELOCITY,FPS							6.33
COMPUTED LOCAL DEPTH AVG VEL,FPS							7.28
(LOCAL VELOCITY)/(AVG CHANNEL VEL)							1.15
BOTTOM WIDTH,FT TRAP SECT							5.00
MAXIMUM FLOW DEPTH,FT TRAP SECT							.25
SIDE SLOPE CORRECTION FACTOR K1							1.00
CORRECTION FOR VELOCITY PROFILE IN BEND							1.00
RIPRAP DESIGN SAFETY FACTOR							1.10
SELECTED STABLE GRADATIONS ALTERNATE GRADATION							
NAME THICKNESS	COMPUTED D30 FT	D30(MIN) FT	D100(MAX) IN	D85/D15	N=THICKNESS/ D100(MAX)	CT	IN
R2200	.50	1.90	35.70	2.80	1.00	1.00	35.7

104+60 side slope							
PROGRAM OUTPUT FOR A TRAPEZOIDAL CHANNEL SIDE SLOPE, STRAIGHT REACH STRAIGHT REACH IS < = 5 WS WIDTHS DS OF ANYTHING CAUSING A FLOW IMBALANCE							
INPUT PARAMETERS							
SPECIFIC WEIGHT OF STONE,PCF							160.0
LOCAL FLOW DEPTH,FT							.2
CHANNEL SIDE SLOPE,1 VER: 2.00 HORZ							
AVERAGE CHANNEL VELOCITY,FPS							6.33
COMPUTED LOCAL DEPTH AVG VEL,FPS							6.33
(LOCAL VELOCITY)/(AVG CHANNEL VEL)							1.00
BOTTOM WIDTH,FT TRAP SECT							5.00
MAXIMUM FLOW DEPTH,FT TRAP SECT							.20
SIDE SLOPE CORRECTION FACTOR K1							.88
CORRECTION FOR VELOCITY PROFILE IN BEND							1.00
RIPRAP DESIGN SAFETY FACTOR							1.10
SELECTED STABLE GRADATIONS ALTERNATE GRADATION							
NAME THICKNESS	COMPUTED D30 FT	D30(MIN) FT	D100(MAX) IN	D85/D15	N=THICKNESS/ D100(MAX)	CT	IN
R2200	.44	1.90	35.70	2.80	1.00	1.00	35.7

Riprap Gutter at Channel Station 107+00

107+00 Invert							
PROGRAM OUTPUT FOR A TRAPEZOIDAL CHANNEL INVERT, STRAIGHT REACH STRAIGHT REACH IS < = 5 WS WIDTHS DS OF ANYTHING CAUSING A FLOW IMBALANCE							
INPUT PARAMETERS							
SPECIFIC WEIGHT OF STONE,PCF							160.0
LOCAL FLOW DEPTH,FT							.6
CHANNEL SIDE SLOPE,1 VER: 4.00 HORZ							
AVERAGE CHANNEL VELOCITY,FPS							9.82
COMPUTED LOCAL DEPTH AVG VEL,FPS							11.29
(LOCAL VELOCITY)/(AVG CHANNEL VEL)							1.15
BOTTOM WIDTH,FT TRAP SECT							5.00
MAXIMUM FLOW DEPTH,FT TRAP SECT							.58
SIDE SLOPE CORRECTION FACTOR K1							1.00
CORRECTION FOR VELOCITY PROFILE IN BEND							1.00
RIPRAP DESIGN SAFETY FACTOR							1.10
SELECTED STABLE GRADATIONS ALTERNATE GRADATION							
NAME	COMPUTED	D30(MIN)	D100(MAX)	D85/D15	N=THICKNESS/	CT	
THICKNESS	D30 FT	FT	IN		D100(MAX)		IN
R2200	1.21	1.90	35.70	2.80	1.00	1.00	35.7

107+00 side slope							
PROGRAM OUTPUT FOR A TRAPEZOIDAL CHANNEL SIDE SLOPE, STRAIGHT REACH STRAIGHT REACH IS < = 5 WS WIDTHS DS OF ANYTHING CAUSING A FLOW IMBALANCE							
INPUT PARAMETERS							
SPECIFIC WEIGHT OF STONE,PCF							160.0
LOCAL FLOW DEPTH,FT							.5
CHANNEL SIDE SLOPE,1 VER: 2.00 HORZ							
AVERAGE CHANNEL VELOCITY,FPS							9.82
COMPUTED LOCAL DEPTH AVG VEL,FPS							9.82
(LOCAL VELOCITY)/(AVG CHANNEL VEL)							1.00
BOTTOM WIDTH,FT TRAP SECT							5.00
MAXIMUM FLOW DEPTH,FT TRAP SECT							.46
SIDE SLOPE CORRECTION FACTOR K1							.88
CORRECTION FOR VELOCITY PROFILE IN BEND							1.00
RIPRAP DESIGN SAFETY FACTOR							1.10
SELECTED STABLE GRADATIONS ALTERNATE GRADATION							
NAME	COMPUTED	D30(MIN)	D100(MAX)	D85/D15	N=THICKNESS/	CT	
THICKNESS	D30 FT	FT	IN		D100(MAX)		IN
R2200	1.07	1.90	35.70	2.80	1.00	1.00	35.7

Riprap Gutter at Channel Station 107+72

107+72 Invert							
PROGRAM OUTPUT FOR A TRAPEZOIDAL CHANNEL INVERT, STRAIGHT REACH STRAIGHT REACH IS < = 5 WS WIDTHS DS OF ANYTHING CAUSING A FLOW IMBALANCE							
INPUT PARAMETERS							
SPECIFIC WEIGHT OF STONE,PCF							160.0
LOCAL FLOW DEPTH,FT							.2
CHANNEL SIDE SLOPE,1 VER: 4.00 HORZ							
AVERAGE CHANNEL VELOCITY,FPS							6.41
COMPUTED LOCAL DEPTH AVG VEL,FPS							7.37
(LOCAL VELOCITY)/(AVG CHANNEL VEL)							1.15
BOTTOM WIDTH,FT TRAP SECT							5.00
MAXIMUM FLOW DEPTH,FT TRAP SECT							.16
SIDE SLOPE CORRECTION FACTOR K1							1.00
CORRECTION FOR VELOCITY PROFILE IN BEND							1.00
RIPRAP DESIGN SAFETY FACTOR							1.10
SELECTED STABLE GRADATIONS ALTERNATE GRADATION							
NAME THICKNESS	COMPUTED D30 FT	D30(MIN) FT	D100(MAX) IN	D85/D15	N=THICKNESS/ D100(MAX)	CT	IN
R2200	.57	1.90	35.70	2.80	1.00	1.00	35.7

107+72 side slope							
PROGRAM OUTPUT FOR A TRAPEZOIDAL CHANNEL SIDE SLOPE, STRAIGHT REACH STRAIGHT REACH IS < = 5 WS WIDTHS DS OF ANYTHING CAUSING A FLOW IMBALANCE							
INPUT PARAMETERS							
SPECIFIC WEIGHT OF STONE,PCF							160.0
LOCAL FLOW DEPTH,FT							.1
CHANNEL SIDE SLOPE,1 VER: 2.00 HORZ							
AVERAGE CHANNEL VELOCITY,FPS							6.41
COMPUTED LOCAL DEPTH AVG VEL,FPS							6.41
(LOCAL VELOCITY)/(AVG CHANNEL VEL)							1.00
BOTTOM WIDTH,FT TRAP SECT							5.00
MAXIMUM FLOW DEPTH,FT TRAP SECT							.13
SIDE SLOPE CORRECTION FACTOR K1							.88
CORRECTION FOR VELOCITY PROFILE IN BEND							1.00
RIPRAP DESIGN SAFETY FACTOR							1.10
SELECTED STABLE GRADATIONS ALTERNATE GRADATION							
NAME THICKNESS	COMPUTED D30 FT	D30(MIN) FT	D100(MAX) IN	D85/D15	N=THICKNESS/ D100(MAX)	CT	IN
R2200	.50	1.90	35.70	2.80	1.00	1.00	35.7