Appendix F: Proposed Hydraulics (Revised Conditions Model)

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

X	Х	XXXXXX	XX	ХХ		XX	XX	Х	X	XXXX
Х	Х	X	Х	Х		Х	Х	Х	Х	Х
Х	Х	Х	Х			Х	Х	Х	Х	X
XXX	XXXX	XXXX	Х		XXX	XX	XX	XXX	XXX	XXXX
Х	Х	X	Х			Х	X	Х	X	X
Х	Х	X	Х	Х		Х	Х	Х	Х	X
Х	Χ.	XXXXXX	XX	XX		Х	Х	Х	X	XXXXX

PROJECT DATA

Project Title: WalkerRunFld Project File: WalkerRunFld.prj

Run Date and Time: 12/8/2010 3:16:02 PM

Project in English units

PLAN DATA

Plan Title: Proposed Conditions

Plan File: p:\PROJECTS\Environmental\PPL - Wetland Permitting Oversite E-726-L8\TASKS\Task 10 -

Floodplain\walker Run HEC-RAS\walkerRunFld.p09

Geometry Title: Proposed Conditions
Geometry File: p:\PROJECTS\Environmental\PPL - Wetland Permitting Oversite
E-726-L8\TASKS\Task 10 - Floodplain\walker Run HEC-RAS\walkerRunFld.g07

Flow Title : Existing Conditions
Flow File : p:\PROJECTS\Environmental\PPL - Wetland Permitting Oversite
E-726-L8\TASKS\Task 10 - Floodplain\Walker Run HEC-RAS\WalkerRunFld.f03

Plan Summary Information: Number of: Cross Sections = 88 Multiple Openings = Culverts Inline Structures =
Lateral Structures = Bridges

Computational Information

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

Computation Options
Critical depth computed only where necessary

Conveyance Calculation Method: Between every coordinate point (HEC2 Style)
Friction Slope Method: Average Conveyance
Computational Flow Regime: Mixed Flow

Encroachment Data

Equal Conveyance = True Left Offset =

Right Offset

			Reach = 1			
RS	Profile		Method Value1	Va	luez	
5862	100 year	storm	encroachment	1	50	108.12
5547	100 year	storm	encroachment	1	130.75	226.17
5282	100 year	storm	encroachment	1	182.76	244
5198	100 year	storm	encroachment	1	176.89	249.89
5107	100 year	storm	encroachment	1	120	221
4995	100 year	storm	encroachment	1	1383	1505
4810			encroachment	1	70.73	245.06
4735	100 year	storm	encroachment	1	1700.14	1990.13
4692			encroachment	1	100.41	364.89
4495			encroachment	1	2041.17	2191.82
4414			encroachment	1	105.71	274.29
4295			encroachment	1	1531.78	1800

4130 4043 3972 3860 3785 3735 3532 3410 3375 3278 3065 2949 2730 2462 2339 2274 2139 2010 1925	100 year storm encroachment	WalkerRunFld 1 65.97 269.33 1 1565 1720 1 197.75 375 1 261 285 1 1413.78 1470 1 167.57 270 1 1577.02 1689.17 1 235.04 355 1 1528.63 1649.15 1 117.52 231.3 1 1567.38 1735.89 1 174.36 299.61 1 374.49 528.2 1 272.27 501.55 1 275 425 1 2325 2475.07 1 96.48 348.92 1 340.14 604.68 1 2690 2953.62 1 121.59 320.86
	walker Run Reach = 2 Profile Method Value1 100 year storm encroachment	

FLOW DATA

Flow Title: Existing Conditions Flow File: p:\PROJECTS\Environmental\PPL - Wetland Permitting Oversite E-726-L8\TASKS\Task 10 - Floodplain\Walker Run HEC-RAS\WalkerRunFld.f03

Flow Data (cfs)

River	Reach	RS			chment 500 year storm
Tributary	1	6850	303.5	303.5	615.69
Tributary	1	4400	303.5	303.5	615.69
Tributary	1	1252	303.5	303.5	615.69
Walker Run	1	5862	1640	1640	3600
Walker Run	1	5 198	1640	1640	3600
Walker Run	2	1602	1860	1860	3100

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Tributary Tributary	1 1	100 year storm 100 year storm enc	Critical roachment	Critical
Tributary Walker Run Walker Run	1 1 1	500 year storm 100 year storm 100 year storm enc	Critical Critical roachment	Critical
Walker Run Walker Run Walker Run	1 2 2	500 year storm 100 year storm 100 year storm enc	Critical roachment	Known WS = 653.29 Known WS
= 654.29 Walker Run	2	500 year storm		Known $WS = 654.6$

GEOMETRY DATA

Geometry Title: Proposed Conditions Geometry File : p:\PROJECTS\Environmental\PPL - Wetland Permitting Oversite E-726-L8\TASKS\Task 10 - Floodplain\Walker Run HEC-RAS\WalkerRunFld.g07

Reach Connection Table

River	Reach	Upstream Boundary	Downstream Boundary
Tributary Walker Run Walker Run	1 1 2	Trib Junc	Trib Junc Trib Junc

JUNCTION INFORMATION

Name: Trib Junc Description:

Energy computation Method

Length acr River	oss Junction Reach	Tributary River	Reach	Length Angle
Walker Run Tributary	1	to Walker Run to Walker Run	2	325.9 133

CROSS SECTION

RIVER: Tributary

RS: 6850 REACH: 1

INPUT Description:								
Station Elevat	ion Data	num=	98					
Sta Ele	ev Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0 717.		717.54	2.18	717.61	3.78	717.66	6.3	717.8
7.85 717.8		718	20.71	718.1	21.89	718.12	30.23	718.06
30.44 718.0		718	34.95	717.97	35.49	717.93	40.01	717.62
40.91 717.		717.38	43.04	717.13	43.18	717.1	43.68	717.04
	17 47.48	716.55	50.04	716.18		716	52.04	715.78
	15 56.01	714.66	58.49	714	60.5	713.45	61.8	713
73.57 712.0		712	75.39		76.44	711.85		711.28
	11 91.39	710.93	91.8	710.91	92.02	710.89	92.48	710.85
96.49 710.		710	102.88	709.75	104.15	709.32		709.26
104.43 709.		709.19	104.87	709.2	105.86	709.3	106.32	709.38
107.84 709.0		710	112.63	710.84	113.19		113.34	711.06
	118.92	712.94	119.09	713	119.23	713.05	122.01	714
123.04 714.		715	126.95	715.63	128.05	716	130.39	716.75
131.16 7		717.25	138.64	718	141.42	718.08	146.9	718.11
148.71 718.0		718	156.17	717.38	157.97	717	159.64	716.99
159.72 716.9		717	161.76	717	162.96	717.28		718
167.49 718.		719	177.43	719.22	185.26	719.81	186.71	719.92
187.13 719.9		720	195.49	720.55	201.16	721		721.56
209.54 721.7		722	224.62	722.84	226.57	723	236.08	723.8
238.51, 72	24 242.33	724.16	249.45	724.46				
	1		2					

Manning's	n Values		num=	3	
Sta	n Val	Sta	n Val	Sta	n Val
0	.05	90.32	.08	113.19	.05

Bank Sta: Left		Lengths: Left Cha		Coeff Contr.	Expan.
90.32	113.19		6.24 905.57	.1	.3

CROSS SECTION

RIVER: Tributary REACH: 1

RS: 5930

INPUT Description:

Station Elevation Data Elev 707.52 705.91 703 Sta Elev 0 707.61 4.46 706 11.48 703.34 Sta .21 4.67 Sta 1.49 6.78 Elev 706.23 704.87 702 707 705 12.85 702.86

```
WalkerRunFld
                                                                23.24
29.87
                        20.11
                                 700.31
    18.18
                701
                                                21
                                                         700
                                                                         699.19
                                                                                      23.8
                                                                                                  699
                                                     697.57
695.24
    24.33
            698.81
                        26.66
                                    698
                                            27.99
                                                                                              696.61
                                                                             697
                                                                                     31.89
                                 695.52
    35.21
                                                                                              694.93
                696
                        40.81
                                            43.76
                                                                 46.22
                                                                             695
                                                                                     47.88
                                           80.01
84.3
101.79
112.58
125.05
    73.56
                        78.44
                                  693.3
                                                         693
                                                                 80.83
                                                                                      82.4
                694
                                                                          692.64
                                                                                                  692
                                                               84.31
104.21
112.72
139.58
                                                                                    86.28
106.79
                        84.28
    83.33
                692
                                     692
                                                         692
                                                                             692
                                                                                                  692
                                                     693.51
693.7
            692.48
                        88.27
                                                                          693.59
                                                                                              693.68
                                     693
                                                                          693.69
  108.18
            693.72
                      110.29
                                 693.73
                                                                                    118.36
                                                                                              693.78
                                  693.9
                                                                         694.93
   120.92
             693.83
                       122.97
                                                         694
                                                                                    140.72
                                                                                                  695
                                          158.07
179.08
196.14
210.72
                                                               162.09
183.24
                                                     696.55
699
  141.28
            695.05
                       153.31
                                    696
                                                                                              697.45
700
                                                                             697
                                                                                       166
                                                                         699.61
                                                                                    185.81
   170.75
                698
                      174.95
                                  698.5
                                                                                              702.76
705
            700.35
703
                      192.66
207.13
                                 701
703.33
                                                     701.53
                                                               199.34
213.77
                                                                                    204.09
  188.27
                                                                         704.54
    205.4
                                                                                    216.32
            705.47
                      221.12
                                 705.84
    218.9
Manning's n Values
                                 num=
                                               3
                                 n Val
     Sta n Val
                          Sta
                                               Sta
                                                      n Val
                        80.01
                                    .08
                                            88.27
                                                         .05
                                 Lengths: Left Channel Right
448.37 429.25 409.23
                                                               Right
Bank Sta: Left
                     Right
                                                                            Coeff Contr.
                                                                                               Expan.
           80.01
                     88.27
                                                                                      .1
CROSS SECTION
RIVER: Tributary REACH: 1
                                 RS: 5500
Description:
Station Elevation Data
                                 num=
                                             96
                       Sta
1.65
14.78
22.97
25.93
      Sta
              Elev
                                   Elev
                                               Sta
                                                        Elev
                                                                   Sta
                                                                            Elev
                                                                                        Sta
                                                                                                Elev
            705.59
703.79
702.9
                                            3.11
14.79
23.58
                                 705.28
                                                        705
703
                                                                  3.68
                                                                           704.9
                                                                                       9.3
                                                                                                  704
                                                                         702.91
702.94
    10.58
                                                                 19.67
                                                                                     20.62
                                                                                               702.9
                                  702.9
                                                     702.92
703.05
                                                                 24.01
35.07
    22.18
                                                                                     24.36
                                                                                              702.98
    24.87
                703
                                 703.05
                                            26.08
                                                                          703.38
                                                                                     37.21
                                                                                              703.44
            703.47
703.31
701
                                 703.49
                                                     703.48
702.52
700
                                                                                            703.41
    39.27
                        41.12
                                            42.58
                                                                 43.53
                                                                          703.46
                                                                                     44.12
                                                                             702
                                                                                     48.86
52.59
    44.76
                        46.18
                                            46.94
                                                                 47.85
                                                                                              701.36
                                 700.22
    49.48
                        50.69
                                            51.08
                                                                 51.86
                                                                           699.5
                                                                                                  699
                       54.24
57.79
62.91
67.85
    53.94
            698.19
                                     698
                                            54.73
                                                     697.69
                                                                 55.88
                                                                             697
                                                                                     57.44
                                                                                              696.04
                                 695.83
                                                                          694.11
    57.51
                696
                                            59.23
                                                         695
                                                                  60.7
                                                                                      60.9
                                                                                                  694
            693.25
691.55
                                                                 65.37
75.95
                                            62.98
67.95
                                                                                     65.4
79.78
                                     693
                                                     692.98
                                                                             692
                                                                                              691.99
    66.48
                                     691
                                                         691
                                                                             691
                                           89.79
107.22
    84.86
                691
                         87.6
                                     691
                                                         691
                                                                 96.84
                                                                             691
                                                                                    105.06
                                                                                                  691
  105.18
                691
                        106.9
                                     691
                                                         691
                                                               114.51
                                                                             691
                                                                                    116.13
                      121.68
127.25
                                           123.18
128.76
137.76
            691.39
                                     692
                                                     692.64
                                                               124.03
                                                                             693
                                                                                    126.02
                                                                                              693.87
  126.33
                694
                                  694.4
                                                         695
                                                               129.16
                                                                         695.13
                                                                                    132.13
                                                                                                  696
            696.22
                      135.68
143.27
153.12
                                                     697.61
700
                                    697
                                                               139.16
                                                                             698
                                                                                    139.62
                                                                                              698.13
                699
                                 699.17
702
704.45
                                                                         700.82
                                                                                                  701
  142.67
                                           146.17
                                                               149.04
                                                                                    149.66
                                                     702.15
705
            701.16
  150.18
                                           153.66
                                                                 156.6
                                                                             703
                                                                                    158.09
                                                                                               703.4
                                                                         705.61
  160.27
                704
                      162.03
                                           164.06
                                                               166.44
                                                                                    168.26
            706.33
  169.59
Manning's n Values
                                num=
      Sta n Val
                         Sta
                                 n Val
                                               Sta
                                                      n Val
                                    .08 118.28
                .05
                        66.48
                                Lengths: Left Channel Right 758.93 739.98 740.88
Bank Sta: Left
                    Right
                                                               Right
                                                                            Coeff Contr.
                                                                                                Expan.
           66.48 118.28
CROSS SECTION
RIVER: Tributary
REACH: 1
                                 RS: 4750
INPUT
Description:
                                            130
Station Elevation Data
                                 num=
                       5ta
7.68
22.84
27.18
                                  Elev
                                                        Elev
               Elev
                                               Sta
                                                                   Sta
                                                                            Elev
                                                                                       Sta
                                                                                                 Elev
            719.11
717
                                            10.17
23.71
28.1
                                                     718.76
716
                                                                        718
715.58
713
                                                                                              717.49
715
                                    719
                                                                 18.45
                                                                                     20.03
                                 716.49
714
    21.92
                                                                 24.48
                                                                                     25.43
            714.49
712
     26.3
                                                     713.46
                                                                 28.92
                                                                                     29.88
                                                                                              712.44
                                                                 33.35
37.43
                                                                         710.38
    30.65
                        31.64
                                 711.37
                                            32.27
                                                         711
                                                                                     33.99
                                                                                                  710
            709.39
707
                                                     708.35
706
                                                                                              707.26
705
    35.06
                         35.7
                                    709
                                            36.83
                                                                                      38.7
                        39.54
44.31
                                                                         705.19
703
                                                                                     42.58
47.5
50.71
    39.13
                                 706.76
                                            40.87
                                                                 42.26
                                                     703.16
701
    43.96
            704.19
                                    704
                                            45.75
                                                                 46.03
                                                                                              702.13
                                                                 49.27
53.27
                                                                         700.99
698
                702
                        49.25
                                 701.01
                                            49.26
    51.78
            699.09
                        51.92
                                    699
                                            52.06
                                                     698.89
                                                                                     53.57
                                                                                              697.79
    54.58
                697
                        55.07
                                 696.68
                                            55.87
                                                         696
                                                                 56.82
                                                                         695.31
                                                                                     57.23
                                                                                                  695
```

```
WalkerRunFld
                                  694
                                         60.18 693.01 60.19
            694.16
                       58.5
                                                                        693
    58.25
                                                                               60.23
                                                                                       692.98
    62.33
               692
                       64.4
                                  691
                                         64.41
                                                     691
                                                            66.77
                                                                        690
                                                                               68.03
                                                                                       689.39
    68.88
               689
                      70.28
                              688.56
                                         71.66
                                                     688
                                                            73.93
                                                                    687.54
                                                                               76.53
                                                                                          687
            686.35
                                                 685.49
                                                                       685
    79.74
                      81.27
                                  686
                                         83.57
                                                            85.56
                                                                               86.56
                                                                                           684
                      94.99
     89.9
               684
                                  684
                                        124.36
                                                     684
                                                          137.07
                                                                        684
                                                                             144.81
                                                                                           684
                              685.09
688
                     176.89
  176.24
               685
                                        183.88
                                                     686
                                                           186.34
                                                                     686.5
                                                                              188.39
                                                                                           687
             687.7
                                                                             197.57
215.87
  191.16
                     192.31
                                        193.07
                                                  688.2
                                                          196.16
                                                                        689
            690
691.74
                     206.17
217.65
                              690.93
                                                 691
691.79
                                         206.7
                                                                    691.48
  200.05
                                                           214.37
                                                                                       691.59
                                                          218.54
221.15
   217.4
                                        218.07
                              691.76
                                                                    691.81
                                                                             219.08
                                                                                       691.82
  219.68
            691.82
                     220.29
                              691.82
                                        221.04
                                                 691.82
                                                                    691.82
                                                                             221.32
                                                                                       691.79
                                                           225.37
  221.59
            691.74
                     222.48
                              691.36
                                        223.33
                                                     691
                                                                    690.05
                                                                             225.47
                                                                                          690
  225.68
            689.91
                     227.73
                                  689
                                        229.96
                                                 688.11
                                                           230.23
                                                                        688
                                                                              230.4
                                                                                       687.93
  232.65
                              686.93
                                       233.41
237.5
247.15
                                                                    686.96
               687
                     233.17
                                                 686.89
                                                           233.91
                                                                             234.15
                                                                                          687
            687.11
                     236.86
245.95
                                                 688.24
691.13
                                                                             242.37
261.76
  234.42
                                  688
                                                           239.62
                                                                        689
                                                                                          690
                              691.05
                                                                    691.51
  245.17
               691
                                                           252.96
    269.9
           692.26
                     288.24
                                692.9
                                        290.57
                                                 692.98
                                                           291.12
                                                                        693
                                                                             296.01
                                                                                       693.22
Manning's n Values
                              num=
                       Sta
                              n Val
      Sta n Val
                                 .08 183.88
               .05
                      81.27
Bank Sta: Left Right
81.27 183.88
                              Lengths: Left Channel 238.3 226.5
                   Right
                                                           Right
                                                                      Coeff Contr.
                                                                                        Expan.
                                                 226.5
                                                           190.7
CROSS SECTION
RIVER: Tributary
                              RS: 4530
Description: U/S XS of Beaver Dam Pond Culvert
Station Elevation Data num=
                       Sta
.38
8.08
                              Elev
695.48
693.32
                                                                      Elev
     Sta
              Elev
                                           Sta
                                                           1.48
12.07
20.83
28.95
39.25
50.78
                                          1.28
9.54
18
            695.63
                                                 695.09
                                                                        695
                                                                                3.09
                                                                                       694.51
                                                 693
690.72
     5.01
               694
                                                                    692.33
                                                                               13.44
                                                                                          692
                      16.91
28.69
37.18
47.66
            691.32
                                  691
                                                                        690
                                                                               24.22
    24.81
               689
                              688.02
                                         28.78
                                                     688
                                                                    687.96
                                                                               29.27
                                                                                       687.87
                                         38.3
49.21
     32.8
               687
                              686.21
                                                     686
                                                                    685.85
                                                                               44.98
                                                                                          685
    46.66
               685
                                  684
                                                     684
                                                                        684
                                                                               51.95
                                                                                          684
   53.56
               684
                      58.64
                                  684
                                         62.64
                                                     684
                                                            65.43
                                                                        684
                                                                                           684
                     83.09
123.54
     82.7
               684
                                  684
                                         98.62
                                                     684
                                                           101.48
                                                                        684
                                                                             107.38
                                                                                          684
                                                                             168.98
    109.3
               684
                                         124.7
                                                     684
                                                           147.47
                                                                        684
                                                                                          684
                     180.32
193.27
    177.3
               684
                                  684
                                        182.51
                                                     684
                                                          188.98
                                                                        684
                                                                              190.4
                                                                                          684
  193.03
               684
                                  684
                                        193.44
                                                     684
                                                            194.9
                                                                        684
                                                                             194.96
                                                                                          684
                                                           196.91
  195.01
               684
                     195.13
                                  684
                                        196.34
                                                     684
                                                                        684
                                                                             203.33
                                                                                          684
  207.17
220.77
               684
                     210.36
                                  684
                                        211.96
                                                     684
                                                           215.52
                                                                        684
                                                                             218.11
                                                                                          684
                                                                             245.5
259.73
               684
                     224.16
                                  684
                                        231.87
                                                     684
                                                           239.24
                                                                        684
                                                                                          685
                                                                    686.31
687.21
                     256.85
262.26
272.58
  253.07
               685
                              685.84
                                        257.54
                                                     686
                                                          258.89
                                                                                       686.43
  261.48
            686.68
                              686.84
                                        263.03
                                                     687
                                                              264
                                                                             267.77
                                                                                          688
                                                          283.12
307.07
                                                 689.37
                                                                                        689.8
                                      280.78
  269.77
             688.4
                                  689
                                                                    689.52
                                                                             287.24
  289.93
               690
                     303.56
                              690.88
                                       305.27
                                                     691
                                                                    691.07
                                                                             307.94
                                                                                       691.11
Manning's n Values
                              num=
                      Sta
39.25
                              n Val
     Sta n Val
                                           Sta
                               .08 256.85
               .05
Bank Sta: Left Right
39.25 256.85
                              Lengths: Left Channel
                                                          Right
29.5
                   Right
                                                                      Coeff Contr.
                                                                                        Expan.
                                         26.8
                                                  29.2
Ineffective Flow _num=
   Sta L Sta R
0 103
                       Elev Permanent
                     686.02
                                    F
      109 307.94 686.02
CULVERT
RIVER: Tributary REACH: 1
                              RS: 4528
Description: Beaver Dam Pond Culvert
Distance from Upstream XS = 10.5
Deck/Roadway Width = Weir Coefficient =
                                     2.6
Upstream Deck/Roadway Coordinates
num= 126
     Sta Hi Cord Lo Cord
                                 Sta Hi Cord Lo Cord
                                                              Sta Hi Cord Lo Cord
        0 699.94
                                 .08 699.93
                                                              .17
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Page 5

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WalkerRunFld
                                      1.81
5.91
12.65
19.94
                                               699.59
698.73
697.57
696
     .37
4.86
              699.82
                                                                        4.29
7.54
                                                                                 699.12
                  699
                                                                                 698.44
                                                                       15.79
20.51
29.34
     9.65
                  698
                                                                                     697
    17.04
              696.74
                                                                                 695.88
    24.52
29.78
                                                 694.9
693
                  695
                                      25.05
                                                                                     694
              693.91
                                       34.3
                                                                                 692.22
                                                                        38.09
                                               691.18
690.88
                                                                       43.98
49.26
60.28
67.46
     39.2
                  692
                                      43.19
                                                                                     691
                                      44.67
55.23
65.16
70.96
84.94
     44.34
              690.93
                                                                                     690
                                                   689
                                                                                 688.18
              689.68
    51.11
                                               687.39
686.33
    61.36
                  688
                                                                                     687
             686.86
686.24
                                                                       80.51
                                                                                 686.24
    68.34
    80.67
                                               686.05
                                                                       86.72
                                                                                 686.04
                                                                       94.45
97.36
104.7
    89.52
95.14
             686.04
686.02
                                     93.66
96.47
                                               686.03
                                                                                 686.03
                                                                                 686.02
686.03
                                               686.02
                                    102.68
109.35
119.45
123.97
             686.02
686.03
   101.68
                                               686.02
                                                                      114.19
   105.44
                                               686.02
                                                                                 686.01
                                                                                 685.78
   117.38
123.15
                                               685.81
685.38
                                                                      120.95
                  686
              685.61
   127.21
139.57
                                                    685
                  685
                                    132.46
                                                                      134.61
144.59
153.25
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                  685
                                    141.83
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                                    149.69
158.41
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   147.06
155
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                                                                      163.68
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685
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   164.26
                  685
                                    164.58
174.29
                                                                      172.54
182.66
   173.23
                                                    685
                  685
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                                    185.42
198.27
                                                                      189.93
                                                                                 684.94
   183.32
                  685
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            , 684.95
   190.82
205.79
207.99
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                                               684.93
                                                                      198.45
                                    205.98
214.82
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                                                                      206.25
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               684.9
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                                                                      215.17
218.85
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685
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                                    218.29
221.47
   216.22
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   220.55
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                  685
                                    222.79
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   232.18
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                                    233.95
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   238.49
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                                      239.5
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   240.63
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                                    242.95
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                                                                       245.9
                                     249.8
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685.37
   246.88
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   252.46
265.16
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                                                                      262.47
                                      260.7
                                                                      269.63
                                                                                     687
                  686
                                    268.07
                                               686.63
   272.57
278.02
                                    273.81
278.88
                                                                      274.81
292.31
                                                                                 688.23
689.45
              687.71
                                                   688
                  689
                                               689.03
                                                                      310.77
   305.41
                  690
                                    309.17
                                                 690.2
                                                                                 690.28
Upstream Bridge Cross Section Data
Station Elevation Data num=
                                                  90
                                    num=
                                                                                                       Elev
694.51
                Elev
                                                  Sta
1.28
9.54
18
                                      Elev
                                                             Elev
                                                                          Sta
                                                                                   Elev
       Sta
                             Sta
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                                                                                             3.09
13.44
24.22
29.27
44.98
              695.63
                                    695.48
693.32
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692.33
                             .38
                                                          695.09
                                                                       12.07
20.83
28.95
39.25
50.78
                          8.08
16.91
      5.01
                  694
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    15.74
              691.32
                                        691
                                                           690.72
                                                                                     690
                                                                                                        689.15
                                                28.78
38.3
49.21
62.64
                          28.69
37.18
                                    688.02
686.21
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    24.81
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    46.66
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101.48
147.47
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                         83.09
123.54
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168.98
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    109.3
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                  684
                         180.32
193.27
    177.3
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   193.03
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218.11
   195.01
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210.36
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                         224.16
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                         256.85
262.26
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687.21
689.52
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                                               257.54
   253.07
                                    685.84
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                                                                                                       686.43
                                                                     264
283.12
                                                                                            267.77
287.24
             686.68
688.4
                                               263.03
280.78
   261.48
269.77
                                    686.84
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                                        689
                                                          689.37
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   289.93
                                    690.88
                                               305.27
                                                               691
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                  690
                         303.56
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                                                                                            307.94
Manning's n Values
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                                    num=
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             n Val
                             Sta
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                  .05
                          39.25
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Bank Sta: Left
39.25
                                    Coeff Contr.
                       Right
                                                         Expan.
                    256.85
                                                 .3
                                            2
Ineffective Flow
                        num=
   Sta L Sta R Elev
0 103 686.02
109 307.94 686.02
                                    Permanent
                                           F
Downstream Deck/Roadway Coordinates
      num= 126
Sta Hi Cord Lo Cord
     num=
                                        Sta Hi Cord Lo Cord
.08 699.93
                                                                          Sta Hi Cord Lo Cord
         0 699.94
                                                                                  699.9
                                                                          .17
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Page 6

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WalkerRunFld
                                      1.81
5.91
12.65
19.94
25.05
34.3
                                                 699.59
698.73
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7.54
15.79
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      4.86
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                                                 697.57
      9.65
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               696.74
     17.04
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                                                                                    695.88
    24.52
29.78
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               693.91
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                                                                                    692.22
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                                       43.19
      39.2
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               690.93
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                                       55.23
65.16
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               689.68
     51.11
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                                                 687.39
686.33
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     61.36
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                                                                        80.51
86.72
94.45
97.36
104.7
114.19
              686.86
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     68.34
                                       84.94
93.66
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               686.04
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95.14
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109.35
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123.97
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                                                 686.02
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   105.44
117.38
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127.21
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                                                 686.02
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                                     141.83
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   164.26
                                     164.58
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                                     174.29
185.42
198.27
   173.23
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   183.32
190.82
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              684.95
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                                     214.82
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235.25
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   232.18
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   238.49
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                                     242.95
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                                      249.8
   246.88
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   252.46
265.16
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                                                                        262.47
                                                                                   685.37
                   685
                                     268.07
                                                 686.63
                   686
                                                                        269.63
                                                                                        687
                                                                                   688.23
689.45
              687.71
   272.57
278.02
                                     273.81
                                                     688
                                                                        274.81
                                                689.03
690.2
                   689
                                     278.88
                                                                        292.31
310.77
   305.41
                   690
                                     309.17
                                                                                   690.28
Downstream Bridge Cross Section Data
                                                  122
Station Elevation Data
                                     num=
                                                            Elev
697.78
695
693.96
                           5ta
2.25
17.58
24.39
35.26
46.73
                                      Elev
                                                  Sta
3.51
19.01
24.56
40.08
                                                                            Sta
                                                                                      Elev
       Sta
                 Flev
                                                                                                   Sta
                                                                                                             Flev
                                                                          8.04
24.3
29.6
                                                                                   697
694.01
                                                                                                10.4
24.35
29.96
              698.39
                                     698
695.27
693.99
                                                                                                          696.58
694
    13.75
24.36
                  696
                  694
692
                                                                                                           692.93
                                                                                        693
                                    691.92
689.76
687.91
685.28
685.08
                                                                691
                                                                         40.93
                                                                                   690.86
                                                                                                43.54
56.28
    34.84
                                                                                                           690.41
                                                  50.78
57.21
73.58
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687
    45.59
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                                                                689
                                                                         51.85
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              687.94
                                                            687.86
685.87
                                                                       76.63
84.22
90.82
                                                                                                          686.74
685.6
                           56.88
                                                                                                64.06
78.89
84.7
    56.66
              686.48
685.36
685.08
684.44
684.19
683.85
    67.41
81.72
87.07
                            73.1
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                         82.81
87.43
93.35
106.71
113.67
119.46
                                                  83.36
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684.79
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                                                                                                91.94
                                                                                                           684.65
                                                  88.66
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                                                94.01
109.3
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121.24
135.14
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200.68
                                     684.38
684.15
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684.08
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111.09
   92.9
104.43
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683.37
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683.44
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683.35
683.32
                                                                       115.76
122.15
139.51
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127.52
   112.38
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              683.44
   118.12
                                                                                                           683.35
                         134.65
                                                                                               140.67
   131.92
                                     683.33
                                                                                                           683.32
              683.33
683.49
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683.33
                                                                       146.54
166.88
                                                                                               152.28
172.36
191.87
                         142.84
                                     683.34
   141.87
                                                                                                           683.42
                                     683.36
683.19
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683.03
                         163.36
   157.84
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              683.21
682.59
                                                            683.17
682.65
                         176.18
                                                                        190.83
   173.32
                                                                                                               683
                                                                                                           682.59
                         198.65
207.73
                                     682.57
682.75
682.6
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682.68
                                                                        201.32
                                                                                               205.33
   198.11
                                                            682.71
                                                                        210.84
                                                                                               212.81
                                                                                                           682.65
   206.51
              682.67
                                                 210.04
                                                                                               222.09
235.86
                                                216.59
232.46
                                                            682.57
683.21
              682.63
   213.82
                          213.87
                                                                        219.18
                                                                                   682.57
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   229.54
              682.91
                         231.92
                                         683
                                                                        234.58
                                                                                       684
                                                                                                           684.47
                                                                                    686.3
                                      685.1
                                                            686
688.34
                                                                                               256.09
294.52
                  685
                         237.7
275.91
315.27
                                                240.19
                                                                        245.86
                                                                                                               687
   237.43
              687.52
689
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                                                 283.94
                                                                        286.47
                                                                                   688.44
   266.97
                                         688
                                     689.42
                                                 320.65
   302.29
                                                            689.56
                                                                       325.31
                                                                                   689.67
                                                                                               329.74
                                                                                                          689.81
              689.97
   338.75
                         339.92
                                     689.99
Manning's n Values
                                     num=
            n Val
                                    n Val
                              Sta
                                                     Sta
                                                             n val
                        117.21
                                        .08 146.54
                  .05
                                                              .05
Bank Sta: Left Right
117.21 146.54
                                     Coeff Contr.
                                                           Expan.
                                             2 .3
Ineffective Flow
                             num=
    Sta L Sta R
                            Elev Permanent
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Page 7

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0 115 686.02
146.54 339.92 685
                    Station= 146.54
Right Levee
                                                  Elevation= 683.44
                                                                     O horiz. to 1.0 vertical O horiz. to 1.0 vertical
Upstream Embankment side slope
Downstream Embankment side slope
Maximum allowable submergence for weir flow = Elevation at which weir flow begins = Energy head used in spillway design =
Spillway height used in design
Weir crest shape
                                                          = Broad Crested
Number of Culverts = 1
Culvert Name
                      Shape
                                     Rise
                                                Span
Culvert H1 Circular 2
FHWA Chart # 55- Circular Culvert
FHWA Scale # 1 - Smooth tapered inlet throat
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist Length Top n
4.3 18 .013
Upstream Elevation = 679.28
                                                  Bottom n Depth Blocked Entrance Loss Coef
                                                                                                                Exit Loss Coef
                                                      .013
               Centerline Station = 106
Downstream Elevation = 679.1
              Centerline Station = 122
CROSS SECTION
RIVER: Tributary
REACH: 1
                                  RS: 4500
Description: D/S XS of Beaver Dam Pond Culvert
Station Elevation Data
                                 num=
                                              122
                                               Sta E16.
3.51 697.78
                                   Elev
                Elev
      Sta
                                                                                Elev
                                  695.27
693.99
691.92
689.76
687.91
686
685.28
685.08
                                                                                         10.4
24.35
             698.39
                                                                     8.04
                                                                                 697
                                                                                                   696.58
                 696
                                              19.01
                                                                     24.3
                                                                             694.01
                         24.39
35.26
46.73
                                                        693.96
691
                                                                     29.6
                                                                                                   692.93
    24.36
                 694
                                               24.56
                                                                                 693
                                                                                          43.54
56.28
    34.84
                 692
                                               40.08
                                                                    40.93
                                                                             690.86
                                              50.78
57.21
73.58
                 690
                                                            689
                                                                    51.85
                                                                              688.8
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685.87
             687.94
    56.66
                         56.88
                                                                    62.06
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             686.48
685.36
                                                                    76.63
                                                                             685.77
    67.41
                          73.1
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                         82.81
87.43
                                                                             685.21
    87.07
             685.08
                                               88.66
                                                            685
                                                                    90.82
                                                                                          91.94
                                  684.38
684.15
683.78
683.39
683.33
683.34
             684.44
                        93.35
106.71
                                              94.01
                                                        684.33
                                                                              684.3
                                                                   111.09
                                                                                        111.21
117.21
127.52
   104.43
             684.19
                                              109.3
                                                        684.08
                                                                                 684
                                             109.3
114.6
121.24
135.14
143.7
165.79
177.33
                                                        683.71
683.35
                                                                   115.76
122.15
  112.38
             683.85
                        113.67
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  118.12
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             683.3
683.33
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683.37
  131.92
                        134.65
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  141.87
                        142.84
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  157.84
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                        163.36
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                                                                   166.88
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682.57
682.75
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                        176.18
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                        198.65
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             682.67
                        207.73
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                                                                  210.84
219.18
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                                             216.59
             682.63
                        213.87
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                                                        682.57
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                       231.92
237.7
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240.19
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245.86
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256.09
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                                                        683.21
                                                                                 684
                                                                                                   684.47
                                                                              686.3
                                    685.1
                685
                                                            686
                                                                                                       687
                       275.91
315.27
                                             283.94
320.65
             687.52
                                      688
                                                        688.34
                                                                   286.47
                                                                             688.44
                                                                                        294.52
   266.97
                 689
                                  689.42
                                                                   325.31
   302.29
                                                        689.56
                                                                             689.67
             689.97
                        339.92
                                  689.99
Manning's n Values
                                  num=
     Sta n Val Sta
0 .05 117.21
                                  n Val
                                                         n val
                                      .08 146.54
Bank Sta: Left
                                  Lengths: Left Channel
                                                                                Coeff Contr.
                      Right
                                                                   Right
                                                                                                    Expan.
          117.21 146.54
                                              87.5
                                          2
Ineffective Flow
                           num=
  Sta L Sta R Elev
0 115 686.02
146.54 339.92 685
                          Elev
                                  Permanent
                                      F
                 Station= 146.54
Right Levee
                                                 Elevation= 683.44
CROSS SECTION
```

RIVER: Tributary

REACH: 1 RS: 4400

```
INPUT
Description:
Station Elevation Data
                                        num=
                                                       14
                                        Elev Sta Elev Sta 679.71 116.53 678.6 128.1 675.98 159.72 675.78 160.48 678.17 181.98 677.84 190
       Sta Elev Sta
36 683.01 104
                                                                                             Elev
                                                                                                                     Elev
                                                                                                          Sta
                                                                                         677.84
676.59
                                                                                                      152.93 677.53
   158.35 677.2 158.8
163.98 677.49 176.22
                                                                                                        161.3 676.98
                                                                                         680.01
Manning's n Values
Sta n Val Sta
36 .05 158.35
                                        num=
                                       n Val
                                                        Sta
                                                                n Val
                                           08 161.3
                                                                     .05
                          Right
                                        Lengths: Left Channel Right 1043.98 1051.3 1040.76
Bank Sta: Left
158.35
                                                                            Right
                                                                                       Coeff Contr.
                                                                                                                    Expan.
CROSS SECTION
RIVER: Tributary
                                        RS: 3356
REACH: 1
TNPUT
Description: U/S XS of RR Bridge No 5
Station Elevation Data
                                        num=
 Sta Elev Sta

-438.69 672.01 -380.28

194.18 670.23 205.77

214.16 667.67 215.07

219.51 670.12 224.24

295.86 673.86 312.17
                                        Elev Sta Elev
671.01 -365.82 670.01
669.77 208.9 670.84
667.67 215.68 667.68
671.09 229.11 672.65
                                                                                             Elev
                                                                                 Sta
                                                                                                          Sta
                                                                                                                     Elev
                                                                           28
210.78
216.52
234.42
                                                                                                                671.01
                                                                                         670.01
                                                                                                          100
                                                                                         669.09 213.43
667.72 217
                                                                                                                  668.53
                                                                                                                  667.83
                                                                                         670.53 267.47
                                        675.66
Manning's n Values
                                        num=
                              Sta
                                       n Val Sta
.05 219.51
 Sta n Val Sta
-438.69 .1 213.43
                                                                 n val
Bank Sta: Left Right 213.43 219.51
                         Right
                                        Lengths: Left Channel
476 296
                                                                             Right
102
                                                                                            Coeff Contr.
                                                                                                                    Expan.
Left Levee
                        Station=
                                            100
                                                         Elevation=
                                                                             671.01
BRIDGE
RIVER: Tributary
                                        RS: 3108
REACH: 1
TNPUT
Description: RR bridge No 5
                                           223
60
Distance from Upstream XS = Deck/Roadway Width = Weir Coefficient =
                                                 2.6
Upstream Deck/Roadway Coordinates
      num= 5
Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord
-200 685.6 0 -94.46 685.6 0 -94.46 685.6 680.6
440 691.8 686.8 600 691.8 0
Upstream Bridge Cross Section Data
Station Elevation Data num=
                                                     110
               Elev Sta Elev 673 0 673 667.9 87.52 667.61 667.23 109.21 667.22 667.2 139.07 667.21 667.1 178.15 667.11 666.94 192.59 666.9
                                                    Sta
65.98
89.94
110.43
144.49
167.64
180.17
                                        EĴēv
                                                                                            Elev
                                                                                  Sta
                                                                                                                     Elev
     Sta
-200
                                                                    Elev
                                                                                                          Sta
                                                                668.53
667.5
667.22
667.21
                                                                                                     72.64
97.4
124.22
155.63
172.35
                                                                            68.5
91.48
113.07
                                                                                         668.34
667.48
                                                                                                                  668.18
667.39
    79.82
                                                                                         667.21
667.21
                                                                                                                  667.2
667.21
   108.25
                                                                             150.36
169.69
   131.06
   157.59
175.36
                                                                667.18
667.08
                                                                                         667.17
666.99
                                                                                                                  667,16
                                                                             183.46
196.85
                                                                                                      186.15
                                                                                                                  666.95
               666.94
666.87
                           192.59
205.43
                                       666.9
666.85
                                                                                         666.89
                                                                                                      200.18
                                                    194.76
                                                                666.89
                                                                                                                  666.87
   189.37
                                                                             212.21
231.84
253.26
274.58
                                                    209.24
229.31
                                                                                         666.85
                                                                                                      216.51
   201.93
                                                                666.86
                                                                                                                  666.85
                                       666.85 209.24
666.82 229.31
666.77 250.97
666.9 268.59
667.46 297.2
667.11 303.84
666.43 307.7
667.51 317.66
669.25 336.78
670.1 357.47
                                                                                                      236.08
  217.29
243.09
                           229.2
247.77
                                                                                         666.82
666.76
               666.85
                                                                666.82
                                                                                                                  666.83
                                                                666.76
666.97
667.5
666.43
                                                                                                      255.23
               666.79
                                                                                                                  666.77
                                                                                         667.11
667.64
                                                                                                      290.14
                           265.38
   258.64
               666.78
                                                                                                                  667.48
                                                                             298.59
                            296.79
                                                                                                      299.67
   292.17
               667.51
               667.26
                            301.63
                                                                             304.49
                                                                                         666.43
                                                                                                      305.02
   301.19
                                                                                                                  666.43
   305.67
               666.43
                            306.14
                                                                666.43
                                                                             309.85
                                                                                         666.56
                                                                                                      311.08
                                                                                                                  666.66
                                                                667.52
669.33
                                                                             324.59
   317.03
               667.45
                           317.51
                                                                                         668.11
                                                                                                      327.01
                                                                                                                  668.33
                                                                            340.28
359.25
377.32
   329.54
               668.58
                           336.02
                                                    336.78
357.47
376.64
                                                                                         669.49
670.97
                                                                                                      346.95
365.23
                                                                                                                  669.76
                           351.03
374.55
                                                                670.81
   347.44
               669.79
                                                                                                                  671.56
                                                                672.72
   368.31
             671.85
                                          672.5
                                                                                           672.8
                                                                                                       385.4
                                                                                                                  673.59
                                       674.47
                                                                              401.6 675.33
                                                                                                     403.24
   392.48
                674.2
                           395.24
                                                    398.11
                                                                674.87
                                                                                                                  675.57
```

```
WalkerRunFld
   407.61 676.19 410.67 676.63 413.6 677.05 413.8 677.07 415.82 677.33 420.01 677.91 424.55 678.49 426.38 678.77 434.98 679.39 436.17 679.47 436.44 679.49 437.44 679.53 437.73 679.54 440 691.8 540 691.8
Manning's n Values
                                    num=
                                   n Val Sta
.1 304.49
      Sta n Val
-200 .1
                                                         n Val Sta
.05 317.51
                             Sta
                                                                                  n val
Bank Sta: Left Right 301.19 317.51
                                    Coeff Contr. Expan.
                     317.51 .3 .5
Station= 100 Elevation= 671.01
Left Levee
Downstream Deck/Roadway Coordinates
     num=
   Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord -94.46 685.6 0 -94.46 685.6 680.6 440 691.8 686.8
Downstream Bridge Cross Section Data
Station Elevation Data
      Sta Elev Sta
                                                              Elev
                                                                                    Elev
                                                                                 682.5
667.9
667.23
667.2
                                                                                                        668.53
667.61
                          0
68.5
91.48
                  682
                                                               682
                                                                                                  60
                                         682
            668.53
667.5
667.22
667.21
667.18
                                                72.64
97.4
124.22
155.63
172.35
186.15
                                    668.34
667.48
667.21
667.21
                                                           668.18
667.39
667.2
667.21
                                                                      79.82
108.25
                                                                                                        667.22
                         113.07
150.36
                                                                      131.06
                                                                                             139.07
                                                                      157.59
175.36
   144.49
                                                                                             164.05
                                                                                             178.15
192.59
   167.64
                         169.69
                                    667.17
                                                           667.16
                                                           666.95
666.87
666.85
              667.08
                         183.46
                                    666.99
                                                                      189.37
                                                                                  666.94
   180.17
                         196.85
212.21
              666.89
                                    666.89
                                                200.18
                                                                      201.93
                                                                                  666.87
                                                                      217.29
243.09
              666.86
                                    666.85
                                                216.51
                                                                                  666.85
                                                           666.83
666.77
              666.82
                         231.84
                                    666.82
                                                236.08
                                                                                  666.79
                                                                                             247.77
                         253.26
274.58
              666.76
                                    666.76
                                                                                  666.78
              666.97
667.5
666.28
                                                290.14
                                    667.11
                                                           667.48
                                                                                  667.51
                                                299.67
305.02
                                                           667.35
666.05
                         298.59
                                    667.64
                                                                      301.19
                                                                                  667.26
                                                                                             301.63
                                                                      305.67
317.03
                         304.49
   303.84
                                    666.05
                                                                                  666.05
              666.39
667.52
                                                311.08
327.01
                          309.85
                                    666.56
                                                           666.66
                                                                                  667.45
   317.66
                         324.59
                                    668.11
                                                                      329.54
                                                           669.76
671.56
673.59
675.57
677.33
                         340.28
359.25
              669.33
                                    669.49
                                                346.95
                                                                      347.44
                                                                                  669.79
                                                365.23
                                                                                  671.85
674.2
              670.81
                                    670.97
                                    672.8
675.33
677.07
679.39
              672.72
                         377.32
                                                 385.4
                                                                                             395.24
   398.11 674.87
413.6 677.05
426.38 678.77
437.73 679.54
                                              403.24
415.82
                           401.6
                                                                      407.61
                                                                                  676.19
                                                                                             410.67
                           413.8
                                                                      420.01
                                                                                  677.91
                         434.98
                                                436.17
                                                                                  679.49
                              440
Manning's n Values
                                    num= 4
n Val Sta
.1 304.49
                                                            n Val Sta n Val .05 317.51 .1
       Sta n Val
-75 .1
                             Sta
Bank Sta: Left Right 301.19 317.51
                                    Coeff Contr.
                                                         Expan.
Upstream Embankment side slope
                                                                         O horiz. to 1.0 vertical
Downstream Embankment side slope
                                                                         O horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape =
                                                             = Broad Crested
Number of Piers = 5
Pier Data
                   Upstream=
Pier Station
                                          -5.9
                num 2

Elev width Elev
0 4 696.5
num 2
Upstream
     Width
Downstream
     width Elev Width Elev
4 0 4 696.5
Pier Data
Pier Station
                     Upstream= 83.28
                                                     Downstream=
                                                                         83.28
                 num=
Upstream
                            widţħ
                                       Elev
      width
                 Elev
                           4 69
2
                 0
num=
        4
Downstream
     Width Elev Width Elev
```

```
Pier Data
Pier Station
                      Upstream= 168.46
                                                  Downstream= 168.46
Upstream
                 num=
     width
                Elev
                          Width
                                     Elev
        4
                    ٥
                              4
                                    696.5
Downstream
                   num=
                                  2
     Width
                Elev
                          Width
        4
                    0
                              4
                                    696.5
Pier Data
Pier Station
                     Upstream= 257.64
                                                  Downstream= 257.64
Upstream
                 num=
     Width
                Elev
                          Width
                                    Elev
                           4
                    0
         4
                                    696.5
                                  2
Downstream
                   num=
     Width
                Elev
                          Width
Pier Data
Pier Station
                     Upstream= 346.82
                                                  Downstream= 346.82
Upstream
                num=
                                     Elev
                Elev
                          width
     Width
                   0
                                   696.5
                                  2
Downstream
                   num=
                          Width
     Width
                                   696.5
                              4
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
CROSS SECTION
RIVER: Tributary
                                  RS: 3060
Description: D/S XS of RR Bridge No 5, U/S XS of Bridge No 2, 6 Station Elevation Data num= 98
Station Elevation Data
                                num=
            Elev
                                   Elev
                                                Sta
                                                                               Elev
                                                                                           Sta
                                                                                       75.95 672.148
100.82 670.131
                                                                                673
671
                 682
                                      682
                                                                   64.18
                                                           676
                                            78.74 671.948
111.76 669
136.79 667.132
                         78.01
    77.44 672.043
                                                                   91.82
                                                                                       120.59 668
140.16 666.969
158.55 666.654
190.3 666.653
                       102.99 669.907
130.23 667.473
                 670
                                                                  118.45 668.231
                                                                  138.85
                                                                                667
                       154.44 666.68
173.87 666.635
                                                                   156.3 666.66
185.3 666.653
    145.2 666.863
                                             155.26 666.666
                                                                            666.66
                                             180.69 666.647
            666.64
                                             201.96 666.623
213.97 666.531
226.26 666.277
                                                                  205.02 666.614
215.69 666.49
             666.65
                        196.46 666.646
                                                                                       206.76 666.606
                       211.59 666.565
223.52 666.327
237.2 666.171
257.44 666.02
275.98 665.958
290.98 666.257
319.25 666.857
                                                                  215.69 666.49
229.89 666.254
                                                                                       218.49 666.39
232.73 666.212
   209.03
             666.59
  220.78 666.337
234.22 666.204
                                             240.44 666.159
257.53 666.019
                                                                                       246.63 666.115
269.27 665.969
                                                                  242.97 666.138
                                                                 259.69 666
279.6 665.973
  247.3 666.111
273.25 665.96
288.25 666.162
                                             277.93 665.962
                                             296.08 666.443
                                                                  311.06
                                                                                667
                                             321.78
                 667
                                                           666
                                                                                 666
                        324.35
                                      666
                                             336.57 666.947
                                                                  337.11 666.988
   323.83
                 666
    344.9 667.568
                                                                  362.17 669
389.62 671.675
                        350.35
                                      668
                                             357.48 668.597
                                                                                       369.51 669.588
           670
672.75
675
                        381.08 670.809
                                             383.04
                                                           671
                                                                                       393.01
                         02.18 673
425.8 675.465
                                             402.92 673.096
                        402.18
                                                                  411.81
                                                                                       419.61
   399.88
                                             429.64
                                                           676
                                                                  431.45 676.282
   422.64
   439.62 677.517
Manning's n Values
                                  num=
                           Sta
                                   n Val
      Sťa
              n Val
                                                 Sta
                                                         n Val
                       318.74
                                      .05 337.11
Bank Sta: Left Right
                                  Lengths: Left Channel
                                                                 Right
                                                                               Coeff Contr.
                                                                                                   Expan.
```

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RRIDGE

weir crest shape

```
RIVER: Tributary
                                                                             RS: 3010
 REACH: 1
INPUT
Description: Bridge No 2 and Pipe Bridge 6
Distance from Upstream XS = 20
Deck/Roadway Width = 90
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
              num= 3
Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord
0 690.9 0 31.84 690.9 685.6
            num=
                                                                                                                                                            Sta Hi Cord Lo Cord
                                                                                                                                                             440
                                                                                                                                                                                     695
Upstream Bridge Cross Section Data
Station Elevation Data num=
Sta Elev Sta Elev
0 682
                                                                                                                                                                                                  Sta Elev
75.95 672.148
100.82 670.131
120.59 668
140.16 666.969
158.55 666.654
190.3 666.653
206.76 666.606
218.49 666.39
232.73 666.212
246.63 666.112
246.63 666.112
246.63 666.113
315.34 667
323.1 665.89
337.27 667
369.51 669.588
                                                                                                                                                  Sta Elev 64.18 673 91.82 671 118.45 668.231 138.85 667 156.3 666.66 185.3 666.664 125.69 666.49 229.89 666.254 242.97 666.138 259.69 666.279.6 665.973 311.06 322.5 665.89 337.11 666.988 362.17 669 389.62 671.675 411.81 678
                                                                             Elev
682
672
                                                                                                                                                                                  Elev
                                                                                                                                  Elev
                                                                                                              Sta
                                                                                                                                                             Sta

        Sta
        Elev
        Sta
        Elev
        Sta
        Elev

        0
        682
        10
        682
        60
        676

        77.44
        672.043
        78.01
        672
        78.74
        671.948

        102.13
        670
        102.99
        669.907
        111.76
        669

        124.12
        667.815
        130.23
        667.473
        136.79
        667.132

        145.2
        666.863
        154.44
        666.68
        155.26
        666.666
        168.04
        666.64
        173.87
        666.635
        180.69
        666.664

        194.79
        666.65
        196.46
        666.646
        201.96
        666.623

        209.03
        666.337
        223.52
        666.327
        226.26
        666.531

        220.78
        666.337
        223.52
        666.327
        226.26
        666.57

        247.3
        666.111
        257.44
        666.02
        257.53
        666.019

        273.25
        665.96
        275.98
        665.87
        277.93
        665.96

        288.25
        666.162
        290.98
        666.257
        296.08

                                     682
                                                                                                                                     676
                                                                10
                                                                                                                60
                                                                                                                                                                                                   369.51 669.588
393.01 672
                                                                                                                                                    411.81
                                                                                                                                                                                    674
                                                                                                                                                                                                    419.61 674.697
                                                                                                                                                    431.45 676.282
                                                                                                                                                                                                    436.25
       439.62 677.517
                                                              440
                                                                                                              540
                                                                                      695
Manning's n Values
                                                                             num=
                                                                             n Val Sta
.1 318.74
              Sta n Val Sta
0 .1 124.12
                                                                                                                               n val
                                                                                                                                                                               n Val
                                                                                                                                                             Sta
                                                                                                                                 .05 337.11
Bank Sta: Left Right 318.74 337.11
                                                                             Coeff Contr.
                                                                                                                         Expan.
Downstream Deck/Roadway Coordinates
            num=
                                                                                     Sta Hi Cord Lo Cord
400 695 690
              Sta Hi Cord Lo Cord
                                                                                                                                                             Sta Hi Cord Lo Cord
         -8.16
                             690.9 685.9
                                                                                                                                                             435
                                                                                                                                                                                     695
Downstream Bridge Cross Section Data
Station Elevation Data num=
                                   Elev
                                                             Sta
                                                                                  Elev
                                                                                                                                  Flev
               Sta
                                                                                                             Sta
                                                                                                                                                             Sta
                                                                                                                                                                                  Flev
                                                                                                                                                                                                            Sta
                                                                                                 -8.16
204
256.85
309.05
                          690.9 -8.16
666.62 134
665.51 255.77
666.4 277.29
679.51 420.6
                                                                                                                            668.62
                                                                                                                                                                                                   26.89
252.14
258.87
                                                                                                                                                                                                                           667.62
                                                                                690.9
                                                                                                                                                             9.3
               -50
                                                                                                                                                                            668.62
                                                                            665.44
665.44
665.84
679.96
                                                                                                                                                    246.49
257.71
338.85
435
                                                                                                                            665.44
                                                                                                                                                                                                                           666.64
                                                                                                                                                                            666.37
         67.11
       254.24
                                                                                                                                                                            665.64
672.2
                                                                                                                                                                                                                           666.43
677.29
                                                                                                                            668.44
679.96
       263.61
                                                                                                                                                                                                   371.24
                                                                                                              435
                                                                                                                                                                            694.61
Manning's n Values
                                                                             num=
              Sta n Val Sta
-50 .1 -8.16
                                                                             n Val
                                                          Sta
                                                                                                                               n Val
                                                                                                                                n Val Sta
.1 252.14
                                                                                                             Sta
                                                                                                                                                                               n Val
                                                                                                                                                                                                                              n Val
                                                                                                  26.89
                                                                                                                                                                                     .05
                                                                                                                                                                                               258.87
                                                                                        .1
Bank Sta: Left Right Coeff C
252.14 258.87
Left Levee Station= 252.14
                                                                             Coeff Contr.
                                                                                                                         Expan.
                                                                                                   .3 .5
Elevation= 666.03
Upstream Embankment side slope = Downstream Embankment side slope = Maximum allowable submergence for weir flow = Elevation at which weir flow begins = Energy head used in spillway design = Spillway height used in design = Weir crest shape
                                                                                                                                                          0 horiz. to 1.0 vertical
                                                                                                                                                          0 horiz. to 1.0 vertical
                                                                                                                                                     .98
```

= Broad Crested

```
Number of Piers = 4
Pier Data
Pier Station
                   Upstream= 112.92
                                                             72.92
                                            Downstream=
Upstream
               num=
    Width
              Elev
                       Width
                                 Elev
                          4
       4
                 0
                                  695
Downstream
                 num=
                       Width
    Width
              Elev
                                 Elev
       4
                 0
                           4
                                  695
Pier Data
Pier Station
                  Upstream= 194.92
                                            Downstream= 154.92
Upstream
               num=
    Width
              Elev
                       Width
       4
                 0
                           4
                                  695
Downstream
                 num=
    Width
              Elev
                       Width
Pier Data
Pier Station
                                276.92
                                            Downstream= 236.92
                   Upstream=
Upstream
               num=
    Width
                       Width
              Elev
       4
                 0
                                  695
Downstream
                 num=
    Width
              Elev
                       Width
Pier Data
Pier Station
                                358.92
                                            Downstream= 318.92
                   Upstream=
               num=
Upstream
    Width
              Elev
                       Width
                        4
       4
                 0
                                  695
Downstream
                 num=
    Width
                       Width
                                Elev
                           4
                                  695
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
CROSS SECTION
RIVER: Tributary
REACH: 1
                              RS: 2834
Description: D/S XS of Bridge No 2, 6
Station Elevation Data
                              num=
  Sta Elev

9.3 668.01

246.49 665.76

257.71 665.03
                                       Sta
67.11
254.24
                       Sta
                                Elev
                                                   Elev
                                                                      Elev
                                                                   665.01
664.89
665.23
679.35
                    26.89
252.14
258.87
                              667.01
666.03
665.82
                                                 666.01
664.9
665.79
                                                          134
255.77
277.29
                                                                                      665.01
665.07
                                                                                 204
                                                                             256.85
                                        263.61
                                                                             309.05
                                        390.72
  338.85
           671.59
                              676.68
                                                  678.9
                                                            420.6
Manning's n Values
                              num=
                    sta
252.14
           n Val
                               n Val
     Sta
9.3
                                                  n Val
                                  .05
                              Lengths: Left Channel
                                                                      Coeff Contr.
Bank Sta: Left
                   Right
                                                          Right
                                                                                        Expan.
         252.14
                  258.87
                                        46.29
                                                 46.1
                                                          46.48
                              252.14
                                           Elevation=
                                                          666.03
Left Levee
                  Station=
CROSS SECTION
```

```
RIVER: Tributary
REACH: 1
                                         RS: 2791.66*
INPUT
Description:
Station Elevation Data
                                                        44
                                        num=
                  Elev
                           Sta
28.52
135.53
247.93
                                           Elev
                                                          Sta
                                                                     Elev
                                                                                              Flev
                                                                                                            Sta
       Sta
                                        Elev
667.4
664.94
665.43
664.51
665.46
667.22
671.99
                                                                              5ta
36.18
185.9
253.57
258.42
265.72
325.08
386.83
416.33
458.58
                                                                                   Sta
                                                                                                                       Flev
                                                    Sta
32.14
150.07
249.05
257.36
263.4
316.85
360.6
413.19
458.58
                                                                                                       68.7
205.47
255
258.54
281.11
337.59
387.57
     10.94 669.01
                                                                  667.18
664.91
665.48
                                                                                           666.92
                                                                                                                    666.04
                665.57
665.19
     94.87
                                                                                           664.88
                                                                                                                    664.82
   233.48
                                                                                           665.59
664.65
665.44
                                                                                                                    664.87
                          247.93
256.31
260.38
315.57
350.39
408.76
442.38
                                                                 664.47
665.45
667.31
674.93
   255.76
259.25
                664.51
                                                                                                                    664.64
                664.66
                                                                                                                    664.92
                                                                                          668.19
678.29
     290.1
                665.52
                                                                                                                    669.65
   344.23
              670.37
                                                                                                                    678.36
   402.4 679.73
433.86 680.13
                                        680.42
679.72
                                                                  680.55
678.74
                                                                                                       420.83
                                                                                           680.75
                                                                                                                  680.81
                                                                                           692.17
Manning's n Values
                                         num=
                                        n Val
       Sta n Val Sta
0.94 .1 253.57
                               Sta
                                                          Sta
                                                                   n Val
                                          .05 260.38
Bank Sta: Left Right 253.57 260.38
                                         Lengths: Left Channel
                                                                              Right
                                                                                              Coeff Contr.
                                                                                                                     Expan.
                                                     46.29
                                                                   46.1
                                                                              46.48
                                                                                                          .3
CROSS SECTION
RIVER: Tributary REACH: 1
                                        RS: 2749.33*
INPUT
Description:
Station Elevation Data
                                        num=
                                                        44
                 Elev Sta
570.01 30.14
565.52 137.07
                                                                              Sta
37.8
187.39
255
                                                   Sta
33.77
151.59
                                           Elev
                                                                     Elev
                                                                                              Elev
       Sta
                                                                                                            Sta
                                                                                                                       Elev
                                                                                                       70.29
206.95
                670.01
                                        667.79
664.86
                                                                  667.43
664.81
                                                                                          667.02
664.75
665.14
                                                                                                                    666.07
     96.44
                665.52
                                                                                                                    664.63
                            249.36
257.85
261.9
323.22
                                        665.09
664.12
665.09
                                                     250.48
258.96
   234.93
                664.88
                                                                  665.14
                                                                                                       256.49
                                                                                                                    664.44
                                                                  664.06
                664.12
                                                                               259.98
                                                                                                        260.1
                                                                                           664.23
                                                                                                                    664.23
                                                     265.26
324.65
                                                                                                       284.93
347.71
403.24
440.21
                                                                 665.11
666.79
                                                                              267.83
333.8
                                                                                           665.09
667.63
                664.29
     260.8
                                                                                                                    664.62
   294.93
               665.16
                                          666.7
                                                                                                                    669.14
                                                                              402.43
435.21
                            361.92
426.79
                                        672.39
681.95
                                                   373.27
431.72
                                                                  676.85
682.13
              669.85
                                                                                            679.9
682.5
   355.08
                                                                                                                    679.96
   419.73
               681.21
                                                                                                                    682.55
              681.03
                            464.16
                                        680.09
                                                    482.17
                                                                  678.12
                                                                              482.17
                                                                                           690.33
Manning's n Values
                                        num=
                                         n Val
                                5ta
255
     Sta n Val
12.58 .1
                                                                   n val
                                                          Sta
                                           .05
                                                       261.9
                          Right
261.9
                                        Lengths: Left Channel 46.29 46.1
Bank Sta: Left
                                                                              Right
                                                                                              Coeff Contr.
                                                                                                                     Expan.
                                                                   46.1
                                                                              46.48
CROSS SECTION
RIVER: Tributary REACH: 1
                                        RS: 2707.*
INPUT
Description:
Station Elevation Data
Sta Elev St
14.23 671.01 31.7
98.01 665.47 138.
236.38 664.57 250.
258.81 663.73 259.
                                        num=
                              Sta
31.77
                                           Elev
                                                         Sta
                                                                     Elev
                                                                                              Elev
                                                                                   Sta
                                                                                                            Sta
                                                                                                                       Flev
                                                                              39.42
188.88
256.43
261.55
269.93
                                                    35.39
                                                                                          667.11
664.62
                                        668.19
                                                                  667.69
664.71
                                                                                                         71.88
                                                                                                                    666.09
                                        668.19
664.79
664.76
663.74
664.73
666.18
                                                    35.39
153.11
251.92
260.55
267.11
332.46
385.94
                             138.6
250.8
259.4
                                                                                                       208.42
257.98
                                                                                                                    664.45
                                                                   664.8
                                                                                            664.7
                                                                                                                    664.02
                                                                                                       261.66
288.76
357.82
418.92
                                                                                           663.81
664.75
                                                                  663.64
                                                                                                                    663.81
                                                                 664.76
666.27
678.76
683.72
677.51
   262.34
               663.92
                            263.41
                                                                                                                    664.31
                            330.88
373.46
                                                                                           667.07
681.51
               664.8
669.32
                                                                              342.52
418.02
   299.75
                                                                                                                    668.64
   365.93
                                                                                                                    681.57
                            444.83
485.94
                                        683.47 450.24
680.46 505.75
   437.05
475.52
               682.69
                                                                              454.09
505.75
                                                                                           684.25
                                                                                                       459.59
                                                                                                                     684.3
               681.93
                                                                                            688.5
Manning's n Values
                                        num=
     Sta n Val Sta
14.23 .1 256.43
                                         n Val
                                Sta
                                                          Sta
                                                                   n Val
                                            .05 263.41
Bank Sta: Left Right 256.43 263.41
                                                                              Right
                                        Lengths: Left Channel
                                                                                              Coeff Contr.
                                                                                                                     Expan.
                                                     46.29
                                                                   46.1
                                                                              46,48
                                                                                                          .3
```

CROSS SECTION

RIVER: Tributary REACH: 1	RS: 2664.66*					
INPUT Description: Station Elevation Data Sta Elev Sta 15.87 672.01 33.4 99.58 665.42 140.13 237.82 664.26 252.23 260.34 663.35 260.95 263.88 663.55 264.93 304.57 664.43 338.54 376.78 668.79 384.99 454.38 684.17 462.86 496.35 682.82 507.72	num= 44 Elev Sta 668.58 37.01 664.71 154.63 664.43 253.35 663.35 262.14 664.36 268.96 665.67 340.26 673.19 398.62 684.99 468.77 680.83 529.33	Elev 667.95 664.6 664.46 663.23 664.41 665.75 680.68 685.31 676.9	Sta 41.04 190.37 257.86 263.11 272.04 351.24 433.62 472.97 529.33	Elev 667.21 664.49 664.25 663.39 664.4 666.51 683.12 686 686.67	Sta 73.48 209.89 259.48 263.22 292.58 3434.59 478.97	Elev 666.12 664.26 663.6 663.39 664.01 668.13 683.17 686.04
Manning's n Values Sta n Val Sta 15.87 .1 257.86	num= 3 n Val Sta .05 264.93	n Val				
Bank Sta: Left Right 257.86 264.93	Lengths: Left Cl 46.29	hannel 46.1	Right 46.48	Coeff	Contr.	Expan.
CROSS SECTION						
RIVER: Tributary REACH: 1	RS: 2622.33*					
INPUT Description: Station Elevation Data Sta Elev Sta 17.51 673.01 35.02 101.15 665.36 141.67 239.27 663.95 253.67 261.86 662.96 262.5 265.43 663.18 266.44 309.4 664.07 346.2 387.63 668.27 396.53 471.71 685.65 480.9 517.19 683.72 529.5	num= 44 Elev Sta 668.97 38.64 664.64 156.15 664.09 254.79 662.96 263.73 664 270.81 665.15 348.06 673.59 411.29 686.52 487.3 681.2 552.92	Elev 668.2 664.5 664.12 662.81 664.06 665.23 682.59 686.89 676.29	Sta 42.66 191.86 259.29 264.68 274.15 359.95 449.21 491.85 552.92	Elev 667.31 664.36 663.81 662.96 664.05 665.95 684.73 687.75 684.83	Sta 75.07 211.36 260.97 264.79 296.4 378.04 450.27 498.34	Elev 666.15 664.07 663.17 662.97 663.7 667.63 684.77 687.79
Manning's n Values Sta n Val Sta 17.51 .1 259.29	num= 3 n Val Sta .05 266.44	n Val				
Bank Sta: Left Right 259.29 266.44	Lengths: Left Cl 46.29	hannel 46.1	Right 46.48	Coeff	Contr.	Expan.
CROSS SECTION						
RIVER: Tributary REACH: 1	RS: 2580.*					
INPUT Description: Station Elevation Data Sta Elev Sta 19.15 674.01 36.65 102.72 665.31 143.2 240.72 663.64 255.1 263.39 662.57 264.04 266.97 662.81 267.96 314.22 663.71 353.86 398.48 667.74 408.06 489.04 687.13 498.93 538.02 684.62 551.27	num= 44 Elev Sta 669.36 40.26 664.56 157.68 663.76 256.22 662.58 265.33 663.64 272.66 664.63 355.86 673.99 423.96 688.04 505.83 681.57 576.5	Elev 668.46 664.4 663.79 662.4 663.71 664.71 684.51 688.48 675.67	Sta 44.28 193.35 260.73 266.24 276.26 368.67 464.81 510.73 576.5	Elev 667.41 664.23 663.36 662.54 663.7 665.39 686.34 689.5 683	Sta 76.66 212.84 262.46 266.35 300.22 388.15 465.95 517.72	Elev 666.18 663.88 662.75 662.55 663.4 667.12 686.38 689.53
Manning's n Values Sta n Val Sta 19.15 .1 260.73	num= 3 n Val Sta .05 267.96	n Val				

```
WalkerRunFld
Lengths: Left Channel Right
46.29 46.1 46 48
           : Left Right 260.73 267.96
Bank Sta: Left
                                                                                      Coeff Contr.
                                                                                                            Expan.
CROSS SECTION
RIVER: Tributary REACH: 1
                                     RS: 2537.66*
INPUT
Description:
Station Elevation Data
                                     num=
                         Sta
38.27
144.73
256.54
265.59
269.47
                                     Elev
669.75
                                                                                                              Elev
       Sta Elev
                                                     Sta
                                                                Elev
                                                                             Sta
                                                                                      Elev
                                               41.88
159.2
257.66
                                                                                               78.25
214.31
263.95
267.91
304.05
                                                             668.72
                                                                                   667.51
664.1
662.92
662.12
663.35
    20.79
                  675
                                                                           45.9
                                                                                                             666.2
                                                                       194.84
262.16
267.81
278.37
377.39
480.4
             665.26
663.33
662.18
662.43
                                     664.49
663.43
662.19
663.27
                                                             664.3
663.45
   104.29
                                                                                                             663.7
   242.17
                                                                                                           662.32
                                                             661.98
663.36
   264.91
268.51
                                                 266.92
274.51
                                                                                                           662.13
                                                                                                           663.09
             663.34
667.21
                                     664.12 363.66
674.39 436.64
689.56 524.36
                                                                                   664.83
687.95
                                                                                               398.26
                                                             664.19
                                                                                                           666.62
687.98
   319.04
                          361.52
                           419.6
                                                             686.42
                                                                                               481.62
   409.33
                                                             690.07
   506.36 688.61
                         516.97
573.05
                                                                                    691.25
                                                                        529.61
                                                                                                 537.1
                                                                                                           691.28
   558.85 685.52
                                     681.95
                                               600.08
                                                             675.06
                                                                        600.08
                                                                                   681.17
Manning's n Values
                                     num=
                                     n Val
       Sta n Val Sta
).79 .1 262.16
                            Sta
                                                Sta
                                                              n val
                                       .05 269.47
           a: Left Right
262.16 269.47
                                     Lengths: Left Channel
Bank Sta: Left
                                                                        Right
                                                                                      Coeff Contr.
                                                                                                            Expan.
                                                 46.29
                                                              46.1
                                                                        46.48
                                                                                                  . 3
CROSS SECTION
RIVER: Tributary REACH: 1
                                     RS: 2495.33*
INPUT
Description:
Station Elevation Data
                                     num=
                                                    44
                         Sta
                                                Sta
43.51
160.72
      Sta Elev
                                       Elev
                                                                Elev
                                                                                      Elev
                                                                            Sta
                                                                                                    Sta
                                                                                                              Elev
            665.21 146.27
663.01 257.98
661.79 267.14
662.06 270.98
                                                            668.97
664.2
663.11
661.56
                                                                        47.52
196.33
   22.43
105.86
                                                                                               79.84
215.78
                                     670.14
                                                                                   667.61
663.97
                                                                                                           666.23
663.51
                                     664.\overline{41}
                                                259.09
268.51
                                                                        263.59
269.37
                                                                                    662.48
                                                                                               265.44
269.47
   243.62
                                     663.09
                                                                                                            661.9
   266.43
                                     661.81
                                                                                     661.7
                                                                                                           661.71
                                                                        280.47
386.11
495.99
548.48
                                                                                               307.87
408.37
                                     662.91
                                                 276.36
371.46
   270.06
                                                             663.01
                                                                                        663
                                                                                                           662.78
              662.98
                          369.18
                                      663.6
                                                             663.68
                                                                                   664.27
689.56
                                                                                                           666.11
   323.87
                                                 449.31
542.89
                                                             688.34
                                                                                                 497.3
   420.18
             666.69
                          431.14
                                                                                                           689.58
                                                             691.65
   523.69
              690.09
                              535
                                     691.09
                                                                                        693
                                                                                               556.48
                                                                                                           693.02
             686.41 594.83
                                     682.32
                                               623.67
                                                             674.45
                                                                                   679.33
                                                                        623.67
Manning's n Values
                                     num=
      Sta n Val Sta
2.43 .1 263.59
                                     n Val
                                                     Sta
                                                              n Val
                                         .05 270.98
Bank Sta: Left Right 263.59 270.98
                                     Lengths: Left Channel 46.29 46.1
                        Right
                                                                        Right
                                                                                      Coeff Contr.
                                                                                                            Expan.
                                                                        46.48
CROSS SECTION
RIVER: Tributary REACH: 1
                                     RS: 2453.*
INPUT
Description:
Station Elevation Data
                                     num=
                         Sta
41.53
147.8
259.41
                                     Elev
670.54
664.34
662.76
               Elev
                                                     Sta
                                                               Elev
                                                                                      Elev
      Sta
                                                                            Sta
                                                                                                   Sta
                                                                                                              Elev
                                                45.13
162.24
260.53
  24.07
107.42
245.07
267.96
                                                                        49.14
197.82
265.02
                                                                                               81.43
217.25
266.93
                                                             669.23
664.09
662.77
                                                                                                           666.26
663.32
                  677
                                                                                     667.7
             665.16
662.7
                                                                                   663.84
662.03
                                                                                                           661.47
                                     662.76
661.42
662.54
663.08
675.2
692.61
682.69
                                                 270.1
278.21
                                                                        270.94
282.58
                          268.69
                                                             661.15
662.67
                661.4
                                                                                    661.28
                                                                                               271.03
                                                                                                           661.29
    271.6
              661.69
                                                                                    662.66
                                                                                               311.69
                                                                                                           662.48
                                                379.27
461.98
                         376.83
442.67
                                                             663.16
690.25
                                                                        394.83
511.59
             662.62
666.16
                                                                                   663.71
691.17
                                                                                               418.49
512.97
                                                                                                           665.61
691.19
   328.69
   431.03
              691.56
687.31
                                                 561.41
647.25
                                                             693.24
673.84
                                                                                   694.75
677.5
                                                                        567.36
647.25
                          553.04
                                                                                               575.86
   541.02
600.51
                                                                                                         694.77
                          616.61
Manning's n Values
                                     num=
       Sta n Val
                              Sta
                                     n Val
                                                     Sta
                                                              n Val
```

					Wa	lkerRunF	1d		
24.07	.1	265.02	.05	272.5	.1				
Bank Sta: 2		Right 272.5	Lengths	: Left C 46.29	hannel 46.1	Right 46.48	Coeff	Contr.	Expan.
CROSS SEC	TION								
RIVER: Tr REACH: 1	ibutary		RS: 241	.0.66*					
INPUT Descripti Station E Sta 25.72 108.99 246.51 269.48 273.14 333.51 441.88 558.35 621.34		Data Sta 43.15 149.33 260.85 270.23 274.01 384.49 454.21 571.07 638.39	num= Elev 670.93 664.26 662.43 661.03 662.18 662.56 675.6 694.13 683.06	44 Sta 46.75 163.76 261.96 271.7 280.06 387.07 474.65 579.94 670.83	Elev 669.49 663.99 662.44 660.73 662.32 662.32 692.17 694.83 673.22	Sta 50.76 199.31 266.45 272.5 284.69 403.54 527.18 586.24 670.83	Elev 667.8 663.71 661.59 660.86 662.31 692.78 696.5 675.67	Sta 83.02 218.73 268.43 272.6 315.51 528.65 528.65 595.24	Elev 666.29 663.13 661.05 660.87 662.17 662.79 696.51
Manning's Sta 25.72	n Value n Val .1	s Sta 266.45	num= n Val .05	3 Sta 274.01	n Val			Y	
Bank Sta:		Right 74.01	Lengths	: Left C 46.29	hannel 46.1	Right 46.48	Coeff	Contr.	Expan.
CROSS SEC	TION		•						
RIVER: Tr REACH: 1	ibutary	•	RS: 236	8.33*					÷
INPUT Descripti Station E Sta 27.36 110.56 247.96 271.01 274.69 338.34 452.73 575.67 642.17		Data Sta 44.78 150.87 262.28 271.78 275.53 392.15 465.74 589.11 660.17	num= Elev 671.32 664.19 662.09 660.65 661.81 662.05 676 695.66 683.43	44 Sta 48.38 165.28 263.4 273.29 281.91 3487.33 598.47 694.42	Elev 669.74 663.89 662.1 660.32 661.97 662.12 694.08 696.41 672.61	Sta 52.38 200.8 267.88 274.07 286.8 412.26 542.78 605.12 694.42	Elev 667.9 663.58 661.14 660.44 661.96 694.39 698.25 673.83	Sta 84.62 220.2 269.92 274.16 319.33 438.71 544.32 614.62	Elev 666.32 662.95 660.62 660.45 661.87 664.6 694.4 698.26
Manning's Sta 27.36	n Value n Val .1	s Sta 267.88	num= n Val .05	3 Sta 275.53	n Val				
Bank Sta: 2	Left 67.88 2	Right 75.53	Lengths	: Left C 46.29	hannel 46.1	Right 46.48	Coeff	Contr.	Expan. .5
CROSS SEC	TION)						
RIVER: Tr REACH: 1	ibutary		RS: 232	6	•				
INPUT Descripti Station E Sta 29 202.29 273.33 343.16 500 634			pe Bridg num= Elev 670 661.77 659.9 661.53 696	e 7 28 54 264.83 275.72 420.98 593 718	Elev 668 661.76 660.03 662.03 696 672	Sta 112.13 269.31 277.04 448.82 617	Elev 665.01 660.7 661.45 664.09 698	Sta 166.8 271.41 283.76 463.58 624	Elev 663.79 660.2 661.62 664.58 700
Manning's Sta 29	n Value n Val .1	s Sta 269.31	num= n Val .05	3 Sta 277.04	n Val				
						n 4-			

```
Bank Sta: Left Right 269.31 277.04
                                  Lengths: Left Channel Right
673.04 669.86 671.65
                      Right
                                                                              Coeff Contr.
                                                                                                  Expan.
BRIDGE -
RIVER: Tributary
REACH: 1
                                  RS: 1790
INPUT
Description: Pipe bridge - No 7
Distance from Upstream XS = 526
Deck/Roadway width = 20
Deck/Roadway Width = Weir Coefficient =
Upstream Deck/Roadway Coordinates
     num=
                   6
   Sta Hi Cord Lo Cord
0 677.93 0
463.6 677.93 672.93
                                 Sta Hi Cord Lo Cord
123.5 677.93 0
463.6 677.93 0
                                                                  Sta Hi Cord Lo Cord
123.5 677.93 672.93
500 677.93 0
Upstream Bridge Cross Section Data
Station Elevation Data
Sta Elev Sta
                               num=
    Sta
-200
                                    Elev
                                                         Elev
                                                                     Sta
                                                                              Elev
                                                                                                   Elev
                     29
202.29
273.33
           678.6
662.39
                                                                            666.6
660.36
                                                                                      112.13
269.31
                                   678.6
                                                        668.6
                                                                                                 663.61
                                          249.41
274.88
                                                                 264.83
275.72
420.98
                                  662.05
                                                       660.37
                                                                                                  659.3
           658.8
660.22
663.18
  271.41
                                  658.86
                                                       658.38
                                                                            658.63
                                                                                                 660.05
  283.76
463.58
                      343.16
                                  660.13 399.81
694.6 560
                                                       660.13
                                                                            660.63
                                                                                       448.82
                                                                                                 662.69
                       463.58
                                                        694.6
                                                                     593
                                                                             694.6
                                                                                          617
                                                                                                  696.6
                           634
                                   698.6
                                                663
                                                        688.6
                                                                             670.6
Manning's n Values
                                  num=
                                               Sta
                           Sta
                                  n Val
                                                        n Val
      Sta n Val
                                                                     Sta
                                                                             n Val
                                   .1 269.31
                                                                 277.04
Bank Sta: Left Right 269.31 277.04
                                  Coeff Contr.
                                                     Expan.
                                             . 3
Downstream Deck/Roadway Coordinates
      Sta Hi Cord Lo Cord
                                   Sta Hi Cord Lo Cord
123.5 677.93 0
463.6 677.93 0
                                                                  Sta Hi Cord Lo Cord
123.5 677.93 672.93
500 677.93 0
    0 677.93 0
463.6 677.93 672.93
Downstream Bridge Cross Section Data
Station Elevation Data
                                               23
                                               Sta
31.4
            Elev
                          Sta
                                   Elev
                                                         Elev
                                                                                                   Elev
      Sta
                                                                     Sta
                        12.63
                                                                 43
256.45
                690
                                     . 688
                                                           684
                                                                                680
                                                                                           48
                                                                                                     678
                                 661.86 245.91
658.38 267.08
659.54 279.61
670.08 500
           665.01 198.13
658.38 265.67
658.6 274.07
                                                       659.93
                                                                            659.51
                                                                                                 659.72
                                                                                      262.44
                                                       658.32
659.65
670.08
  264.16
                                                                 268.29
                                                                            658.32
                                                                                      269.24
           658.6
670.15
  271.93
                                                                 315.47
                                                                            660.02
                                                                                      400.34
  434.93
                       448.28
Manning's n Values
                                  num=
            n Val Sta
.1 262.44
                                  n Val
                                                        n Val
                                   .05 274.07
Bank Sta: Left Right 262.44 274.07
                      Right
                                  Coeff Contr.
                                                     Expan.
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
Elevation at which weir flow begins
Energy head used in spillway design
                                                                  .98
Spillway height used in design
Weir crést shape
                                                         = Broad Crested
Number of Piers = 3
Pier Data
Pier Station
                                      208.5
                    Upstream=
                                                 Downstream=
               num=
Upstream
                          width
    Width
               Elev
                0
num=
                           4
        4
                                      700
Downstream
                                   Elev
     Width Elev
                         Width
```

```
Pier Data
Pier Station
                   Upstream=
                                  293.5
                                            Downstream=
                                                             293.5
Upstream
               num=
                       width
    width
              Elev
                                 Elev
        4
                 n
                           4
                                  700
Downstream
                 num=
    Width
              Elev
                       Width
                                 Elev
        4
                 n
                           4
                                  700
Pier Data
Pier Station
                   Upstream=
                                  378.5
                                            Downstream=
                                                             378.5
Upstream
               num=
    Width
              Elev
                       Width
                 0
Downstream
                 num=
    Width
              Elev
                       Width
                                Elev
Number of Bridge Coefficient Sets = 1
Low Flow Methods and Data
        Energy
Selected Low Flow Methods = Highest Energy Answer
        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
CROSS SECTION
RIVER: Tributary
REACH: 1
                              RS: 1658
Description: D/S XS of Pipe Bridge No 7
Station Elevation Data
                              num=
                                           Sta
                                                                      Elev
     Sta
             Elev
                        Sta
                                Elev
                                                   Elev
                      12.63
                                                                                      678
659.72
               690
                                 688
                                          31.4
                                                    684
                                                               43
                                                                       680
                                                                                  48
                                                 659.93
                              661.86
657.96
659.54
  173.75
           665.01
                                       245.91
                                                          256.45
                                                                   659.51
                                                                             262.44
                    198.13
                    265.67
274.07
                                                 657.99
  264.16
           658.26
                                       267.08
                                                          268.29
                                                                    658.05
                                                                             269.24
            658.6
                                       279.61
                                                 659.65
                                                          315.47
                                                                    660.02
                                                                             400.34
                                                                                      661.36
           670.15
                    448.28
                              670.08
Manning's n Values
                              num=
            n Val
                        Sta
                               n Val
                                           Sta
                                                  n Val
                    262.44
                                 .05
Bank Sta: Left
                   Right
                              Lengths: Left Channel
                                                          Right
                                                                      Coeff Contr.
         262.44
                  274.07
                                       48.34
                                                 49.66
CROSS SECTION
RIVER: Tributary
REACH: 1
                              RS: 1608.33*
INPUT
Description:
Station Elevation Data
                              num=
                                        121
     Sta
             Elev
                        Sta
                                Elev
           690.33
                              688.67
                                                 685.33
                                                           41.78
                                                                       682
                                                                              46.63
                              675.15
673.26
   46.86
           680.31
                      48.47
                                                 674.36
                                                           61.11
                                                                   674.01
                                                                              65.48
                                                                                      673.62
           673.39
672.61
                                                 673.14
672.24
   68.04
                      69.43
                                         70.77
                                                           72.14
                                                                   673.02
                                                                                      672.89
                               672.5
    76.6
                                         80.66
                                                           85.11
                                                                   671.84
  92.6
119.77
                    100.12
122.29
           671.16
                              670.49
                                       115.09
                                                 669.11
                                                                   669.09
                                                                             116.38
                                                                   666.37
664.25
661.86
           668.66
                              668.43
                                       130.25
                                                 667.68
                                                          144.15
     149
           665.93
                     159.59
                              664.97
                                       159.99
                                                 664.94
                                                          167.52
                                                                             168.81
                    181.92
                              662.66
                                       186.29
                                                 662.15
                                                          188.89
                                                                             192.49
                                                                                      661.44
           661.34
                    202.91
                              661.02
                                       203.95
                                                 660.99
                                                          204.09
                                                                   660.98
                                                                             224.34
237.65
                                                                                      660.28
           660.26
                     229.95
                              660.08
                                       232.03
                                                 660.01
                                                          236.59
                                                                   659.85
                                                                                      659.82
                     239.65
                                       242.41
                                                 659.66
                                                          246.21
                                                                   659.53
                                                                             248.34
                    249.35
                                                  659.5
                                                                   659.57
                                       251.69
```

```
658.3 257.2
657.97 261.03
658.15 263.68
659.49 275.05
660 309.71
660.26 322.74
660.61 340.19
661.24 362.9
661.64 379.88
662.32 400.99
663.29 406.4
664.76 413.89
                                                                                                          WalkerRunFld
                                                                                              658.16 257.84
658.03 261.23
658.24 265.06
659.58 295.58
660.07 311.21
                     659.27
657.97
658.1
659.45
                                         256.6
259.62
263
     255.39
258.09
                                                                                                                                   658.01 258.03 657.97
                                                                                                                                                     261.25
266.75
297.48
                                                                                                                                   658.03
                                                                                                                                                                       658.03
     262.6
269.18
                                                                                                                                    658.41
                                                                                                                                                                       658.63
                                         271.09
                                                                                                                                   659.87
                                       271.09
304.6
321.1
336.61
361.28
373.79
391.23
406.22
413.58
                                                                                                                                                                          659.9
                      659.91
     297.82
                                                                                                                                                                       660.11
                                                                                                                                   660.09
                                                                                                                                                     313.04
                                                                                               660.29
660.69
                       660.13
                                                                                                                 324.28
348.77
                                                                                                                                                      333.34
                                                                                                                                   660.32
                                                                                                                                                                       660.53
     335.55
352.83
                      660.58
661.01
                                                                                                                                   660.9
661.31
661.86
                                                                                                                                                     350.23
366.71
                                                                                                                                                                       660.94
                                                                                               661.28
661.85
662.56
663.32
664.82
                                                                                                                363.89
380.13
402.95
                                                                                                                                                                       661.41
                                                                                                                                                     386.01
405.09
                                                                                                                                                                       662.09
                       661.59
     372.24
     387.56
                      662.16
                                                                                                                                                                       663.06
                                                                                                                                   662.61
     405.58 663.16
413.01 664.65
453.73 673.73
                                                                                                                 411.48
                                                                                                                                                                       664.49
                                                                                                                                   664.34
                                                                                                                                                      412.23
                                                                                                                 414.68
                                                                                                                                   668.81
                                                                                                                                                     439.59
                                                                                                                                                                      673.79
Manning's n Values
Sta n Val Sta
0 .095 254.97
                                                                                    3
                                                           num=
                                                           n Val
                                                                                                 n val
                                                                                    Sta
                                                           .05 269.18
                                                                                                 . 095
                                                          Lengths: Left Channel 48.34 49.66
Bank Sta: Left Right 254.97 269.18
                                                                                                                 Right
                                                                                                                                      Coeff Contr.
                                                                                                                                                                          Expan.
                                                                                                                 50.16
CROSS SECTION
RIVER: Tributary REACH: 1
                                                          RS: 1558.66*
TNPUT
Description:
Station Elevation Data
Sta Elev St
0 690.67 11.9
45.49 682.65 47.0
66.05 671.05 67.3
74.35 670.42 75.6
89.89 669.21 97.1
                                                                                                              Sta
40.55
59.32
70.03
82.62
111.87
139.92
162.61
183.36
198.12
229.66
239
                                                          num=
                                                                               121
                                                                           121
Sta
29.61
55.52
68.7
78.3
111.72
126.44
155.3
                                          Sta
11.91
47.05
67.39
75.61
97.19
118.7
                                                                                                                                                    Sta
45.27
63.56
71.43
86.15
112.97
                                                          Elev
689.33
672.49
670.95
660.32
668.66
666.89
663.96
669.62
659.86
659.35
659.35
658.34
                                                                                                                                        Elev
                                                                                                   Elev
                                                                                                                                                                            Elev
                                                                                               686.67
671.84
670.85
670.1
667.49
666.25
663.92
                                                                                                                                                                      682.67
                                                                                                                                   684
671.56
670.75
669.77
667.48
665.11
663.36
660.58
669.42
659.46
658.02
659.46
658.02
659.46
659.9
      45.49
66.05
74.35
89.89
                                                                                                                                                                       671.23
670.64
                                                                                                                                                                       669.49
667.39
                      667.1
664.74
662.96
660.93
                                                                                                                                                     143.3
163.86
     116.26
                                                                                                                                                                       664.84
                                        118.7
154.91
176.59
196.97
223.22
232.63
     144.63
                                                                                                                                                                       663.26
                                                                            180.83
197.98
225.24
235.32
                                                                                               661.62
660.59
659.81
659.52
     166.93
                                                                                                                                                     186.86
217.77
                                                                                                                                                                       661.03
     189.34
                                                                                                                                                                       660.02
                      660.93
660.01
659.62
659.34
659.19
657.97
658.15
659.36
                                                                                                                                                     230.69
241.07
     218.18
231.92
                                                                                                                                                                       659.65
659.36
                                                          659.6 235.32
659.35 244.32
658.34 249.61
657.97 255.15
658.2 258.13
659.41 270.49
660.06 307.1
660.38 320.85
660.84 339.29
661.74 363.27
662.36 381.2
663.46 403.49
664.43 409.2
665.61 417.11
                                        232.63
242.05
249.04
253.57
257.36
266.31
301.69
319.12
335.5
361.55
374.77
393.19
409.01
416.79
                                                                                                                239
246.63
250.21
255.37
292.17
308.67
322.47
348.34
364.31
381.46
405.55
414.57
417.94
                                                                                                                                                     247.51
250.39
                                                                                               659.4
658.19
     241.86
247.9
                                                                                                                                                                       659.48
                                                                                                                                                                       657.97
                                                                                               658.19
658.07
658.29
659.51
660.15
660.41
                                                                                                                                                     255.39
261.56
     250.52
                                                                                                                                                                       658.07
     256.92
                                                                                                                                                     294.18
310.61
332.04
     264.29
                                                                                                                                                                       659.93
     294.53
                                                                                                                                                                       660.21
                                                                                                                                   660.46
661.25
661.85
662.69
     311.88
334.38
                      660.23
                                                                                                                                                                       660.74
                      660.81
                                                                                                                                                      349.89
                                                                                                                                                                       661.31
                                                                                               661.81
662.68
663.78
664.46
665.66
                      661.41
662.27
     352.63
                                                                                                                                                      367.28
                                                                                                                                                                              662
     373.12
                                                                                                                                                      387.67
                                                                                                                                                                       663.07
                      663.18
664.33
665.52
677.39
     389.31
408.34
                                                                                                                                                      407.82
                                                                                                                                   663.85
                                                                                                                                                                       664.25
                                                                                                                                                     415.36
444.25
                                                                                                                                   665.28
673.45
                                                                                                                                                                          665.4
     416.18
459.19
Manning's n Values
Sta n Val Sta
0 .09 247.51
                                                          num=
                                                         n Val
                                                              n val Sta
.05 264.29
                                                                                                 n Val
                                                                                                    .09
Bank Sta: Left Right 247.51 264.29
                                                          Lengths: Left Channel 48.34 49.66
                                                                                                                 Right
                                                                                                                                       Coeff Contr.
                                                                                                                                                                          Expan.
                                                                                              49.66
                                                                                                                 50.16
                                                                                                                                                          . 3
CROSS SECTION
RIVER: Tributary
REACH: 1
                                                          RS: 1509.*
TNPUT
Description:
Station Elevation Data
                                                                               121
                                                           num=
                                                            Elev
                                          Sta
11.55
45.63
65.36
73.33
                                                                              Sta
28.72
53.84
66.63
75.94
                                                                                                                                        Elev
           Sta Elev
                                                                                                    Elev
                                                                                                                        Sta
                                                                                                                                                            Sta
                                                                                                                                                                            Elev
                                                                                                                                                       43.9
61.64
69.27
83.55
                                                                                               688
669.32
668.56
667.96
                                                                                                                39.33 686 43.9
57.53 669.1 61.64
67.92 668.48 69.27
80.13 667.7 83.55
108.49 665.87 109.56
                            691
                                                                 690
                                                                                                                                                                     685
668.85
      44.12 684.99
64.06 668.72
72.11 668.22
87.17 667.26
                                                          669.83
668.64
668.14
                                                                                                                                                                       668.4
667.48
                                                                          108.35
                                                                                               665.87
                      667.26
                                           94.26
                                                           666.83
                                                                                                                                                                      665.79
```

```
WalkerRunFld
                                                              135.7
157.71
177.82
192.14
  112.75
140.27
            665.54 115.12 665.36 122.62 663.55 150.24 662.94 150.62
                                                    664.82
                                                                        663.84
                                                                                  138.98
                                                                                          663.63
                                                    662.91
                                                                        662.47
                                                                                  158.92
                                                                                            662.38
                                          175.38
192.01
    161.9
             662.15
                      171.26
                                661.43
                                                    661.09
                                                                         660.9
                                                                                 181.22
                                                                                            660.61
             660.52
                      191.03
                                                                                   211.2
   183.63
                                660.21
                                                    660.19
                                                                        660.19
                                                                                            659.76
            659.75
659.46
                                                    659.6
659.39
                      216.48
225.61
234.75
                                659.64
   211.6
224.92
                                          218.44
                                                              222.74
                                                                        659.51
                                                                                  223.73
                                                                                            659.49
                                          228.22
236.95
                                659.45
                                                                        659.32
                                                              231.79
                                                                                   233.8
                                                                                            659.27
                                                    659.3
658.21
                                                                        659.34
   234.56
            659.26
                                659.26
                                                              239.19
                                                                                  240.04
                                658.37
657.98
658.25
            659.11
657.98
                      241.49
247.53
   240.41
                                          242.01
                                                              242.58
                                                                        658.04
                                                                                  242.76
                                                                                            657.98
                                          249.27
   242.94
                                                    658.11
                                                              249.52
                                                                        658.12
                                                                                  249.54
            658.2
659.27
                       251.72
                                                              254.28
   251.23
                                          252.57
                                                    658.33
                                                                        658.48
                                                                                  256.38
                                                                        659.92
660.27
                                                                                  290.88
    259.4
                      261.52
                                659.33
                                          265.93
                                                    659.44
                                                              288.76
   291.25
             659.97
                      298.79
                                660.12
                                          304.48
                                                    660.23
                                                              306.14
                                                                                  308.18
                                 660.5
                                                    660.54
                                                                        660.59
   309.52
             660.33
                      317.14
                                          318.96
                                                              320.67
                                                                                  330.75
                                                                                            660.95
   333.21
             661.04
                      334.39
                                661.08
                                          338.38
                                                    661.21
                                                              347.92
                                                                        661.61
                                                                                  349.54
                                                                                            661.68
   352.43
             661.81
                      361.82
                                662.24
                                          363.63
                                                    662.33
                                                              364.72
                                                                        662.39
                                                                                  367.86
                                                                                            662.58
                                          382.51
405.99
                                                                        663.53
665.1
666.21
   374.01
             662.95
                      375.74
                                663.08
                                                    663.51
                                                              382.78
                                                                                  389.33
                                                                                            664.05
                                664.59
665.58
                      395.14
   391.05
              664.2
                                                    665.01
                                                              408.16
                                                                                  410.55
                                                                                            665.44
   411.09
              665.5
                       411.8
                                              412
                                                     665.6
                                                              417.65
                                                                                  418.49
                                                                                             666.
                                          420.33
                      419.99
   419.36
              666.4
                                666.46
                                                     666.5
                                                              421.21
                                                                        678.09
                                                                                  448.91
                                                                                            681.08
   464.64
            681.04
Manning's n Values
                                num=
      ng s n val
Sta n Val
085
                         Sta
                                n Val
                                              Sta
                                                     n Val
                      240.04
               .085
                                   .05
                                           259.4
                                                       .085
                     Right
259.4
Bank Sta: Left
                                Lengths: Left Channel
                                                              Right
                                                                          Coeff Contr.
                                                                                             Expan.
          240.04
                                          48.34
                                                    49.66
CROSS SECTION
RIVER: Tributary
                                RS: 1459.33*
REACH: 1
INPUT
Description:
Station Elevation Data
                                num=
                                           121
          Elev
691.33
                       Sta
11.19
                                Elev
690.67
667.17
                                           Sta
27.83
52.17
                                                       Elev
                                                                  Sta
                                                                          Elev
                                                             38.11
55.74
65.81
77.63
105.12
131.48
                                                                                   42.54
59.72
                                                                                           687.33
                                                    689.33
                                                                           688
            687.33
                        44.21
                                                    666.8
666.27
665.82
                                                                        666.65
                                                                                            666.47
                       63.33
                                666.33
665.96
    62.07
            666.38
                                           64.56
                                                                        666.22
                                                                                   67.12
                                                                                            666.15
    69.87
            666.02
                                           73.57
                                                                        665.64
                                                                                   80.95
                                                                                            665.46
                      91.32
111.54
145.57
165.93
                                                                        664.25
662.58
                                    665
                                          104.98
    84.46
            665.31
                                                    664.26
                                                                                  106.16
                                663.83
                                                    663.39
  109.24
            663.98
                                          118.81
                                                                                  134.66
                                                                                            662.42
                                                              152.8
172.29
                                                                        661.57
660.42
                                                                                  153.98
175.58
  135.91
            662.36
                                661.92
                                          145.93
                                                     661.9
                                                    660.56
659.79
                                660.82
                                          169.92
  156.86
            661.33
                                659.81
659.42
659.3
659.17
                                                             186.16
215.81
  177.91
            660.11
                      185.08
                                          186.04
                                                                        659.79
                                                                                  204.63
  205.01
            659.49
                      209.75
                                          211.65
                                                     659.4
                                                                        659.34
                                                                                  216.77
                                                                                            659.32
            659.31
                      218.6
227.44
                                          221.12
229.58
                                                    659.26
                                                                        659.21
                                                                                  226.52
   217.92
                                                              224.58
                                                                                            659.18
            659.17
                                                              231.75
  227.27
                                                     659.2
                                                                        659.23
                                                                                  232.57
                                                                                            659.24
                                658.41
657.99
658.3
659.25
660.19
                                                    658.24
658.15
                                                              234.95
243.67
            659.04
                                          234.42
                                                                                  235.12
  232.92
                      233.93
                                                                        658.05
                                                                                            657.99
                      241.48
  235.36
            657.99
                                           243.4
                                                                        658.16
                                                                                  243.69
                                          247.02
                                                                        658.52
659.95
  245.54
            658.26
                      246.08
                                                    658.37
                                                               248.9
                                                                                  251.19
                                                                                             658.7
                      256.74
295.89
315.16
  254.52
            659.18
                                          261.37
                                                    659.37
                                                              285.35
                                                                                  287.57
                                          301.86
317.07
                                                                        660.35
660.73
661.96
                                                                                            660.39
                                                                                  305.75
  287.97
            660.01
                                                    660.31
                                                              303.61
            660.42
661.27
   307.16
                                660.62
                                                    660.66
                                                              318.87
                                                                                  329.46
                                                                                            661.17
   332.04
                      333.28
                                661.32
                                          337.47
                                                    661.47
                                                              347.49
                                                                                  349.19
                                                                                            662.04
                      362.1
376.71
              662.2
                                662.75
                                          363.99
                                                    662.85
                                                              365.14
                                                                        662.93
                                                                                  368.44
                                                                                            663.17
            663.63
    374.9
                                 663.8
                                          383.83
                                                    664.34
                                                              384.11
                                                                        664.36
                                                                                  390.98
                                                                                            665.04
                                                    666.24
666.73
                                                              410.77
420.74
    392.8
            665.23
                      397.09
                                665.73
                                          408.48
                                                                        666.35
                                                                                  413.27
                                                                                            666.62
  413.85
422.53
                                666.72
            666.67
                      414.59
                                           414.8
                                                                        667.15
                                                                                  421.61
                                                                                            667.21
            667.27
                      423.19
                                667.31
                                          423.55
                                                    667.34
                                                              424.47
                                                                        682.72
                                                                                  453.57
                                                                                            684.72
  470.09
           684.69
Manning's n Values
                                num=
      Sta n Val Sta
0 .08 232.57
                        Sta
                                n Val
                                              Sta
                                                     n Val
                                 .05 254.52
Bank Sta: Left Right 232.57 254.52
                                Lengths: Left Channel
                                                              Right
                                                                          Coeff Contr.
                                                                                             Expan.
                                          48.34
                                                   49.66
CROSS SECTION
RIVER: Tributary REACH: 1
                                RS: 1409.66*
TNPUT
Description:
```

```
WalkerRunFld
Station Elevation Data
                                                                                                       121
                                                                            num≔
                                                                                                                                                                                 Elev
                                                                                                        Sta
26.93
              Sta
                                  Elev
                                                            Sta
                                                                            Elev
691.33
664.51
664.02
663.78
663.18
662.3
660.9
660.21
659.4
659.4
                                                                                 Elev
                                                                                                                                  Elev
                                                                                                                                                                                                                                 Elev
                                                    Sta
10.83
42.79
61.29
68.77
88.39
107.96
140.89
                            691.67
689.66
                                                                                                                                                                                                      41.17
57.81
                                                                                                                                                       36.88
53.95
                                                                                                                            690.67
                                                                                                                                                                                                                          689.67
                                                                                                                                                                                   690
                                                                                                                            664.28
663.98
663.68
                                                                                                                                                                           664.2
663.95
                                                                                                        50.49
                                                                                                                                                                                                                           664.09
                            664.04
663.82
                                                                                                                                                  53.95
63.69
75.14
101.74
127.26
147.9
166.76
                                                                                                   62.48
71.21
101.61
114.99
141.25
164.47
180.06
204.85
214.02
226.83
237.52
241.46
299.25
315.19
         60.07
                                                                                                                                                                                                      64.96
                                                                                                                                                                                                                           663.91
         67.62
                                                                                                                                                                            663.57
                                                                                                                                                                                                       78.35
                                                                                                                                                                                                                           663.45
                                                                                                                           663.68
662.64
661.96
660.03
659.4
659.19
659.13
658.27
658.19
658.41
659.31
                             663.36
662.42
661.17
                                                                                                                                                                                                   102.75
         81.75
                                                                                                                                                                            662.64
                                                                                                                                                                                                                              662.6
      105.74
                                                                                                                                                                           661.32
                                                                                                                                                                                                   130.33
      131.54
151.83
                                                                                                                                                                           660.68
                                                                                                                                                                                                   149.03
                                                                                                                                                                                                                           660.63
                            660.52
659.69
659.24
659.15
659.09
                                                    160.61
179.14
203.01
211.58
220.14
226.37
235.43
240.44
251.96
292.98
313.18
332.17
362.37
377.69
399.04
417.38
426.4
                                                                                                                                                                           659.94
                                                                                                                                                                                                   169.95
                                                                           659.4 180.06

659.2 204.85

659.15 214.02

659.09 222.21

658.45 226.83

657.99 237.52

658.34 241.46

659.17 256.81

660.25 299.25

660.75 315.19

661.56 336.56

663.25 364.36

664.52 385.14

666.86 410.98

667.86 417.6
                                                                                                                                                  180.19
208.88
217.37
224.31
227.33
237.81
243.51
281.94
301.07
317.07
347.06
365.56
385.44
413.38
                                                                                                                                                                           659.4
659.16
                                                                                                                                                                                                   198.06
         172.2
                                                                                                                                                                                                                           659.24
      198.43
210.93
                                                                                                                                                                                                   209.81
219.25
                                                                                                                                                                         659.11
      219.97
                                                                                                                                                                           659.12
                                                                                                                                                                                                   225.11
227.48
237.84
                                                                                                                                                                                                                           659.12
                            658.96
657.99
658.31
659.09
      225.43
227.79
                                                                                                                                                                           658.06
                                                                                                                                                                           658.2
658.55
659.97
660.44
660.86
                                                                                                                                                                                                   246.01
      239.86
                                                                                                                                                                                                                          658.73
      249.63
                                                                                                                                                                                                   284.27
                                                                                                                                                                                                                           660.03
                                                                                                                            660.39
660.79
661.74
663.37
      284.68
304.79
                             660.04
660.52
                                                                                                                                                                                                   303.32
                                                                                                                                                                                                                           660.49
                                                                                                                                                                                                   328.16
348.85
                                                                                                                                                                                                                           661.38
      330.87
352.03
                                661.5
662.6
                                                                                                                                                                           662.31
                                                                                                                                                                                                                           662.41
                                                                                                                                                                           663.46
                                                                                                                                                                                                   369.01
                                                                                                                                                                                                                           663.76
      375.78
394.54
                                                                                                                                                                                                  392.64
416
424.74
                             664.32
666.25
                                                                                                                            665.17
667.47
667.87
                                                                                                                                                                           665.2
667.59
668.08
                                                                                                                                                                                                                           666.02
                                                                                                                                                                                                                          667.81
                            667.83
668.14
         416.6
425.7
                                                                                                                                                                                                                          668.11
                                                                                                                                                   423.82
                                                                                                                                                   427.74
                                                                                                                            668.18
                                                                                                                                                                           687.36
                                                                                                                                                                                                   458.23
                                                                                                                                                                                                                          688.36
                          688.35
Manning's n Values num= 3
Sta n Val Sta n Val Sta
0 .075 225.11 .05 249.63
                                                                                                                              n Val
.075
                                                                            Lengths: Left Channel 48.34 49.66
Bank Sta: Left Right 225.11 249.63
                                                                                                                                                   Right
                                                                                                                                                                                Coeff Contr.
                                                                                                                                                                                                                              Expan.
                                                                                                                                                   50.16
                                                                                                                                                                                                         . 3
                                                                                                                                                                                                                                    . 5
CROSS SECTION
RIVER: Tributary
REACH: 1
                                                                            RS: 1360
Description: U/S XS of Bridge No 3
Station Elevation Data num= 104
       ation Elevation Data num=

Sta Elev Sta Elev
0 692 40 692
55.89 661.708 58.08 661.707
62.81 661.661 65.38 661.618
75.75 661.436 79.04 661.405
99.34 661 102.23 660.857
126.01 660 127.18 659.98
146.79 659.703 155.28 659.601
173.2 659 174.09 658.989
196.28 658.984 198.06 658.985
206.92 659 210.16 659.002
216.87 659.001 217.64 659
2216.87 659.001 217.64 659
2219.84 658 220.21 658
2234.8 658.391 238.12 658.584
280.97 660.065 281.4 660.078
302.43 660.616 311.2 660.867
329.7 661.73 331.06 661.792
                                                                                                104

Sta Elev

41.37 661.85

59.26 661.703

66.49 661.595

85.46 661.35

104.38 660.771

136.22 659.885

159.01 659.499

174.21 658.999

201.95 658.992

211.98 659.003

217.94 658.88

229.38 658

244.74 659

290.08 660.31

313.3 660.914

335.65 662

364.72 663.894

386.46 666
                                                                                                                                                  Sta Elev

48.82 661.755

60.41 661.694

68.85 661.538

98.24 661.027

111.18 660.526

136.56 659.877

161.23 659.46

191.49 658.982

202.85 658.992

212.84 659.002

219.24 658.295

231.64 658.227
                                                                                                                                                                                                  Sta Elev

52.16 661.744

61.58 661.68

72.65 661.501

98.37 661.025

123.04 660.053

142.99 659.282

191.85 658.982

204.56 658.995

214.84 659.001

219.7 658.07

231.99 658.242

278.53 660.529

326.87 661.587

348.5 662.778

369.59 664.346

394.3 667
                                                                                                                                                                                                           Sta
                                                                                                                                                                                                                               Elev
      126.01 660
146.79 659.703
      173.2 659
196.28 658.984
      206.92 659
216.87 659.001
                                                                                                                                                  231.64 658.227
231.64 658.227
247.18 659.09
296.63 660.471
315.27 661
      219.84
      280.97 660.065
302.43 660.616
329.7 661.73
                                                                                                                                                  315.27 661
346.63 662.658
365.98 664
386.77 666.037
418.73 669
427.87 669.017
481 692
                                                    331.06 661.792
362.64 663.75
378.66 665.236
400.99 668
      351.83
                                      663
                                                 378.66 665.236 386.46 666
400.99 668 413.48 668.692
420.4 669.006 426.91 669.016
429.99 669.014 431 692
                                                                                                                                                                                                   394.3 667
419.36 669.003
428.87 669.016
      376.67
                                      665
      396.29 667.279
420.17 669.006
429.6 669.015
Manning's n Values
                                                                            num=
                                                        Sta
                                                                           n Val
             Sta n Val Sta
0 .07 217.64
                                                                                                             Sta
                                                                                                                               n Val
                                                                              .05 244.74
                                                                                                                               .07
Bank Sta: Left Right 217.64 244.74
                                                                            Lengths: Left Channel 110 108
                                                                                                                                                   Right
100
                                                                                                                                                                                Coeff Contr.
                                                                                                                                                                                                                             Expan.
                                                                                                                                 108
BRIDGE
```

RIVER: Tributary

REACH: 1 RS: 1281

```
INPUT
 Description: Bridge No 3
 Distance from Upstream XS =
Deck/Roadway Width =
Weir Coefficient =
                                                    2.6
 Upstream Deck/Roadway Coordinates
        Sta Hi Cord Lo Cord
    Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord 0 703.91 0 5.92 703.91 0 414.08 712 707 414.08 712 0
                                                                                     Sta Hi Cord Lo Cord
                                                                                   5.92 703.91 698.91
500 712
 Upstream Bridge Cross Section Data
 Station Elevation Data num=
                              5ta
5.92
        Sta Elev
                                                                                                                          Elev
                            Sta Elev

5.92 692

58.08 661.618

79.04 661.405

102.23 660.857

127.18 659.98

155.28 659.601

174.09 658.999

198.06 658.985

210.16 659.002

217.64 659
                                                        5.92 661.85
59.26 661.703
66.49 661.595
                                                                                                            52.16 661.744
61.58 661.68
                     692
                                                                                  48.82 661.755
     55.89 661.708
62.81 661.661
75.75 661.436
                                                                                  60.41 661.694
                                                                                  68.85 661.538
98.24 661.027
                                                                                                           72.65 661.501
98.37 661.025
                                                        85.46
                                                                   661.35
                                                                                111.18 660.526
136.56 659.877
161.23 659.46
                     661
                                                       104.38 660.771
                                                                                                          123.04 660.053
    126.01
                     660
                                                       136.22 659.885
                                                                                                          142.99 659.783
    146.79 659.703
                                                       159.01 659.499
                                                                                                          166.49 659.282
                     659
                                                                                191.49 658.982
                                                       174.21 658.999
                                                                                                          191.85 658.982
                                                                                202.85 658.992
212.84 659.002
    196.28 658.984
                                                       201.95 658.992
                                                                                                          204.56 658.995
                                                                                                          214.84 659.001
219.7 658.07
231.99 658.242
    206.92 659
216.87 659.001
                                                       211.98 659.003
217.94 658.88
                           210.16 659.002

217.64 659

225 657

238.12 658.584

281.4 660.078

311.2 660.867

331.06 661.792

362.64 663.75

378.66 665.236
                                                                                212.84 659.002
219.24 658.295
231.64 658.227
247.18 659.09
296.63 660.471
315.27 661
346.63 662.658
    219.84
                     658
                                                       229.38
                                                                        658
                                                                                                          278.53 660
298.54 660.529
     234.8 658.391
                                                       244.74
                                                                        659
    280.97 660.065
                                                       290.08
                                                                 660.31
                                                      313.3 660.914
335.65 662
                                                                                                          326.87 661.587
348.5 662.778
    302.43 660.616
              663
665
                                                                                365.98 664
386.77 666.037
                                                                                                         369.59 664.346
394.3 667
                                                       364.72 663.894
                                                                                                  664
    351.83
    376.67
                                                      386.46
                                                                        666
    396.29 667.279
                             400.99
                                               668
                                                      413.48 668.692
                                                                                414.08 669.014
Manning's n Values
Sta n Val Sta
0 .07 217.64
                                         num=
                                         n Val
                                                           Sta
                                                                     n val
                                           .05 244.74
Bank Sta: Left Right
217.64 244.74
                                         Coeff Contr.
                                                                  Expan.
 Downstream Deck/Roadway Coordinates
                                              Sta Hi Cord Lo Cord
                                                                                   Sta Hi Cord Lo Cord
        Sta Hi Cord Lo Cord
                     692
712
                                    0
                                            41.84 703.91 0
                                                                               41.84 703.91 698.91
                                  707
Downstream Bridge Cross Section Data
 Station Elevation Data
                           Sta
41.84
249.14
258.88
                                                                               Sta
130.71
253.09
272.66
                                                                                             Elev Sta
658.23 195.23
656.64 254.08
658.28 351.77
        Sta Elev
                                           Elev
                                                                      Elev
   4.92 692
245.69 657.68
256.22 657.22
414.17 660.7
                                         692 41.84
657.6 250.31
657.46 262.11
                                                                   660.58
657.05
657.67
                                                                                                                      657.77
Manning's n Values
                                         num=
       Sta n Values
4.92 .07 245.69
                                         n Val
                                                           Sta
                                                                     n val
                                            .08 262.11
Bank Sta: Left Right 245.69 262.11
                                         Coeff Contr.
                                                                 Expan.
                                                                                   O horiz. to 1.0 vertical O horiz. to 1.0 vertical
Upstream Embankment side slope
Opstream Embankment side slope =
Downstream Embankment side slope =
Maximum allowable submergence for weir flow =
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape =
                                                                      = Broad Crested
Number of Piers = 3
Pier Data
Pier Station
                       Upstream=
                                              107.5
                                                          Downstream= 143.42
Upstream
                   num=
      width
                   Elev
                                Width
                                             Elev
```

```
Downstream
                 num=
    Width Elev Width Elev
4 0 4 710
Pier Data
Pier Station Upstream=
                                     210
                                             Downstream= 245.92
Upstream
               num=
                        width
                                  Elev
    width
              Elev
              O
num=
                                  710
                        4
       4
Downstream
    Width
              Elev
                        Width Elev
       4
Pier Data
Pier Station
                                  312.5
                  Upstream=
                                             Downstream= 348.42
Upstream
               num=
                        width
                                  Elev
              Elev
    width
                        Wiuc.
4
2
              . 0
        4
                                  709
Downstream
                  num=
                       Width
    Width
              Elev
                                Elev
        4
                  0
                         4
                                   710
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
CROSS SECTION
RIVER: Tributary
                               RS: 1252
REACH: 1
INPUT
Description: D/S XS of Bridge No 3
                                           19
Station Elevation Data
                               num=
                    Sta
73
249.14
258.88
                                       Sta
73
250.31
                                                     Elev
                                                                        Elev
     Sta Elev
                                 Elev
                                                                                   Sta
                                                                                           Elev
                                                            130.71
253.09
272.66
                                                  660.58
657.05
657.67
                                                                     658.23
656.64
658.28
                                                                               195.23
254.08
     4.92
               692
                                                                                        657.77
                                   692
  245.69 657.68
256.22 657.22
                               657.6
657.46
                                                                                        656.68
                                        262.11
449
                                                                               351.77
                                                                                        658.51
             660.7
                                  663
                                                     .710
Manning's n Values
                               num=
                                n Val
     Sta n Val Sta
4.92 .07 245.69
                                            Sta
                                  .08 262.11
Bank Sta: Left Right 245.69 262.11
                               Lengths: Left Channel
                                                            Right
                                                                        Coeff Contr.
                                                                                          Expan.
                                            48
                                                      49
                                                            49.34
CROSS SECTION
RIVER: Tributary
                               RS: 1203.*
REACH: 1
INPUT
Description:
Station Elevation Data
                                           35
                               num=
             Elev
                                 Elev
                                                     Elev
                                                                        Elev
     Sta
                         Sta
                                            Sta
                                                                                           Elev
  3.28
177.09
           681.6
657.78
657.19
                                                            73.01
251.92
257.2
260.83
                      58.66
                                         73.01
                               681.34
657.64
                                                  681.24
657.46
                                                                      660.29
657.36
                                                                               132.12
253.54
                                                                                        658.31
                                        249.88
255.99
                       198.2
                                                                                         657.21
  254.41
                               656.8
656.31
657.24
658.38
                                                                               258.23
                                                   656.8
                     255.94
                                                                      656.59
                                                                                         656.63
                                                                               262.24
277.95
                                                  656.4
657.54
658.75
                                                                     656.52
657.85
           656.56
                      259.59
                                         260.43
                                                                                        656.92
  263.6
286.05
           657.13
657.93
                                         267.22
371.8
                                                            273.48
415.8
                     264.49
                                                                                        657.98
                     358.37
                                                                      661.13
                                                                               421.81
                                                                                         661.41
                                          466.7
                                                  695.32
                                                             480.8
  457.22 663.76
                     457.22
                                695.1
                                                                         696
                                                                              532.12
                                                                                            702
Manning's n Values
                                            3
                               num=
```

C++ " 1/-1	WalkerRunFld				
Sta n Val Sta 3.28 .073 249.88	n Val Sta n Val 08 267.22 .073				
Bank Sta: Left Right 249.88 267.22	Lengths: Left Channel 48 49	Right Coeff Contr. 49.34 .1	Expan.		
CROSS SECTION					
RIVER: Tributary REACH: 1	RS: 1154.*				
INPUT Description: Station Elevation Data Sta Elev Sta 1.64 671.19 58.33 179.56 657.65 201.17 259.67 656.77 261.57 264.99 656.39 266.09 269.37 656.89 270.1 291.47 657.55 364.97 465.43 664.53 465.43	num= 35 Elev Sta Elev 670.67 73.02 670.47 657.5 254.07 657.23 656.55 261.63 656.55 655.98 266.78 656.13 657.02 272.34 657.41 658.25 378.62 658.52 680.19 475.07 680.63	Sta Elev Sta 73.02 660 133.52 256.59 657.07 258.6 263.13 656.28 264.4 267.11 656.23 268.26 278.69 657.68 283.24 423.34 661.77 429.45 489.4 682 541.56	Elev 658.39 656.46 656.61 657.69 662.12 694		
Manning's n Values Sta n Val Sta 1.64 .077 254.07	num= 3 n Val Sta n Val .08 272.34 .077				
Bank Sta: Left Right 254.07 272.34	Lengths: Left Channel 48 49	Right Coeff Contr. 49.34 .1	Expan.		
CROSS SECTION					
RIVER: Tributary REACH: 1	RS: 1105				
INPUT Description: Station Elevation Data Sta Elev Sta 0 660.79 58 263.66 656.39 267.27 272.59 655.65 273.38 296.89 657.17 385.44 551 686	num= 21 Elev Sta Elev 660.01 182.03 657.52 656.3 269.06 655.96 655.95 275.14 656.65 658.29 430.88 662.41	Sta Elev Sta 258.26 657.01 261.27 270.58 656.29 271.28 277.45 657.28 283.91 483.44 665.95 498	Elev 656.79 656.21 657.51 668		
Manning's n Values Sta n Val Sta 0 .08 258.26	num= 3 n Val Sta n Val .08 277.45 .08				
Bank Sta: Left Right 258.26 277.45	Lengths: Left Channel 287 295	Right Coeff Contr.	Expan.		
CROSS SECTION					
RIVER: Tributary REACH: 1	RS: 810				
INPUT Description: Station Elevation Data Sta Elev Sta 3.67 658.53 16.9 307.34 656.47 308.53 314.06 654.79 314.94 318.8 654.78 320.94 602.78 658.01 619	num= 25 Elev Sta Elev 657.88 160 656.82 655.21 309.94 654.96 653.84 315.53 654.71 655.51 327.28 655.79 660 626 662	Sta Elev Sta 271.95 656.84 302.8 311.1 654.83 313.17 316.36 654.9 317.37 351.67 656.4 565.4 688 664 707	Elev 656.15 654.83 654.24 656.84 666		
Manning's n Values Sta n Val Sta 3.67 .08 307.34	num= 3 n Val Sta n Val .08 320.94 .08		-		
Bank Sta: Left Right 307.34 320.94	Lengths: Left Channel 228 224	Right Coeff Contr. 222 .1	Expan.		
CROSS SECTION					

	wa	rkerkam ra	t
RIVER: Tributary REACH: 1	RS: 587		
INPUT Description: Station Elevation Data Sta Elev Sta -362 658.01 -200 102.91 654.9 103.88 110.17 653.78 110.56 132.53 655.09 307.17	num= 18 Elev Sta Elev 657.01 0 656.21 654.39 105.93 654.47 654.16 111.32 654.28 656.16 344.29 658.01	Sta Elev Sta 18.41 655.67 92.6 108.13 654.79 109.33 112.69 654.85 114.18	Elev 655.34 653.92 654.96
Manning's n Values Sta n Val Sta -362 .08 102.91	num= 3 n Val Sta n Val .08 114.18 .08		
Bank Sta: Left Right 102.91 114.18	Lengths: Left Channel 122 126	Right Coeff Contr. 127 .1	Expan.
CROSS SECTION		<u>.</u>	
RIVER: Tributary REACH: 1	RS: 463		
INPUT Description: Station Elevation Data Sta Elev Sta -416 658.01 -250 194.42 654.32 208.57 194.42 654.32 208.57 233.37 654.53 278.57 557 658.01	num= 21 Elev Sta Elev 657.01 -87 656.01 654.65 213.7 654.92 654.2 224.25 653.23 654.4 400 655.01	Sta Elev Sta 0 655.59 109.8 215.61 654.29 217.64 226.46 653.59 227.82 496.5 656.01 525.1	Elev 654.54 654.15 654.41 657.01
Manning's n Values Sta n Val Sta -416 .08 213.7	num= 3 n Val Sta n Val .08 233.37 .08		
Bank Sta: Left Right 213.7 233.37	Lengths: Left Channel 105 105	Right Coeff Contr. 104 .1	Expan.
CROSS SECTION			
RIVER: Tributary REACH: 1	RS: 357	·	
INPUT Description: Station Elevation Data Sta Elev Sta -626.5 660.01 -604.5 0 655.01 153.93 191.14 653.59 193.32 206.36 654.46 350	num= 20 Elev Sta Elev 658.01 -594.5 657.01 654.15 175.05 653.71 653.82 195.38 654.05 655.01 528.59 656.01	Sta Elev Sta -584.5 656.01 -479.5 185.31 653.59 188.41 198.28 654.41 202.04 549.3 657.01 596.9	Elev 655.01 652.4 654.7 658.01
Manning's n Values Sta n Val Sta -626.5 .08 185.31	num= 3 n Val Sta n Val .08 191.14 .08		
Bank Sta: Left Right 185.31 191.14	Lengths: Left Channel 179 175	Right Coeff Contr. 168 .1	Expan.
CROSS SECTION			
RIVER: Tributary REACH: 1	RS: 183		
INPUT Description: Station Elevation Data Sta Elev Sta -631.8 658.01 -603 -242 654.01 11.07 191.7 654.33 196.59	num= 20 Elev Sta Elev 657.01 -586 656.01 654.27 105.3 654.68 653.2 201.52 652.43	Sta Elev Sta -551 655.01 -252 160.67 655.27 176.42 202.85 652.14 208.19	Elev 654.01 654.35 653.86

```
Manning's n Values
                                          num=
    Sta n Val Sta
-631.8 .08 191.7
                                          n Val
                                              .08 208.19
Bank Sta: Left Right
191.7 208.19
                                          Coeff Contr.
                                                                  Expan.
 CROSS SECTION
RIVER: Walker Run
REACH: 1
                                          RS: 5862
INPUT
Description:
 Station Elevation Data
                                                          22
                                          num=
   Sta Elev Sta
6.57 692.9 16.52
61.77 675.79 63.16
75.29 677.24 83.9
134.28 678.08 144.98
275.94 705.68 283.35
                                                                       Elev
                                            Elev
                                                                                                Elev
                                                           Sta
                                                                                     Sta
                                                                                                                           Elev
                                                      30.12 679.79
66.68 676.21
93.4 677.98
173.49 677.49
                                                        30.12
                                                                                                            59.74
                                          686.09
                                                                                              679.9
676.51
                                                                                    46.8
                                                                                                                       679.08
                                                                                  70.59
                                                                                                        72.5
126.96
                                          675.53
677.66
678.89
                                                                                                                        676.66
                                                                                108.12 680.46
203.06 682.96
                                                                                                                       680.02
                                                                                                          252.93
                                                                                                                      692.83
                                          706.71
Manning's n Values
                                          num=
       Sta n Val Sta
6.57 .1 59.74
                                         n Val
                                                           Sta
                                                                     n Val
                                                        75.29
                        Right
75.29
                                          Lengths: Left Channel Right 200.9 314.2 312.6
                                                                                                Coeff Contr. Expan.
Bank Sta: Left
               59.74
                                                                                                              .1
                                                                                                                         3
CROSS SECTION
RIVER: Walker Run
REACH: 1
                                          RS: 5547
INPUT
Description:
Station Elevation Data
                                                      - 19
                                          num=
                                                                                             Elev Sta Elev
674.46 108.85 672.92
670.1 219.35 669.38
670.93 227.99 671 87
              Elev Sta
683.2 30.72
672.73 212.69
669.9 222.1
673.4 245.5
                                         Elev Sta Elev
673.65 63.49 674.03
671.49 215.49 671.05
669.99 224.66 670.6
678.64 264.68 690.27
                                                                                Sta
97.47
218.29
226.17
273.75
        Sta
   9.27
130.75
220.92
230.09
                                                                                             691.73
Manning's n Values
Sta n Val Sta
9.27 .1 215.49
                                          num=
                                         n Val
                                           n Val Sta
.05 226.17
                                                                     n val
Bank Sta: Left Right 215.49 226.17
                                          Lengths: Left Channel 266.1 262
                                                                                Right 254.2
                                                                                                Coeff Contr.
                           Right
                                                                                                                        Expan.
CROSS SECTION
RIVER: Walker Run
REACH: 1
                                          RS: 5282
Description: u/s XS of Beach Grove Road Bridge
Station Elevation Data num= 15

Sta Elev Sta Elev Sta Elev

0 681.12 55.69 675.84 85.36 674.65

207.55 670.04 212.26 669.41 214.34 667.03

230.88 671.08 241.05 670.68 255.44 674.6
                                                                               Sta Elev Sta
174.96 673.59 184.04
219.14 667.34 223.57
304.55 678.17 320
                                                                                                                          Flev
                                                                                                                      670.66
                                                                                                                       668.03
                                                                                                                     679.29
Manning's n Values num=
Sta n Val Sta n Val Sta
1 212.26 .05 230.88
                                                                     n Val
Bank Sta: Left Right 212.26 230.88
                                         Lengths: Left Channel
                                                                                                Coeff Contr.
                                                                                 Right
                                                                                                                         Expan.
212.26 230.88 82

Ineffective Flow num= 2

Sta L Sta R Elev Permanent
0 174 677.42 F
253 320 677.42 F
                                                                                  86.2
                                                                     83.7
BRIDGE
```

```
RIVER: Walker Run
REACH: 1
                                        RS: 5250
Description: Beach Grove Road
Distance from Upstream XS =
Deck/Roadway Width
Weir Coefficient
                                               19.3
Upstream Deck/Roadway Coordinates
num= 13
                            o Cord Sta Hi Cord Lo Cord

0 202.64 677.41 0

671.5 217.27 677.42 672.7

673.4 220.96 677.43 673.3

671.5 226.87 677.43 668.95
                                                                            Sta Hi Cord Lo Cord
214.6 677.42 667.71
218.96 677.42 673.3
222.65 677.43 672.7
        Sta Hi Cord Lo Cord
   201.96 677.41
216.27 677.42
                                                                                                     667.71
   219.96 677.43
224.11 677.43
237.26 677.43
                                                                              226.9
Upstream Bridge Cross Section Data
Station Elevation Data
                                       num=
                                                       16
                         Sta
55.69
212.26
                                       Elev Sta
675.84 85.36
669.41 214.61
                 Elev
                                                                   Elev
                                                                                 Sta
                                                                                            Elev
                                                                                                                    Elev
   0 681.12
207.55 670.04
230.88 671.08
                                                                674.65
667.71
                                                                            174.96
220.04
                                                                                         673.59 184.04
668.18 223.99
                                                                                                                 670.66
667.71
                          241.05
                                        670.68
                                                   255.44
                                                                  674.6
Manning's n Values
                             Sta
                                        num=
       Sta n Val Sta
0 .1 212.26
                                       n Val Sta
.05 230.88
                                                                  n Val
Bank Sta: Left Right 212.26 230.88
                         Right
                                       Coeff Contr.
                                                               Expan.
Ineffective Flow num=
    Sta L Sta R Elev Permanent
0 174 677.42 F
253 350 677.42 F
                   350 677.42
Downstream Deck/Roadway Coordinates
     num=
                  . 13
                                                                            Sta Hi Cord Lo Cord
206.44 677.49 0
209.11 677.42 672.08
212.8 677.43 672.68
        Sta Hi Cord Lo Cord
                                            Sta Hi Cord Lo Cord
   193.8 677.34 0 194.48 677.4
207.04 677.48 667.76 208.11 677.42
210.8 677.42 672.68 211.8 677.64
214.49 677.43 672.08 215.95 677.43
                                                                    Ö
                                                                670.88
                                                                672.78
                                                                670.88
                                                                              218.1
Downstream Bridge Cross Section Data
Station Elevation Data
                                       num=
                 Elev
                                          Elev
      Sta
                                                        Sta
             724.65 -176.11
689.65 -41.11
  -226.11
                                                                704.54 -106.11
679.45 13.04
                                        709.54 -156.11
                                                                                         699.65
                                                                                                                 694.84
                                                                                                     -96.11
                                       684.65 -6.11
668 204.89
669.45 244.99
684.24 413.89
710.04 513.89
                                                                            13.04
207.05
272.89
  -66.11
                                                                                         678.07
                                                                                                        71.2
                                                                                                                 669.33
             668.34
667.71
                         186.89
221.89
378.89
                                                                                         667.71
671.76
                                                                                                     212.14
306.75
                                                                                                                 668.18
677.78
   123.89
                                                                667.74
   216.09
                                                                670.15
   363.89
               679.45
                                                                689.34
                                                                             435.89
                                                                                                     453.89
                                                                                         694.54
                           493.89
                                                                             528.89
Manning's n Values
                                       num=
       Sta n Val Sta
5.11 .1 204.89
                                        n val
                                                        Sta
                                                                  n val
                                         .05 221.89
                                        Coeff Contr.
Bank Sta: Left
                          Right
                                                               Expan.
           204.89 221.89
Ineffective Flow num=
  Sta L Sta R Elev
-226.11 176.89 677.42
249.89 538.89 677.42
                              Elev Permanent
                                                                               0 horiz. to 1.0 vertical 0 horiz. to 1.0 vertical
Upstream Embankment side slope
Downstream Embankment side slope
Bownstream Embankment Side Stope

Aximum allowable submergence for weir flow =

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
```

```
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
CROSS SECTION
RIVER: Walker Run
REACH: 1
                                    RS: 5198
Description: FEMA BIA d/s XS of Beach Grove Road Bridge
Station Elevation Data
                                    num=
                                                 31
  Sta
-226.11
              Elev Sta
724.65 -176.11
                                      Elev
                                                             Elev
                                                                                   Elev
                                                                                                         Flev
                                                   Sta
                                   Elev Sta
709.54 -156.11
684.65 -6.11
668 204.89
666.58 221.89
679.45 378.89
704.65 493.89
                                                                   5ta
-106.11
13.04
207.96
244.99
413.89
                                                         704.54
679.45
667.74
669.45
684.24
                                                                                699.65
                                                                                           -96.11
                                                                                                      694.84
             689.65
668.34
665.85
677.78
                                                                                           71.2
212.14
272.89
435.89
                        -41.11
                                                                                678.07
                                                                                                      669.33
665.71
   -66.11
                        186.89
217.97
                                                                                665.96
670.15
689.34
                                                                                                      671.76
694.54
   215.99
                         363.89
468.89
   306.75
   453.89 699.34
538.89 724.24
                                                          710.04
                                                                                714.45
                                                                                                      719.54
                                                                     513.89
                                                                                           528.89
Manning's n Values
Sta n Val Sta
-226.11 .1 204.89
                                   num=
                                   n Val Sta
.05 221.89
                                                           n val
Bank Sta: Left Right 204.89 221.89
                                                                                   Coeff Contr.
                                   Lengths: Left Channel
                                                                     Right
89.3
                       Right
                                                                                                        Expan.
                                    89.8
                                                           90.1
                                                                                              . 3
Ineffective Flow
                            num≔
 Sta L Sta R Elev Permanent
-226.11 176.89 677.42 F
249.89 538.89 677.42 F
CROSS SECTION
RIVER: Walker Run
                                    RS: 5107
REACH: 1
INPUT
Description:
Station Elevation Data
                                    num=
                                                 18
                        Sta
37.49
158.69
166.43
302.28
                                      Elev
             Elev
677.51
667
                                              Sta
96.16
161.58
169.94
                                                             Elev
                                                                         Sta
                                                                                   Flev
                                                                                                         Flev
      Sta
                                   670.27
666.07
665.04
                                                                    133.14
163.25
                                                                                668.48
664.65
     1.11
                                                          668.4
664.84
                                                                                               139
                                                                                                          668
                                                                                           164.42
      144
                                                                                                      664.59
            665.03
668.33
                                                           666.9
                                                                         221
                                                                                    667
                                                   349
  238.09
                                    669.86
                                                          678.03
Manning's n Values
                                   num=
                                     n Val
                                                   Sta
144
     Sta n Val
1.11 .1
                          Sta
37.49
                                                           n Val
                                                                         Sta
                                                                                 n val
                                                                                               Sta
                                                                                                        n val
                                                              .05
                                                                     169.94
                                                                                    .11 238.09
                                        .11
                                    Lengths: Left Channel
Bank Sta: Left
                                                                     Right
112
                                                                                   Coeff Contr.
               eft Right.
144 169.94
                                                                                                        Expan.
                                                 112
                                                             112
                                                                                              .1
                                                                                                           . 3
CROSS SECTION
RIVER: Walker Run
                                    RS: 4995
REACH: 1
INPUT
Description: FEMA BHZ
Station Elevation Data
                                    num=
                                                 34
     Sta Elev
1000 724.34
                           Sta
1010
                                   Elev
719.54
                                                 Sta
1022
                                                            Elev
                                                                         Sta
                                                                                   Flev
                                                                                               Sta
                                                                                                         Elev
                                                         714.54
691.74
674.84
                                                                        1055
1150
                                                                                709.65
691.74
                                                                                              1075
                                                                                                      704.45
                                                                                              1180
     1100
            699.45
                           1120
                                    694.84
                                                 1140
                                                                                                      689.34
            684.74
                           1300
                                   676.74
                                                                        1383
                                                                                    669
                                                                                              1387
     1270
                                                 1315
                                                                                                          668
                                                                                                       668.9
                                                                                              1505
     1392
                 667
                           1440
                                    666.24
                                                 1497
                                                              667
                                                                        1501
                                                                                    668
             667.74
                                                          674.54
                                                                                679.45
                                                 1635
                                                                                                      690.04
     1540
                           1610
                                    669.45
                                                                        1662
                                                                                              1685
```

Energy

```
WalkerRunFld
        1725 686.74
1835 709.84
                                        1750
1850
                                                    689.45
                                                                         1770
                                                                                     694.45
                                                                                                                     699.34
                                                                                                                                         1810 704.34
                                                                                                         1780
                                                                                     719.34
                                                                                                         1895
Manning's n Values
                                                    num=
                   n Val
        Sťa
1000
                                          Sta
                                                      n Val
                                                                           Sta
                                                                                       n Val
                                                                                                           Sta
                                                                                                                       n val
                                                                                                                                           Sta
                                                                                                                                                       n Val
                                        1383
                                                                         1392
                                                                                                                                         1610
Bank Sta: Left
                                  Right
1497
                                                    Lengths: Left Channel
                                                                                                     Right
                                                                                                                         Coeff Contr.
                                                                                                                                                        Expan.
                    1392
                                                                     180.8
                                                                                    181.3
                                                                                                                                         .1
CROSS SECTION
RIVER: Walker Run
REACH: 1
                                                    RS: 4810
INPUT
Description:
Station Elevation Data
                                                    num=
                                                                         60
                              $\text{Sta} & \text{Elev} \\
\text{06.08} & 668 & 70.73 & 667.243 \\
7 & 81.53 & 666 & 105.92 & 665.242 \\
4 & 116.22 & 663.356 & 116.96 & 663 \\
3 & 120.56 & 663.14 & 122.83 & 664 \\
2 & 135.86 & 665.045 & 154.3 & 665.142 \\
3 & 180.17 & 665.3 & 180.7 & 665.3 \\
200.97 & 665 & 211.96 & 665.141 \\
241.82 & 666.19 & 245.06 & 667 \\
250 & 668.001 & 252.44 & 668.004 \\
255.55 & 668.001 & 252.44 & 668.004 \\
255.55 & 668.001 & 256.08 & 668 \\
258.59 & 667.961 & 288.1 & 666 \\
$\text{28}$
         Sta Elev
0 673.03
                                                                                                           Sta
                                                                                                                         Elev
                                                                                                                                           Sta
                                                                                                       57.63
                                                                                                                     668.16
                                                                                                                                       64.81 668.208
    65.68 668.122
75.4 666.647
115.25 664
                                                                                                      71.83 667.059
                                                                                                                                       72.15
                                                                                                                                                           667
                                                                                                     113.64
                                                                                                                                     113.91 664.818
                                                                                                                           665
                                                                                                    118.18 662.871
125.34 664.475
162.99 665.18
                                                                                                                                     119.73 662.932
    120.24
                          663
                                                                                                                                       128.1
    133.43 665.032
                                                                                                                                     165.61 665.201
                                                                                                    181.83 665.3
223.37 665.3
247.93 667.645
252.46 668.004
257.45 667.938
321.23 667.68
    178.31
                      665.3
                                                                                                                                       185.8
                                                                                                                                                     665.25
    190.21 665.165
                                                                                                                                     249.2 668
252.53 668.004
257.73 667.957
                          666
    249.5 668
255.19 668.001
257.9 667.966
Z57...
Manning's n Values
Sta n Val Sta
1 57.63
                                                                                                      5ta
128.1
                                                                                                                                     Sta
258.59
                                                     n Val
                                                                          Sta
                                                                                       n Val
                                                                                                                      n Val
                                                                                                                                                       n val
                                                          .11 113.64
Bank Sta: Left
                                                    Lengths: Left Channel
                                                                                                                         Coeff Contr.
                                                                                                     Right
                                                                                                                                                       Expan.
               113.64
                                  128.1
CROSS SECTION
RIVER: Walker Run
REACH: 1
                                                    RS: 4735
INPUT
Description: FEMA BHY
Station Elevation Data
                                                    num=
                                                                        Sta
902
1375
                                                                                        Elev
         Sta
                        Elev
                                                        Elev
                                          Sta
                                                                                                           Sta
                                                                                                                         Elev
          783
                          694
                                          895
                                                          694
                                                                                          696
                                                                                                          933
                                                                                                                           696
                                                                                                                                         1003
                                                                                                                                                           696
                   694
683.74
                                                                                    690
679.54
1708.72 668 1709.45 668 1710.13 668 1716.64 667.49 1719.92 667
1721.48 666.749 1726.83 666 1728.55 665.722 1734.13 665 1739.14 664.952
1752.79 664.8 1756.71 664.732 1767.42 664.59 1769.17 664.59 1771.11 664.599
1772.15 664.613 1775.69 664.672 1781.28 664.8 1793.07 664.416 1805.05 664
1807.11 663.406 1808.61 663 1809.81 662.542 1811.01 662.258 1812.45 662.633
1813.53 663 1813.83 663.21 1814.96 664 1821.41 664.218 1825.33 664.237
1830.8 664.295 1844.45 664.489 1871.09 664.907 1876.95 665 1882.27 665.608
1885.67 666 1886.97 666.323 1889.7 667 1890.9 667.064 1909.49 666.951
1909.55 666.956 1917.09 666.674 2000 669.45 2020 674.65 2042 679.84
        1203
                                       1369
                                                          692
                                                                                                         1388
                                                                                                                           686
                                                                                                                                         1390
Manning's n Values
                                                    num=
                                                                                                                          Val Sta
.11 1882.27
         Sta n Val Sta
783 .1 1734.13
                                                     n Val
                                                                          Sta
                                                                                      n Val
                                                                                                                      n Val
                                                                                                          Sta
                                                                                                                                                       n Val
                                                       .11 1805.05
                                                                                         .05 1814.96
Bank Sta: Left
                                 Right
                                                    Lengths: Left Channel
                                                                                                    Right
                                                                                                                        Coeff Contr.
                                                                                                                                                       Expan.
             1805.05 1814.96
                                                                      41.8
CROSS SECTION
RIVER: Walker Run
REACH: 1
                                                    RS: 4692
```

INPUT

```
Description:
Station Elevation Data
                                                       num=
                                                                       Sta Elev
29.44 673.96
120.39 668
131.99 666
176.11 664.456
197.09 663.916
                                                                                                         Sta Elev
39.22 671.77
122.3 668
134.43 665.482
178.71 664.392
198.85 663.834
                                                          Elev
673.9
                     Elev
676.54
                                           Sta
14.2
                                                                                                                                           Sta Elev
100.41 668.46
124.73-667.454
          Sta
                                     14.2 673.9

117.8 668

129.52 666.456

174.31 664.51

195.53 664

203.64 663.897

229.54 664.259

294.26 665.639

316.64 666.554

331.96 666.203
    115.19
                            668
    126.96 667
150.39 664.915
187.44 664.226
201.06 663.773
224.56 664.251
                                                                                                                                            136.94
                                                                                                                                                                    665
                                                                                                                                            181.33 664.388
                                                                                                                                            200.84 663.787
                                                                                                         216.1 664.145
280.45 664.929
300.25 666.484
322.95 666.329
                                                                        206.14
                                                                                               664
                                                                                                                                            218.05
                                                                                                                                                           664.16
                                                                        234.53 664.327
297.98 666
320.98 666.408
380.91 669.4
                                                                                                                                            282.17 664.936
    287.78
307.96
                           665
                                                                                                                                            302.51
                                                                                                                                                                   667
                     666.83
                                                                                                                                            329.57 666.282
     329.66 666.29
                                                                                                            419.8
                                                                                                                                                   423
                                                                                                                                  678
           424
                            676
                                            433
                                                              680
Manning's n Values
                                                       num=
                                         Sta
          Sta n Val Sta
2.2 .1 136.94
                                                       n Val
                                                                                           n Val
                                                                              Sta
                                                                                                                Sta
                                                                                                                             n Val
                                                                                                                                                  Sta
                                                                                                                                                               n val
                                                             .11 195.53
                                                                                                                                  .11 302.51
                                                                                                          206.14
                                                                                               .05
                                                       Lengths: Left Channel 188.7 197
 Bank Sta: Left
                                    Right
                                                                                                          Right
                                                                                                                                Coeff Contr.
                                                                                                                                                               Expan.
                 195.53 206.14
                                                                                                          188.8
                                                                                                                                                .1
                                                                                                                                                                  . 3
CROSS SECTION
RIVER: Walker Run
                                                       RS: 4495
REACH: 1
INPUT
Description: FEMA BHX
Station Elevation Data
                                                       num=
                                                                            86
                                          Sta
1232
                        Elev
                                                        Elev
                                                                              Sta
                                                                                             Elev
                                                                                                                                Elev
                                                                                                                                                                 Elev
                                                                                             710
710
         1198
                           694
                                                                            1261
                                                                                                              1279
                                                            700
                                                                                                                                  716
                                                                                                                                                1307
                                                                                                                                                                   716
 1411 718 1688 718 1713 710 1774 690 1805 680
1820 679.74 2003 667.576 2006.92 667.612 2011.35 667.652 2018.97 667.902
2020.87 667.974 2021.45 667.975 2022.29 667.977 2025.06 667.984 2026.78 667.987
2027.89 667.99 2029.03 667.99 2032.09 667.994 2033 667.996 2035.46 667.987
2036.6 668 2039.69 667.326 2041.17 667 2042.52 666.736 2046.49 666
2047.63 665.765 2051.55 665 2061.5 664.535 2067.59 664.252 2073.17 664.091
2073.93 664.089 2078.82 664.087 2080.05 664.084 2083.21 664.075 2091.76 664.056
2097.57 664.038 2101.06 664.028 2109.99 664 2114.37 663.524 2116.41 663.305
2117.18 663.233 2121.29 663.713 2123.77 664 2124.99 664 2125.39 664
2138.05 664 2142.26 664 2146.61 664 2149.65 664 2152.42 664
2164.57 664.267 2171.35 664.553 2173.93 664.594 2181.16 665 2184.58 665.607
2186.64 666 2189.87 666.635 2191.82 667 2199.16 667.003 2219.84 666.825
2222.42 665.866 2230 664.079 2231.69 664.473 2232.04 664.556 2235.56 665.015
2242.2 665.926 2242.71 666 2244.28 666 2244.52 666 2244.73 666
2238 669.54 2300 674.24 2306 676 2313 676 2321 680
2338 690 2345 692 2370 694 2486 696 2495 700
                                                             718
        1411
                           718
                                          1688
                                                                            1713
                                                                                                              1774
                                                                                                                                  690
                                                                                                                                                1805
                                                                                                                                                                   680
         2515
                            710
Manning's n Values
                                                      num=
                                         Stą
          Sta n Val Sta
1198 .1 2036.6
                                                      n Val
                                                                                          n Val
                                                                              Sta
                                                                                                                Sta
                                                                                                                             n Val
                                                                                                                                                               n val
                                                                                               .05 2123.77
                                                            .11 2109.99
                                                                                                                                  .11 2244.73
                                                      Lengths: Left Channel 77.5 81
Bank Sta: Left Right 2109.99 2123.77
                                                                                                          Right 77.6
                                                                                                                               Coeff Contr.
                                                                                                                                                               Expan.
                                                                                               81
CROSS SECTION
RIVER: Walker Run
REACH: 1
                                                       RS: 4414
INPUT
Description:
Station Elevation Data
                                                      num=
                       Elev
673.7
                                          Sta
1.31
                                                                         Sta Elev
19.96 669.88
                                                          Elev
                                                                                                                                                                 Elev
          Sta
                                                                                                                                           105.71
    -5.7 673.7
105.98 666.94
137.09 664.014
                                                                                                           70.87
                                                      671.76
                                                                                                                           667.77
                                                                                                                                                                   667
                                                                       19.96 609.88
110.36 665.876
138.95 664
169.07 663.978
177.51 663.013
179.14 663.063
187.66 663.778
190.54 663.877
223 32
                                     109.83 666
137.29 664.006
164.86 663.977
                                                                                                                                            128.45 664.158
                                                                                                         114.28
                                                                                                                                 665
                                                                                                          151.88 663.973
                                                                                                                                            152.23 663.974
                                                                                                         172.77 663.817
177.55 663.014
181.06 663.262
    164.32 663.974
                                                                                                                                            173.49 663.764
    174.35 663.649
178.49 662.971
                                      175.33 663.466
                                                                                                                                            178.12
                                      178.66
                                                              663
                                                                                                                                            181.27 663.281
    183.82 663.485
189.28 663.798
                                      186.11 663.666
                                                                                                         188.15
202.44
                                                                                                                                            188.44 663.796
                                                                                                                           663.78
                                      189.93 663.833
208.27 664
239.7 664
                                                                                                                                  664
                                                                                                                                            207.78
    207.97
                                                                                                                                            226.1 664
263.16 664.644
                           664
                                                                        223.32
                                                                                               664
                                                                                                          224.04
                                                                                                                                  664
                                                                                                         252.71
289.21
      236.4
                            664
                                                                        246.89
                                                                                               664
                                                                                                                                  664
                                      271.32 665.454
    269.13
                            665
                                                                        274.29
                                                                                               666
                                                                                                                           666.75
                                                                                                                                            296.88 667.165
```

```
WalkerRunFld
    298.28 666.355 316.64 665.969 317.16 665.968
318.14 666 318.59 666 331.76 668.59
                                                                                                                                       666 317.52
676 385
                                                                                                               317.2
383
                                                                                                                                                                           666
                                                                                  425
                                                                 680
Manning's n Values
                                                         num=
                                          Sta
                                                         n Val Sta
.11 169.07
          Sta n Val Sta
-5.7 .1 128.45
                                                                                               n Val
                                                                                                                     Sta
                                                                                                                                  n val
                                                                                                                                                         Sta
                                                                                                                                                                      n val
                                                                                                   .05
                                                                                                              190.54
                                                                                                                                       .11 331.76
                                                         Lengths: Left Channel 114.9 119
                                                                                                              Right
117.5
Bank Sta: Left
                                   Right
                                                                                                                                     Coeff Contr.
                                                                                                                                                                      Expan.
                 169.07 190.54
                                                                                                                                                       .1
                                                                                                                                                                           . 3
CROSS SECTION
RIVER: Walker Run
REACH: 1
                                                         RS: 4295
INPUT
Description: FEMA BHW
Station Elevation Data
                                                         num=
                                                                                88
                                                          Elev
                                            Sta
1145
                      Elev
           Sta
                                                                               Sta
1151
                                                                                                 Elev
                                                                                                                     Sta
                                                                                                                                     Elev
                                                                                                                                                         Sta
                                                                                                                                                                        Elev
                                                            710
                                                                                                  708
708
                            710
                                                                                                                   1167
                                                                                                                                       708
                                                                                                                                                      1173
                                                                                                                                                                           710
                            710
                                            1208
                                                                708
                                                                                                                                       710

        1201
        710
        1208
        708
        1218
        708
        1223
        710
        1253
        700

        1312
        680
        1370
        674.24
        1408
        669.34
        1470
        669.45
        1507.95
        667.187

        1509.22
        667.198
        1510.67
        667.211
        1513.14
        667.293
        1519.31
        667.527
        1520.9
        667.476

        1522.86
        667.413
        1524.07
        667.283
        1525.97
        667.08
        1526.72
        667
        1528.93
        666.464

        1530.85
        666
        1531.78
        665.82
        1535.97
        665
        1537.1
        664.796
        1541.24
        664

        1546.87
        663.846
        1555.86
        663.6
        1558.07
        663.572
        1565.76
        663.496
        1569.64
        663.469

        1573.24
        663.581
        1606.93
        663.395
        1611.2
        663.587
        1589.02
        663.6
        1590.64
        663.469

        1590.4
        663.581
        1606.93
        663.395
        1611.2
        663.343
        1614.72
        663.297
        1626.09

         1201
                                                                               1218
                                                                                                                   1223
                                                                                                                                                       1253
                                                                                                                                                                           700
  1715.85 664.216 1721.6 665 1726.29 665.903 1726.69 1753 665.29 1762.02 665.598 1769.22 665.843 1773.58 1820 674.24 1875 679.65 1896 674 1903 1915 674 1930 680 1949 690 1953
                                                                                                                                       666 1744.06 665.521
666 1800 666.45
                                                                                                                                       672
                                                                                                                                                       1908
                                                                                                                                                                           672
                            696
                                            2250
                                                                700
                                                                                2285
Manning's n Values
                                                         num=
                                                        n Val Sta
                                            Sta
                                                                                              n Val
                                                                                                                                  n Val
          Sta n Val
                                                                                                                     Sta
                                                                                                                                                         Sta
                                                                                                                                                                      n Val
                              .1 1519.31
                                                            .11 1639.19
                                                                                                 .05 1652.17
Bank Sta: Left Right
1639.19 1652.17
                                                         Lengths: Left Channel 160.8 170.5
                                                                                                               Riaht
                                                                                                                                     Coeff Contr.
                                                                                                                                                                      Expan.
                                                                                                              164.4
                                                                                                                                                       .1
CROSS SECTION
RIVER: Walker Run
REACH: 1
                                                         RS: 4130
Description:
Station Elevation Data
                                                         num=
                                                                               51
                                      Sta Num=
Sta Elev
38.19 668.15
92.08 665.946
106.76 663
127.3 662.968
154.8 663
                                                                             Sta Elc.
65.97 666.24
          Sta Elev
0.79 672.78
                                                                                                                                    Elev
                                                                                                              90.55 666.158
100.19 664.775
116.25 662.936
                                                                                                                                                    91.61 666.009
                                                                        98.82 665
107.96 662.985
130.71 663
156.55 663
                         666
                                                                                                                                                  105.05
                                                                                                                                                                         664
    91.72 666
106.39 663.159
124.72 662.947
                                                                                                                                                  120.19 662.935
                                                                                                              136.98 663
160.84 662.674
                                                                                                                                                  145.11 663
166.49 662.262
190 663.361
                                                                                                                                       663
                            663
                                       174.9 663 179.99 663.043
210.12 664 213.33 664.489
220.89 664.961 221.71 664.955
237.05 664.971 238.12 664.969
370.38 665.85 415.17 670.09
    171.27 662.654
                                                                                                              180.66
                                                                                                                              663.04
                                                                                                                                                  218.2 664.985
227.28 664.933
253.95 665.83
    198.82 663.597
                                                                                                              215.93
                                                                                                                                       665
    218.74 664.983
229.38 664.933
                                                                                                              226.08 664.933
                                                                                                              239.02
                                                                                                                                       665
    269.33 665.98
                                                                                                                                       672
Manning's n Values
                                                         num=
          Sťa
                     n val
                                            Sta
                                                          n Val
                                                                                 Šta
                                                                                               n val
                                                                                                                     Sta
                                                                                                                                  n Val
                                                                                                                                                        Sta
                                                                                                                                                                      n val
                                                            .11 156.55
                                          90.55
                                                                                                                174.9
                                                                                                                                      .11 239.02
                                                                                                 .05
                                    Right
174.9
                                                         Lengths: Left Channel
                                                                                                              Right
81.1
Bank Sta: Left
                                                                                                                                     Coeff Contr.
                                                                                                                                                                      Expan.
                 156.55
CROSS SECTION
```

```
RIVER: Walker Run
REACH: 1
                                                                  RS: 4043
 INPUT
 Description: FEMA BHV
 Sta Elev 1127 714 1175 712 1211 710 1217 708 1228 708 1235 710 1269 704 1282 704 1294 700 1324 690 1330 674.54 1390 671.54 1520 667.84 1580.33 666 1582.28 665.776 1590.68 665 1594.63 664.551 1600.28 664 1606.73 663.761 1610.6 663.775 1618.4 663 1621.16 662.919 1623.52 662.858 1625.01 662.825 1629.53 662.932 1631.2 662.974 1631.53 662.982 1632.7 663 1648.17 663.419 1662.23 664 1664.92 664.369 1670 665 1670.44 665 1673.62 664.991 1673.97 664.99 1676.78 664.988 1680.44 664.98 1680.85 664.98 1681.37 664.978 1682.77 664.977 1689.01 664.975 1692.57 664.975 1693.29 665 1740 667.24 1910 669.54 1960 674.65 1965 672 1971 672 1987 680 2011 692 2107 694 2310 696 2355 710 2425 736
 Station Elevation Data
Manning's n Values
                                                                 num=
                                                                n Val Sta
.11 1618.4
                                                                                                                             Sta
           Sta n Val Sta
1127 .1 1580.33
                                                                                             Sta n Val
                                                                                                                                                    n Val
                                                                                                                                                                                            n val
                                                                                                           .05 1632.7
                                                                                                                                                                          1670
 Bank Sta: Left Right
1618.4 1632.7
                                                                 Lengths: Left Channel
                                                                                                                             Right 73.6
                                                                                                                                                      Coeff Contr.
                                                                                                                                                                                            Expan.
                                                                                       67.9
                                                                                                           88.3
 CROSS SECTION
 RIVER: Walker Run
                                                                 RS: 3972
 REACH: 1
 INPUT
 Description: U/S XS of Market Street Bridge
                                                                Elev Sta Elev
670.24 197.75 670.47
663 270.18 661.21
663 295.4 664
666.78 391.2 666
 Station Elevation Data
                                                            num≔
     Sta Elev Sta
123.85 674.24 171.83
223.06 665.53 225.4
                                                                                                                                                      Elev
                                                                                                                            204.44 667.88 215.91 667.02
277.41 661.6 281.39 661.43
298.04 664.769 299.32 664.863
                                          225.4
287.4
372.3
     285.52 661.64
315.58 665.35
                                                                                                                                    536 666.78
                                                                                                                                                                            559 667.64
      748.66 669.45 788.66 674.34
 Manning's n Values
                                                                 num=
                                                                 n Val Sta
.05 299.32
            Sta n Val Sta
3.85 .1 225.4
                                                                                                           n Val
                                                                                                                             Sta n Val
372.3 .1
                                              19ht Lengths: Left Channel

9.32 101.2 98.1

num= 2

Elev Permanent

670.8 F
Bank Sta: Left Right 225.4 299.32
                                                                                                                                                     Coeff Contr.
                                                                                                                             Right
100.6
                                          Right
                                                                                                                                                                                           Expan.
                                                                                                                                                                          . 3
Ineffective Flow
Sta L Sta R
123.85 202.37 (
341.4 788.66 (
                                                670.3
BRIDGE
RIVER: Walker Run
REACH: 1
                                                          RS: 3914
Description: Market Street u/s
Distance from Upstream XS = 40.1
Deck/Roadway Width = 43.1
Weir Coefficient = 2.5
Upstream Deck/Roadway Coordinates
     num= 16
Sta Hi Cord Lo Cord
0 673.611 673.611
216.18 671.069 671.069
260.36 673.78 663.04
283.42 673.78 669.04
285.1 670.45 664.36
435.84 667.629 667.629

        Sta Hi Cord
        Lo Cord
        Sta Hi Cord
        Lo Cord

        71.3
        672.778
        672.278
        151.64
        671.546
        671.546

        254.71
        670.8
        664.72
        260.35
        670.8
        663.3

        260.37
        673.78
        669.04
        272.2
        673.78
        669.04

        283.43
        673.78
        663.08
        285
        673.78
        664.36

        287.02
        670.3
        665.83
        339.19
        669.234
        669.234

 Upstream Bridge Cross'Section Data
 Station Elevation Data num=
                                                                                          19
                                                                Elev
674.7
   Sta Elev Sta Elev
-113.65 679.5 -20.65 674.7
216.18 671.069 254.71 664.72
                                                                                            Sta Elev Sta Elev Sta Elev
0 673.611 71.3 672.778 151.64 671.546
261 663.04 272.49 661.04 283.42 663.08
                                                                                          Sta
```

```
walkerRunFld
   287.02 665.83 339.19 669.234 435.84 667.629 464.35 604.35 674.8 684.35 679.7 769.35 684.6 1200
                                                                                       668.7 554.35
                                                                                                               669.7
                                                                                       684.6
Manning's n Values
                                      num=
 Sta n Val Sta
-113.65 .1 254.71
                                      n Val
                                                       Sta
                                                                n Val
                                        .05 287.02
Bank Sta: Left Right 254.71 287.02
                                      Coeff Contr.
                                                             Expan.
Ineffective Flow
                              num=
 Sta L Sta R
-113.65 202.37
                             Elev Permanent
                            670.8
                                          F
                 1200
    341.4
                           670.3
Downstream Deck/Roadway Coordinates
                   15
     num=
       Sta Hi Cord Lo Cord
                                         Sta Hi Cord Lo Cord
71.3 672.778 672.278
                                                                          Sta Hi Cord Lo Cord
151.64 671.546 671.546
         0 673.611 673.611
                                                                                    671.576
670.8
673.42
   216.18 671.069 671.069 254.71 670.8 664.72 260.36 673.42 668.72 272.2 673.42 668.72 283.43 673.42 661.35 285 673.42 664.36 289.14 670.3 664.78 339.19 669.234 669.234
                                      254.71 670.8 664.72
272.2 673.42 668.72
285 673.42 664.36
                                                                          260.35
283.42
                                                                                                  661.95
                                                                                                  668.72
                                                                           285.1
                                                                                      670.45
                                                                                                  664.36
                                                                          435.84 667.629 667.629
Downstream Bridge Cross Section Data
Station Elevation Data
                                     num=
                                                  Sta Elev
-20.65 674.7
254.71 664.72
339.19 669.234
       Sta
                Elev Sta
                                        Elev
                                                                                         Elev
                                                                                                  Sta Elev
71.3 672.778
272.49 661.04
                                                                               Sta
   -230 679.5 -113.65 679.5 -20.65
151.64 671.546 216.18 671.069 254.71
283.42 663.08 287.02 665.83 339.19
554.35 669.7 604.35 674.8 684.35
                                                                                 0 673.611
                                                                              261 663.04
                                                                          435.84 667.629
                                                                                                  464.35
                                                                                                               668.7
                                                                          769.35
Manning's n Values
                                      num=
      Sta n Values
-230 .1 -113.65
                                      n Val Sta
.1 254.71
                                                               n val
                                                                                       n val
                                                               .055 287.02
Bank Sta: Left Right 254.71 287.02
                         Right
                                      Coeff Contr.
                                                            Expan.
                                                                 . 8
Ineffective Flow
                             num=
    Sta L Sta R
-230 200
                             Elev Permanent
                            670.9
                                       F
       310 769.35
                            670.3
                                                                             0 horiz. to 1.0 vertical 0 horiz. to 1.0 vertical
Upstream Embankment side slope
Downstream Embankment side slope
Bownstream Embankment Side Stope

aximum allowable submergence for weir flow =
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
                                                                           .98
                                                                       668.7
weir crést 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 =
                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
CROSS SECTION
RIVER: Walker Run
REACH: 1
                                      RS: 3860
Description: D/S XS of Market Street Bridge
Station Elevation Data num=
Sta Elev Sta Ele
                                        Elev
                                                       Sta
                                                                 Elev
                                                                              Sta
                                                                                         Elev
                                                                                                      Sta
                                                                                                                 Elev
```

	21 2.1					
117.66 675.84 137.05 262.64 664.21 265.16 288.12 663.96 295.78	663.32 266.08 661	WalkerRunF 1.65 219.23 1.15 272.52 5.91 349.26		668.65 661.59 668.52		
Manning's n Values Sta n Val Sta 117.66 .1 219.23	num= 5 n Val Sta n .12 265.16	Val Sta 055 288.12	n Val Sta .06 334.66	n Val .04		
Bank Sta: Left Right 265.16 288.12 Ineffective Flow num= Sta L Sta R Elev 117.66 200 670.9 310 357.79 670.3	Lengths: Left Chanr 75.5 68 2 Permanent F F	nel Right 3.6 74.8	Coeff Contr. .4	Expan.		
CROSS SECTION						
RIVER: Walker Run REACH: 1	RS: 3785					
1012 714 1145 1260 684.65 1290 1426.79 661 1430.1 1436.82 661 1439.14 1463.66 663.18 1467.67 1477.84 665 1477.88	Elev Sta 710 1160 679.74 1318 674 660.85 1431.45 660 661.16 1457.87 664 1469.67 665 1477.94 667.24 1580 666	Tlev Sta 710 1203 1.84 1360 1.96 1431.99 662 1458.82 1.41 1472.57 665 1479.92 1.74 1650 670 1827	Elev Sta 692 1225 669.34 1412 661 1435.13 662.19 1462.77 665 1474.69 665 1480.99 666.15 1760 670 1845	Elev 692 664.95 661 663 665 665 669.45 680		
Sťa n Val Sta		Val Sta .12 1480.99				
Bank Sta: Left Right 1412 1472.57	Lengths: Left Chann 63.5 56	el Right	Coeff Contr.	Expan.		
CROSS SECTION						
RIVER: Walker Run REACH: 1	RS: 3735					
	Elev Sta 675.8 101.02 670 660.48 186.63 660 195.08 661.63 240.01 661.68 250.62 661 662 269.46 662	Tlev Sta 1.65 135.38 1.49 186.72 661 203.49 1.61 241.57 1.71 252.67 1.52 272.84 1.13 298.4 1.13 420	Elev Sta 669.18 157.56 660.46 187.27 661.11 234.44 661.64 242.67 661.76 261.64 663 275.62 664.17 306.64 666 422	Elev 666.89 660.56 661.6 661.63 661.92 663.39 664.14 666		
Manning's n Values Sta n Val Sta 46.72 .1 174.59	num= 4 n Val Sta n .055 190.57	Val Sta .12 340	n Val .04			
Bank Sta: Left Right 174.59 190.57	Lengths: Left Chann 208.1 193		Coeff Contr.	Expan.		
CROSS SECTION						
RIVER: Walker Run REACH: 1	RS: 3532					
INPUT Description: FEMA BHT Station Elevation Data Sta Elev Sta	num= 86 Elev Sta E	lev Sta	Elev Sta	Elev		

		WalkerRunf	:ld	
1000 714 1260 1368 684.95 1390 1492.15 661 1494.56 1502.81 661 1503.38 1509.96 660.87 1510.56 1527.55 662 1531.58 1560.38 662.32 1561.67 1573.77 660.89 1577.02 1606.68 660.8 1616.06 1630.88 660.76 1632.64 1650.3 660.51 1653.61 1661.18 658.94 1662 1665.93 660 1665.97 1677.45 660.63 1678.76 1711.27 661.02 1719.48 1770 665.74 1850 2000 680 2024	714 1310 679.74 1428 661 1497.2 661 1505.44 660.88 1513.01 662.51 1535.35 662 1566.52 660.79 1618.17 660.73 1635.02 660.19 1655.15 658.87 1662.85 660.02 1666.12 660.71 1689.17 662 1722.58 666.34 1970 692 2161	712 1352 674.34 1489.73 661 1497.87 661 1508.4 661 1523.66 663 1540.62 660.79 1627.35 660.68 1637.73 660.68 1637.73 660.65 1696.73 660.75 1696.73 662.37 1726.32 670 1973 694 2360	710 1360 661 1490.27 661 1499.76 661 1509.25 661 1526.48 663 1557.67 661 1570.41 660.84 1604.01 660.78 1629.71 660.62 1648.78 659.3 1660.1 659 1665.67 660.42 1674.49 660.82 1710.74 663 1750 668 1976 696 2369	710 661 661 661.71 663 660.94 660.77 660.62 659 659.9 661.46 661 666.34
Sta n Val Sta	num= 5 n Val Sta .1 1648.78	n Val Sta .06 1668.34		n Val .08
Bank Sta: Left Right 1648.78 1668.34	Lengths: Left C 123.6	hannel Right 125 123.9	Coeff Contr. .1	Expan
CROSS SECTION		÷		
RIVER: Walker Run REACH: 1	RS: 3410			,
INPUT Description: Station Elevation Data Sta Elev Sta 33.79 674.7 76.45 127.56 661.14 129.03 142.94 660 147.75 172.81 661.72 182.05 195.65 661.95 195.89 202.22 661.25 203.08 215 660 286.94 296.11 658.92 296.16 301.23 660 305.18 372.42 662 372.5 402.12 664.21	num= 51 Elev Sta 668.35 118.62 661 130.2 660.61 151 661.83 185.53 661.95 196.08 661.21 203.57 660 292.1 658.92 297.06 660.06 360 662.02 376.43	Elev Sta 664.23 124.75 660.26 130.68 661 157.96 661.89 186.48 661.94 196.17 661.16 203.9 659.48 292.19 658.95 297.65 660.06 368.41 663 381.4	Elev Sta 661.35 124.85 660 138.5 661.36 165.48 661.9 195.32 661.94 196.63 661.1 204.29 659.47 295.01 659 299.62 661 368.55 662.93 385.18	Elev 661.36 660 661.49 661.89 661 659.02 659.46 661.04 663.96
Manning's n Values Sta n Val Sta 33.79 .08 124.75	num= 5 n Val Sta .1 286.94	n Val Sta .05 301.23	n Val Sta .1 372.42	n Val .08
Bank Sta: Left Right 286.94 301.23	Lengths: Left C	hannel Right 35 34.9	Coeff Contr.	Expan .3
CROSS SECTION				
RIVER: Walker Run REACH: 1	RS: 3375			
INPUT Description: FEMA BHS Station Elevation Data Sta Elev Sta 988 714 1208 1320 684.34 1338 1421.81 661.99 1423.45 1430.45 661.52 1435.64 1440 660.83 1441.57 1464.7 660.48 1468.14 1472.79 660.82 1479.61 1489.6 661.05 1495.46 1503.38 660.98 1506.72 1537.4 659.65 1538.24 1572.96 659.78 1575.61 1599.68 659.66 1601.63 1606.53 657.97 1607.99	num= 90 Elev Sta 714 1255 679.95 1360 661.86 1424.56 661 1447.71 660.71 1468.6 660.94 1480.67 661.07 1499.84 660.81 1522.07 659.65 1545.07 659.65 1545.07 659.82 1580.07 659 1604.09 658 1608.43	Elev Sta 712 1291 674.65 1420 661.76 1424.89 661 1438.89 660 1451.29 660.73 1469.2 660.94 1483.28 661.05 1502.67 659.77 1528.63 659.65 1546.45 659.7 1563.93 659.85 1586.63 658.53 1605.43 658.08 1610.14	Elev Sta 710 1305 664.54 1421.52 661.79 1426.25 661 1439.66 660 1458.24 660.75 1470.03 661 1489.17 661 1503.12 659.69 1531.51 659.64 1554.57 659.75 1569.61 659.9 1598.22 658.03 1606.47 659 1610.55	Elev 710 661.96 661.7 661 660.75 661.04 660.98 659.69 659.67 659.77 660 657.99

•				
1611.37 660 1631.33 1677.17 662.38 1679.64 1705 664.24 1800 1901 668 1908	660.32 1671.63 663 1679.72 666.74 1888 668 1932	WalkerRunf 661 1673.22 663 1680.1 668 1893 680 1957	661.4 1675.64 663 1680.34 670 1897 692 2116	662 663 670 694
Manning's n Values Sta n Val Sta 988 .08 1421.52	num= 5 n Val Sta .1 1598.22	n Val Sta .05 1611.37	n Val Sta .1 ·1705	n Val .08
Bank Sta: Left Right 1598.22 1611.37	Lengths: Left Ch	hannel Right 96 103.3	Coeff Contr.	Expan.
CROSS SECTION				
RIVER: Walker Run REACH: 1	RS: 3278			
INPUT Description: Station Elevation Data Sta Elev Sta 40.42 666.96 56.89 81.04 660.09 81.46 111.94 659.22 112.62 156.74 659.01 160.34 166.03 657.99 166.14 173.99 658.91 175.26 225 659.2 231.3 286.69 659.25 289.27 336.28 661 339.14 343.67 662.84 343.81 453 668 653	num= 52 Elev Sta 663.45 68.42 660 94.29 659.22 117.52 659 161.5 658.05 168.81 659.22 242 659.3 300.2 661.71 340.3 662.88 344.38	Elev Sta 662.57 75.07 659.62 111.19 659.24 139.22 658.49 163.91 658.44 172.27 659.05 204.68 659.3 255.25 659.49 332.26 662 341.7 662.72 345.42	Elev Sta 662.03 76.37 659.22 111.85 659.04 153.04 658.08 164.9 658.76 173.42 659.1 212.3 659.3 277.78 660 335.19 662.33 342.25 662.71 450	Elev 661 659.22 659.01 658 658.88 659.12 659.08 660.73 662.47
Manning's n Values Sta n Val Sta 40.42 .06 76.37	num= 5 n Val Sta .08 160.34	n Val Sta .05 175.26	n Val Sta .08 340.3	n Val .06
Bank Sta: Left Right 160.34 175.26	Lengths: Left Ch	nannel Right 214 204.6	Coeff Contr. .1	Expan.
CROSS SECTION				
RIVER: Walker Run REACH: 1	RS: 3065		,	
INPUT Description: FEMA BHR Station Elevation Data Sta Elev Sta 888 714 1301 1388 710 1405 1474.43 660.71 1475.09 1479.96 660.54 1481.67 1493.71 659.08 1494.24 1519.95 658.53 1527.95 1544.34 658.63 1554.25 1568.87 658.79 1569.18 1590.33 658.6 1593.99 1619.49 658.49 1620.03 1637.92 658.31 1639.65 1655.88 658.19 1663.41 1684.91 658.03 1687.34 1692.56 656.75 1692.59 1697.34 658 1701.15 1750.69 658.68 1752.38 1766.8 658.85 1771.75 1779.76 661 1780.08 1831 666 1833 2066 668 2068 2384 668 2400	num= 102 Elev Sta 714 1348 669.74 1425 660.7 1475.71 660.42 1483.06 659 1495.27 658.69 1567.38 658.78 1570.26 658.56 1601.9 658.48 1626.57 658.28 1641.75 658.17 1665.27 658.17 1665.27 658.61 1754.21 659 1773.09 661.09 1782.79 666 1844 668 2081	Elev Sta 712 1368 664.54 1465.04 660.68 1476.78 660.33 1484.98 658.97 1495.79 658.6 1534.1 658.77 1567.62 658.78 1570.92 658.5 1605.27 658.43 1627.51 658.26 1649.82 658.12 1676.69 657.5 1690.38 656.75 1694.85 656.75 1694.85 658.61 1746.13 658.63 1756.59 659.33 1775.76 662 1805 668 1849 670 2138	Elev Sta 708 1382 660.87 1473.01 660.64 1478.13 660.2 1486.52 658.96 1516.92 658.59 1542.56 658.77 1567.88 658.78 1581.03 658.47 1613.35 658.41 1628.55 658.24 1652.44 658.1 1680.99 657 1690.5 657 1690.5 657 1690.5 657 1690.5 667 1690.5 667 1690.5 667 1690.5 667 1690.5 667 1690.5 667 1690.5 667 1690.5 667 1690.5 667 1690.5 670 1777.05 664.34 1828 670 2056 670 2211	Elev 708 660.71 660.59 658.58 658.58 658.72 658.39 658.22 658.07 657.33 658.59 658.86 660.32 666.54 670 668
Manning's n Values Sta n Val Sta 888 .06 1486.52	num= 5 n Val Sta .08 1687.34	n Val Sta .05 1697.34	n Val Sta .08 1782.79	n Val .06
Bank Sta: Left Right 1687.34 1697.34	Lengths: Left Ch 129.8	nannel Right 116.6 121.4	Coeff Contr. .1	Expan.

CROSS SECTION

RIVER: Walker Run REACH: 1 RS: 2949 **INPUT** Description: Station Elevation Data num= Sta 26.4 Elev 710 Sta 17.6 Sta Elev Elev Elev Elev 706 706 710 659.48 659.08 657.82 657.76 106.73 119.65 659.92 659 109.72 131.83 659.69 659.53 118.37 141.52 172.22 202.88 224.77 658.19 134.85 658 657.78 657.76 150.6 181.6 168.39 201.25 154.47 657.77 657.02 656.97 196.62 657.01 657 656.74 657 656.79 214.52 227.96 216.28 235.14 220.44 239.37 656.88 656.95 208.06 656.81 656.86 239.92 656.85 657.76 657.21 658 657.43 658 241.06 657 244.18 246.32 658 263.53 266.22 266.62 318.22 349.25 658 290.8 658 299.61 658 658 658 335.13 658 657.93 658 657.96 366.29 412.2 657.92 376.49 657.92 388.48 398.28 657.96 418.32 658 431 658.44 449.64 444 659.6 445.6 660 448.16 660.63 661 661.67 464.54 662.65 474.11 665.45 Manning's n Values num= n Val Sta n Val Sta n Val Sta n Val n val .06 111.72 .08 214.52 .05 241.06 .08 453.68 Lengths: Left Channel Coeff Contr. Right Right Expan. 214.52 241.06 211 213.4 221.1 .1 CROSS SECTION RIVER: Walker Run REACH: 1 RS: 2730 Description: FEMA BHQ U/S XS of Walker Run Prop Bridge Station Elevation Data num= 83 lev Sta 714 -377.17 Elev Sta 714 -201.17 710 89.83 710 -107.17 -421.78 712 -122.17 -75.17 708 -57.17 89.83 694 135.83 692 162.83 262.83 325.72 346.25 658.64 202.83 686 686 304.83 680 306 319.28 658.28 658 658.33 658.24 657.34 329.58 322.31 658.18 339.2 350.92 367.4 382.57 430 352.81 345.48 658.01 656.8 362.38 374.49 656.82 656.86 656.02 655.83 656.61 656.8 656.59 656.82 360.52 656.83 370.87 656.81 656.25 655.66 656.32 656 409.31 373.85 395.38 416.6 656.02 412.81 430.27 431.42 439.81 469.29 436.88 466.97 478.25 656.32 434.92 656 442.6 456.04 656.64 464.73 656.57 472.01 656.67 474.24 656.78 656.78 656.98 476.14 656.72 656.77 479.98 656.75 656.79 481.47 656.75 656.79 486.72 484.7 490.65 491.55 656.8 656.99 658 538.29 717.97 505.42 656.98 515.12 516.8 528.2 657 657 668.42 687.12 774.2 538.41 657 658.42 662 663 754.54 818.47 739.24 664 745.24 665 668 668 792.47 829.47 832.47 805.47 666 810.47 666 668 666 1593.22 1040.47 668 1043.47 666 Manning's n Values num= Sta n Val n val n val n val n Val 687.12 .06 334 .08 416.6 .05 439.81 .08 .06 Bank Sta: Left Right 430 439.81 Lengths: Left Channel 237.4 231.9 Coeff Contr. Right Expan. 231.9 23Ŏ.8 RIVER: Walker Run RS: 2620 Description: Bridge on Site B Walker Run Distance from Upstream XS = Deck/Roadway Width

```
Weir Coefficient
                                            2.5
Upstream Deck/Roadway Coordinates
      num=
                     6
       Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord 0 673.19 0 160 673.19 0 705 668.26 667.26 716 667.65 0
                                                                            Sta Hi Cord Lo Cord
305 672.26 671.26
736 667.65 0
Upstream Bridge Cross Section Data
Station Elevation Data num=

Sta Elev Sta Ele

-421.78 714 -377.17 71

-75.17 708 -57.17 71

202.83 686 262.83 68
                                                     Sta
                                      Elev
                                                                Elev
                                                                             Sta
                                                                                       Elev
                                                                                                              Elev
                                        714 -201.17
710 89.83
                                                                                    710 -107.17
692 162.83
658.64 319.28
                                                                712 -122.17
694 135.83
                                                                                                               708
                                                                                                                688
                                                                        306
                                          686
                                                 304.83
                                                                 680
                                                                                                           658.36
                                                329.58
350.92
367.4
382.57
              658.33
658.01
                          325.72
346.25
                                     658.28
658
                                                            658.24
657.34
                                                                                    658.18
656.8
   322.31
                                                                             334
                                                                                                 339.2
                                                                                                           658.11
                                                                                               355.33
373.25
409.31
                                                                        352.81
   345.48
                                                                                                           656.83
              656.83
656.81
                                                            656.8
656.59
                                                                                    656.82
656.32
   360.52
                          362.38
                                     656.82
                                                                        370.87
                                                                                                           656.81
   373.85
                          374.49
                                     656.86
                                                                        395.38
              656.25
655.66
                          416.6
436.88
                                     656.02
655.83
                                                            656.02
656
                                                                                    656
656.32
   412.81
                                                     430
                                                                        430.27
                                                                                                431.42
                                                 439.81
                                                                          442.6
                                                                                                456.04
              656.57
656.72
                          466.97
478.25
486.72
                                                                                    656.67
656.75
656.79
                                     656.61
                                                 469.29
                                                             656.64
                                                                        472.01
                                                                                                474.24
                                                                                                           656.69
                                                                        481.47
491.55
528.2
687.12
774.2
                                                                                               482.95
492.37
                                     656.73
656.78
                                                            656.75
656.79
   476.14
                                                 479.98
                                                 490.65
516.8
               656.77
                                     656.98
657
               656.98
                          515.12
                                                             656.99
                                                                                        657
                                                                                                538.29
                   657
                          658.42
                                                 668.42
                                                                 658
                                                                                        662
                                                                                                                663
   739.24
                   664 745.24
                                          665
                                                 754.54
                                                                 668
                                                                                        668
                                                                                               792.47
   805.47
                   666
                          810.47
                                          666
                                                 818.47
                                                                 668
                                                                        829.47
                   668 1043.47
                                          666 1593.22
Manning's n Values
                                                     5
                                     num=
                                                            n Val Sta
.05 439.81
                                     n Val
.08
  Sta n Val
-421.78 .06
                              Sta
                                                     Sta
                                                                                     n Val
                                                                                                             n val
                                                  416.6
                                                                                        .08 687.12
Bank Sta: Left Right
430 439.81
                                     Coeff Contr.
                                                           Expan.
Downstream Deck/Roadway Coordinates
       Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord 0 673.19 0 130 673.19 0 575 668.26 667.26 682.2 667.65 0
                                                                            Sta Hi Cord Lo Cord
175 672.26 671.26
Downstream Bridge Cross Section Data
Station Elevation Data num=
                                                Sta
169.7
216.39
       Sta Elev
                          Sta
                                      Elev
                                                                Elev
                                                                                       Elev
   0 675
194.31 657.58
231.11 656.33
                                          666
657
                                                            662
656.69
                                                                        176
219.45
                              105
                                                                                        660
                                                                                                               658
                         211.95
                                                                                    656.65
                                                                                               222.52
                                                                                                           656.63
                                    656.33
656.07
656.09
656.08
656.05
656.06
656.04
                         241.63
275.1
                                                                        262.61
285.09
                                                 250.53
                                                              656.2
                                                                                    656.04
                                                                                               264.91
              656.06
656.09
                                                 279.86
                                                             656.07
                                                                                    656.08
                                                                                               293.79
   295.78
                          306.04
                                                 308.92
                                                             656.08
                                                                        310.65
                                                                                    656.09
                                                                                                312.14
              656.08
656.05
                          322.32
347.14
   319.96
                                                 328.92
                                                             656.06
                                                                        333.01
                                                                                    656.06
                                                                                                337.43
                                                                        354.99
371.78
   341.59
                                                 350.97
                                                             656.06
                                                                                    656.06
                                                                                                355.25
              656.06
656.04
                           356.3
386.2
                                                 365.12
390.9
                                                             656.06
                                                                                    656.05
                                                                                                378.51
   383.44
                                                             656.04
                                                                        397.79
                                                                                    656.03
                                                                                               406.48
                                     656
654.75
                                                            655.17
654.97
              656.01
654.9
                                                                        433.4
437.79
                                                                                        655
655
   418.61
                          431.55
                                                 433.09
                                                                                                433.64
                          435.69
                                                 436.92
                                                                                               438.31
                                                                                    655.89
657.05
   439.78
                   656
                          442.48
                                         656
                                                 474.44
                                                                 656
                                                                        480.93
                                                                                               496.46
                                     656.18
658.87
660.56
                                                 532.81
555.99
590.14
                           505.3
                                                                 657
                                                                        533.28
                                                                                                 540.1
                                                                                               572.87
597.54
            658
660.22
                                                                        560.72
591.26
                                                                                    659.3
660.92
   542.97
                          554.45
                                                                 659
   577.28
599.58
                          584.19
603.22
                                                             660.86
              661.63
                                     661.88
                                                 605.32
                                                                 662
                                                                        658.58
                                                                                    665.36
                                                                                               678.36
                                                                                                           665.96
                             1000
Manning's n Values
                                     num=
       Sta n Val Sta
0 .06 211.95
                                      n Val Sta
.08 431.55
                                     n Val
                                                              n Val Sta
.05 439.78
                                                              n Val
                                                                                     n Val
                                                                                                            n Val
                                                                                      .08 590.14
Bank Sta: Left Right
431.55 439.78
                                     Coeff Contr.
                                                           Expan.
                                                                           0 horiz. to 1.0 vertical 0 horiz. to 1.0 vertical
Upstream Embankment side slope
Downstream Embankment side slope
Maximum allowable submergence for weir flow =
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
                                                                         .98
Weir crest shape
                                                               = Broad Crested
```

Number of Piers = 4

```
Pier Data
Pier Station
                                          330.2
                                                                            300.2
                        Upstream=
                                                       Downstream=
Upstream
                  num=
                             width
                                         Elev
     Width
                 Elev
                              2 671.26
                     0
          2
Downstream
                     num=
      Width
                 Elev
                             Width
                                         Elev
                                 2 671.26
         2
Pier Data
Pier Station
                                        410.2
                       Upstream=
                                                       Downstream= \ 380.2
Upstream
                  num=
                             width
                                         Elev
     Width
                 Elev
                             2 671.26
2
                     0
         2
Downstream
                     num=
     width
                 Elev
                            Width
                                         Elev
                                2 671.26
Pier Data
Pier Station
                                          490.2
                                                                            460.2
                        Upstream=
                                                       Downstream=
Upstream
                  num=
                             Width
     Width
                 Elev
                                         Elev
                   0
                              2 671.26
         2
Downstream
                     . num=
                 Elev
                            Width
                                        Elev
     Width
                                 2 671.26
Pier Data
Pier Station
                                                                            540.2
                                          570.2
                        Upstream=
                                                       Downstream=
Upstream
                  num=
                             Width
                                         Elev
     Width
                 Elev
         2
                     0
                               2 671.26
Downstream
                     num=
                                      2
      Width
                             Width
                                         Elev
                 Elev
                     0
                                 2 671.26
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 =
                                                                 1.5
                                                               .8
658.5
               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
CROSS SECTION
RIVER: Walker Run
REACH: 1
                                      RS: 2497
Description: D/S XS of Walker Run Prop Bridge
Station Elevation Data num= 72
                                                                                               Sta
194.31
231.11
272.27
295.78
319.96
341.59
355.57
                         Sta
169.7
216.39
250.53
                                         Elev
                                                     Sta
176
                                                                                        Elev
                                                                                                            Elev
657.58
       Sta
                 Elev
                                                                Elev
                                                                             Sta
                                                                        182
222.52
264.91
293.79
312.14
                  663
657
                                          662
                                                                 660
                                                                                    658
656.63
656.09
656.09
656.06
656.05
656.05
656.29
655.29
657.71
                                                219.45
262.61
285.09
310.65
                                                             656.65
656.04
   211.95
                                      656.69
                                                                                                            656.33
                                     656.2
656.07
656.08
656.06
656.06
656.04
              656.33
   241.63
                                                                                                            656.06
                          279.86
308.92
              656.07
656.09
                                                             656.08
656.09
    275.1
                                                                                                            656.09
   306.04
                                                                                                            656.08
                                                310.05
333.01
354.99
371.78
397.79
433.4
437.79
                                                                        337.43
355.25
378.51
406.48
             656.08
656.05
656.06
656.04
                                                             656.06
656.05
656.03
                          328.92
350.97
   322.32
347.14
                                                                                                            656.05
                                                                                                            656.06
                                                                                                383.44
418.61
433.9
439.78
                         365.12
390.9
    356.3
386.2
                                                                                                            656.04
                                                                                                            656.01
              656
654<u>.7</u>5
                                     655.17
654.97
                                                                 655
655
   431.55
                          433.09
                                                                         433.64
                                                                                                             654.9
                                                                         438.31
                         436.92
   435.69
                                                                                                                656
                         474.44
532.81
                                                             655.89
657.05
                                                                                                501.55
542.97
                  656
                                          656
657
                                                 480.93
                                                                        496.46
  442.48
505.3
                                                                                                                656
                                                 533.28
              656.18
                                                                          540.1
                                                                        585.34
   554.45
              658.87
                          555.99
                                          659
                                                 560.72
                                                               659.3
                                                                                     660.05
                                                                                                           665.36
                                                                                                658.58
```

î.

	WalkerRunFld	
678.36 665.96 682.31	667.16	•
Sťa n Val Sta	num= 5 n Val Sta n Val Sta n Val Sta .08 431.55 .05 439.78 .08 585.34	
Bank Sta: Left Right 431.55 439.78	Lengths: Left Channel Right Coeff Contr. 33.8 35.1 35.9 .3	Expan.
CROSS SECTION		
RIVER: Walker Run REACH: 1	RS: 2462	
Sta Elev Sta 0 662 26 194.47 657.86 200.62 233.59 656 244.38 262.67 655.9 264.18 289.65 655.91 298.05 333.33 655.24 335.99 345.99 655 347.04 358 655 465 512.02 657 515.93 546.52 659 555.06	num= 51 Elev Sta Elev Sta Elev Sta 662 70.39 659.98 130.3 658.42 191.55 657.68 214.06 657.25 223.61 657 230.7 655.94 249.84 655.91 254.12 655.9 258.8 655.9 270.27 655.9 276.39 655.9 283.92 655.91 321.59 655.41 325.07 655.33 330.35 655.23 339.76 655.14 344.9 655.03 345.18 654.92 350.97 654.61 354.06 654.81 357.06 655 475 656 510.01 656.95 510.72 657.74 517.81 658 537.09 658.53 543.64 659.14 560.39 659.8 629.95 661.26 684.19	Elev 657.89 656.3 655.9 655.9 655.02 655.02 655.04 658.86 664.6
	num= 5 n Val Sta n Val Sta n Val Sta .08 345.99 .05 357.06 .08 510.01	
Bank Sta: Left Right 345.99 357.06	Lengths: Left Channel Right Coeff Contr. 117 123 126.5 .1	Expan.
CROSS SECTION		
RIVER: Walker Run		
REACH: 1	RS: 2339	
INPUT Description: FEMA BHP Station Elevation Data		Elev 680 669 664 655.77 655.27 655.23 655.23 655.25 655.48 655.40 656.87 656.87 658.48 659.96
INPUT Description: FEMA BHP Station Elevation Data Sta Elev Sta 1002.3 712 1055.3 1360.3 680 1410.3 1601.8 668 1634.5 1787.68 662.91 1824.83 2212.33 656.29 2214.36 2228.06 655.7 2234.48 2250.48 655.26 2254.59 2264.33 655.23 2266.6 2308.41 655.33 2315.43 2337.74 655.21 2341.08 2348.65 655.28 2349.76 2354.43 655.29 2254.59 2414.16 655 2414.9 2418.2 654.44 2421.13 2450.38 656.73 2463.09 2496.25 657 2496.41 2528.18 658.55 2530.86 2603.04 660.02 2606.09	num= 101 Elev Sta Elev Sta Elev Sta 710 1070.3 710 1208.3 700 1293.3 688 1538.7 680 1583.6 670 1592.4 667 1747.5 666 1757 665 1776 659.26 1888 659.65 2100 657.34 2209.01 656.48 2216.73 656.27 2220.07 656 2226.21 655.47 2237.75 655.41 2241.37 655.39 2244.6 655.31 2257.14 655.25 2262.59 655.21 2264.25 655.32 2321.54 655.25 2300.54 655.33 2303.12 655.32 2321.54 655.27 2325.04 655.23 2347.67 655.35 2350.65 655.43 2351.77 655.48 2352.92 655.48 2358.37 655.47 2361.11 655.42 2413.3 654.46 2415.59	680 669 664 656.91 655.77 655.27 655.23 655.23 655.25 655.44 656.9 656.87 658.88 659.96
INPUT Description: FEMA BHP Station Elevation Data	num= 101 Elev Sta Elev Sta Elev Sta 710 1070.3 710 1208.3 700 1293.3 688 1538.7 680 1583.6 670 1592.4 667 1747.5 666 1757 665 1776 659.26 1888 659.65 2100 657.34 2209.01 656.48 2216.73 656.27 2220.07 656 2226.21 655.47 2237.75 655.41 2241.37 655.39 2244.6 655.31 2257.14 655.25 2262.59 655.21 2264.25 655.24 2299.05 655.35 2300.54 655.33 2303.12 655.32 2321.54 655.27 2325.04 655.26 2333.98 655.21 2343.81 655.21 2345.91 655.23 2347.67 655.48 2358.37 655.47 2361.11 655.48 2352.92 655.48 2358.37 655.47 2361.11 655.24 24417.86 655.2428.82	680 669 664 656.91 655.77 655.27 655.23 655.25 655.48 655.01 654.38 656.9 656.87 658.48 659.96

RIVER: Walker Run RS: 2274 TNPUT Description: Station Elevation Data 100 num= Sta -46.1 89.33 127.83 151.42 174.69 178.84 187.03 Sta Elev -75 664 Elev 663.17 Elev Elev Sta Sta Sta Elev 659.97 656.49 16.47 96.48 657.72 656 45.83 -23 93.94 -75 664 67.54 658.17 123.78 655.21 145.96 655.07 171.56 655.05 178.01 655.06 185.32 655.05 198 654.86 206.05 654 656.46 655.09 655.06 655.06 655.06 115.41 655.33 655.09 128.92 157.67 177.39 655.09 655.04 136.61 138.38 655.08 655.04 655.06 167.72 177.55 158.35 655.05 655.06 655.06 177.46 655.06 180.13 181.79 655.06 183.41 655.05 655.04 653.95 655 188.39 201.75 187.03 190.37 655.03 197.78 199.56 206.47 654 205.3 220.33 653.98 203.12 653.9 206.05 654.2 216.7 231.37 654 208.38 655 655 226.47 238.01 655 655 222.84 236.43 655 228.67 655 655 234.06 655 655 655 239.75 655 243.55 655 241.29 655 249.93 258.3 267.98 655 253.81 655 256.01 655 257.29 259.56 274.42 262.07 285.91 655 655 655 655 655 260.69 655 263.95 655 279.63 655 655 289.82 292.73 655 299.5 310.99 297.33 655 301.91 655 655 303.86 655 306.15 655 308.81 655 348.92 655.98 349.83 656.02 369.84 658.08 460.9 659.19 655.4 655.99 655 655.98 657 655 655.99 657.7 314 326.12 329.29 655.44 349.18 360.13 382.25 557.25 349.06 356.2 376.37 507.83 349.26 362.04 349.69 656 364.41 658.04 658 658.13 659.46 658.96 658.34 455.12 448.6 659.08 660.35 636 663.34 650.4 665.34 Manning's n Values num= 6 Sta n Val -75 .06 n Val Sta n Val n Val Sta .08 197.78 Sta n Val Sta n Val 89.33 -46.1 .06 .05 208.38 .08 349.83 .06 Bank Sta: Left Right 197.78 208.38 Lengths: Left Channel 136.2 136.2 Coeff Contr. Right 129.1 Expan. 136.2 .1 CROSS SECTION RIVER: Walker Run REACH: 1 RS: 2139 TNPUT Description:
Station Elevation Data

Sta Elev Sta
-101 660.01 41.82
306.47655.5074 313.91
340.14 656 343.15
368.38 654.49 386.15
396.46 654.13 397.8
414.8 654.09 416.99
432.95 654.07 441.66
463.62 654.06 467.64
489.58 653.78 492.25
518.06 654.42 524.76
556.53 654.62 558.69
595.53 654.97 596.52 Description: num= 70 Elev Sta 658.6 77.75 655.54 324.93 655.59 347.59 654.15 388.45 654.13 405.14 654.08 422.83 654.07 446.94 654.05 471.35 653.31 495.12 num= Elev Sta Elev 217.23 654.68 334.22 656 350.81 654.89 394.41 654.14 E]ev 655.4 305.8 336.38 353.02 654.64 306.47655.5074
340.14 656
368.38 654.49
396.46 654.13
414.8 654.07
463.62 654.06
489.58 653.78
518.06 654.42
556.53 654.62
595.53 654.97
604.68 656.84
636.66 657.56 656 654.89 654.14 654.87 655 394.86 413.09 428.92 460.16 488.21 503.87 654.14 654.11 654.08 654.07 654.14 406.63 425.39 449.97 476.36 495.94 548.38 654.1 654.08 654.06 654.09 654.08 654.06 446.94 471.35 495.12 534.26 569.44 597.08 608.39 818.4 654.05 653.81 654.7 654.65 654.03 654 653.31 654.54 654.62 654 654.2 654.64 555.21 583.54 654.62 579.37 600.77 614.45 654.7 655.89 657.14 654.76 596.52 605.35 767.34 654.99 655 657.09 601.22 656 657 658.35 657.36 626.18 659.6 905 662.46 916.1 663.58 Manning's n Values num= Sta n Val Sta -101 .06 340.14 n Val n val Sta .08 488.21 n Val n Val Sta 600.77 Sta n val .05 495.94 .08 .06 Lengths: Left Channel 126.7 129 Bank Sta: Left Right 488.21 495.94 Coeff Contr. Right 129.7 Expan. .3 .1 CROSS SECTION RIVER: Walker Run REACH: 1 RS: 2010 Description: FEMA BHO 96 Station Elevation Data num= Elev Elev Elev Flev Sta Sta Sta Sta Sta Flev Page 42

1190 690 1390 1682 662 1798 2300 655.95 2460 2636.82 654.74 2662.58 2682.97 655 2685.25 2707.11 654.81 2722.01 2753.12 653.59 2760.72 2779.62 653.17 2783.13 2800.7 653.35 2803.83 2825.18 653.85 2832.33 2834.88 653.81 2835.73 2837.86 653.8 2838.52 2842.43 653.72 2849.7 2874.36 652.7 2876.58 2882.28 653.13 2896.3 2938.69 654.66 2984.34 2969.66 654.66 2984.34 2989.51 656 2993.12	WalkerRunFld 690 1512 690 1531 700 153 659.74 2030 656.54 2295 655.65 223 655.95 2470 654.34 2475 655.95 266 654.93 2666 655 2667.83 655 2668. 655 2690.83 655 2698.43 655 2698. 654.57 2737.58 654.07 2738.89 654.03 2739. 653.46 2761.93 653.44 2767.05 653.33 2777.4 653.15 2790.43 653.22 2794.01 653.22 2796.3 653.82 2832.84 653.82 2833.41 653.81 2833. 653.81 2836.34 653.81 2836.82 653.81 2833. 653.82 2839.4 653.82 2833.41 653.81 2833. 653.8 2839.4 653.72 2840.29 653.77 2841. 653.8 2839.4 653.73 2840.29 653.77 2841. 653.8 2839.4 653.79 2840.29 653.79 2841. 653.49 2916.66 654 2922.94 654.29 2925.6 654.32 2931.58 654.29 2933.44 654.27 2935. 655.2 2984.5 655.03 2985.31 655.19 2988. 655.7 2994.67 657 3230 659.65 33.4	98 654.34 654.74 655,78 655 78 653.22 97 653.23 31 653.81 12 653.83 69 654.58 69 654.58
	num= 5 n Val Sta n Val Sta n Val 5 .08 2870.92 .05 2879.56 .08 2994.6	ta n Val 67 .06
Bank Sta: Left Right 2870.92 2879.56	Lengths: Left Channel Right Coeff Control 84.1 85.6 88.3 .1	r. Expan. .3
CROSS SECTION		
RIVER: Walker Run REACH: 1	RS: 1925	·
INPUT Description: Station Elevation Data Sta Elev Sta -232.06 658.01 -166.67 83.73 655 84.22 88.89 655 93.3 152.32 653.06 154.68 172.47 653.3 191.08 214.31 652.07 215.72 232.09 653.08 233.06 241.45 653.12 250.54 258.5 653.2 261.07 291.28 653.15 296.08 368.74 655.3 496.43	655.4 34.55 654.38 78.78 654.68 83.5 655 84.97 655 85.45 655 87.6 655 100.05 655 121.59 654.03 137.5 653.02 155.34 653.01 155.95 653.02 157.3 653.12 204.42 653 209.26 653 211.6 652.3 218.15 652.69 218.56 652.74 219.8 653.09 233.24 653.09 236.42 653.1 238.5 653.19 250.85 653.19 251.07 653.19 252.2 653.2 268.26 653.2 272.82 653.2 283.2	04 655 98 653.3 12 653.03 05 652.67 85 653 98 653.11 26 653.2
Manning's n Values Sta n Val Sta -232.06 .06 121.59		ta n Val 34 .06
Bank Sta: Left Right 209.26 219.85	Lengths: Left Channel Right Coeff Control 282.6 325.9 321 .1	r. Expan.
CROSS SECTION		
RIVER: Walker Run REACH: 2	RS: 1602	
INPUT Description: Station Elevation Data Sta Elev Sta -627.1 658.01 -562.09 48.57 654.71 66.44 91.51 650.67 93.9 108.02 654.27 243 560.78 658.01	num= 21 Elev Sta Elev Sta Elev Sta 656.01 -429.8 655.01 -285.4 654.01 20.8 654.61 72.14 654.79 85.07 654.21 87.8 650.84 96.86 651.6 98.18 651.9 100 654.08 428.23 655.01 456.83 656.01 487.3	32 651.4 .7 654.03
Manning's n Values Sta n Val Sta -627.1 .08 85.07	num= 3 n Val Sta n Val .06 100.7 .08	
Bank Sta: Left Right 85.07 100.7	Lengths: Left Channel Right Coeff Conta 202.2 203.5 203 .1	r. Expan.

CROSS SECTION

		· ·	
RIVER: Walker Run REACH: 2	RS: 1402		
INPUT Description: Station Elevation Data Sta Elev Sta -214.73 660.01 -151.73 -47.9 653.01 -26.6 143.69 653.86 148.69 156.89 651.34 158.69 165.69 649.95 166.99 172.09 654.15 177.99 246.57 653.84 359.8 536.5 656.01 540.2	num= 38 Elev Sta Elev 657.01 -116.53 656.01 653.01 61.72 652.96 654.03 153.69 654.21 650.52 160.49 650.2 650.67 168.49 651.36 653.93 183.69 653.92 654.16 416.89 654.15 657.01 548.5 658.01	Sta Elev Sta Ele -65.33 655.01 -57.33 654.0 129.69 653.53 136.69 653. 156.09 654.04 156.39 652. 161.99 649.8 163.69 649.8 169.29 651.84 169.89 653.6 187.1 653.79 232.35 653.3 519.9 654.01 527.8 655.0	01 .6 .1 32 54 34
Manning's n Values Sta n Val Sta -214.73 .08 156.09	num= 3 n Val Sta n Val .06 169.89 .08		
Bank Sta: Left Right 156.09 169.89	Lengths: Left Channel 183 194	Right Coeff Contr. Expa 196.3 .1 .3	
CROSS SECTION			
RIVER: Walker Run REACH: 2	RS: 1208		
INPUT Description: FEMA BHN Station Elevation Data Sta Elev Sta 1000 724.54 1035 1190 694.84 1225 1528 665.15 1570 1765 651.34 2205	num= 18 Elev Sta Elev 719.34 1060 714.65 689.54 1265 684.95 659.45 1680 651.74 659.24 2220 664.24	Sta Elev Sta Ele 1080 709.34 1165 699.5 1380 674.54 1470 669.6 1740 651.34 1752 650.7	54 55
Manning's n Values Sta n Val Sta 1000 .08 1740	num= 3 n Val Sta n Val .06 1765 .08		
Bank Sta: Left Right 1740 1765	Lengths: Left Channel 228.9 218.5	Right Coeff Contr. Expa 209.9 .1 .3	
CROSS SECTION			
RIVER: Walker Run REACH: 2	RS: 990		
INPUT Description: Station Elevation Data Sta Elev Sta -41.4 660.01 -4.3 125.76 650.82 126.92 138.23 653.22 149.36 497.17 656.01 516.5	num= 17 Elev Sta Elev 656.01 32.63 652.9 650.45 132.87 649.47 652.61 186.43 652.59 658.01	135.28 649.66 136.76 650.4 234.63 654.38 362.19 653.4)7 3
Manning's n Values Sta n Val Sta -41.4 .08 118.97	num= 3 n Val Sta n Val .06 138.23 .08		
Bank Sta: Left Right 118.97 138.23	Lengths: Left Channel 56.8 56.5	Right Coeff Contr. Expa 58.9 .1 .3	
CROSS SECTION			
RIVER: Walker Run REACH: 2	RS: 933	•	
INPUT Description: FEMA BHM		Day 44	

```
WalkerRunFld
                                        num=
                                                        26
Station Elevation Data
       Sta E.C.
1000 724.54
                 Elev
                                Sta
                                          Elev
                                                         Sta
                                                                    Elev
                                                                                             Elev
                                                                                                           Sta
                                                                                                                  704.34
      1000
                               1035
                                        719.54
                                                        1088
                                                                 714.74
                                                                                 1120
                                                                                          710.04
                                                                                                          1152
               699.74
                               1238
1445
      1200
                                        694.84
                                                        1270
                                                                 689.84
                                                                                 1290
                                                                                          684.65
                                                                                                          1340
                                                                                                                   679.95
               674.95
                                        669.34
649.74
                                                                                 1530
1750
      1402
                                                        1480
                                                                664.45
                                                                                          659.74
                                                                                                          1590
                                                                                                                 654.45
                                                                                          654.54
      1700
               650.95
                               1710
                                                        1720
                                                                 650.65
                                                                                                          1900
                                                                                                                   657.04
      2080
               659.84
                               2200
                                        663.45
                                                        2300
                                                                 663.65
                                                                                 2400
                                                                                          663.45
                                                                                                          2500
                                                                                                                   664.95
      2590
               664.34
Manning's n Values
                                        num=
       Sta n Val
                                Sta
                                                         Sta
      1000
                   .09
                               1700
                                            .05
                                                        1720
                                                                      .09
                          Right
1720
Bank Sta: Left
                                        Lengths: Left Channel
                                                                             Right
                                                                                             Coeff Contr.
                                                                                                                    Expan.
               1700
                                                      48.7
                                                                  48.4
CROSS SECTION
RIVER: Walker Run
                                        RS: 884
Description: U/S XS of Farm Road Culvert
Station Elevation Data
                                     num≔
   Sta Elev Sta

-288 691.97 -147.11

71.68 653.18 101.89

123.02 648.62 125.03

524 662.27 538
                                                        Sta
                                                                    Elev
                                                                                             Elev
                                                                                  Sta
                                        671.47 -33
653.2 117.08
649.16 129.44
                                                                660.01
652.72
653.21
                                                                               12.49
                                                                                          656.08
                                                                                                        52.79
                                                                                                                   653.68
                                                                                          649.74
652.41
                                                                               120.1
                                                                                                        121.4
                                                                                                                   649.01
                                                                             174.49
                                                                                                      194.38
                                        663.17
                                                      560.8
                                                                 664.45
                                                                             607.89
Manning's n Values
                                        num=
                                       n Val Sta
.05 129.44
      Sta n Val Sta
-288 .09 117.08
                                                         Sta
                                                                  n Val
Bank Sta: Left Right 117.08 129.44
                                        Lengths: Left Channel 20.6 19.1
                                                                             Right
19.6
                                                                                             Coeff Contr.
                                                                                                                    Expan.
Ineffective Flow num= 2

Sta L Sta R Elev Permanent

-288 112.93 652.53 F

133.68 607.89 652.53 F
RIVER: Walker Run
REACH: 2
                                        RS: 875
Description: Private Farm Road
Distance from Upstream XS =
Deck/Roadway Width = Weir Coefficient =
Upstream Deck/Roadway Coordinates
                     17
  Sta Hi Cord Lo Cord
12.14 656.071 656.071 52.52 653.686 653.686
115.86 653.386 649.74 122.61 652.528 648.62
124.23 652.54 648.9 130.22 653.444 653.21
194.42 653.1 652.9 217.91 652.805 652.805
465.08 656.47 656.47 522.51 662.265 662.265
535.81 663.177 663.177 535.99 663.037 663.037
                                                                            Sta Hi Cord Lo Cord
71.38 653.5 653.18
122.83 652.53 648.66
173.58 653.2 652.41
378.6 653.084 653.084
535.78 663.101 663.101
Upstream Bridge Cross Section Data
Station Elevation Data
                                        num=
                                                       20
                                       Elev Sta
671.47 -2.11
653.2 116.89
648.62 124.23
652.9 297.89
  sta Elev Sta
-322.11 691.97 -147.11
71.38 653.18 101.3
121.18 649.01 122.65
173.58 652.41 194.42
                                                                    Elev
                                                                                             Elev
                                                                                  Sta
                                                                656.57
652.72
648.9
                                                                             12.14 656.071
120.15 649.74
124.43 649.16
                                                                                         556.071 52.52 653.686
649.74 120.82 648.93
649.16 129.48 653.21
                                                                 656.07
                                                                             337.89
                                                                                                      607.89
Manning's n Values
Sta n Val Sta
-322.11 .09 116.89
                                        num=
                                       n Val
                                                         Sta
                                                                 n Val
                                           .05 129.48
Bank Sta: Left Right
116.89 129.48
                                        Coeff Contr.
                                                               Expan.
Ineffective Flow
                               num=
    Sta L Sta R
                              Elev Permanent
```

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```
-322.11 112.93 652.53
133.68 607.89 652.53
 Downstream Deck/Roadway Coordinates
         num=
                             24
    num= 24
Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord 12.14 656.071 656.071 52.52 653.686 653.686 77.11 653.4 652.55
115.86 653.386 651.91 122.61 652.528 649.92 122.73 652.53 650.54
122.85 652.53 651.24 123.07 652.53 651.64 123.32 652.53 650.54
123.57 652.53 651.64 123.79 652.53 651.24 123.91 652.53 650.8
124.03 652.53 650.11 126.1 652.53 648.93 130.22 653.444 649.62
136.9 653.4 652.21 185.27 653.2 652.86 217.91 652.805 652.8
378.6 653.084 653.084 465.08 656.47 656.47 522.51 662.265 662.265
535.78 663.101 663.101 535.81 663.177 663.177 535.99 663.037 663.037
 Downstream Bridge Cross Section Data
                                                                           18
                                                       Elev Sta Elev
671.47 -2.11 656.57
651.91 123.34 649.92 1
649.62 136.9 652.21 1
656.67 607.89 664 667
 Station Elevation Data num
                                                                                                            Sta Elev Sta Elev
12.14 656.071 52.52 653.686
124.03 650.11 125.51 649.41
185.27 652.86 218.62 652.8
           Sta
                         Elev
                                            Sta
   Sta Elev Sta

-322.11 691.97 -147.11

77.11 652.55 116.71

126.1 648.93 130.12

297.89 656.07 337.89
 Manning's n Values
                                                         num=
   Sta n Values
-322.11 .09 116.71
                                                        n Val
                                                                                Sta
                                                                                             n Val
                                                                        136.9
                                                           .05
                                                                                                 .09
 Bank Sta: Left Right 116.71 136.9
                                                         Coeff Contr.
                                                                                         Expan.
116.71 136.9

Ineffective Flow num= 2

Sta L Sta R Elev Permanent
-322.11 109 652.53 F
                                                                     2 .3
           136 607.89 652.53
                                                                                                                 O horiz. to 1.0 vertical O horiz. to 1.0 vertical
 Upstream Embankment side slope
Downstream Embankment side slope
                                                                                               =
maximum allowable submergence for weir flow =
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
weir crest shape =
                                                                                                              .98
                                                                                                        654.4
                                                                                                = Broad Crested
 Number of Culverts = 1
Culvert Name Shape Rise Span

Culvert #1 Circular 2.75

FHWA Chart # 2 - Corrugated Metal Pipe Culvert

FHWA Scale # 3 - Pipe projecting from fill

Solution Criteria = Highest U.S. EG

Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef

2.2 14.9 .023 .023 .1 .9

Upstream Elevation = 648.96

Centerline Station = 123.3

Downstream Elevation = 649.411
                                                                                                                                                                                      Exit Loss Coef
 Downstream Elevation = 649.411
                        Centerline Station = 123.2
 CROSS SECTION
 RIVER: Walker Run
                                                         RS: 863
 REACH: 2
 TNPUT
 Description: D/S XS Farm Road Culvert
                                                                        15
 Station Elevation Data num=
       Sta Elev Sta

-294 691.97 -147.11

72.57 652.55 113.12

133.22 652.21 182
                                                        Elev Sta
671.47 -22.2
651.91 120.43
652.85 214.18
                                                                                                Elev
                                                                                                                                  Elev
                                                                                                                                                      Sta
                                                                                                                                                                     Elev
                                                                                                             24.99 655.04
123.41 648.96
                                                                                                                                                               653.86
649.62
                                                                                           660.01
649.92
                                                                                                                                                 34.67
                                                                                                                                                 126.4
                                                                                                                                                      588
                                                                                             652.8
                                                                                                             518.46
                                                                                                                                                                664.67
                                                                                                                            662.27
 Manning's n Values
                                                         num=
          Sta n Val Sta
-294 .09 113.12
                                                         n val
                                                                                 Sta
                                                                                             n Val
                                                            .05 133.22
                                                         Lengths: Left Channel
157.2 147.1
 Bank Sta: Left Right 113.12 133.22
                                                                                                             Right
138.4
                                                                                                                                  Coeff Contr.
 Ineffective Flow num=
Sta L Sta R Elev
-294 109 652.53
                                                                      2
                                                         Permanent
                                                                    F
```

136 588 652.53 F

CROSS SECTION

RIVER: Walker Run REACH: 2 RS: 715 INPUT Description: Station Elevation Data num= 17 Elev 655.41 648.52 648.52 Sta Elev Sta 40.88 653.76 46.14 104.64 647.91 107.47 114.47 650.93 126.37
 Sta
 Elev
 Sta

 -92.4
 658.01
 2.21

 100.08
 650.67
 101.47

 110.34
 648.14
 111.67

 278.3
 653.09
 365.34
 Elev Elev 46.14 107.47 77.95 653.57 77.95 651.4 647.9 108.96 648.04 650.97 191.93 651.64 651.4 656.46 Manning's n Values
Sta n Val Sta
-92.4 .09 100.08 num= n Val Sta .05 114.47 n val .09 Bank Sta: Left Right 100.08 114.47 Lengths: Left Channel Right Coeff Contr. Expan. 172 178.4 188.1 .1 . 3 CROSS SECTION RIVER: Walker Run RS: 536 REACH: 2 **INPUT** Description: 16 Station Elevation Data num= Sta Elev Sta -86.6 657.01 -45.02 170.47 649.65 172.89 182.05 647.71 182.91 269.71 656.85 Elev Sta Elev 655.01 5.76 652.05 647.93 174.84 647.22 648.29 184.3 650.54 Sta Elev Elev 48.16 650.97 149.99 651.14 176.44 647.18 179.25 646.97 176.44 191.59 650.96 206.95 652.58 Manning's n Values 3 num= Sta n Val Sta 86.6 .09 170.47 n Val n Val Sta 184.3 . .09 .05 Lengths: Left Channel Right 110.1 Bank Sta: Left Coeff Contr. Right 184.3 Expan. 89.9 107 170.47 .1 . 3 CROSS SECTION RIVER: Walker Run RS: 428 REACH: 2 INPUT Description: FEMA BHL 19 Station Elevation Data num= Sta Elev 1000 686.54 1150 664.54 1430 647.24 1750 661.74 Sta 1050 Elev Elev Sta Elev Sta Elev 679.84 655.54 684.84 674.45 651.74 656.65 1130 669.65 1090 1110 1250 1550 659.34 1350 1605 1410 649.34 1210 1440 649.65 654.34 1630 659.45 1860 664.45 1880 666 2920 666 Manning's n Values num= Sta n Val 1000 .09 Sta 1410 n Val Sta n Val .05 1440 Right Coeff Contr. Bank Sta: Left Right 1440 Lengths: Left Channel Expan. 1410 84.2 119.6 CROSS SECTION RIVER: Walker Run RS: 350 REACH: 2 INPUT Description: 18 Station Elevation Data num=

Sta Elev 30.04 652.51

Sta

Elev

Sta Elev 7.67 656.47

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Sta

50.26 651.27 122.31 650.39 128.41 647.64

Elev

Sta

Elev

```
WalkerRunFld
  131.05 647.09 132.71 647.08 135.14 647.17 138.64 647.65 139.08 648.11 140.48 648.18 141.29 649.59 150.13 650.23 156.97 649.72 249.39 650.76 267.01 652.4 309.86 655.02 325.84 655.85
                       309.86
                                             325.84
                                                       655.85
Manning's n Values
                                  num=
                                                 3
      Sta n Val Sta
7.67 .09 122.31
                                  n Val
                                                Sta
                                                         n val
                                    n Val Sta
.05 141.29
Bank Sta: Left Right 122.31 141.29
                                  Lengths: Left Channel
                                                                  Right
165.9
                                                                               Coeff Contr.
                                                                                                   Expan.
                                            169.4
                                                       222.4
CROSS SECTION
RIVER: Walker Run
REACH: 2
                                  RS: 185
INPUT
Description:
Station Elevation Data
                                               20
                                  num=
                       Sta
15.53
33.4
44.77
                                  Elev
658.78
647.67
646.96
                                             Sta
23.2
34.97
46.4
      Sta Elev
8.8 659.55
                                                          Elev
                                                                      Sta
                                                                               Elev
                                                                                           Sta
                                                                                                     Elev
                                                                   25.13
37.17
49.26
                                                                                        29.31
40.26
59.74
                                                       653.48
646.89
647.15
                                                                             652.64
                                                                                                  649.46
                                                                            646.4
649.32
655.74
    32.38 649.12
                                                                                                  646.66
           646.41
                                                                                                  649.89
  197.88 650.38
                      234.08
                                  652.49
                                            273.02
                                                       654.62
Manning's n Values
Sta n Val
                                  num=
                        Sta
32.38
                                  n Val
                                                 Sta
                                                         n Val
                                      .05
                                              49.26
                                                                  Right 36.4
Bank Sta: Left
                                  Lengths: Left Channel
                      Right
                                                                               Coeff Contr.
                                                                                                   Expan.
           32.38
                      49.26
                                              39.3
                                                           58
CROSS SECTION
RIVER: Walker Run
REACH: 2
                                  RS: 147
INPUT
Description: FEMA BHK
Station Elevation Data
                                  num=
                                               27
      Sta
               Elev
                           Sta
                                    Elev
                                                 Sta
                                                          Elev
                                                                                                    Elev
                                                                      Sta
                                                                                           Sta
                                                       691.54
681.65
                                                                                                  687.54
676.95
           699.45
                                                1100
     1000
                          1040
                                  694.84
                                                                     1170
                                                                             689.54
                                                                                          1210
                                               1400
1580
     1260 682.65
                          1340
                                  684.95
                                                                     1440
                                                                            679.65
                                                                                          1490
     1530
           674.84
                          1555
                                  669.65
646.74
654.74
                                                       664.34
649.34
                                                                     1610
                                                                            659.24
                                                                                          1640
                                                                                                  655.04
     1650
           649.45
                          1660
                                                1670
                                                                     1750
                                                                                          1830
                                                                                                  654.84
                                                                             651.74
     1870
           655.84
                          1900
                                                1925
                                                        659.34
                          3100
Manning's n Values
                                  num=
                                  n Val
      Sta n Val
                           Sta
                                                 Sta
                                                         n Val
                .09
                          1650
                                               1670
                      Right
1670
Bank Sta: Left
                                  Lengths: Left Channel 138.5 154.5
                                                                  Right
134.1
                                                                               Coeff Contr.
                                                                                                   Expan.
CROSS SECTION
RIVER: Walker Run
REACH: 2
                                  RS: 011
Description: U/S XS of Market Street Bridge
Station Elevation Data num= 19
 Sta Elev
-177.52 656.04
53.81 646.7
64.38 648.11
                       Sta
33.24
54.7
69.53
                                    Elev
                                                Sta
                                                          Elev
                                                                      Sta
                                                                               Elev
                                                                                           Sta
                                                                                                    Elev
                                                       652.67
645.71
649.32
653.77
                                  653.12
645.84
648.34
                                              38.49
57.12
79.21
                                                                   45.07
                                                                            649.46
645.74
                                                                                        51.29
61.18
                                                                                                   648.2
                                                                   59.41
                                                                                                  646.53
                                                                  111.92
                                                                            649.09
                                                                                         167.8
                                                                                                   651.4
                      251.06
           651.46
                                  651.01
                                              293.8
Manning's n Values
                                  num=
                                                 3
      Sta n Val
7.52 .09
                                  n Val
                          Sta
                                                Sta
                                                         n val
                        51.29
                                    .05
                                              64.38
                                  Lengths: Left Channel
Bank Sta: Left Right 51.29 64.38
                                                                  Right 43.7
                                                                               Coeff Contr.
                                                                                                   Expan.
                                              39.9
Ineffective Flow
                        num=
```

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```
Sta L Sta R Elev
.77.52 42 652.95
                                      Elev Permanent
   -177.52
            90 352.41 652.95
BRIDGE
RIVER: Walker Run
                                                    RS: -10
REACH: 2
TNPUT
Description: Market Street
Distance from Upstream XS = Deck/Roadway Width = Weir Coefficient =
                                                               8.5
                                                             24.9
Upstream Deck/Roadway Coordinates
num= 19
        num=
  num= 19
Sta Hi Cord Lo Cord
-172.52 655.288
44.69 654.155
62.61 656.065 647.975
65.9 656.125 650.675
69.6 656.065 647.975
98.44 654.145
                                                     Sta Hi Cord Lo Cord
32.59 653.113
62.11 656.025 644.195
63.5 656.085 649.645
66.3 656.125 650.645
70 656.045 646.915
                                                                                                         Sta Hi Cord Lo Cord
                                                                                                    44.69 652.945
62.5 656.045 646.915
/65.5 656.125 650.645
68.3 656.085 649.645
70.35 656.025 644.915
                                                     98.45 652.945
                                                                                                    172.12
                                                                                                                    652.5
    253.49 653.245
Upstream Bridge Cross Section Data
Station Elevation Data num= 17
Sta Elev Sta Elev Sta
-172.52 655.288 32.43 652.375 38.83 6
59.2 645.945 61.39 645.095 65.45 6
86.15 648.555 116.5 649.245 172.12
350.6 655.245 358.85 656.245
                                                                   Sta Elev
38.83 651.925
65.45 644.995
                                                                                                    Sta Elev
48.62 648.705
67.71 645.785
                                                                                                                                     Sta Elev
55.15 647.445
70.85 647.355
                                                                                    652.5 253.49 653.245
                                                                                                                                     332.2 654.325
Manning's n Values
                                                   num=
                                     Sta
55.15
                                                   n val
                                                                    Sta
70.85
         Sťa n Val
2.52 .09
                                                                                     n Val
  -172.52
                                                        .05
Bank Sta: Left Right Coeff Cont 55.15 70.85

Ineffective Flow num= 2 Sta L Sta R Elev Permanent -172.52 42 652.95 F 90 358.85 652.95 F
                                                   Coeff Contr.
                                                                                 Expan.
                                                              2 .3
Downstream Deck/Roadway Coordinates
  num= 19
Sta Hi Cord Lo Cord
-199.02 655.288
18.19 653.665
36.11 656.095 648.765
39.4 656.225 650.865
43.1 656.095 648.765
71.94 654.415
      num=
                           19
                                                                                                   Sta Hi Cord Lo Cord
18.19 652.945
36 656.075 647.915
39 656.225 650.835
41.8 656.165 649.835
43.85 656.025 646.665
145.62 652.5
                                                     Sta Hi Cord Lo Cord
6.09 653.113
35.61 656.025 645.195
37 656.165 649.835
39.8 656.225 650.835
43.5 656.075 647.995
71.95 652.945
    226.99 653.245
Downstream Bridge Cross Section Data
Station Elevation Data num=
Sta Elev Sta Ele
                                   Sta Elev
-6.99 653.185
33.72 646.465
48.1 645.855
   Sta Elev
-199.02 655.288
31.8 647.955
44.81 644.305
                                                                    Sta Elev
1.13 653.145
36.22 645.845
51 647.395
                                                                                                     Sta Elev
13.19 650.795
39.63 644.505
61.17 647.815
                                                                                                                                     26.39 648.445
42.3 643.715
72.07 651.545
                                                                     332.2 654.325
                                 226.99 653.245
                                                                                                     350.6 655.245
                                                                                                                                  358.85 656.245
    145.62
                   652.5
Manning's n Values
                                                   num=
                                                  n Val
  Sta n Val
-199.02 .09
                                         Sta
                                                                         Sta
                                                                                     n Val
                        .09
                                       31.8
                                                                           51
                                                                                          .09
                                                   Coeff Contr.
Bank Sta: Left Right
                                                                               Expan.
                                  51
                                        51
num= 2
                    31.8
Ineffective Flow
  Sta L Sta R Elev Permanent
-199.02 15.72 652.95 F
63.89 358.85 652.95 F
Upstream Embankment side slope
                                                                                                       0 horiz. to 1.0 vertical
Downstream Embankment side slope
                                                                                                       O horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = Elevation at which weir flow begins =
                                                                                                     . 98
```

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```
WalkerRunFld
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 =
                                                         1.5
                                                       652.5
              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
CROSS SECTION
RIVER: Walker Run
REACH: 2
                                 RS: -30
Description: D/S XS of Market Street Bridge
Station Elevation Data
                                 num=
                                             Sta
-4.4
37.35
52.27
                           Sta
                                   Elev
               Elev
                                                        Elev
                                                                    Sta
                                                                             Elev
                       -46.68
35.6
                                                                                      17.96
41.82
63.11
                                                      653.95
647.22
646.61
                                                                                               651.54
645.27
648.57
                                 654.28
 -199.02
            656.04
                                                                   4.43
                                                                            653.9
                                                                 38.98
53.56
    30.08
              649.2
                                 648.71
                                                                           646.6
            644.46
                        48.05
                                 645.07
                                                                          648.15
            650.16
                        85.95
                                 652.29
                                             181.4
                                                       651.9
                                                                273.84
                                                                          653.77
                                                                                     319.73
Manning's n Values
                                 num=
      Sta n Val
                           Sta
                                 n Val
                                               Sta
                                                       n Val
 -199.02
                         35.6
                                             53.56
                                     .05
Bank Sta: Left
35.6
                                                                Right 52.9
                     Right
                                 Lengths: Left Channel
                                                                             Coeff Contr.
                                                                                                Expan.
                      53.56
                                             39.8
                                                       41.7
Ineffective Flow
                                         2
                           num=
 Sta L
-199.02
           Sta R
15.72
                         Elev
                                 Permanent
                                       F
    63.89 319.73
CROSS SECTION
RIVER: Walker Run
REACH: 2
                                 RS: -78
INPUT
Description:
Station Elevation Data
                                              17
                                 num=
                                 Elev
649.27
645.43
648.11
           Elev
653.95
645.82
                                             Sta
36.56
54.96
      Sta
                           Sta
                                                        Elev
                                                                             Elev
                                                                                                  Elev
                                                                  42.24
58.47
                                                      649.66
645.72
                                                                                      46.48
62.68
                         8.17
                                                                           648.9
                                                                                               646.51
                        52.33
71.37
                                                                          646.11
649.71
    49.12
                                                                                               648.65
            648.62
                                                      648.01
            652.01
                        299.5
                                 653.01
Manning's n Values
                                 num=
      Sta n Val
                                               Šta
                           Sta
                                  n Val
                                                       n val
                .09
                        36.56
                                     .05
                                             62.68
Bank Sta: Left
36.56
                                 Lengths: Left Channel
                                                                             Coeff Contr.
                     Right
                                                                Right
                                                                                                Expan.
                     62.68
                                             70.8
                                                       70.8
                                                                 80.2
CROSS SECTION
RIVER: Walker Run
REACH: 2
                                 RS: -154
```

Description:

		rkerkunfia	
Station Elevation Data Sta Elev Sta -151.5 656.03 0 30.73 645.21 33.05 43.72 648.39 63.07 218.8 653.01	num= 16 Elev Sta Elev 654.28 13.15 649.96 644.9 35.85 645.52 648.9 97 649.15	Sta Elev Sta 23.45 649.01 28.15 40.46 645.66 41.74 199.07 650.01 206.89	Elev 648.96 646.07 651.01
Manning's n Values Sta n Val Sta -151.5 .09 28.15	num= 3 n Val Sta n Val .05 43.72 .09		
Bank Sta: Left Right 28.15 43.72	Lengths: Left Channel 75 75	Right Coeff Contr. 75 .1	Expan.
CROSS SECTION	•		
RIVER: Walker Run REACH: 2	RS: -255		
INPUT Description: FEMA BHJ Station Elevation Data Sta Elev Sta 1000 684.34 1092 1310 660.04 1330 1408 645.74 1412 1570 649.04 1610 1750 669.34 1790	num= 22 Elev Sta Elev 679.54 1128 674.34 657.54 1350 654.84 647.95 1450 649.65 649.84 1670 654.34 674.84	Sta Elev Sta 1170 669.34 1230 1372 649.74 1405 1490 649.24 1525 1712 659.34 1740	Elev 664.54 647.24 649.34 664.84
Manning's n Values Sta n Val Sta 1000 .09 1405	num= 3 n Val Sta n Val .05 1412 .09		
Bank Sta: Left Right 1405 1412	Coeff Contr. Expan.		

Profile Output Table - Encroachment 1

River Top Wdth Act (ft)	Reach Q Left (cfs)	River Q Channel (cfs)	Sta Q Right (cfs)	Profile Enc Sta L Ch S	W.S. Elev Prof Sta L Ch Sta R (ft) ft) (ft)	Delta WS Enc Sta R (ft) (ft)	E.G. Elev (ft)
Walker Run 162.84 Walker Run 58.12 Walker Run 172.55	1 71.66 1 74.40	5862 716.24 5862	852.11	100 year storm 59. 100 year storm 6 50.00 500 year storm	680.72 74 75.29	0.86 108.12 1.28	681.63 683.30 683.38
Walker Run 217.39 Walker Run 95.42 Walker Run 229.98	1 1264.99 1 1273.20 1 2893.85	5547 324.04 55547 366.80 5547 556.42	50.96	100 year storm 215. 100 year storm 130.75 215. 500 year storm 215.	676.98 226.17 677.97 49 226.17 679.67 49 226.17	0.99 226.17 2.68	677.08 678.12 679.80
Walker Run 79.00 Walker Run 61.24 Walker Run 296.26	524.10 1 513.13 1 1862.89	5282 894.12 5282 950.86 5282 1157.68	221.78 176.01 579.43	100 year storm 212. 100 year storm e 182.76 212. 500 year storm 212.	676.02 230.88 677.03 26 230.88 679.11 26 230.88	1.00 244.00 3.09	676.40 677.38 679.31
Walker Run 43.70 Walker Run 25.94 Walker Run 295.47	835.78 1 845.44 1 2652.76	5250 535.54 5250 632.74 5250 230.15	BR U 268.68 BR U 161.82 BR U 717.09	100 year storm 212. 100 year storm e 182.76 212. 500 year storm 212.	.26 230.88 674.49 .26 230.88 679.08	0.06 244.00 4.65	675.87 676.66 679.22
Walker Run	1	5250		100 year storm			674.39

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		WalkerRunFld			
37.51 826.40 Walker Run 1	348.56 465.04	204.89	221.89	0.10	674 44
37.51 767.55	5250 BR D 377.01 495.44	100 year storm e 176.89 204.89	673.32 221.89	249.89	674.44
Walker Run 1 . 37.51 1823.62	5250 BR D 472.70 1303.68	500 year storm 204.89	675.12 221.89	1.90	678.09
					/
Walker Run 1	5198	100 year storm	671.55		672.97
73.00 507.50 Walker Run 1	992.97 139.52 5198	204.89 100 year storm e	221.89 672.64	1.09	673.44
73.00 492.58 Walker Run 1	935.68 211.74 5198	176.89 204.89 500 year storm	221.89 673.56	249.89 2.01	675.95
73.00 1147.10	1889.95 562.94	204.89	221.89		
Mallian Rom 1	F107	100	671 40		
Walker Run 1 280.17 344.74		100 year storm 144.00	671.48 169.94		671.61
Walker Run 1 101.00 172.93	5107 886.79 580.29	100 year storm e 120.00 144.00	672.37 169.94	0.88 221.00	672.64
Walker Run 1 298.84 928.16	5107	500 year storm 144.00	673.22 169.94	1.74	673.43
230.04 320.10	1030.03 1373.13	144.00	103.34		
Walker Run 1	4995	100 year storm	671.35		671.44
263.68 46.08 Walker Run 1	1308.91 285.01 4995	1392.00 100 year storm e	1497.00 672.34	0.99	672.44
122.00 34.74 Walker Run 1	1575.62 29.64 4995	1383.00 1392.00 500 year storm	1497.00 673.01	1505.00 1.66	673.20
291.10 155.94	2676.77 767.28	1392.00	1497.00	1.00	0/3.20
Walker Run 1 321.99 331.96	4810 280.07 1027.96	100 year storm 113.64	671.26 128.10		671.29
Walker Run 1 174.33 315.47	4810 350.74 973.79	100 year storm e 70.73 113.64	672.26 128.10	1.00 245.06	672.30
Walker Run 1	4810	500 year storm	672.85	1.60	672.93
343.00 798.73	542.33 2258.94	113.64	128.10		
Walker Run 1	4735	100 year storm	671.22		671.25
326.32 633.79 Walker Run 1	207.56 798.65 4735	1805.05 100 year storm e	1814.96 672.24	1.02	672.26
289.99 617.64 Walker Run 1	195.78 826.58 4735	1700.14 1805.05 500 year storm	1814.96 672.78	1990.13 1.56	672.84
341.14 1374.08	398.75 1827.17	1805.05	1814.96	1.50	072.04
		100	c=4 00		c=4 22
Walker Run 1 339.30 544.02		100 year storm 195.53	671.20 206.14		671.22
Walker Run 1 264.48 534.62	4692 189.99 915.39	100 year storm e 100.41 195.53	672.23 206.14	1.03 364.89	672.25
Walker Run 1 361.11 1248.59	4692 379.46 1971.95	500 year storm 195.53	672.74 206.14	1.54	672.80
301.11 1240.33	3/3.40 13/1.33	193.33	200.14		
Walker_Run 1	4495	100 year storm	671.11		671.13
336.79 607.54 Walker Run 1	253.51 778.95 4495	2109.99 100 year storm e	2123.77 672.12	1.02	672.17
150.65 653.55 Walker Run 1	343.20 643.25 4495	2041.17 2109.99 500 year storm	2123.77 672.54	2191.82 1.43	672.60
364.35 1381.30	505.83 1712.88	2109.99	2123.77	2.45	072.00
walkan pom	4414	100	671 00		C74 10
Walker Run 1 340.84 549.94	4414 354.83 735.23	100 year storm 169.07	671.08 190.54		671.10
Walker Run 1 168.58 514.96	4414 442.09 682.95	100 year storm e 105.71 169.07	672.09 190.54	1.02 274.29	672.13
Walker Run 1 359.74 1282.42	4414 717.71 1599.88	500 year storm 169.07	672.46 190.54	1.39	672.53
, , , , , , , , , , , , , , , , , , , ,	,1,,,1 1555,00	105.07	130.34		
Walker Run 1	4295	100 year storm	671.05		671.06
417.07 765.21 Walker Run 1	193.71 681.08 4295	1639.19 100 year storm e	1652.17 672.08	1.03	672.09
268.22 685.39 Walker Run 1	208.43 746.17 4295	1531.78 1639.19 500 year storm	1652.17 672.40	1800.00 1.35	672.44
438.83 1733.52	391.97 1474.51	1639.19	1652.17	2.55	012.77

				WalkerRunFld			
Walker Run 422.39	· 1 524 48	4130 279.58	835.94	100 year storm	671.01 174.90		671.03
Walker Run	1	4130	614.50	100 vear storm e	672.03	1.02	672.06
203.36 Walker Run	641.29 1	4130 384.21 4130 558.08	614.50	65.97 156.55 500 year storm	672.31	269.33 1.29	672.35
460.98	1137.28	558.08	1904.64	156.55	174.90		
Walker Run	1	4043		100 year storm	670.98		671.00
514.26	501.68	277.13	861.18	1618.40	1632.70	2 22	
Walker Run 155.00	1 446.28	4043 397.11	796.62	100 year storm e 1565.00 1618.40	671.97 1632.70	0.99 1720.00	672.02
Walker Run 567.20	1 1163.68	4043 510.72	1925.60	500 year storm 1618.40	672.24 1632.70	1.26	672.29
Walker Run	1 10	3972 905.10		100 year storm	670.96		670.98
597.89 Walker Run	T	3972		225.40 100 year storm e	671.95	. 0.99 375.00	671.99
177.25 Walker Run	69.41 1	1273.58 3972	297.01	197.75 225.40 500 year storm	299.32 672.20	375.00 1.24	672.25
622.89	125.68	1758.15	1716.17	225.40	299.32	-	
Mallian Bun	1	2014		100	667.46		670 16
Walker Run _23.06	1	3914 1640.00		100 year storm 254.71	287.02		670.16
Walker Run 152.53	$\frac{1}{15.13}$	3914 1128.29	BR U 496.58	100 year storm e 197.75 254.71	671.27 287.02	3.81 375.00	671.82
Walker Run 445.39	1 311.86	3914 1613.59	BR U 1614.81	500 year storm 254.71	672.20	4.74	672.25
773.33	J11.00 ,	1013.33	1014.01	254.71	207.02		
Walker Run	1	3914	BR D	100 year storm	667.48		670.17
23.06 Walker Run	1	1640.00 3914	BR D	254.71 100 year storm e	668.46	0.98	670.48
22.42 Walker Run	1 1	1640.00 3914		261.00 254.71 500 year storm	287.02	285.00 2.93	672.24
275.12	311.86	1613.59	1614.81	254.71	287.02	2.33	0,2121
		2000		100	666 07		660 33
Walker Run 37.70	1 33.80	3860 1565.62	40.59	100 year storm 265.16	666.07 288.12		669.32
Walker Run 24.00	1 51.19	3860 1588.81		100 year storm e 261.00 265.16	667.11 288.12	1.04 285.00	669.87
Walker Run 70.94	1 194.50	3860 2682.30	723.21	500 year storm 265.16	669.66 288.12	3.59	672.24
70.54	154.50	2002.50	, 23.21	. 203110	200.12		
Walker Run	1	3785		100 year storm	665.19		666.52
76.26 Walker Run	0.22 1	1638.08 3785		1412.00 100 year storm e	1472.57 666.20	1.01	666.98
56.22 Walker Run	1 1 14.03	1640.00 3785		1413.78 1412.00 500 year storm	1472.57 665.96	1470.00 0.77	669.65
104.48	14.03	3499.08	86.89	1412.00	1472.57	• • • • • • • • • • • • • • • • • • • •	003.03
		2725		100	CCF 10		CCE 27
Walker Run 241.03	1 52.47	3735 469.99		100 year storm 174.59	665.10 190.57		665.37
Walker Run 102.43	1 63.28	3735 572.72	1004.01	100 year storm e 167.57 174.59	666.02 190.57	0.92 270.00	666.35
Walker Run 319.95	1 113.10	3735 716.81		500 year storm 174.59	666.63 190.57	1.53	666.96
319.93	113.10	710.01	2770.03	174.55	190.57		
Walker Run	1	3532		100 year storm	663.74		663.88
254.48 Walker Run	901.75 1	375.28 3532	362.98	1648.78 100 year storm e	1668.34 664.72	0.98	664.99
112.15 Walker Run	835.34 1	562.70 3532	241.96	1577.02 1648.78 500 year storm	1668.34 665.26	1689.17 1.52	665.50
	2094.27	681.11	824.62	1648.78	1668.34		233.30
	1	2440		100	662 62		663.00
Walker Run 254.07	1 863.72	3410 292.08	484.21	100 year storm 286.94	662.82 301.23		663.00
Walker Run 119.96	1 599.38	3410 433.89	606.72	100 year storm e 235.04 286.94	663.77 301.23	0.96 355.00	664.08
Walker Run	1 1993.16	3410 544.78	1062.06	500 year storm 286.94	664.22 301.23	1.40	664.52
201.40	T333.TO	JTT./0	1002.00	200.34	JUI. 23		

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			WalkerkullFlu			
255.90 100 Walker Run 120.52 83 Walker Run	9.53 343.1 1 3 8.95 460.2	375 L 340.84 375	100 year storm 1598.22 100 year storm e 1528.63 1598.22 500 year storm 1598.22	662.38 1611.37 663.41 1611.37 663.78 1611.37	1.03 1649.15 1.40	662.64 663.77 664.15
264.03 48 Walker Run 113.78 53 Walker Run	0.85 224.6	278 1 705.59 278	100 year storm 160.34 100 year storm e 117.52 160.34 500 year storm 160.34	661.78 175.26 662.69 175.26 663.14 175.26	0.91 231.30 1.36	661.90 662.99 663.36
301.63 105 Walker Run 168.51 107 Walker Run	1.76 179.0 1 3 1.74 226.7)65) 341.57)65	100 year storm 1687.34 100 year storm e 1567.38 1687.34 500 year storm 1687.34	660.64 1697.34 661.74 1697.34 661.97 1697.34	1.10 1735.89 1.33	660.77 661.89 662.18
349.10 48 Walker Run 125.25 47 Walker Run	9.41 352.79 1 29 9.51 624.39 1 29	949	100 year storm 214.52 100 year storm e 174.36 214.52 500 year storm 214.52	659.99 241.06 661.02 241.06 661.35 241.06	1.03 299.61 1.36	660.10 661.30 661.53
153.71 67 Walker Run	7.43 124.9	730 L 762.83 730	100 year storm 430.00 100 year storm e 374.49 430.00 500 year storm 430.00	659.23 439.81 660.15 439.81 660.57 439.81	0.92 528.20 1.34	659.30 660.30 660.70
358.70 54 Walker Run 149.71 66 Walker Run	8.40 139.69 1 20 2.47 217.10	520 BR U 5 760.37 520 BR U	100 year storm 430.00 100 year storm e 374.49 430.00 500 year storm 430.00	658.91 439.81 659.76 439.81 660.24 439.81	0.85 528.20 1.33	659.01 659.97 660.40
367.34 110 Walker Run 223.28 109 Walker Run	1.86 101.50 1 20 1.79 130.1	520 BR D 520 BR D 520 BR D	100 year storm 431.55 100 year storm e 272.27 431.55 500 year storm 431.55	658.89 439.78 659.79 439.78 660.21 439.78	0.90 501.55 1.33	658.94 659.85 660.32
Walker Run 229.28 108 Walker Run	6.33 107.33 1 24 3.13 126.83	197 ! 430.05 197	100 year storm 431.55 100 year storm e 272.27 431.55 500 year storm 431.55	658.40 439.78 659.48 439.78 659.64 439.78	1.07 501.55 1.24	658.48 659.55 659.78
383.73 59 Walker Run 150.00 64 Walker Run	0.93 136.6 1 24 8.95 223.8	62 767.19 62	100 year storm 345.99 100 year storm e 275.00 345.99 500 year storm 345.99	658.29 357.06 659.31 357.06 659.52 357.06	1.01 425.00 1.22	658.36 659.44 659.64
445.75 134 Walker Run 150.07 111 Walker Run	6.00 109.9 1 2 3.61 201.8	339 324.50 339	100 year storm 2413.30 100 year storm e 2325.00 2413.30 500 year storm 2413.30	657.83 2421.13 658.58 2421.13 659.07 2421.13	0.76 2475.07 1.25	657.92 658.84 659.19

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Walker Run 281.37 Walker Run 252.44 Walker Run 410.38	600.83 1 608.23	2274 156.52 87 2274	2.11 5.25	year storm 197.78 year storm e 96.48 197.78 year storm 197.78	657.41 208.38 658.50 208.38 658.61 208.38	1.08 348.92 1.20	657.55 658.56 658.84
Walker Run 562.23 Walker Run 264.54 Walker Run 726.28	1283.56 1 950.85	2139 99.48 58 2139	8.61 9.67 100	year storm 488.21 year storm e 40.14 488.21 year storm 488.21	657.23 495.94 658.32 495.94 658.42 495.94	1.08 604.68 1.19	657.26 658.36 658.47
Walker Run 1023.33 Walker Run 263.62 Walker Run 1214.50	1291.15 1 1108.56	2010 112.76 41 2010	4.64 100 8.68 26	year storm 2870.92 year storm e 90.00 2870.92 year storm 2870.92	657.16 2879.56 658.21 2879.56 658.34 2879.56	1.05 2953.62 1.19	657.17 658.24 658.36
Walker Run 846.16 Walker Run 199.27 Walker Run 895.22	903.88 1 683.74	1925 167.63 78 1925	7.23 8.63 100	year storm 209.26 year storm e 21.59 209.26 year storm 209.26	657.12 219.85 658.12 219.85 658.29 219.85	1.00 320.86 1.17	657.13 658.17 658.32
Walker Run 1080.54 Walker Run 466.99 Walker Run 1187.88	1076.84 2 626.90	1602 184.94 104 1602	2.51 100 8.16 -1	year storm year storm e 00.00 85.07 year storm 85.07	656.98 100.70 657.90 100.70 658.16 100.70	0.91 366.99 1.18	656.99 657.92 658.18
Walker Run 686.83 Walker Run 443.49 Walker Run 722.58	836.58 2 842.96	1402 152.98 86 1402	5.86 4.06 -	year storm 156.09 year storm e 26.60 156.09 year storm 156.09	656.88 169.89 657.80 169.89 658.07 169.89	0.92 416.89 1.20	656.89 657.82 658.09
Walker Run 456.81 Walker Run 345.12 Walker Run 539.64	682.86	1208 286.60 92 1208	9.85 100 2.42 16	year storm 1740.00 year storm e 27.49 1740.00 year storm 1740.00	656.74 1765.00 657.72 1765.00 657.92 1765.00	0.98 1972.61 1.18	656.77 657.74 657.97
Walker Run 511.53 Walker Run 122.69 Walker Run 533.88	588.54 2 722.27	990 544.24 59 990	9.66 100 3.49	year storm 118.97 year storm e 63.74 118.97 year storm 118.97	656.54 138.23 657.39 138.23 657.72 138.23	0.85 186.43 1.18	656.57 657.55 657.76
Walker Run 282.76 Walker Run 120.00 Walker Run 366.27	873.79 2 835.26	933 733.70 29 933	8.61 100 1.04 16	year storm 1700.00 year storm e 30.00 1700.00 year storm 1700.00	656.25 1720.00 657.17 1720.00 657.40 1720.00	0.92 1750.00 1.15	656.46 657.39 657.65
Walker Run 292.08 Walker Run 133.19 Walker Run	528.24 2 573.37	884	9.98 7.01 500	year storm 117.08 year storm e 61.19 117.08 year storm Page 55	656.05 129.44 656.98 129.44 657.23	0.93 194.38 1.18	656.25 657.23 657.44

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347.54	969.41	562.31	1568.29	WalkerRunFld 117.08	129.44		
Walker Run	2	875			Culvert		~
Walker Run 302.32 Walker Run 129.08 Walker Run 351.16	548.91 2 647.52	863 550.99 863 717.28 863 763.77	760.10 495.20 1392.46	100 year storm 113.12 100 year storm e 52.92 113.12 500 year storm 113.12	656.03 133.22 656.90 133.22 657.20 133.22	0.87 182.00 1.17	656.18 657.14 657.38
Walker Run 357.68 Walker Run 132.37 Walker Run 417.70	2 373.28 2 426.64 2 691.93	715 399.05 715 552.33 715 544.39	1087.67 881.02 1863.68	100 year storm 100.08 100 year storm e 59.56 100.08 500 year storm 100.08	655.76 114.47 656.57 114.47 656.91 114.47	0.81 191.93 1.15	655.83 656.73 657.01
Walker Run 305.51 Walker Run 201.19 Walker Run 343.92	2 1267.04 2 1306.87 2 2161.64	536 403.78 536 403.81 536 573.44	189.18 149.32 364.93	100 year storm 170.47 100 year storm e 5.76 170.47 500 year storm 170.47	655.51 184.30 656.41 184.30 656.59 184.30	0.90 206.95 1.08	655.59 656.47 656.71
Walker Run 319.53 Walker Run 273.25 Walker Run 357.75	2 609.78 2 658.02 2 1094.98	428 777.09 428 693.25 428 1127.31	473.13 508.73 877.72	100 year storm 1410.00 100 year storm e 1276.75 1410.00 500 year storm 1410.00	655.36 1440.00 656.34 1440.00 656.39 1440.00	0.98 1550.00 1.03	655.46 656.40 656.54
Walker Run 301.02 Walker Run 236.97 Walker Run 317.24	2 513.12 2 540.43 2 894.49	350 431.84 350 414.20 350 645.97	915.04 905.37 1559.53	100 year storm 122.31 100 year storm e 30.04 122.31 500 year storm 122.31	655.30 141.29 656.30 141.29 656.31 141.29	1.00 267.01 1.00	655.36 656.34 656.40
Walker Run 264.17 Walker Run 84.87 Walker Run 282.18	2 52.88 2 86.53 2 91.86	185 471.17 185 863.30 185 709.34	1335.95 910.17 2298.81	100 year storm 100 year storm 25.13 32.38 500 year storm 32.38	655.12 49.26 655.84 49.26 656.02 49.26	0.72 110.00 0.90	655.19 656.14 656.15
Walker Run 191.48 Walker Run 127.63 Walker Run 243.67	2 43.17 2 48.34 2 80.38	147 806.03 147 772.49 147 1225.11	1010.81 1039.18 1794.51	100 year storm 1650.00 100 year storm e 1642.37 1650.00 500 year storm 1650.00	654.82 1670.00 655.81 1670.00 655.49 1670.00	0.99 1770.00 0.67	655.10 656.01 655.99
Walker Run 382.56 Walker Run 184.57 Walker Run 430.41	2 147.14 2 230.08 2 306.75	011 411.53 011 480.36 011 616.60	1301.34 1149.56 2176.65	100 year storm 51.29 100 year storm 6 51.29 500 year storm 51.29	654.70 64.38 655.68 64.38 655.30 64.38	0.98 174.39 0.59	654.78 655.78 655.44
Walker Run 416.58 Walker Run 167.91 Walker Run 497.59	2 369.91 2 571.87 2 831.07	-10 221.51 -10 230.32 -10 145.41	BR U 1277.58 BR U 1052.77 BR U 2107.22	100 year storm 55.15 100 year storm e 55.15 -10.18 55.15 500 year storm 55.15	654.70 70.85 655.68 70.85 655.30 70.85	0.98 174.39 0.59	654.78 655.78 655.44

Walker Run	2	-10	BR D	WalkerRunFld 100 year storm	654.36		654.78
396.11 Walker Run	369.91 2	221.51 -10	1277.58 BR D	31.80 100 year storm e	51.00 654.48	0.12	655.21
159.80 Walker Run	571.87 2	230.32 -10	1052.77 BR D	9.65 31.80 500 year storm	51.00 654.90	215.96 0.54	655.32
470.41	831.07	145.41	2107.22	31.80	51.00		
Walker Run 255.23	2 184.99	-30 1010.37	664.64	100 year storm 35.60	653.53 53.56		654.02
Walker Run 206.31	2 196.84	-30 858.73		100 year storm e	654.43	0.90	654.68
Walker Run	2	-30	804.44	9.65 35.60 500 year storm	53.56 654.90	215.96 1.38	655.32
384.37	371.25	1236.46	1492.29	35.60	53.56		
Walker Run 312.39	2 240.34	-78 654.22	965.44	100 year storm 36.56	653.52 62.68		653.63
Walker Run 199.28	2 89.24	-78 716.65	1054.11	100 year storm e 22.89 36.56	654.40 62.68	0.87 222.17	654.50
Walker Run	2	-78		500 year storm	654.87	1.35	655.00
314.50	417.78	905.37	1776.85	36.56	62.68		
Walker Run 216.03	2 130.75	-154 515.64	1213.61	100 year storm 28.15	653.37 43.72		653.49
Walker Run 190.19	103.03	-154 478.86	1278.11	100 year storm e 13.50 28.15	654.32 43.72	0.95 203.69	654.40
Walker Run 253.36	2 244.84	-154 730.73	2124.44	500 year storm 28.15	654.68 43.72	1.31	654.85
233.30	244.04	730.73	2124.44	20.13	43.72		
Walker Run 299.31	2 311.80	-255 171.63	1376.57	100 year storm 1405.00	653.29 1412.00		653.35
Walker Run	2	-255		100 year storm e	654.29	1.00	654.32
316.96 Walker Run	306.07 2	150.51 -255	1403.42	1405.00 500 year storm	1412.00 654.60	1.31	654.68
321.15	507.27	242.01	2350.71	1405.00	1412.00		
Tributary 40.97	1 40.67	6850 257.28	5.55	100 year storm 90.32	711.95 113.19		712.55
Tributary 40.97	1 40.67	6850 257.28	5.55	100 year storm e 90.32	711.95 113.19	0.00	712.55
Tributary	1 164.92	6850 423.30		500 year storm	712.72	0.77	713.53
52.94	104.92	423.30	27.47	90.32	113.19		
Tributary 105.67	1 68.85	5930 50.86	183.79	100 year storm 80.01	695.49 88.27		695.55
Tributary	1 68.85	5930	183.79	100 year storm e	695.49 88.27	0.00	695.55
105.67 Tributary	1	50.86 5930		80.01 500 year storm	696.21	0.72	696.32
121.05	169.33	77,.77	368.59	80.01	88.27		
Tributary	1 1.03	5500 297.42	5.05	100 year storm	692.04		692.52
56.50 Tributary	1 .	5500		66.48 100 year storm e	118.28 692.04	0.00	692.52
56.50 Tributary	1.03 1	297.42 5500	5.05	66.48 500 year storm	118.28 693.23	1.19	693.61
62.13	15.50	561.98	38.21	66.48	118.28		
Tributary 105.21	1 0.07	4750 303.35	0.08	100 year storm 81.27	686.28 183.88		686.32
Tributary	1	4750		100 year storm e	686.28	0.00	686.32
105.21 Tributary	0.07 1	303.35 4750	0.08	81.27 500 year storm	183.88 686.89	0.61	686.97
110.85	2.31	610.88	2.50	81.27	183.88		
Tributary	1	4530	0.01	100 year storm 39.25	686.03		686.04
219.53 Tributary	0.02	303.47 / 4530		100 vear storm e	256.85 686.03	0.00	686.04
219.53 Tributary	0.02 1	303.47 4530	0.01	39.25 500 year storm	256.85 686.37	0.34	686.39
222.97	0.44	614.93	0.33	39.25	256.85		

Tributary	1	4528		Culvert		
Tributary 31.54 Tributary 31.54 Tributary 122.43	1 23.76 1 23.76 1 7.10	4500 279.74 4500 279.74 4500 79.82 528.77	100 year storm 117.21 100 year storm e 117.21 500 year storm 117.21	684.80 146.54 684.80 146.54 685.00 146.54	0.00	685.52 685.52 685.13
Tributary 66.08 Tributary 66.08 Tributary 62.22	1 180.37 1 180.37 357.47	37.56 85.57 4400 37.56 85.57 4400 101.09 157.13	100 year storm 158.35 100 year storm e 158.35 500 year storm 158.35	678.48 161.30 678.48 161.30 678.28 161.30	0.00 -0.20	679.05 679.05 682.54 671.02
614.41 Tributary 614.41 Tributary 615.24	269.22 1 269.22 1 546.82	33.09 1.19 3356 33.09 1.19 3356 66.40 2.47	213.43 100 year storm e 213.43 500 year storm 213.43	219.51 671.01 219.51 671.02 219.51	0.00 0.01	671.02 671.06
Tributary 218.53 Tributary 218.53 Tributary 223.93	1 243.37 1 243.37 1 497.95	3108 BR U 58.22 1.90 3108 BR U 58.22 1.90 3108 BR U 108.71 9.03	100 year storm 301.19 100 year storm e 301.19 500 year storm 301.19	668.29 317.51 668.29 317.51 668.83 317.51	0.00 0.54	668.32 668.32 668.88
Tributary 226.80 Tributary 226.80 Tributary 246.40	1 228.93 1 228.93 1 492.44	3108 BR D 74.42 0.15 3108 BR D 74.42 0.15 3108 BR D 119.14 4.11	100 year storm 301.19 100 year storm e 301.19 500 year storm 301.19	667.73 317.51 667.73 317.51 668.33 317.51	0.00 0.61	667.84 667.84 668.44
Tributary 219.14 Tributary 219.14 Tributary 235.49	1 251.71 1 251.71 1 505.92	3060 50.26 1.53 3060 50.26 1.53 3060 100.38 9.39	100 year storm 318.74 100 year storm e 318.74 500 year storm 318.74	667.66 337.11 667.66 337.11 668.27 337.11	0.00 0.61	667.69 667.69 668.32
Tributary 207.38 Tributary 207.38 Tributary 224.84	1 248.48 1 248.48 1 499.70	3010 BR U 53.97 1.05 3010 BR U 53.97 1.05 3010 BR U 107.51 8.48	100 year storm 318.74 100 year storm e 318.74 500 year storm 318.74	667.54 337.11 667.54 337.11 668.15 337.11	0.00 0.61	667.58 667.58 668.21
Tributary 229.94 Tributary 229.94 Tributary 261.23	1 264.13 1 264.13 1 522.28	3010 BR D 18.67 20.70 3010 BR D 18.67 20.70 3010 BR D 37.47 55.93	100 year storm 252.14 100 year storm e 252.14 500 year storm 252.14	667.04 258.87 667.04 258.87 667.66 258.87	0.00 0.61	667.07 667.07 667.70
Tributary 246.16 Tributary 246.16 Tributary 275.00	1 259.77 1 259.77 1 519.75	2834 20.02 23.70 2834 20.02 23.70 2834 37.81 58.14	100 year storm 252.14 100 year storm e 252.14 500 year storm 252.14	666.51 258.87 666.51 258.87 667.11 258.87	0.00 0.59	666.54 666.54 667.14
Tributary 242.56	1 241.53	2791.66* 26.11 35.87	100 year storm 253.57	666.30 260.38		666.32

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			WalkerRunFld			
Tributary	1 241.53	2791.66* 26.11 35.87	100 year storm e	666.30	0.00	666.32
242.56 Tributary	1	2791.66*	253.57 500 year storm	260.38 666.88	0.58	666.92
272.79	487.94	45.98 81.77	253.57	260.38		
Tributary	1	2749.33*	100 year storm	666.06		666.10
240.94 Tributary	221.18 1	33.01 49.31 2749.33*	255.00 100 year storm e	261.90 666.06	0.00	666.10
240.94 Tributary	221.18 1	33.01 49.31 2749.33*	255.00 500 year storm	261.90 666.64	0.57	666.68
271.08	454.26	54.93 106.50	255.00	261.90	0.57	000.00
Tributary	1	2707.*	100 year storm	665.81		665.85
238.80 Tributary	198.34 1	40.12 65.04 2707.*	256.43 100 year storm e	263.41 665.81	0.00	665.85
238.80	198.34	40.12 65.04	256.43	263.41		
Tributary 270.83	415.08	2707.* 63.86 136.76	500 year storm 256.43	666.37 263.41	0.56	666.43
Tributary	1	2664.66*	100 year storm	665.53		665.58
239.34 Tributary	173.65	47.35 82.51 2664.66*	257.86	264.93 665.53	0.00	665.58
239.34	173.65	47.35 82.51	100 year storm e 257.86	264.93		
Tributary 270.47	372.47	2664.66* 72.68 170.54	500 year storm 257.86	666.09 264.93	0.56	666.15
Tributary	1	2622.33*	100 year storm	665.23		665.29
239.57	147.12	54.48 101.90	100 year storm 259.29	266.44	0.00	
Tributary 239.57	$\frac{1}{147.12}$	2622.33* 54.48 101.90	100 year storm e 259.29	665.23 266.44	0.00	665.29
Tributary 270.11	327.52	2622.33* 81.16 207.01	500 year storm 259.29	665.79 266.44	0.56	665.86
Tributary	1	2580.*	100 year storm	664.90		664.97
234.73 Tributary	120.61 1	60.89 122.00 2580.*	260.73	267.96 664.90	0.00	664.97
234.73	120.61	60.89 122.00	100 year storm e 260.73	267.96		
Tributary 271.32	1 281.43	2580.* 89.10 245.16	500 year storm 260.73	665.46 267.96	0.56	665.54
Tributary	1	2537.66*	100 year storm	664.55		664.63
229.77 Tributary	95.03 1	66.84 141.63 2537.66*	262.16 100 year storm e	269.47 664.55	0.00	664.63
229.77	95.03	66.84 141.63	262.16	269.47		
Tributary 269.14	235.01	2537.66* 96.32 284.36	500 year storm 262.16	665.12 269.47	0.57	665.21
Tributarv	1	2495.33*	100 year storm	664.17		664.27
219.10 Tributary	74.73 1	71.17 157.60 2495.33*	263.59 100 year storm e	270.98 664.17	0.00	664.27
219.10 Tributary	74.73 1	71.17 157.60 2495.33*	263.59 500 year storm	270.98 664.77	0.60	664.87
264.27	194.41	101.08 320.20	263.59	270.98	0.00	004.07
Tributary	1	2453.*	100 year storm	663.79		663.89
196.17 Tributary	60.31 1	74.01 169.19 2453.*	265.02 100 year storm e	272.50 663.79	0.00	663.89
196.17 Tributary	60.31 1	74.01 169.19 2453.*	265.02 500 year storm	272.50 664.44	0.65	664.54
261.26	160.39	103.43 351.86	265.02	272.50	0.03	004.54
Tributary	1	2410.66*	100 year storm	663.44		663.52
100 00	49.76	73.18 180.56	266.45 100 year storm e	274.01	0.00	663.52
198.83 Tributary 198.83	1 49.76	2410.66* 73.18 180.56	266.45	663.44 274.01		
Tributary 261.97	1 134.82	2410.66* 101.12 379.75	500 year storm 266.45	664.16 274.01	0.72	664.24
Tributary	1	2368.33*	100 year storm	663.17		663.23
			Page 59			
		•	· ·			

206.48	43.05	67.77 192.67	WalkerRunFld 267.88	275.53		
Tributary 206.48	1 43.05	2368.33* 67.77 192.67	100 year storm e 267.88	663.17 275.53	0.00	663.23
Tributary	1	2368.33*	500 year storm	663.96	0.78	664.02
268.08	117.76	95.17 402.75	267.88	275.53		
Tributary	1	2326	100 year storm	663.02		663.05
219.83	38.59	58.96 205.96 2326	269.31	277.04	0.00	663.05
Tributary 219.83	1 38.59	58.96 205.96	100 year storm e 269.31	663.02 277.04		
Tributary 279.76	1 104.07	2326 87.45 424.17	500 year storm 269.31	663.82 277.04	0.81	663.86
Tributary	1	1790 BR U	100 year storm	661.86		661.89
219.09 Tributary	45.10 1	56.21 202.19 1790 BR U	269.31 100 year storm e	277.04 661.86	0.00	661.89
219.09 Tributary	45.10 1	56.21 202.19 1790 BR U	269.31 500 year storm	277.04 662.67	0.81	662.71
282.43	120.73	87.04 407.93	269.31	277.04	0.01	002.71
Tributary 190.40	1 66.29	1790 BR D 99.72 137.49	100 year storm 262.44	661.80 274.07		661.84
Tributary	1	1790 BR D	100 year storm e	661.80	0.00	661.84
190.40 Tributary	66.29 1	99.72 137.49 1790 BR D	262.44 500 year storm	274.07 662.59	0.79	662.66
200.73	150.31	159.36 306.02	262.44	274.07		
Taibutany	1	1658	100 year storm	661.44		661.52
Tributary 192.24	57.05	118.90 127.55	100 year storm 262.44	274.07		
Tributary 192.24	1 57.05	1658 118.90 127.55	100 year storm e 262.44	661.44 274.07	0.00	661.52
Tributary	1 133.72	1658 175.84 306.12	500 year storm 262.44	662.21 274.07	0.77	662.30
208.28	133.72	173.84 300.12	202.44	,		
Tributary	1	1608.33*	100 year storm	661.25		661.35
164.59 Tributary	63.97 1	139.58 99.95 1608.33*	254.97 100 year storm e	269.18 661.25	0.00	661.35
164.59	63.97	139.58 99.95	254.97	269.18		662.11
Tributary 195.87	1 154.70	1608.33* 215.24 245.75	500 year storm 254.97	661.99 269.18	0.74	002.11
•						
Tributary 156.16	1 69.27	1558.66* 154.43 79.80	100 year storm 247.51	661.06 264.29		661.17
Tributary	1	1558.66*	100 year storm e	661.06	0.00	661.17
156.16 Tributary	69.27 1	154.43 79.80 1558.66*	247.51 500 year storm	264.29 661.77	0.71	661.91
183.08	167.89	243.01 204.80	247.51	264.29		
Tuškutanu	1	1509.*	100 year storm	660.88		660.98
Tributary 150.59	1 76.33	162.62 64.55	100 year storm 240.04	259.40		
Tributary 150.59	1 76.33	1509.* 162.62 64.55	100 year storm e 240.04	660.88 259.40	0.00	660.98
Tributary	1 182.13	1509.* 260.50 173.06	500 year storm 240.04	661.55 259.40	0.67	661.69
176.83	102.13	200.30 173.00	240.04	233.40		
Tributary	1	1459.33*	100 year storm	660.69		660.79
149.88 Tributary	86.20 1	165.48 51.83 1459.33*	232.57 100 year storm e	254.52 660.69	0.00	660.79
149.88	86.20	165.48 51.83	232.57	254.52		
Tributary 176.57	200.67	1459.33* 269.41 145.61	500 year storm 232.57	661.33 254.52	0.64	661.47
Tributary 151.44	1 99.66	1409.66* 162.61 41.23	100 year storm 225.11	660.50 249.63		660.59
Tributary	1	1409.66*	100 year storm e	660.50	0.00	660.59
151.44 Tributary	99.66 1	162.61 41.23 1409.66*	225.11 500 year storm	249.63 661.10	0.60	661.24
188.41	228.01	267.45 120.24	225.11	249.63		

		1260	WalkerRunFld			660.40
Tributary 174.95	1 125.25	1360 146.83 31.42	100 year storm 217.64	660.33 244.74	0.00	660.40
Tributary 174.95	1 125.25	1360 146.83 31.42	100 year storm e 217.64	660.33 244.74	0.00	660.40
Tributary 212.10	1 282.06	1360 240.27 93.36	500 year storm 217.64	660.91 244.74	0.58	661.01
	_	4204				-
Tributary 110.93	1 70.04	1281 BR U 223.20 10.26	100 year storm 217.64	659.65 244.74		660.02
Tributary 110.93	1 70.04	1281 BR U 223.20 10.26	100 year storm e 217.64	659.65 244.74	0.00	660.02
Tributary 159.64	1 209.43	1281 BR U 356.04 50.22	500 year storm 217.64	660.15 244.74	0.51	660.60
			`			
Tributary 254.17	1 195.49	1281 BR D 42.29 65.71	100 year storm 245.69	659.03 262.11		659.06
Tributary 253.06	1 195.87	1281 BR D 42.82 64.80	100 year storm e 245.69	659.01 262.11	-0.02	659.04
Tributary 286.90	1 379.33	1281 BR D 64.24 172.11	500 year storm 245.69	659.52 262.11	0.49	659.57
Tributary 255.39	1 192.72	1252 46.73 64.05	100 year storm 245.69	659.03 262.11		659.06
Tributary 254.49	1 193.12	1252 47.27 63.11	100 year storm e 245.69	659.01 262.11	-0.02	659.04
Tributary 281.54	1 372.28	1252 73.40 170.01	500 year storm 245.69	659.52 262.11	0.49	659.57
Tributary 257.48	1 174.39	1203.* 54.52 74.59	100 year storm 249.88	658.85 267.22		658.87
Tributary 255.86	1 174.78	1203.* 55.85 72.87	100 year storm e 249.88	658.81 267.22	-0.03	658.84
Tributary 280.29	1 345.10	1203.* 85.11 185.48	500 year storm 249.88	659.32 267.22	0.47	659.36
	272020		2,0,00			
Tributary 256.92	1 156.23	1154.* 63.66 83.61	100 year storm 254.07	658.66 272.34		658.68
Tributary 253.21	1 156.13	1154.* 67.20 80.17	100 year storm e 254.07	658.58 272.34	-0.07	658.62
Tributary 278.97	1 317.55	1154.* 100.62 197.51	500 year storm 254.07	659.08 272.34	0.43	659.13
270137	3233		237107	2,2,3,		
Tributary 251.49	1 139.53	1105 73.78 90.19	100 year storm 258.26	658.45 277.45		658.48
Tributary 237.30	1 138.11	1105 85.80 79.59	100 year storm e 258.26	658.26 277.45	-0.19	658.31
Tributary 271.28	1 285.86	1105 122.81 207.02	500 year storm 258.26	658.78 277.45	0.33	658.84
271.20	203.00	122.01 207.02	230.20	211.43		
Tributary 483.04	1 68.44	810 59.73 175.32	100 year storm 307.34	657.29 320.94		657.31
Tributary 586.48	1 101.63	810 30.26 171.61	100 year storm e 307.34	657.97 320.94	0.68	657.97
Tributary 596.53	1 226.32	810 49.82 339.54	500 year storm 307.34	658.29 320.94	1.00	658.30
350.33	220.32	43.02 333.34	307.34	320.34		
Tributary 528.17	1 112.58	587 23.18 167.74	100 year storm 102.91	657.03 114.18		657.04
Tributary 692.76	1 1 140.80	587 14.92 147.78	100 year storm e 102.91	657.94 114.18	0.90	657.94
Tributary 706.29	1 298.86	587 27.43 289.40	500 year storm 102.91	658.21 114.18	1.17	658.21
700.23	290.00	21.73 203.40	102.91	117.10		
Tributary 776.32	1 150.82	463 16.81 135.86	100 year storm 213.70	657.02 233.37	•	657.02
Tributary 957.60	1 1 160.67	463 13.53 129.30	100 year storm e 213.70	657.93 233.37	0.92	657.93
Tributary 973.00	1 331.35	463 26.05 258.29	500 year storm 213.70	658.20 233.37	1.18	658.20
5,5.00	,,,,,,	20.03 230.25	213.70	233.31		

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Tributary 1143.98	1 216.15	357 4.62	82.73	100 year storm 185.31	657.01 191.14		657.01
Tributary 1196.87	1 213.46	357		100 year storm e	657.93	0.92	657.93
Tributary 1203.42	1 431.49	3.51 357 6.71	86.54 177.48	185.31 500 year storm 185.31	191.14 658.19 191.14	1.18	658.19
Tributary 1134.98	1 229.80	183 9.58	64.12	100 year storm 191.70	657.01 208.19		657.01
Tributary 1234.23	1 225.72	183	69.76	100 year storm e 191.70	657.93 208.19	0.92	657.93
Tributary 1242.80	1 455.50	8.01 183 15.63	144.56	500 year storm 191.70	658.19 208.19	1.18	658.19

ERRORS WARNINGS AND NOTES Errors Warnings and Notes for Plan : Prop

RS: 6850

River: Tributary Reach: 1 RS: 6850 Profile: 500 year storm
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth

for the water surface and continued on with the calculations. warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7

or greater than 1.4.

This may indicate the need for additional cross sections.

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate

the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated

water surface came back below critical depth. This indicates that there is not a valid

The subcritical answer.

program defaulted to critical depth.
River: Tributary Reach: 1 RS: 5930 Profile: 100 year storm
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7

or greater than 1.4.

This may indicate the need for additional cross sections.

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate

the need for additional cross sections.

Note: Hydraulic jump has occurred between this cross section and the previous upstream section.

River: Tributary Reach: 1 RS: 5930 Profile: 100 year storm e

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7

or greater than 1.4.

This may indicate the need for additional cross sections.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate

the need for additional cross sections. Note: Hydraulic jump has occurred between this cross section and the previous upstream section.

River: Tributary Reach: 1 RS: 5930 Profile: 500 year storm

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7

or greater than 1.4.

This may indicate the need for additional cross sections.

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate

the need for additional cross sections.

Note: Hydraulic jump has occurred between this cross section and the previous upstream section.

River: Tributary Reach: 1 RS: 5500 Profile: 100 year storm

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth

for the water surface and continued on with the calculations.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross on. This may indicate
the need for additional cross sections.

section. Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated

water surface came back below critical depth. This indicates that there is not a valid subcritical answer. program defaulted to critical depth.

WalkerRunFld RS: 5500 River: Tributary Reach: 1 RS: 5500 Profile: 100 year storm e
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

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

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate

the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
River: Tributary Reach: 1 RS: 5500 Profile: 500 year storm
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 This may indicate the need for additional cross sections.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Tributary Reach: 1 RS: 4750 Profile: 100 year storm
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
River: Tributary Reach: 1 RS: 4750 Profile: 100 year storm e
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
River: Tributary Reach: 1 RS: 4750 Profile: 500 year storm
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
River: Tributary Reach: 1 RS: 4530 Profile: 100 year storm
Warning:Critical depth could not be determined within the specified number of iterations. The program used the iteration

with the lowest energy.

Warning:During subcritical analysis, the water surface upstream of culvert went to critical depth.

River: Tributary Reach: 1 RS: 4530 Profile: 100 year storm e

Warning:Critical depth could not be determined within the specified number of iterations. The program used the iteration with the lowest energy.

Warning:During subcritical analysis, the water surface upstream of culvert went to critical depth.

River: Tributary Reach: 1 RS: 4528 Profile: 100 year storm

Warning:During subcritical analysis, while trying to calculate culvert and weir flow, the program could not get a balance of energy within the specified tolerance and number of trials. The program used the solution with the minimum error. Warning:During subcritical analysis, the water surface upstream of culvert went to critical depth.

River: Tributary Reach: 1 RS: 4528 Profile: 100 year storm Culv: Culvert #1

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

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

River: Tributary Reach: 1 Rs: 4528 Profile: 100 year storm e

Warning:During subcritical analysis, while trying to calculate culvert and weir flow, the program could not get a balance of energy within the specified tolerance and number of trials. The program used the solution with the minimum error.

Warning:During subcritical analysis, the water surface upstream of culvert went to critical depth.

River: Tributary Reach: 1 Rs: 4528 Profile: 100 year storm e Culv: Culvert #1

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

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

outlet energy grade answer may not be valid.

River: Tributary Reach: 1 RS: 4500 Profile: 100 year storm

Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth

for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated

water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The

program defaulted to critical depth. Multiple critical depths were found at this location. The critical depth with the lowest, Note:

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

River: Tributary Reach: 1 RS: 4500 Profile: 100 year storm e Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid water surface came back below critical depth. This indicates that there is not a valid subcritical answer.

program defaulted to critical depth. Multiple critical depths were found at this location. The critical depth with the lowest, Note: Note: Multiple Critical depths were round at this location. The critical depth series were round at this location. The critical depth series and continued on with the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7

or greater than 1.4.

This may indicate the need for additional cross sections.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate

the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated

water surface came back below critical depth. This indicates that there is not a valid

subcritical answer. The

program defaulted to critical depth. Multiple critical depths were found at this location. The critical depth with the lowest, Note:

valid, energy was used.
River: Tributary Reach: 1 Rs: 4400 Profile: 100 year storm
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest,

valid, energy was used.
River: Tributary Reach: 1 Rs: 4400 Profile: 100 year storm e
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest,

valid, energy was used.
River: Tributary Reach: 1 RS: 4400 Profile: 500 year storm
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate

the need for additional cross sections.
Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Tributary Reach: 1 RS: 3356 Profile: 100 year storm
warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth

for the water surface and continued on with the calculations.
Warning:Divided flow computed for this cross-section.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated

water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The

program defaulted to critical depth.

Note: Hydraulic jump has occurred between this cross section and the previous upstream section.

River: Tributary Reach: 1 RS: 3356 Profile: 100 year storm e

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth

for the water surface and continued on with the calculations.
Warning:Divided flow computed for this cross-section.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate

the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid

subcritical answer. program defaulted to critical depth.

Note: Hydraulic jump has occurred between this cross section and the previous upstream section.
River: Tributary Reach: 1 RS: 3356 Profile: 500 year storm
Warning: The energy equation could not be balanced within the specified number of iterations. The

program used critical depth

for the water surface and continued on with the calculations.
Warning:Divided flow computed for this cross-section.
Warning:Critical depth could not be determined within the specified number of iterations. The program used the iteration with the lowest energy.

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross on. This may indicate the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The

program defaulted to critical depth.

Note: Hydraulic jump has occurred between this cross section and the previous upstream section.

River: Tributary Reach: 1 RS: 3108 Profile: 100 year storm

Warning:Pier drag coefficient of 2.0 assumed for Class B flow.

River: Tributary Reach: 1 RS: 3108 Profile: 100 year storm Upstream

Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for the changed by more than 0.5 ft (0.15 m). This may indicate the need for the changed by more than 0.5 ft (0.15 m). This may indicate the need for the changed by more than 0.5 ft (0.15 m).

River: Tributary Reach: 1 RS: 3108 Profile: 100 year storm Upstream

Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional čross sections.

Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate

the need for additional cross sections.

Manning's n values were composited to a single value in the main channel Multiple critical depths were found at this location. The critical depth

The critical depth with the lowest, Note: valid, energy was used.
River: Tributary Reach: 1 RS: 3108 Profile: 100 year storm Downstream
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7

or greater than 1.4.

This may indicate the need for additional cross sections.
Warning:Critical depth could not be determined within the specified number of iterations. The program used the iteration

with the lowest energy.

Note: Manning's n values were composited to a single value in the main channel.

River: Tributary Reach: 1 RS: 3108 Profile: 100 year storm e

Warning:Pier drag coefficient of 2.0 assumed for Class B flow.

River: Tributary Reach: 1 RS: 3108 Profile: 100 year storm e Upstream

Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate

the need for additional cross sections.
Manning's n values were composited to a single value in the main channel,
Multiple critical depths were found at this location. The critical depth The critical depth with the lowest, Note:

valid, energy was used.
River: Tributary Reach: 1 RS: 3108 Profile: 100 year storm e Downstream
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7

or greater than 1.4.

This may indicate the need for additional cross sections.

Warning:Critical depth could not be determined within the specified number of iterations. The program used the iteration

with the lowest energy.

Note: Manning's n values were composited to a single value in the main channel.

River: Tributary Reach: 1 RS: 3108 Profile: 500 year storm Upstream

Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth

for the water surface and continued critical depth for the water surface and continued on with the calculations.

WalkerRunFld Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections. Manning's n values were composited to a single value in the main channel.
Multiple critical depths were found at this location. The critical depth with the lowest, Note: Note: valid, energy was used.
River: Tributary Reach: 1 RS: 3108 Profile: 500 year storm Downstream
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations. Warning:Critical depth could not be determined within the specified number of iterations. The program used the iteration with the lowest energy. Note: Manning's n values were composited to a single value in the main channel.
River: Tributary Reach: 1 RS: 3010 Profile: 500 year storm Downstream
Warning:Critical depth could not be determined within the specified number of iterations. The program used the iteration with the lowest energy.
River: Tributary Reach: 1 RS: 2834 Profile: 500 year storm
Warning:Critical depth could not be determined within the specified number of iterations. The program used the iteration with the lowest energy. cary Reach: 1 RS: 2326 program used the iteration with the lowest energy.
River: Tributary Reach: 1 RS: 1790 Profile: 100 year storm Downstream
Warning:Critical depth could not be determined within the specified number of iterations. The program used the iteration with the lowest energy.

River: Tributary Reach: 1 RS: 1790 Profile: 100 year storm e Upstream

Warning:Critical depth could not be determined within the specified number of iterations. program used the iteration with the lowest energy.

River: Tributary Reach: 1 RS: 1790 Profile: 100 year storm e Downstream

Warning: Critical depth could not be determined within the specified number of iterations. The program used the iteration with the lowest energy.

River: Tributary Reach: 1 RS: 1360 Profile: 100 year storm

Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
River: Tributary Reach: 1 RS: 1360 Profile: 100 year storm e
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
River: Tributary Reach: 1 RS: 1360 Profile: 500 year storm
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.
River: Tributary Reach: 1 RS: 1281 Profile: 100 year storm Upstream
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections. Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The

program defaulted to critical depth.
River: Tributary Reach: 1 RS: 1281 Profile: 100 year storm Downstream
Warning:The energy equation could not be balanced within the specified number of iterations. The

WalkerRunFld program used critical depth for the water surface and continued on with the calculations.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Warning:Critical depth could not be determined within the specified number of iterations. The program used the iteration

with the lowest energy. with the lowest energy.

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.

River: Tributary Reach: 1 RS: 1281 Profile: 100 year storm e Upstream
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4 or greater than 1.4. This may indicate the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth. tary Reach: 1 RS: 1281 Profile: 100 year storm e Downstream River: Tributary Reach: 1 RS: 1281 Profile: 100 year storm e Downstream
Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Warning:Critical depth could not be determined within the specified number of iterations. The program used the iteration with the lowest energy. Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate $\frac{1}{2}$ the need for additional cross sections.
River: Tributary Reach: 1 RS: 1281 Profile: 500 year storm Upstream
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Warning:Critical depth could not be determined within the specified number of iterations. The program used the iteration

with the lowest energy. Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth. River: Tributary Reach: 1 RS: 1281 Profile: 500 year storm Downstream

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning:Critical depth could not be determined within the specified number of iterations. The program used the iteration with the lowest energy. Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate $\frac{1}{2}$ the need for additional cross sections.

River: Tributary Reach: 1 RS: 1105 Profile: 100 year storm
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.

River: Tributary Reach: 1 RS: 1105 Profile: 100 year storm e

**River: Tributary Reach: 1 RS: 1105 Profile: 100 year storm e River: Tributary Reach: 1 RS: 1105 Profile: 100 year storm e
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
River: Tributary Reach: 1 RS: 1105 Profile: 500 year storm
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.

WalkerRunFld River: Tributary Reach: 1 Rs: 810 Profile: 100 year storm
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

River: Tributary Reach: 1 RS: 810 Profile: 100 year storm e

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

River: Tributary Reach: 1 RS: 810 Profile: 500 year storm

Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
River: Tributary Reach: 1 RS: 587 Profile: 100 year storm
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
River: Tributary Reach: 1 RS: 587 Profile: 100 year storm e
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

River: Tributary Reach: 1 RS: 587 Profile: 500 year storm

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

Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
River: Tributary Reach: 1 RS: 463 Profile: 100 year storm
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
River: Tributary Reach: 1 RS: 463 Profile: 100 year storm e
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
River: Tributary Reach: 1 RS: 463 Profile: 500 year storm
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 Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.

River: Tributary Reach: 1 RS: 357 Profile: 500 year storm

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

River: Tributary Reach: 1 RS: 183 Profile: 500 year storm

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

River: Walker Run Reach: 1 RS: 5862 Profile: 100 year storm e

Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth

for the water surface and continued on with the calculations.

Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections. additional čross sections. Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Warning:The cross section had to be extended vertically during the critical depth calculations.

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections. Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated

water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth. Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth. Run Reach: 1 RS: 5862 Profile: 500 year storm River: Walker Run Reach: 1 Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections. warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated

water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The

program defaulted to critical depth.
River: Walker Run Reach: 1 RS: 5547 Profile: 100 year storm Note: Hydraulic jump has occurred between this cross section and the previous upstream section.

River: Walker Run Reach: 1 RS: 5547 Profile: 100 year storm e Note: Hydraulic jump has occurred between this cross section and the previous upstream section. River: Walker Run Reach: 1 RS: 5547 Profile: 500 year storm Note: Hydraulic jump has occurred between this cross section and the previous upstream section.

River: Walker Run Reach: 1 RS: 5282 Profile: 100 year storm

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.
Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used. River: Walker Run Reach: 1 River: Walker Run Reach: 1 RS: 5282 Profile: 100 year storm e 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.

Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used. River: Walker Run Reach: 1 RS: 5282 Profile: 500 year storm Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used. River: Walker Run Reach: 1 kiver: Walker Run Reach: 1 RS: 5250 Profile: 100 year storm Upstream
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections. Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Walker Run Reach: 1 RS: 5250 Profile: 100 year storm Downstream
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections. Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections. Multiple critical depths were found at this location. The critical depth with the lowest, Note: valid, energy was used. River: Walker Run Reach: 1 : Walker Run Reach: 1 RS: 5250 Profile: 100 year storm e Upstream Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for RS: 5250 additional cross sections.

Warning:Critical depth could not be determined within the specified number of iterations. The program used the iteration with the lowest energy. warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate $\frac{1}{2}$ the need for additional cross sections. Multiple critical depths were found at this location. The critical depth with the lowest, Note: valid, energy was used.
River: Walker Run Reach: 1 RS: 5250 Profile: 100 year storm e Downstream
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections. Multiple critical depths were found at this location. The The critical depth with the lowest. valid, energy was used. River: Walker Run Reach: 1 e: walker Run Reach: 1 RS: 5250 Profile: 500 year storm Upstream warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections. Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections. Multiple critical depths were found at this location. The critical depth with the lowest, Note: valid, energy was used. River: Walker Run Reach: 1 walker Run Reach: 1 RS: 5250 Profile: 500 year storm Downstream warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections. Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections. Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross

WalkerRunFld section. This may indicate the need for additional cross sections. Multiple critical depths were found at this location. The critical depth with the lowest. Note: valid, energy was used. River: Walker Run Reach: 1 walker Run Reach: 1 RS: 5198 Profile: 100 year storm warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections. Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections. Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used. River: Walker Run Reach: 1 : Walker Run Reach: 1 RS: 5198 Profile: 100 year storm e 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.
Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used. River: Walker Run Reach: 1 RS: 5198 Profile: 500 year storm Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections. Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater ťhan 1.4. This may indicate the need for additional cross sections.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used. River: Walker Run Reach: 1 : walker Run Reach: 1 RS: 5107 Profile: 100 year storm
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections. : walker Run Reach: 1 RS: 5107 Profile: 100 year storm e Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 River: Walker Run Réach: 1 or greater ťhan 1.4. This may indicate the need for additional cross sections.

: walker Run Reach: 1 RS: 5107 Profile: 500 year storm

Note: Hydraulic jump has occurred between this cross section and the previous upstream section.

: walker Run Reach: 1 RS: 4414 Profile: 100 year storm e
warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 River: Walker Run Réach: 1 River: Walker Run Reach: 1 or greater than 1.4. This may indicate the need for additional cross sections. r Run Reach: 1 RS: 4295 Profile: 500 year storm River: Walker Run Reach: 1 RS: 4295 Profile: 500 year storm
Warning:Divided flow computed for this cross-section.
River: Walker Run Reach: 1 RS: 4130 Profile: 100 year storm e
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.
River: Walker Run Reach: 1 RS: 4043 Profile: 100 year storm
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
River: Walker Run Reach: 1 RS: 4043 Profile: 100 year storm e
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.

This may indicate the need for additional cross sections.

Profile: 500 year storm River: Walker Run Reach: 1 RS: 4043 Profile: 500
Warning: Divided flow computed for this cross-section. warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections. : Walker Run Reach: 1 RS: 3972 Profile: 100 year storm Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for River: Walker Run Réach: 1 additional cross sections.

warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7

WalkerRunFld or greater than 1.4. This may indicate the need for additional cross sections. Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used. River: Walker Run Reach: 1 walker Run Reach: 1 RS: 3972 Profile: 100 year storm e 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.

Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used. River: Walker Run Reach: 1 RS: 3972 Profile: 500 year storm Multiple critical depths were found at this location. The critical depth with the lowest, Note: valid, energy was used. River: Walker Run Reac Reach: 1 RS: 3914 Profile: 100 year storm warning:The sluice gate calculations did not converge during the pressure flow only calculation.

Note: The weir over a bridge is submerged, the energy answer was used.

Note: The downstream water surface is below the minimum elevation for pressure flow. The sluice gate equations were used for pressure flow.
River: Walker Run Reach: 1 RS: 3914 Profile: 100 year storm Upstream
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used. River: Walker Run Reach: 1 : Walker Run Reach: 1 RS: 3914 Profile: 100 year storm Downstream warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used. River: Walker Run Reach: 1 : Walker Run Reach: 1 RS: 3914 Profile: 100 year storm e Warning:The sluice gate calculations did not converge during the pressure flow only calculation. Note: Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded. The downstream water surface is below the minimum elevation for pressure flow. The sluice gate equations were used River: Walker Run Reach: 1 RS: 3914 Profile: 100 year storm e Upstream
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections. for pressure flow. Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections. Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used. River: Walker Run Reach: 1 r: walker Run Reach: 1 RS: 3914 Profile: 100 year storm e Downstream warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections. Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Walker Run Reach: 1 RS: 3914 Profile: 500 year storm
Note: The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow. River: Walker Run Reach: 1 RS: 3914 Profile: 500 year storm Upstream For the cross section inside the bridge at the upstream end, the water surface and energy have been projected from the upstream cross section. The selected bridge modeling method does not compute answers inside the bridge. Multiple critical depths were found at this location. The critical depth with the lowest, Note: valid, energy was used. River: Walker Run Reach: 1 RS: 3914 Profile: 500 year storm Downstream Note: For the cross section inside the bridge at the downstream end, the water surface is based on critical depth over the
weir. The energy has been projected.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used. River: Walker Run Reach: 1 walker Run Reach: 1 RS: 3860 Profile: 100 year storm Warning:Divided flow computed for this cross-section. Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections. The energy method has computed a class B profile. Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used. River: Walker Run Reach: 1 RS: 3860 Profile: 100 year storm e Warning: The energy equation could not be balanced within the specified number of iterations. The

for the water surface and continued on with the calculations.

program used critical depth

WalkerRunFld

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7

or greater than 1.4.

This may indicate the need for additional cross sections.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate

the need for additional cross sections.

Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid

subcritical answer. The

program defaulted to critical depth. Multiple critical depths were found at this location. The critical depth with the lowest, Note: valid, energy was used. River: Walker Run Reach: 1

: Walker Run Reach: 1 RS: 3860 Profile: 500 year storm Warning:The energy equation could not be balanced within the specified number of iterations. The

program used critical depth

for the water surface and continued on with the calculations.
Warning:The cross-section end points had to be extended vertically for the computed water surface.
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. water surface came back below critical depth. This indicates that there is not a valid

subcritical answer. The program defaulted to critical depth.

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used. River: Walker Run Reach: 1

: Walker Run Reach: 1 RS: 3785 Profile: 100 year storm Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for

additional cross sections.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate

the need for additional cross sections.

Hydraulic jump has occurred between this cross section and the previous upstream section.

Run Reach: 1 RS: 3785 Profile: 100 year storm e Note: River: Walker Run Reach: 1

Note: Hydraulic jump has occurred between this cross section and the previous upstream section.

River: Walker Run Reach: 1 RS: 3785 Profile: 500 year storm

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.

Or greater than 1.4.

This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate

the need for additional cross sections.
Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used. River: Walker Run Reach: 1

Kiver: Walker Run Reach: 1 RS: 3735 Profile: 100 year storm
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate

the need for additional cross sections.

River: Walker Run Reach: 1 RS: 3735 Profile: 100 year storm e

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate

the need for additional cross sections.

River: Walker Run Reach: 1 RS: 3735 Profile: 500 year storm

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate

the need for additional cross sections.

Note: Hydraulic jump has occurred between this cross section and the previous upstream section.

River: Walker Run Reach: 1 RS: 3410 Profile: 500 year storm

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

River: Walker Run Reach: 1 RS: 3375 Profile: 100 year storm

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7

or greater than 1.4.

This may indicate the need for additional cross sections.
River: Walker Run Reach: 1 RS: 3375 Profile: 500 year storm
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

RS: 3278 Profile: 100 year storm River: Walker Run Reach: 1

WalkerRunFld

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

River: Walker Run Reach: 1 RS: 3278 Profile: 100 year storm e
 Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
 the need for additional cross sections.

River: Walker Run Reach: 1 RS: 3278 Profile: 500 year storm
 Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
 the need for additional cross sections the need for additional cross sections.
River: Walker Run Reach: 1 RS: 2730 Profile Profile: 100 year storm e warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.
Run Reach: 1 RS: 2620 Profile: 100 year storm River: Walker Run Reach: 1 RS: 2620 Profile: 100 year storm

Note: The water surface computed by the sluice gate equation (during pressure only calculations) is below the physical low chord of the bridge. The downstream water surface is below the minimum elevation for pressure flow. The sluice Note: gate equations were used for pressure flow. Note: Pressure flow was attempted because the energy, from the low flow method, was high enough. However, the pressure flow answer was below the low chord. Therefore, the pressure answer is not valid. : Walker Run Reach: 1 RS: 2620 Profile: 100 year storm Upstream Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 River: Walker Run Reach: 1 or greater than 1.4. This may indicate the need for additional cross sections. Run Reach: 1 RS: 2620 Profile: 100 year storm e River: Walker Run Reach: 1 RS: 2620 Profile: 100 year storm e

Note: The water surface computed by the sluice gate equation (during pressure only calculations) is below the physical low chord of the bridge. The downstream water surface is below the minimum elevation for pressure flow. The sluice gate equations were used for pressure flow. Pressure flow was attempted because the energy, from the low flow method, was high enough. Note: However, the pressure
flow answer was below the low chord. Therefore, the pressure answer is not valid.
River: Walker Run Reach: 1 RS: 2620 Profile: 100 year storm e Upstream
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
River: Walker Run Reach: 1 RS: 2620 Profile: 100 year storm e Downstream
Warning:Critical depth could not be determined within the specified number of iterations. The program used the iteration with the lowest energy.

River: Walker Run Reach: 1 RS: 2620 Profile: 500 year storm

Note: The water surface computed by the sluice gate equation (during pressure only calculations) is below the physical low chord of the bridge.

The downstream water surface is below the minimum elevation for pressure flow. The sluice Note: The downstream water surface is below the minimum elevation for pressure flow. The sluice gate equations were used for pressure flow. Pressure flow was attempted because the energy, from the low flow method, was high enough. Note: However, the pressure flow answer was below the low chord. Therefore, the pressure answer is not valid.
River: Walker Run Reach: 1 RS: 2620 Profile: 500 year storm Upstream
Warning:Critical depth could not be determined within the specified number of iterations. The program used the iteration with the lowest energy.
River: Walker Run Reach: 1 RS: 2620 Profile: 500 year storm Downstream
Warning:Critical depth could not be determined within the specified number of iterations. The program used the iteration with the lowest energy. River: Walker Run Reach: 1 RS: 2462 Profile: 100 year storm e warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
River: Walker Run Reach: 1 RS: 2339 Profile: 100 year storm e
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
River: Walker Run Reach: 1 RS: 2274 Profile: 100 year storm
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
River: Walker Run Reach: 1 RS: 2274 Profile: 500 year storm
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7

walkerRunFld

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or greater than 1.4.
         This may indicate the need for additional cross sections.
: Walker Run Reach: 1 RS: 2139 Profile: 500 year storm
Warning:The_conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7
River: Walker Run Reach: 1
or greater than 1.4.
         This may indicate the need for additional cross sections.
: Walker Run Reach: 1 RS: 1925 Profile: 500 year storm
Warning:The cross-section end points had to be extended vertically for the computed water surface.
: Walker Run Reach: 2 RS: 1602 Profile: 500 year storm
River: Walker Run Reach: 1
River: Walker Run Reach: 2 RS: 1602 Profile: 500 year storm
Warning:The cross-section end points had to be extended vertically for the computed water surface.
River: Walker Run Reach: 2 RS: 1402 Profile: 500 year storm
Warning:The cross-section end points had to be extended vertically for the computed water surface.
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.
: Walker Run Reach: 2 RS: 1208 Profile: 100 year storm e
Warning:The_conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7
River: Walker Run Reach: 2
or greater than 1.4.
         This may indicate the need for additional cross sections.
: Walker Run Reach: 2 RS: 990 Profile: 100 year storm
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7
River: Walker Run Reach: 2
or greater than 1.4.
         This may indicate the need for additional cross sections.
: Walker Run Reach: 2 RS: 990 Profile: 500 year storm
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7
River: Walker Run Reach: 2
or greater than 1.4.
This may indicate the need for additional cross sections.
River: Walker Run Reach: 2 RS: 884 Profile: 100 year storm
Warning:Critical depth could not be determined within the specified number of iterations. The
program used the iteration
with the lowest energy.
River: Walker Run Reach: 2 RS: 884
River: Walker Run Reach: 2 RS: 884 Profile: 100 year storm e
Warning: The cross section had to be extended vertically during the critical depth calculations.
River: Walker Run Reach: 2 RS: 884 Profile: 500 year storm
Warning: Critical depth could not be determined within the specified number of iterations. The program used the iteration
with the lowest energy.
River: Walker Run Reach: 2 RS: 875
         : walker Run Reach: 2 RS: 875 Profile: 100 year storm e
warning:During subcritical analysis, while trying to calculate culvert and weir flow, the program
could not get a balance of
                         energy within the specified tolerance and number of trials. The program used the solution
with the minimum error.
         warker Run Reach: 2 RS: 875 Profile: 100 year storm e Culv: Culvert #1 warning:During the culvert inlet control computations, the program could not balance the ert/weir flow. The reported
River: Walker Run Reach: 2
culvert/weir flow.
inlet energy grade answer may not be valid.

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

River: Walker Run Reach: 2 RS: 863 Profile: 100 year storm e

Warning: The cross section had to be extended vertically during the critical depth calculations.

River: Walker Run Reach: 2 RS: 715 Profile: 100 year storm e

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7
or greater than 1.4.
                        This may indicate the need for additional cross sections.
River: Walker Run Réach: 2
                                                           RS: 715
                                                                                  Profile: 500 year storm
         Warning:The cross-section end points had to be extended vertically for the computed water surface.
Walker Run Reach: 2 RS: 350 Profile: 100 year storm e
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7
River: Walker Run Reach: 2
or greater than 1.4.
                        This may indicate the need for additional cross sections.
r Run Reach: 2 RS: 350 Profile: 500 year storm
River: Walker Run Reach: 2
                                                           RS: 350
         Warning:The cross-section end points had to be extended vertically for the computed water surface.
Walker Run Reach: 2 RS: 185 Profile: 100 year storm
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7
River: Walker Run Reach: 2
or greater than 1.4.
This may indicate the need for additional cross sections.
River: Walker Run Reach: 2 RS: 185 Profile: 500 year storm
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7
or greater than 1.4.
This may indicate the need for additional cross sections.
River: Walker Run Reach: 2 RS: 147 Profile: 100 year storm
Warning:Divided flow computed for this cross-section.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7
or greater than 1.4.
This may indicate the need for additional cross sections.
River: Walker Run Reach: 2 RS: 147 Profile: 500 year storm
Warning:Divided flow computed for this cross-section.
         Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7
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WalkerRunFld

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or greater than 1.4.
                  This may indicate the need for additional cross sections.
                er Run Réach: 2 RS: 011 Profile: 100 year storm
Multiple critical depths were found at this location. The critical depth with the lowest,
River: Walker Run Réach: 2
       Note:
valid, energy was used.
River: Walker Run Reach: 2
      r: Walker Run Reach: 2 RS: 011 Profile: 100 year storm e
Warning:The cross section had to be extended vertically during the critical depth calculations.
Note: Multiple critical depths were found at this location. The critical depth with the lowest,
valid, energy was used.
River: Walker Run Reach: 2 RS: 011 Profile: 500 year storm
Warning:Critical depth could not be determined within the specified number of iterations. The
program used the iteration
with the lowest energy.
River: Walker Run Reach: 2 RS: -10 Profile: 100 year storm
Note: The downstream water surface is above the minimum elevation required for orifice flow. The
orifice flow equation was
used for pressure flow.
River: Walker Run Reach: 2 RS:
                                           RS: -10
                                                            Profile: 100 year storm Upstream
      Warning:Critical depth could not be determined within the specified number of iterations. The
program used the iteration
                  with the lowest energy.
                  For the cross section inside the bridge at the upstream end, the water surface and energy
have been projected from
                  the upstream cross section. The selected bridge modeling method does not compute answers
inside the bridge.
                 Multiple critical depths were found at this location. The critical depth with the lowest,
valid, energy was used.
River: Walker Run Reach: 2
                 , rRun Reach: 2 RS: -10 Profile: 100 year storm Downstream
For the cross section inside the bridge at the downstream end, the water surface is based on
      Note:
critical depth over the
weir. The energy has been projected.
Note: Multiple critical depths were found at this location. The critical depth with the lowest,
valid, energy was used.
River: Walker Run Reach: 2 RS: -10 Profile: 100 year storm e
Note: The downstream water surface is above the minimum elevation required for orifice flow. The
orifice flow equation was
used for pressure flow.
River: Walker Run Reach: 2 RS: -10 Profile: 100 year storm e Upstream
Note: For the cross section inside the bridge at the upstream end, the water surface and energy
have been projected from
                  the upstream cross section. The selected bridge modeling method does not compute answers
inside the bridge.
      Note:
                Multiple critical depths were found at this location. The critical depth with the lowest,
valid, energy was used.
River: Walker Run Reach: 2
River: Walker Run Reach: 2 RS: -10 Profile: 100 year storm e Downstream

Note: For the cross section inside the bridge at the downstream end, the water surface and energy are based on critical
                  depth over the weir.
                 Multiple critical depths were found at this location. The critical depth with the lowest,
valid, energy was used.
River: Walker Run Reach: 2
                 r Run Reach: 2 RS: -10 Profile: 500 year storm
The downstream water surface is above the minimum elevation required for orifice flow. The
      Note:
orifice flow equation was
                 used for pressure flow.
                                            RS: -10
River: Walker Run Reach: 2
                                                            Profile: 500 year storm Upstream
      Note:
                For the cross section inside the bridge at the upstream end, the water surface and energy
have been projected from
                  the upstream cross section. The selected bridge modeling method does not compute answers
inside the bridge.
                Multiple critical depths were found at this location. The critical depth with the lowest,
      Note:
valid, energy was used.

River: Walker Run Reach: 2 RS: -10 Profile: 500 year storm Downstream

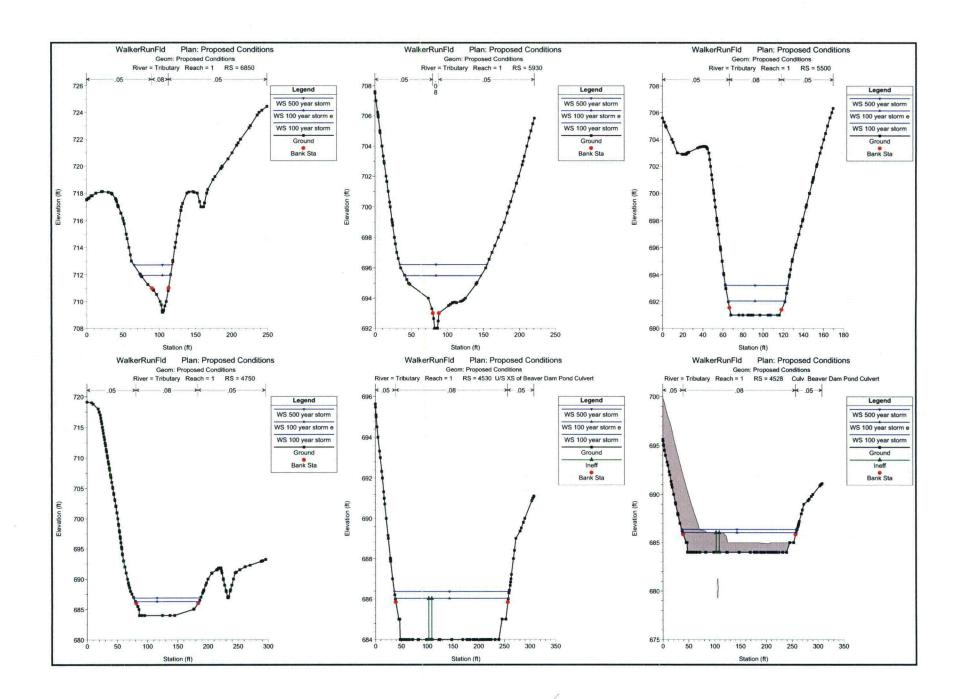
Note: For the cross section inside the bridge at the downstream end, the water surface and energy
have been projected from
                 the downstream cross section. The selected bridge modeling method does not compute answers
inside the bridge.
      Note:
                Multiple critical depths were found at this location. The critical depth with the lowest,
valid, energy was used.
River: Walker Run Reach: 2
      : Walker Run Reach: 2 RS: -30 Profile: 100 year storm
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7
or greater than 1.4.
                 This may indicate the need for additional cross sections.
Multiple critical depths were found at this location. The critical depth with the lowest,
valid, energy was used.
River: Walker Run Reach: 2
      : Walker Run Reach: 2 RS: -30 Profile: 100 year storm e
Warning:The cross section had to be extended vertically during the critical depth calculations.
Note: Multiple critical depths were found at this location. The critical depth with the lowest,
valid, energy was used.
River: Walker Run Reach: 2
                                            RS: -30
                                                            Profile: 500 year storm
```

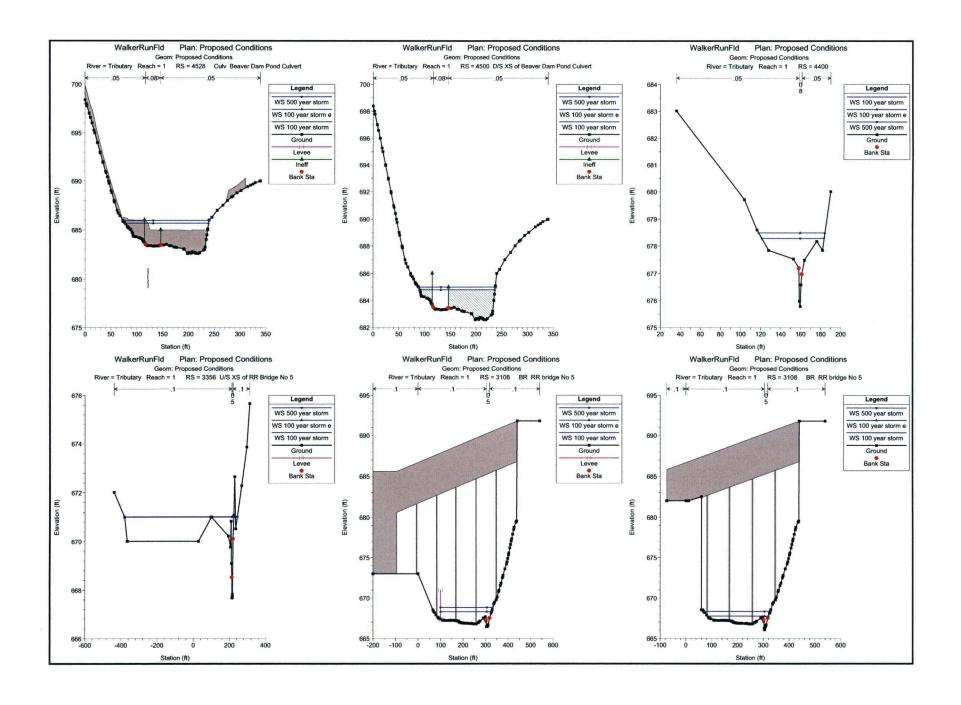
WalkerRunFld

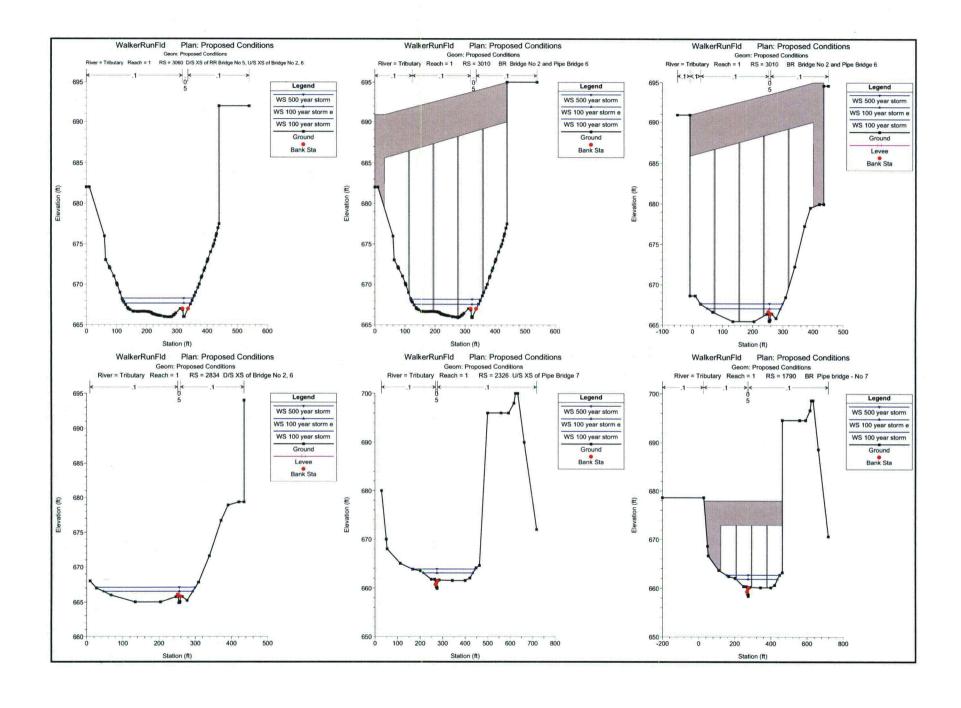
WalkerRunFld
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

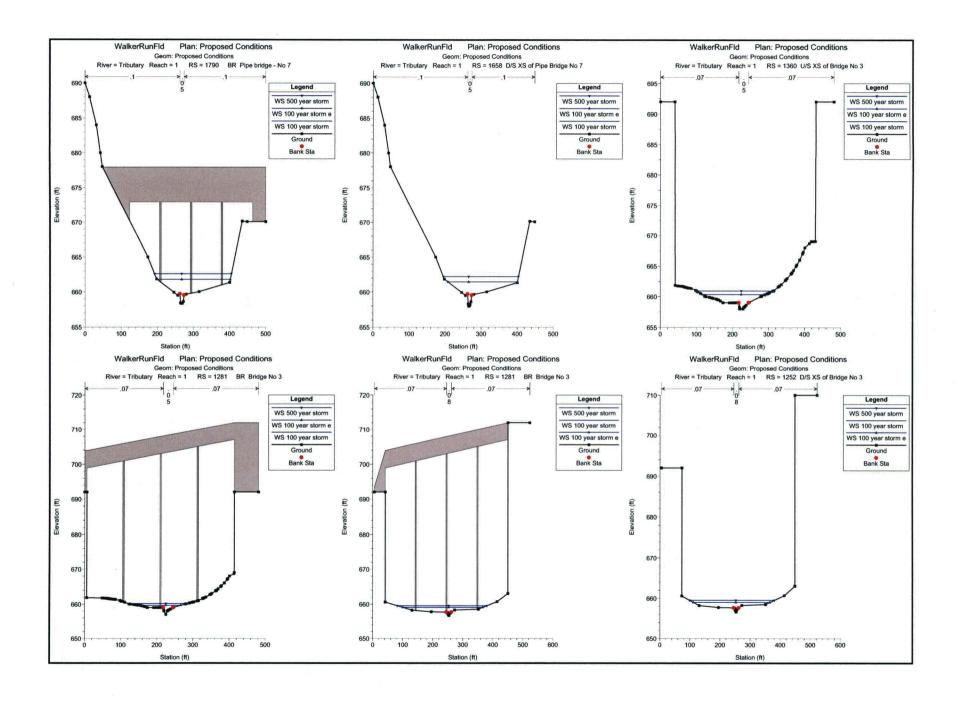
This may indicate the need for additional cross sections.
Warning:Critical depth could not be determined within the specified number of iterations. The program used the iteration
With the lowest energy.

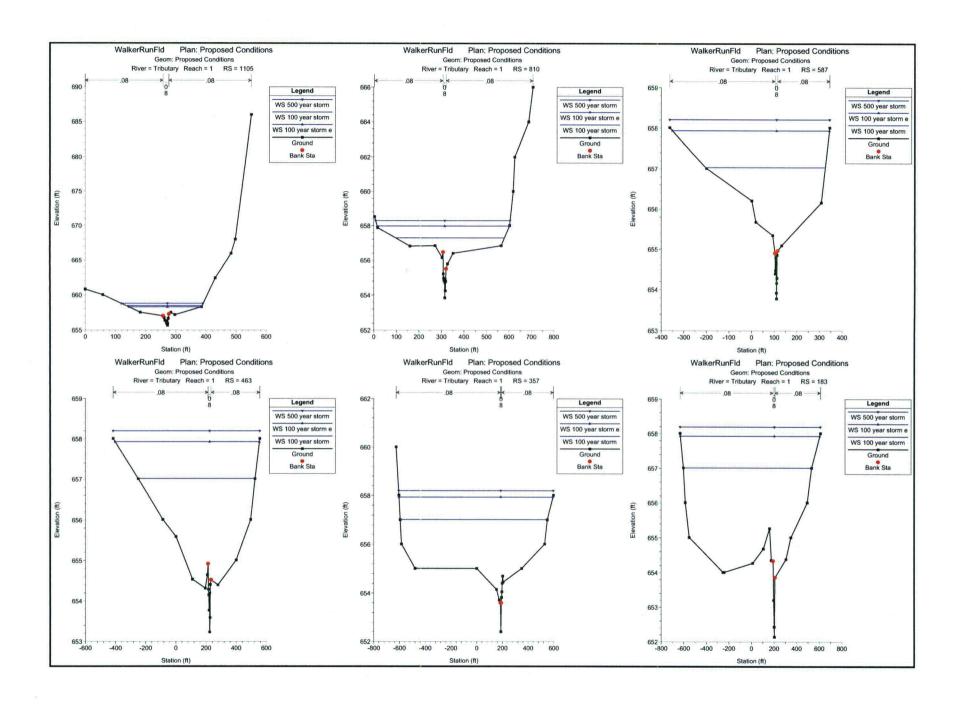
River: Walker Run Reach: 2 RS: -78 Profile: 100 year storm
Warning:The cross-section end points had to be extended vertically for the computed water surface. River: Walker Run Reach: 2 RS: -78 Profile: 500 year storm
Warning:The cross-section end points had to be extended vertically for the computed water surface. River: Walker Run Reach: 2 RS: -154 Profile: 100 year storm
Warning:The cross-section end points had to be extended vertically for the computed water surface. River: Walker Run Reach: 2 RS: -154 Profile: 500 year storm
Warning:The cross-section end points had to be extended vertically for the computed water surface. River: Walker Run Reach: 2 RS: -154 Profile: 500 year storm
Warning:The cross-section end points had to be extended vertically for the computed water surface.

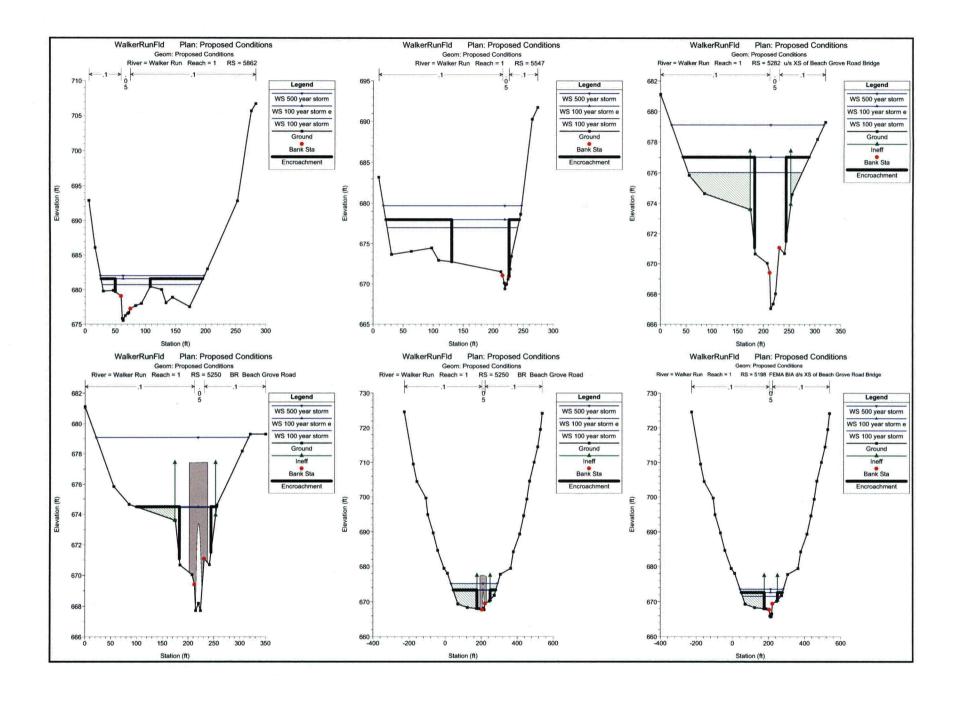


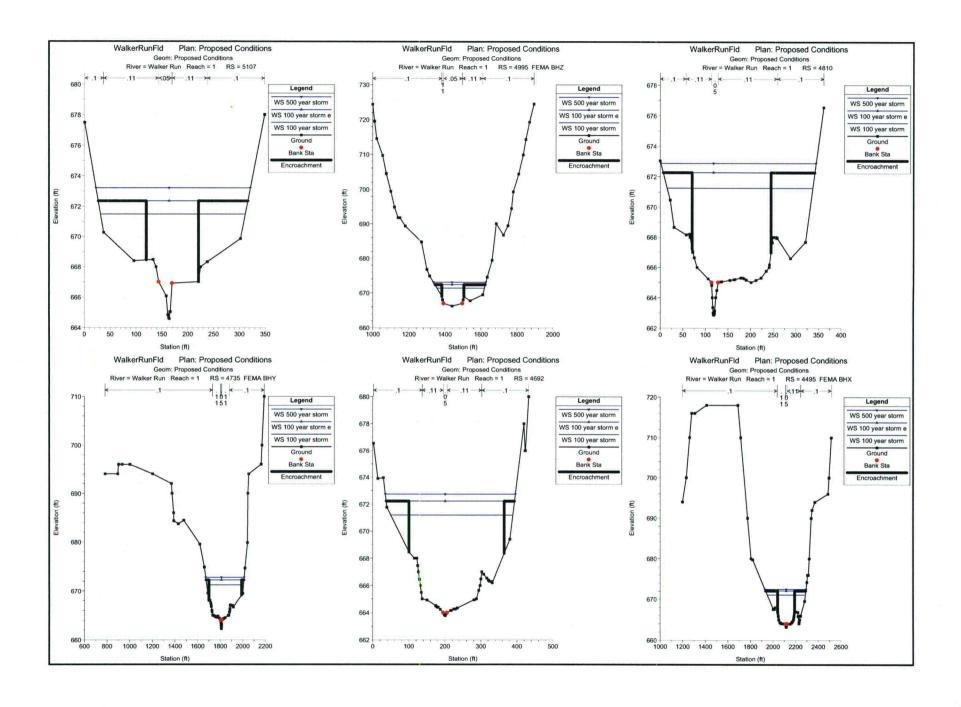


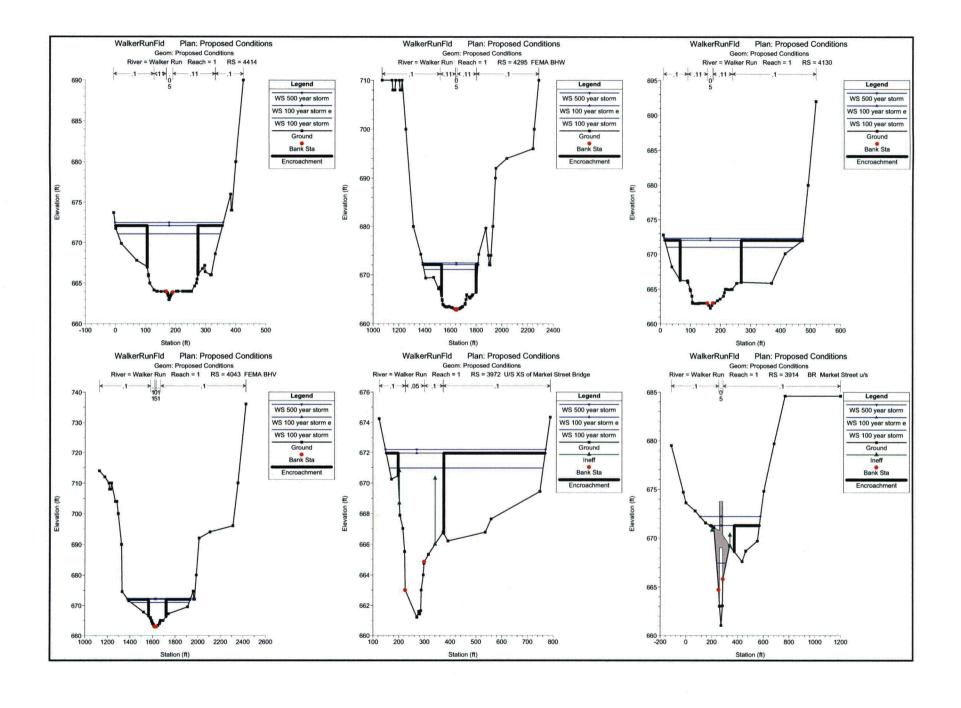


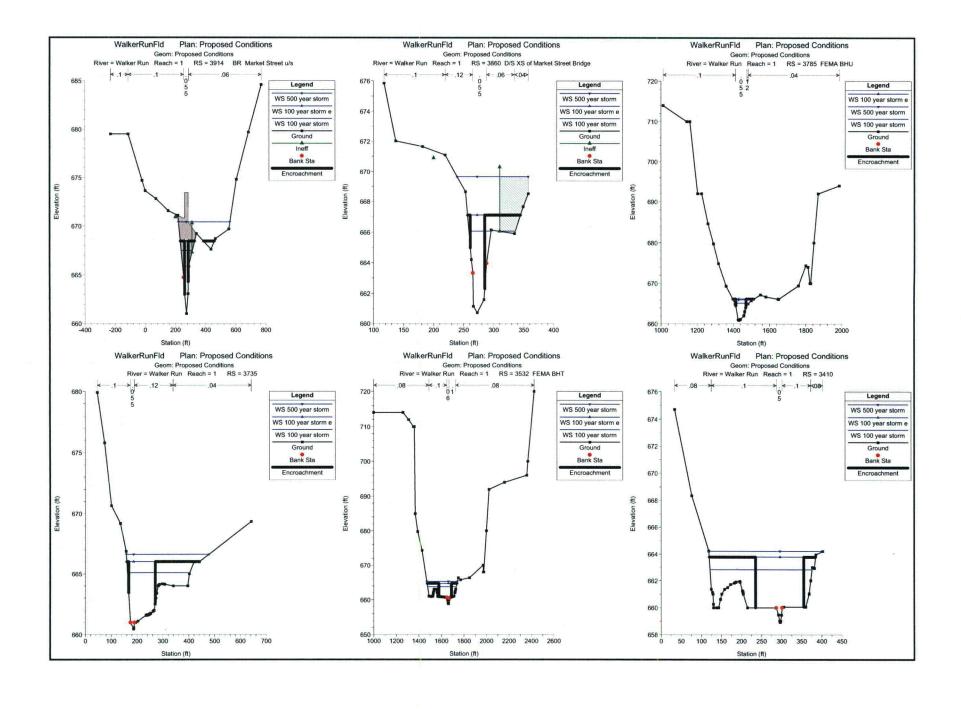


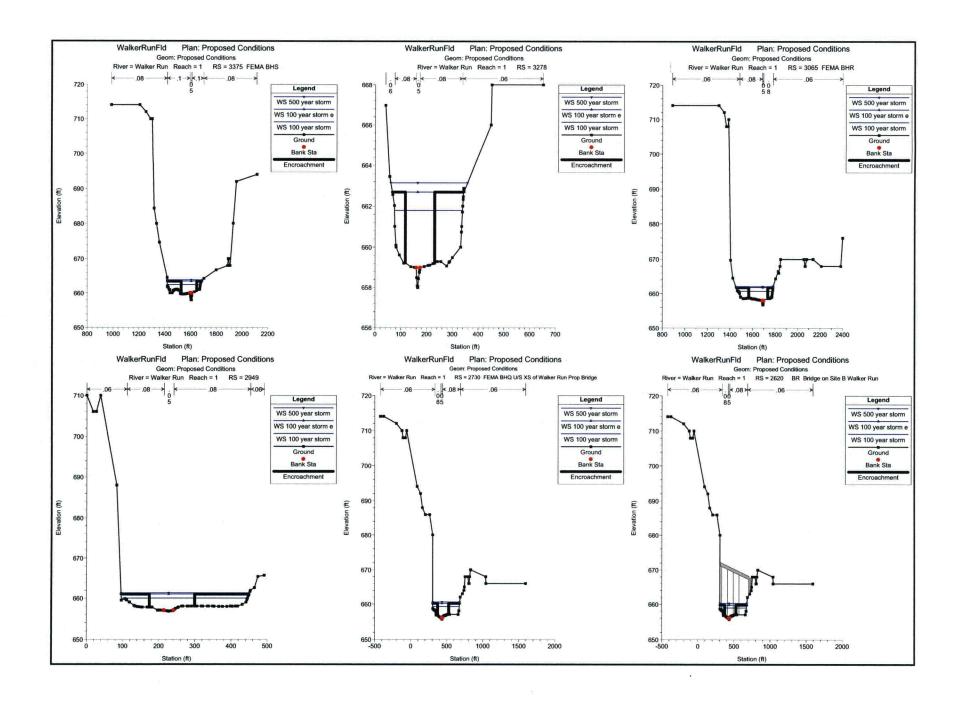


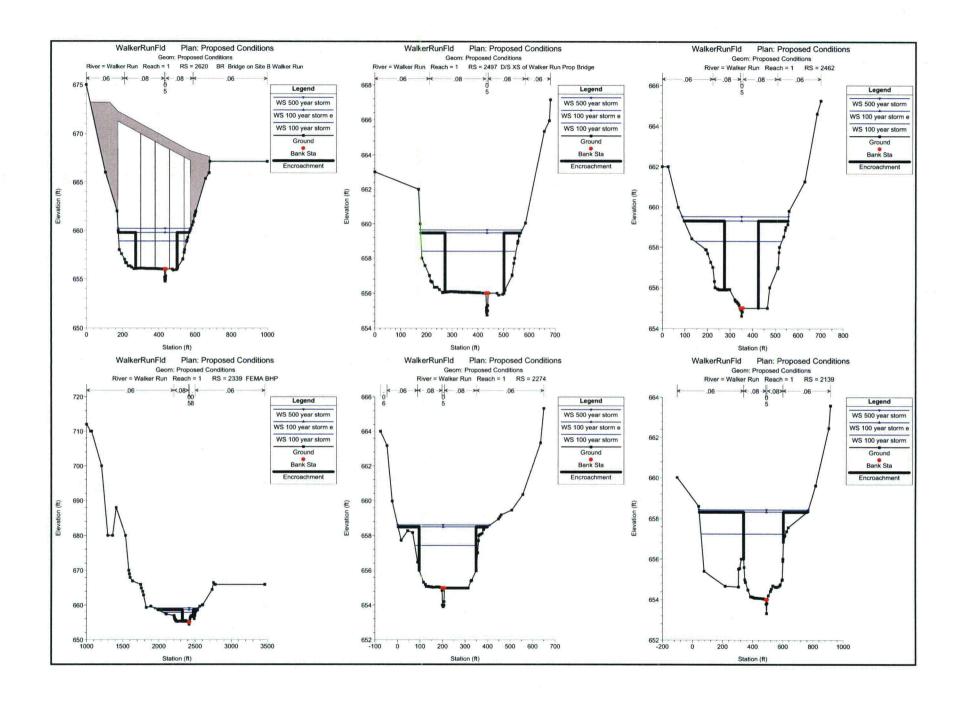


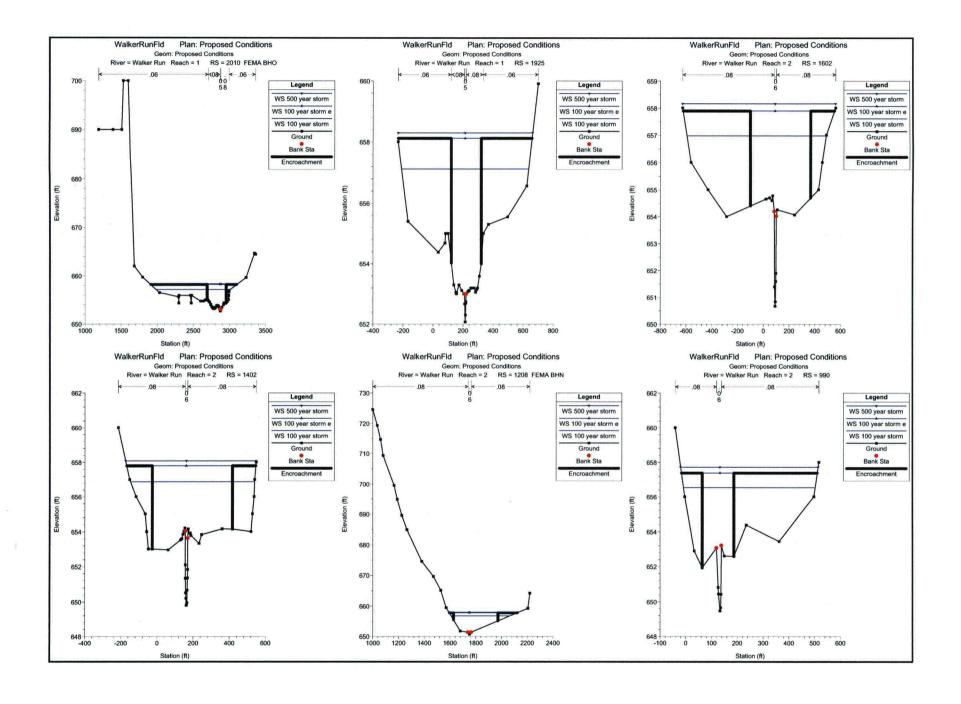


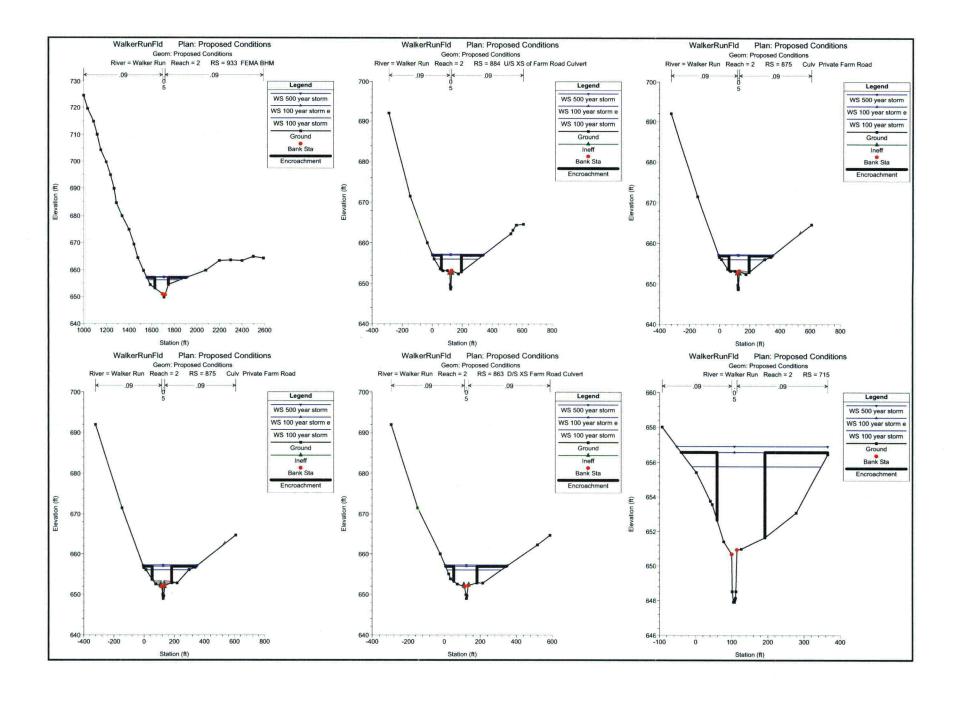


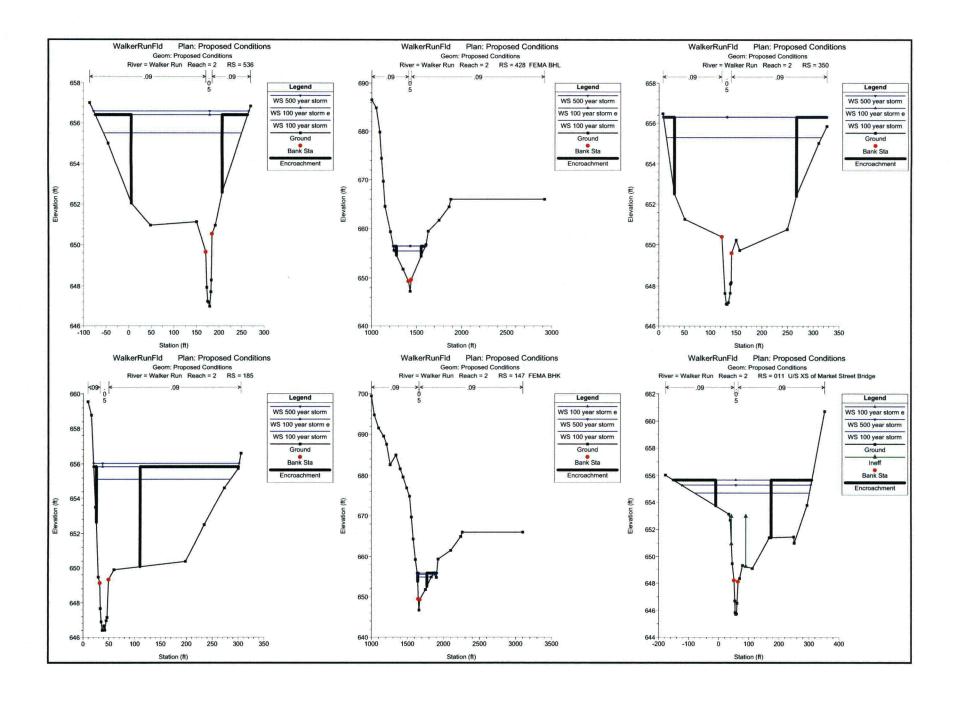


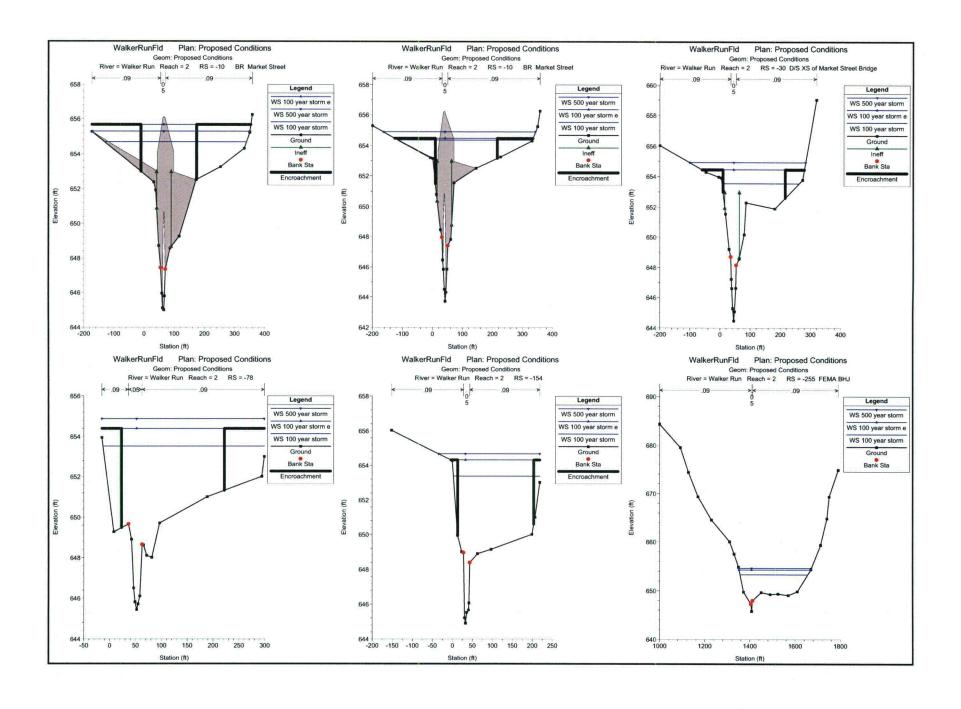


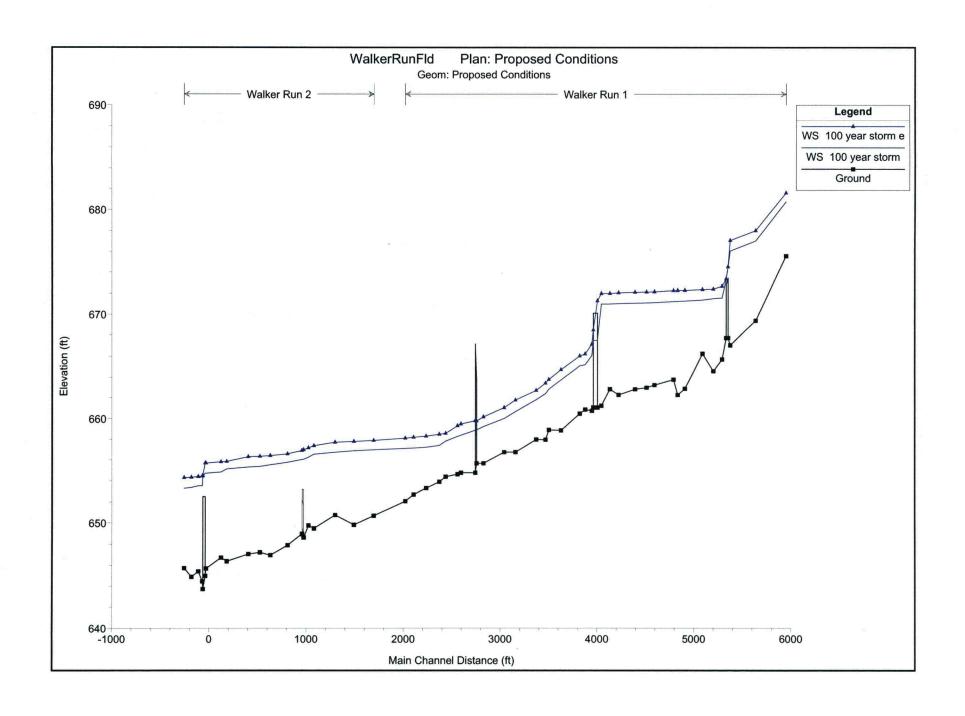


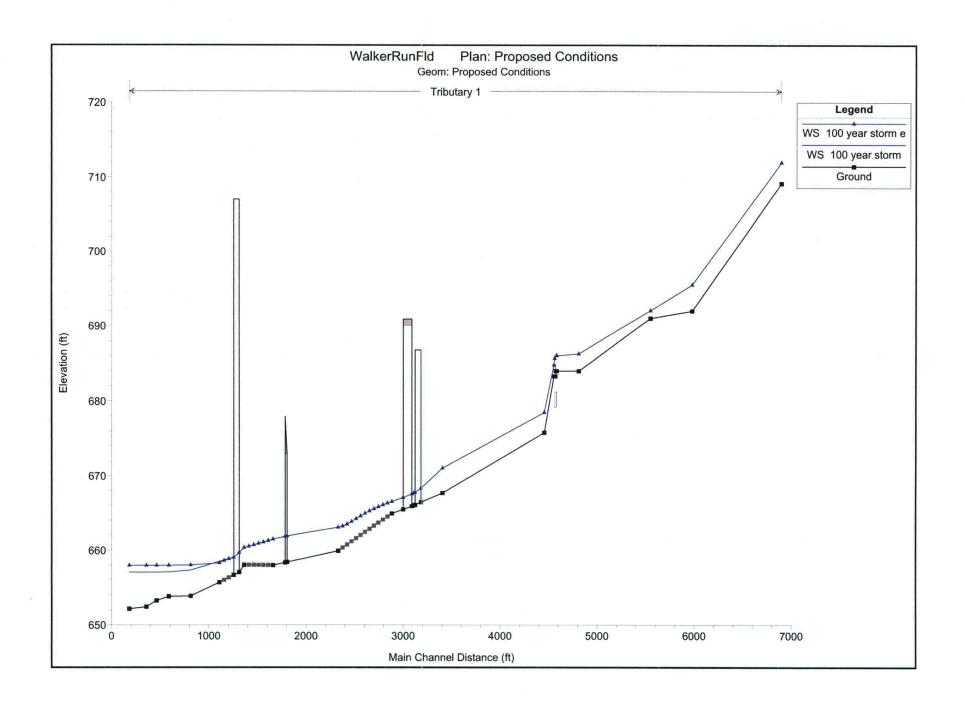


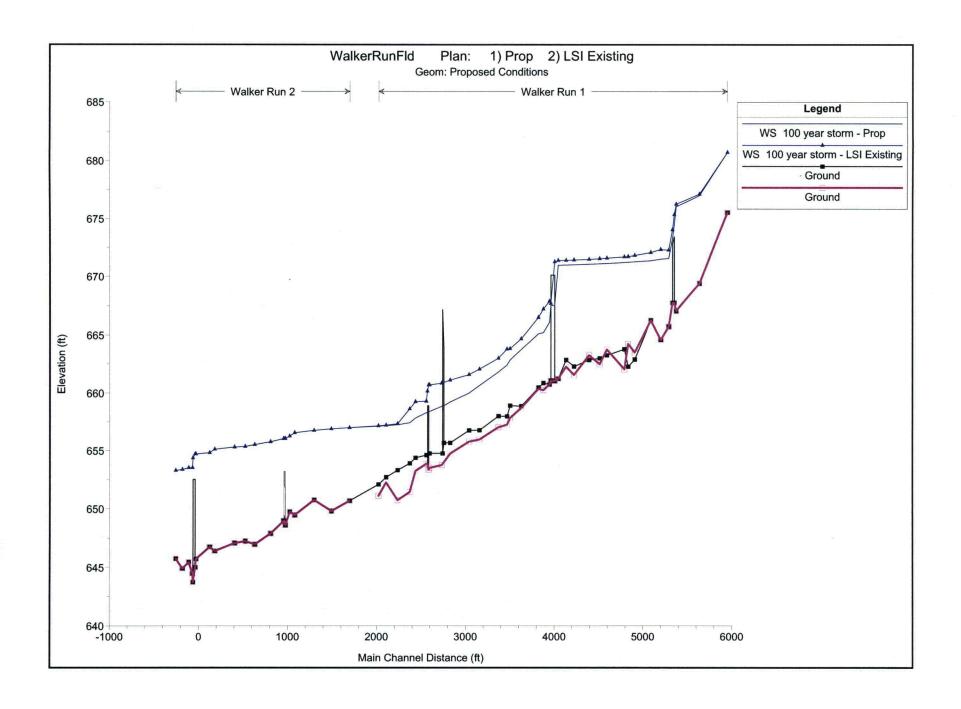


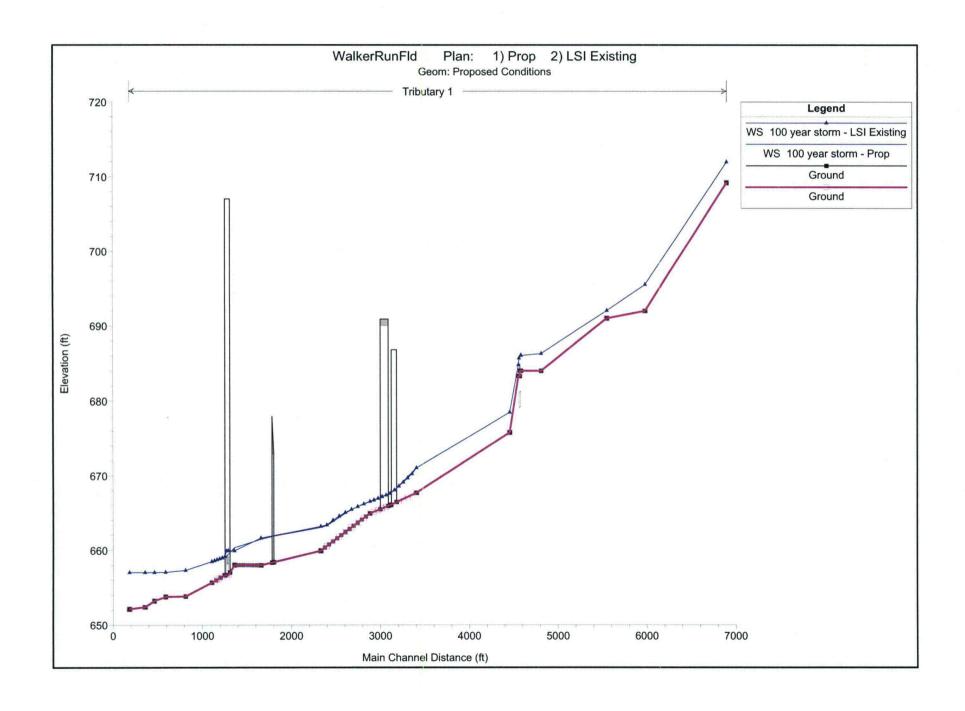












Appendix G: Manning's Roughness Coefficient Conditions

Land studies

Walker Run Existing Conditions Manning's "n" Values

Bell Bend Nuclear Power Plant Salem Township, Luzerne County, PA December 2010

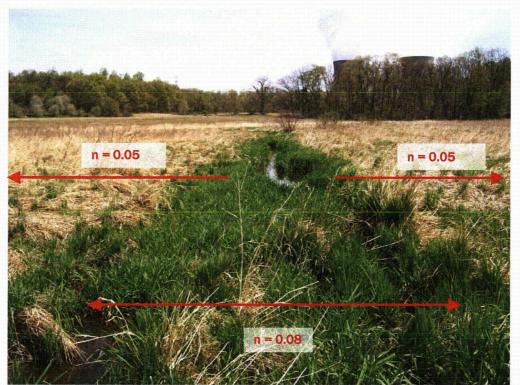


Photo #1: Tributary #1 through open field in lower reach

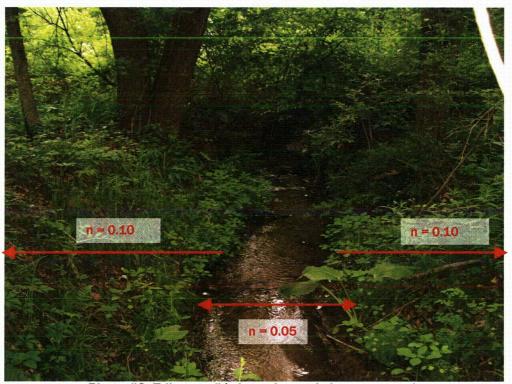


Photo #2: Tributary #1 through woods in upper reach

Appendix H: Hydrology Data

Walker Run Flood Study Report

Bell Bend Nuclear Power Plant Salem Township, Luzerne County, PA Flow Study Comparison



Method	Combined Q ₁₀₀ (ft ³ /s)	Tributary Q ₁₀₀ (ft ³ /s)	Walker Run Q ₁₀₀ (ft ³ /s)	
FEMA	1860.0	-1	1640.0	
Hydraflow 1				
(Rizzo data, Tc =IL regression)	2953.4	940.0	2259.2	
Hydraflow 2				
(Rizzo data, Tc =SCS Lagtime)	1392.9	538.2	1091.2	
Hydraflow 3				
(LSI data, Tc measured)	1877.2	303.5	1628.3	
USGS Regression 1 (Rizzo data)	1088.9	361.4	909.0	
USGS Regression 2 (LSI data)	1065.4			

Hydraflow 1: (Rizzo Data, Tc = IL regression) (from Paul C. Rizzo Associates, Inc.'s BBNPP - Walker Run - Evaluation of Probable Maximum Flood Event)

(Tc computed from Clark Unit Hydrograph equation: $Tc = 1.54L^{0.875}S^{-0.181}$)

	Description	DA (mi²)	DA (ac)	Tc (min)	L (ft)	S (ft/ft)	CN	$Q_{100} (ft^3/s)$
Subarea 2	Walker Run watershed	2.433	1557.12	124.8	17,900	0.013	76	2259.22
Subarea 3	Tributary watershed	0.685	438.4	72.6	10,950	0.025	76	939.99
	Combined Q ₁₀₀ :	2953.35	ft³/s					

Hydraflow 2: (Rizzo Data, Tc = SCS Lagtime) (from Paul C. Rizzo Associates, Inc.'s BBNPP - Walker Run - Evaluation of Probable Maximum Flood Event)

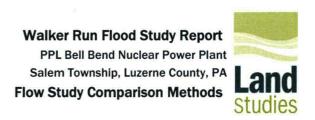
(Tc computed from SCS Lag Formula: $Tc = 0.00526L^{0.8}(1000/CN-9)^{0.7}S^{-0.5}$

	Description	DA (mi²)	DA (ac)	Tc (min)	L (mi)	S (ft/ft)	CN	$Q_{100} (ft^3/s)$
Subarea 2	Walker Run watershed	2.433	1557.12	316.6	17,900	0.013	76	1091.18
Subarea 3	Tributary watershed	0.685	438.4	154.1	10,950	0.025	76	538.16
	Combined Q ₁₀₀ :	1392.9	ft ³ /s					

Hydraflow 3: (LSI Data, Tc = Measured)

(Tc and land use computations on following page)

	Description	DA (mi²)	DA (ac)	Tc (min)	L (ft)	S (ft/ft)	CN	Q ₁₀₀ (ft ³ /s)
Subarea 2	Walker Run watershed	2.433	1557.12	128.6	n/a	n/a	66	1628.3
Subarea 3	Tributary watershed	0.685	438.4	166.4	n/a	n/a	61	303.5
	Combined Q ₁₀₀ :	1877.2	ft ³ /s					



Hydraflow 3 (LSI data, Tc Measured): Tc and Land Use Computations

Time of concentration

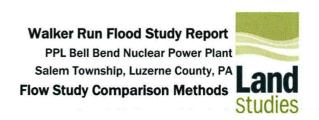
Tributary
Tc = 166.4 min

Walker Run Tc = 128.6 min

	Shallow			Shallow	
Sheet Flow	Concentrated Flow	Channel	Sheet Flow	Concentrated Flow	Channel
L = 300 feet	L = 4,100 feet	L = 6,600 feet	L = 300 feet	L = 7,000 feet	L = 10,000 feet
S = 2.5 %	S = 7.3 %	S = 0.7 %	S = 0.8 %	S = 4.5 %	S = 1.4 %
n = 0.24	unpaved	n = 0.08	n = 0.24	unpaved	n = 0.05
		$A = 70 \text{ ft}^2$			$A = 100 \text{ ft}^2$
		P = 150 ft			P = 80 ft

Land Use

		Tributary	Walker Run
	DA	438.4 ac	1557.1 ac
	Woods	50% (219.2 ac)	60 % (934.3 ac)
	Meadow	50% (219.2 ac)	40% (622.8 ac)
	A Soils	20%	10%
	B/D Soils	10%	
	C Soils	70%	90%
Woods			
	A Soils	43.84 ac	93.43 ac
	B Soils	21.92 ac	-
	C Soils	153.44 ac	840.87 ac
Meadow			
	A Soils	43.84 ac	62.28 ac
	B Soils	21.92 ac	:
	C Soils	153.44 ac	560.52 ac



USGS Regression 1: Rizzo Data (from Paul C. Rizzo Associates, Inc.'s BBNPP - Walker Run - Evaluation of Probable Maximum Flood Event)

Regression Equation: $Q_{100} = 925.8DA^{0.7278}(1+0.01F)^{-1.1342}(1+0.01U)^{0.4040}(1+0.01C)^{-1.2691}(1+0.01CA)^{-0.4637}$

	Description	DA (mi²)	F (% cover forest)	U (% cover urban)	C (% carbonate)	CA (% cover wetlands)	Q ₁₀₀ (ft ³ /s)
Subarea 2	Walker Run watershed	2.43	50	0	10	20	909.0
Subarea 3	Tributary watershed	0.685	50	0	10	20	361.4
Combined	Total	3.118	50	0	10	20	1088.9

USGS Regression 2: LSI Data

Regression Equation: $Q_{100} = 925.8DA^{0.7278}(1+0.01F)^{-1.1342}(1+0.01U)^{0.4040}(1+0.01C)^{-1.2691}(1+0.01CA)^{-0.4637}$

			F (% cover	U (% cover	C (%	CA (% cover	ar v á t
	Description	DA (mi ²)	forest)	urban)	carbonate)	wetlands)	$Q_{100} (ft^3/s)$
Combined	Total	2.87	50	10	10	20	1065.4

Hydrograph Summary Report Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2008 by Autodesk, Inc. v6.052

łyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	2259.22	2	788	24,954,640				SA 2 (Walker)
2	SCS Runoff	939.99	2	758	7,041,988				SA 3 (Trib)
3	Combine	2953.35	2	784	31,996,620	1, 2			Sub-basins 2+3
5	SCS Runoff	1091.18	2	904	24,903,670				SA2 SCS Lag Tc
6	SCS Runoff	538.16	2	806	7,021,232				SA3 SCS Lag Tc
7	Combine	1392.90	2	896	31,924,910	5, 6			Lag Tc 2+3
9	SCS Runoff	1628.30	2	792	18,763,540				SA 2 (Walker) Tc-TR55
10	SCS Runoff	303.47	2	816	4,473,283				SA 3 (Trib) Tc- TR55
11	Combine	1877.17	2	794	23,236,800	9, 10	*****		TR-55 2+3
									·
									·
							٠.		
			,						
	k Flow from F):	. E 00 0		Deture 5	eriod: 100	V	10/04-5-4-	/, Dec 8, 2010

F-11a



Ву_	PJM	Date	3/11/08	_ Subject _	BBNPP - Walker Run - Evaluation	Sheet No.	1 of 6
					able Maximum Flood Event	Project No.	
	.By Farm						

PJM = Paul J Martinchich Z Ma fished

FAM = Fehmida Mesania Fehm. da Mesania

DJW = David Wallner Dim Mesania

(3m)

Purpose:

Estimate the Probable Maximum Flood (PMF) event for Walker Run, which flows adjacent to the BBNPP Site near Berwick, PA. This calculation evaluates and quantifies the flow in Walker Run due to runoff from the Probable Maximum Precipitation (PMP), or Storm (PMS), event.

The resultant stream levels in Walker Run are evaluated in a separate calculation.

References:

Clark, C.O., 1945, "Storage and the Unit Hydrograph," Transactions: American Society of Civil Engineers, Vol. 110, p. 1419-1488.

DJW, 3/07/08, "Probable Maximum Storm Event for Walker Run Watershed," Project No. 07-3891, RIZZO Calculation.

Mesania, Fehmida, 2008, "Verification & Validation for HEC-HMS 3.1.0," RIZZO, Project No. 08-9006.

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Hydrologic Engineering Center (HEC), USACE Water Resources Support Center, June 1978, "Hydrometeorological Report No. 51 (HMR-51): Probable Maximum Precipitation Estimates, United States East of the 105th Meridian."

Hydrologic Engineering Center, USACE Water Resources Support Center, April 1987, "Hydrometeorological Report No. 52 (HMR52): Probable Maximum Storm Computation (Eastern U.S.)."

Hydrologic Engineering Center (HEC), USACE Water Resources Support Center, December 2006, "HEC Hydrologic Modeling System (HEC-HMS), Version 3.1.0, Build 1206"

JDP, 3/05/08, "BBNPP, Walker Run - HEC-RAS Analysis," Project No. 07-3891, RIZZO Calculation.

By PJM Date 3/11/08 Subject BBNPP - Walker Run - Evaluation Sheet No. 4 of Games Of Probable Maximum Flood Event Project No. 07-3891

Chkd.By Fam Date 03-31-08

4. Basin Losses

The HEC-HMS program is used to perform the runoff analyses. The SCS Curve Number Method will be used as the Basin Loss Method. The SCS method requires the input parameters, Curve Number (CN), Time of Concentration (T_c), Basin Lag Time (T_p), Basin Area (A_b), and Initial Abstraction (I_a).

CN: For the overall watershed, CN = 76 was selected based on SCS published values for Soil Type C and Grass/Woods mixture (see *Sheet B5*).

Use CN = 76

 I_a : From TR-55, Equation 2-4 (S = 1000/CN-10) and Equation 2-2 (I_a = 0.2S), for CN = 76, I_a is estimated to be 0.6316 inches.

Use $I_a = 0.6316$

5. Basin Transform

The Clark (1945) Method as presented by Straub, et.al. (2000) will be used as the Transform Method. The Clark method requires the input parameters:

L = Watercourse Length along stream to watershed Boundary (miles)

S = Watercourse Slope from 10% to 85% of stream length (ft/mile)

which in turn are used to calculate:

 T_c = Time of Concentration (hours) and

R = Storage Coefficient (hours).

These parameters are shown on *Table C-1* on *Sheet C-2*.

6. PMS Rainfall Hyetograph

The PMS Rainfall Hyetograph was developed in a separate calculation by RIZZO (DJW, 3/07/08). The rainfall hyetograph is included in *Attachment E*.

Ohkd. By DM Date 3/11/08

Sheet No. C2 of 7

TABLE C-1
Calculation of Clark Parameters for Subbasin Areas

	A	L	L	1	T	El	.					
Sub-Basin	(sq. mi.)	(ft)	(mi)	(ft)	(ft)	El. _{10%} (ft)	El. _{85%} (ft)	S (ft/mi)	S (ft/ft)	T _c	R	$R/(T_c+R)$
SB-A1	0.979	13,200	2.500	1320	11,220	535			` /	(hr)	(hr)	(dim)
SB-A2	2.433	17,900	3.390				758	89.2	0.017	1.52	0.65	0.30
SB-A3				1790	15,215	658	893	69.3	0.013	2.08	0.87	
OD-M3	0.685	10,950	2.074	1095	9,308	653	922					0.30
::					>,500	055	922	129.7	0.025	1.21	0.45	0.27

AVG:

0.29

STDEV:

0.01



Sheet No. C3 of 7

In cooperation with the Illinois Department of Natural Resources, Office of Water Resources

Equations for Estimating Clark Unit-Hydrograph Parameters for Small Rural Watersheds in Illinois

By Timothy D. Straub, Charles S. Melching, and Kyle E. Kocher

Water-Resources Investigations Report 00-4184

Equation Development

For small rural watersheds in Illinois, three methods were used to develop new equations for estimating T_C and R. Similar to the Graf and others (1982b) study, a multiple-linear regression analysis was used to determine mathematical relations among watershed characteristics and (T_C+R) , and an attempt was made to determine regional values of $R/(T_C+R)$. The second method involved using multiple-linear regression analysis to determine mathematical relations among watershed characteristics and average values of T_C and R for each watershed. No storm characteristics or seasonal effects were analyzed in the second method. The third method involved using multiple-linear regression analysis to determine mathematical relations among watershed, storm, and seasonal characteristics and values of T_C and R for each storm. Overall, the second method yielded the best equations, as described in the following sections.

Results Based on Methods Similar to the Graf and others (1982b) Study

In the first method, equations for estimating (T_C+R) were developed utilizing multiple-linear regression to relate the logarithm of the average (T_C+R) for each watershed to logarithms of watershed area and main-channel length and slope. The multiple-linear regression of logarithms resulted in an estimation equation

$$h_{pi} = aW_1^{b1} W_2^{b2} , (8$$

where

 h_{pi} is hydrograph parameter i [in this case $(T_C + R)$], W_j are watershed characteristics j, bj are exponents corresponding to watershed characteristics j, and

a is a coefficient.

Watershed characteristics were added one at a time to the regression model (eq. 8), and characteristics were retained in the regression model only if the corresponding exponents were statistically significant (the corresponding 95-percent confidence interval for the parameter did not include zero) and the sign of the exponent was correct from a physical viewpoint. For example, hydrograph-timing parameters should increase with increasing area and main-channel length

Sheet No. CG of 7

and decrease with increasing main-channel slope. From the regression, an equation involving the length and slope was determined to yield the highest coefficient of determination (R^2 =0.74).

Next, the average $[R/(T_C+R)]$ values for each watershed were plotted on a map of the State of Illinois. Contours were drawn to try to determine regional trends in the values, but all such attempts were unsuccessful. Before abandoning the method similar to that used by Graf and others (1982b) because of the inability to find regional trends in average $[R/(T_C+R)]$, the logarithm of these values were regressed against watershed characteristics similar to the previous regression, using values of average (T_C+R) . All combinations of the regression yielded very poor coefficient of determination (R^2) values (highest equaling 0.38). With no reliable method of determining $[R/(T_C+R)]$, this method was abandoned.

Interestingly, the coefficient and exponents for the Graf and others (1982b) equation for (T_C+R) were not within the 95-percent confidence intervals when compared to the equation developed for (T_C+R) for this study, except for a slight overlap in the length exponent. The upper and lower confidence bounds for the length exponent were 0.650 and 0.339, respectively, for the (T_C+R) equation developed in this study.

Results Based on Average Values of T_C and R for Each Watershed

The second method, determined to be the overall best method in this study, utilized multiple-linear regression analysis to relate the logarithms of the average T_C and average R for each watershed to logarithms of watershed area and main-channel length and slope. Equations for the T_C and R estimations (in hours) that yield the highest R^2 values included main-channel length and slope and are

$$T_C = 1.54 L^{0.875} S^{-0.181}$$
 and (9)

$$R = 16.4 L^{0.342} S^{-0.790}, (10)$$

where

L is the stream length measured along the main (ML) channel from the watershed outlet to the watershed divide, in mi, and

S is the main-channel slope determined from elevations at points that represent 10 and 85 percent of the distance along the channel

U.S. Department of the Interior U.S. Geological Survey

TECHNIQUES FOR ESTIMATING MAGNITUDE AND FREQUENCY OF PEAK FLOWS FOR PENNSYLVANIA STREAMS

by Marla H. Stuckey and Lloyd A. Reed

Water-Resources Investigations Report 00-4189

prepared in cooperation with

PENNSYLVANIA DEPARTMENT OF TRANSPORTATION

Lemoyne, Pennsylvania

U.S. DEPARTMENT OF THE INTERIOR BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY
Charles G. Groat, Director

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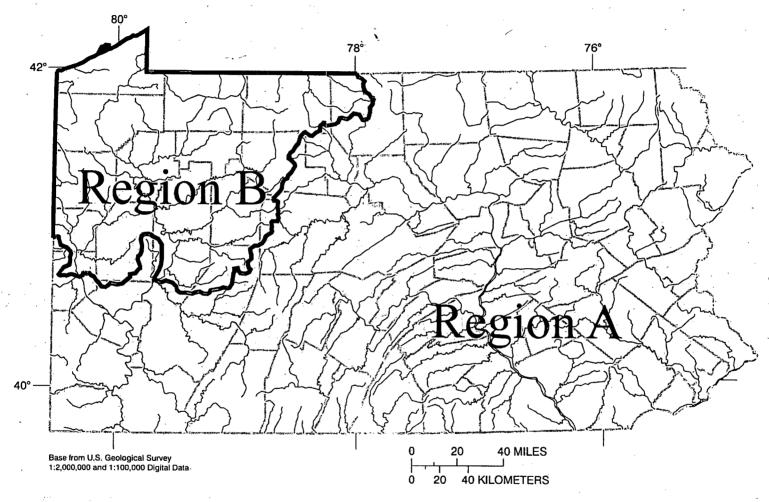


Figure 3. Flood-frequency regions in Pennsylvania.

Table 1. Regression coefficients for use with regression equations for peak flows on Pennsylvania streams

[Q_{T} discharge for the T-year flood; ft³/s, cubic feet per second; Q_{10} , 10-year flood flow; Q_{25} , 25-year flood flow; Q_{50} , 50-year flood flow; Q_{50} , 50-year flood flow; Q_{50} , 500-year floo

99 A			Basin charac	teristic coeffici	ents		Residual en		Coefficient of
Q _T return flow (ft ³ /s)	Intercept . (A)	Drainage area (b)	Percentage forested area (c)	Percentage urban development (d)	carbonate	Percentage controlled area (f)	Log units	Percent	determination (R ²)
Region A									
Q_{10}	2.5243	0.7770	-0.9712	1.0217	-1.7184	-0.5719	0.18	43	0.93
Q ₂₅	2.7145	.7556	-1.0324	.7608	-1.5302	5302	.19	45 [.]	.91
Q_{50}	2.8441	.7414	-1.0821	.5785	-1.3955	4980	.21	50	.89
Q ₁₀₀	2.9665	.7278	-1.1342	.4040	-1.2691	4637	.23	55	.87
Q_{500}	3.2294	6994	-1.2666	.0208	9877	3834	.27	66	.82
Region B						}			
Q_{10}	2.3105 -	.7255				-1.2425	.12	28	.96
Q_{25}	2.4418	.7108				-1.3700	.13	30	.95
Q_{50}	2.5276	.7017	***			-1.4695	.14	33	.94
Q ₁₀₀	2.6069	6932		-÷-		-1.5677	.16	38	.92
Q ₅₀₀	2.7673	.6776				-1.8055	.19	45	.89

Region A

 $Q_{10} = 334.4 \text{ DA}^{.7770} (1 + .01\text{F})^{-.9712} (1 + .01\text{U})^{1.0217} (1 + .01\text{C})^{-1.7184} (1 + .01\text{CA})^{-.5719}$

 $Q_{25} = 518.2 \text{ DA}^{.7556} (1 + .01\text{F})^{-1.0324} (1 + .01\text{U})^{.7608} (1 + .01\text{C})^{-1.5302} (1 + .01\text{CA})^{-.5302}$

 $Q_{50} = 698.4 \cdot \text{DA}^{.7414} \cdot (1 + .01 \text{F})^{-1.0821} \cdot (1 + .01 \text{U})^{.5785} \cdot (1 + .01 \text{C})^{-1.3955} \cdot (1 + .01 \text{CA})^{-.4980}$

 $Q_{100} = 925.8 \text{ DA} \cdot ^{7278} (1 + .01\text{F})^{-1.1342} (1 + .01\text{U})^{.4040} (1 + .01\text{C})^{-1.2691} (1 + .01\text{CA})^{-.4637}$

 $Q_{500} = 1.696 \text{ DA} \cdot \frac{6994}{1 + .01} (1 + .01F)^{-1.2666} (1 + .01U)^{.0208} (1 + .01C)^{-.9877} (1 + .01CA)^{-.3834}$

Region B

 $Q_{10} = 204.4 \text{ DA}^{.7255} (1 + .01\text{CA})^{-1.2425}$

 $Q_{25} = 276.6 \text{ DÅ}^{.7108} (1 + .01\text{CA})^{-1.3700}$

 $Q_{50} = 337.0 \text{ DA}^{.7017} (1 + .01\text{CA})^{-1.4695}$

 $Q_{100} = 404.5DA^{.6932} (1 + .01CA)^{-1.5677}$

 $Q_{500} = 585.2 \text{ DA}^{.6776} (1 + .01\text{CA})^{-1.8055}$



POINT PRECIPITATION **FREQUENCY ESTIMATES** FROM NOAA ATLAS 14



BERWICK, PENNSYLVANIA (36-0611) 41.0667 N 76.25 W 587 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 2, Version 3 G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley NOAA, National Weather Service, Silver Spring, Maryland, 2004 Extracted: Fri May 22 2009

Cor	nfiden	ce Lin	nits	75	Seaso	nality		Locat	ion Ma			er Info		SIS dat	a N	laps	Docs	F	Return to State Map
	Precipitation Frequency Estimates (inches)																		
ARI* (years)	<u>5</u> min	10 min	15 min	30 min	60 min	120 min	<u>3 hr</u>	<u>6 hr</u>	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day	
1	0.34	0.52	0.64	0.84	1.03	1.21	1.32	1.66	2.04	2.41	2.84	3.18	3.75	4.33	5.90	7.34	9.28	11.17	
2	0.40	0.62	0.76	1.01	1.25	1.46	1.58	1.98	2.44	2.89	3.40	3.80	4.47	5.14	6.96	8.62	10.83	12.98	
5	0.47	0.72	0.89	1.22	1.53	1.80	1.96	2.43	3.01	3.58	4.21	4.65	5.43	6.19	8.14	9.92	12.26	14.58	
10	0.52	0.80	0.98	1.36	1.74	2.08	2.27	2.82	3.50	4.20	4.92	5.41	6.28	7.09	9.15	11.02	13.46	15.93	
25	0.58	0.89	1.10	1.55	2.01	2.50	2.74	3.40	4.25	5.18	6.07	6.61	7.61	8.48	10.68	12.66	15.23	17.91	
50	0.63	0.96	1.19	1.70	2.23	2.85	3.15	3.91	4.92	6.08	7.12	7.72	8.82	9.74	12.02	14.08	16.73	19.59	
100	0.69	1.03	1.28	1.85	2.47	3.26	3.63	4.50	5.69	7.16	8.37	9.03	10.24	11.19	13.54	15.64	18.36	21.39	
200	0.74	1.10	1.37	2.00	2.72	3.72	4.17	5.17	6.59	8.43	9.87	10.58	11.91	12.86	15.25	17.38	20.13	23.34	
500	0.82	1.21	1.50	2.23	3.08	4.42	5.02	6.24	8.01	10.51	12.29	13.08	14.57	15.48	17.86	19.98	22.72	26.17	
1000	0.88	1.28	1.61	2.41	3.38	5.05	5.77	7.19	9.29	12.45	14.55	15.39	17.01	17.84	20.14	22.21	24.90	28.53	

^{*} These precipitation frequency estimates are based on a <u>partial duration series</u>, ARI is the Average Recurrence Interval.

Please refer to <u>NOAA Atlas 14 Document</u> for more information. NOTE: Formatting forces estimates near zero to appear as zero.

	* Upper bound of the 90% confidence interval Precipitation Frequency Estimates (inches)																	
ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.37	0.58	0.71	0.94	1.15	1.35	1.48	1.87	2.31	2.69	3.23	3.59	4.23	4.83	6.45	7.99	10.04	11.99
2	0.44	0.69	0.84	1.13	1.38	1.63	1.78	2.24	2.76	3.23	3.88	4.28	5.05	5.74	7.60	9.36	11.71	13.94
5	0.52	0.81	0.99	1.35	1.70	2.01	2.20	2.74	3.40	4.00	4.79	5.24	6.12	6.90	8.87	10.77	13.25	15.65
10	0.57	0.89	1.09	1.51	1.93	2.33	2.54	3.17	3.94	4.67	5.59	6.08	7.06	7.89	9.96	11.96	14.55	17.10
25	0.65	0.99	1.22	1.72	2.23	2.79	3.07	3.82	4.77	5.73	6.86	7.38	8.52	9.41	11.60	13.71	16.45	19.21
50	0.70	1.07	1.32	1.89	2.48	3.19	3.54	4.39	5.52	6.70	8.02	8.59	9.85	10.77	13.02	15.22	18.07	20.97
100	0.76	1.15	1.42	2.06	2.75	3.65	4.07	5.05	6.39	7.85	9.40	10.01	11.41	12.34	14.63	16.89	19.81	22.88
200	0.82	1.23	1.53	2.23	3.03	4.17	4.69	5.83	7.41	9.21	11.03	11.69	13.22	14.14	16.46	18.76	21.70	24.98
500	0.92	1.35	1.68	2.49	3.45	4.98	5.67	7.06	9.05	11.42	13.69	14.39	16.11	17.00	19.23	21.55	24.45	28.03
1000	0.99	1.44	1.80	2.71	3.80	5.72	6.56	8.17	10.56	13.44	16.16	16.88	18.77	19.56	21.68	23.94	26.79	30.57

^{*}The upper bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are greater than.
**These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.

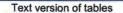
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

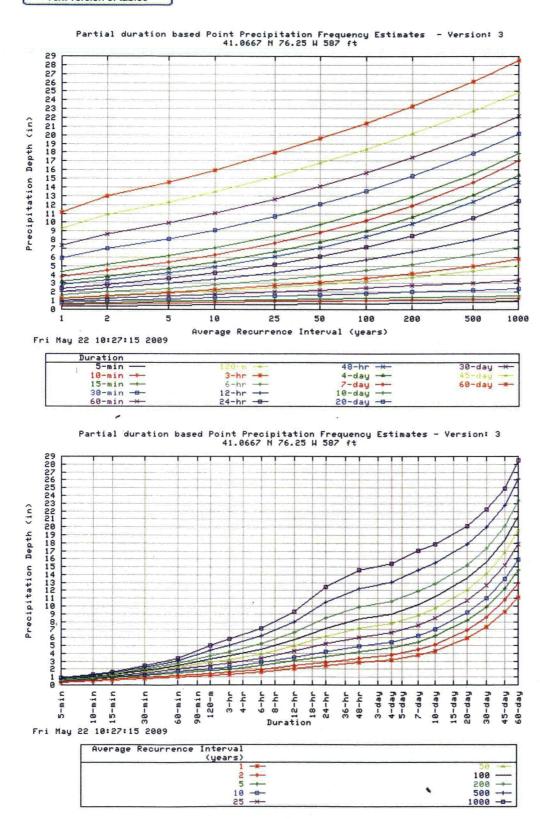
	* Lower bound of the 90% confidence interval Precipitation Frequency Estimates (inches)																	
ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.30	0.47	0.57	0.76	0.93	1.09	1.19	1.48	1.83	2.18	2.54	2.87	3.38	3.94	5.44	6.82	8.67	10.50
2	0.36	0.56	0.68	0.91	1.12	1.31	1.43	1.78	2.19	2.61	3.04	3.43	4.04	4.68	6.41	7.99	10.11	12.21
5	0.42	0.65	0.80	1.09	1.37	1.61	1.76	2.17	2.70	3.23	3.75	4.19	4.89	5.62	7.48	9.18	11.43	13.70
10	0.47	0.72	0.88	1.23	1.56	1.86	2.03	2.51	3.12	3.77	4.38	4.87	5.63	6.41	8.39	10.18	12.54	14.95
25	0.52	0.80	0.98	1.39	1.80	2.22	2.43	3.00	3.76	4.61	5.36	5.90	6.79	7.63	9.76	11.67	14.16	16.78
50	0.56	0.85	1.06	1.51	1.99	2.52	2.78	3.43	4.32	5.37	6.24	6.85	7.82	8.72	10.95	12.95	15.52	18.31
100	0.61	0.91	1.13	1.64	2.19	2.86	3.17	3.91	4.95	6.27	7.27	7.96	9.02	9.96	12.26	14.32	16.99	19.94
200	0.65	0.97	1.21	1.77	2.40	3.23	3.61	4.46	5.66	7.32	8.49	9.22	10.41	11.36	13.75	15.84	18.57	21.70
500	0.71	1.05	1.31	1.94	2.69	3.80	4.27	5.29	6.76	8.98	10.43	11.26	12.56	13.53	15.97	18.09	20.86	24.23
1000	0.76	1.11	1.39	2.08	2.92	4.28	4.84	6.01	7.73	10.48	12.18	13.10	14.51	15.46	17.89	19.98	22.75	26.30

^{*} The lower bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are less than.

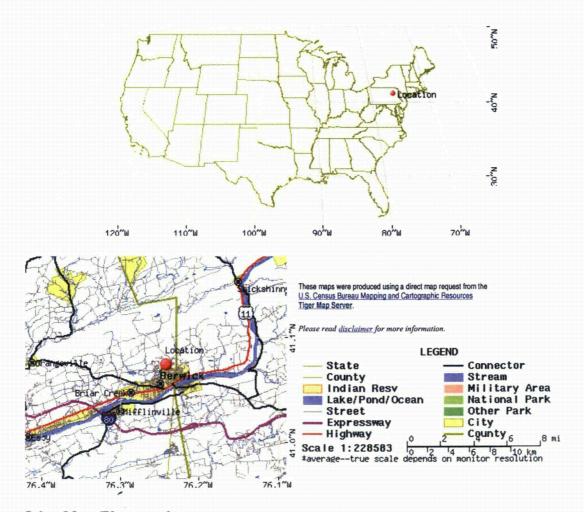
** These precipitation frequency estimates are based on a <u>partial duration maxima series</u>, ARI is the Average Recurrence Interval.

Please refer to <u>NOAA Allas 14 Document</u> for more information. NOTE: Formatting prevents estimates near zero to appear as zero.





Maps -



Other Maps/Photographs -

View USGS digital orthophoto quadrangle (DOQ) covering this location from TerraServer; USGS Aerial Photograph may also be available from this site. A DOQ is a computer-generated image of an aerial photograph in which image displacement caused by terrain relief and camera tilts has been removed. It combines the image characteristics of a photograph with the geometric qualities of a map. Visit the <u>USGS</u> for more information.

Watershed/Stream Flow Information -

Find the Watershed for this location using the U.S. Environmental Protection Agency's site.

Climate Data Sources -

Precipitation frequency results are based on data from a variety of sources, but largely NCDC. The following links provide general information about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study, please refer to NOAA Atlas 14 Document.

Using the National Climatic Data Center's (NCDC) station search engine, locate other climate stations within:

+/-30 minutes ...OR... +/-1 degree of this location (41.0667/-76.25). Digital ASCII data can be obtained directly from NCDC.

Hydrometeorological Design Studies Center DOC/NOAA/National Weather Service 1325 East-West Highway Silver Spring, MD 20910 (301) 713-1669

Questions?: HDSC Questions@noaa gov

Disclaimer

in the Means

U.S. DEPARTMENT OF HOMELAND SECURITY - FEDERAL EMERGENCY MANAGEMENT AGENCY OVERVIEW & CONCURRENCE FORM

O.M.B No. 1660-0016 Expires: 12/31/2010

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1 hour per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, U.S. Department of Homeland Security, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. Please do not send your completed survey to the above address.

A. REQUESTED RESPONSE FROM DHS-FEMA

This request is for a (check one):		-				•				
☑ CLOMF		om DHS-FEMA commenting o I hydrology changes (See 44 C			built as propos	ed, would justify	a map revision, or				
☐ LOMR:		om DHS-FEMA officially revisi vations. (See 44 CFR Ch. 1, Pa		ıap to shov	v the changes	to floodplains, reg	gulatory floodway or				
			B. OVERVIEW								
The NFIP map p	anel(s) affected	for all impacted communities i	is (are):								
Community No.	Community Na	ame		State	Map No.	Panel No.	Effective Date				
Ex: 480301	City of Katy		***************************************	TX	480301	0005D	02/08/83				
480287 420625	Harris County Salem Townsh	nip, Luzerne County		PA	48201C 420625	0220G 0020B	09/28/90 03/18/80				
420023	Salem Tomici	ap, cazeme county		1-7	420020	00200	03/10/00				
 Project Name/Ide FEMA zone desi Basis for Reques The basis for 	 4. FEMA zone designations affected: A4, B, C (choices: A, AH, AO, A1-A30, A99, AE, AR, V, V1-V30, VE, B, C, D, X) 5. Basis for Request and Type of Revision: 										
⊠ Physical	. Change		Data 🛛 Regulator	y Floodwa	y Revision	☑ Base Map (Changes				
☐ Coastal	Analysis	☑ Hydraulic Analysis	☐ Hydrologi	ic Analysis		☐ Corrections					
☐ Weir-Da	m Changes	☐ Levee Certification	☐ Alluvial F	an Analysi	s	☐ Natural Cha	anges				
New Tor	pographic Data	Other (Attach Description	n)								
Note: A ph	otograph and na	arrative description of the area	of concern is not requ	ired, but is	very helpful d	uring review.					
b. The area of revis	ion encompasse	es the following structures (che	eck all that apply)								
Structures:		☐ Channelization	☐ Levee/Floodwall	⋈	Bridge/Culvert						
		☐ Dam	☐ Fill	⋈	Other (Attach i	Description)					

2 2 2 2 2

C. REVIEW FEE

Has the review fee for the appropriate request category b	een included?		X Yes Fe	ee amount: \$ <u>4,400</u>					
		[☐ No, Attach Explan	ation					
Please see the DHS-FEMA Web site at http://www.fen	na.gov/plan/preve	nt/fhm/frm_fees.	shtm for Fee Amour	nts and Exemptions.					
	D. SIGN	ATURE							
All documents submitted in support of this request are co fine or imprisonment under Title 18 of the United States C			nderstand that any fal	se statement may be punishable by					
Name: Terry Harpster, VP Bell Bend Project Dev		Company: PPL	Bell Bend, LLC	İ					
Mailing Address: 38 Bomboy Lane, Suite 2		Daytime Telepho	one No.: 570-802-811	11 Fax No.: 570-802-8119					
Berwick, PA 18603		E-Mail Address:	tlharpster@pplweb.c	om					
Signature of Requester (required):	pt 5	Date: Feb 4, 2011							
As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter of Map Revision (LOMR) or conditional LOMR request. Based upon the community's review, we find the completed or proposed project meets or is designed to meet all of the community floodplain management requirements, including the requirement that no fill be placed in the regulatory floodway, and that all necessary Federal, State, and local permits have been, or in the case of a conditional LOMR, will be obtained. In addition, we have determined that the land and any existing or proposed structures to be removed from the SFHA are or will be reasonably safe from flooding as defined in 44CFR 65.2(c), and that we have available upon request by FEMA, all analyses and documentation used to make this determination.									
Community Official's Name and Title: Karen Karchner, Zoning/ Building Code Official Community Name: Salem Township									
Mailing Address:	one No.: 570-752-439	99 Fax No.: 570-752-4661							
P.O. Box 405, 38 Bomboy Lane Berwick, PA 18603	,	၉-Mail Address:	lem codes s alemtownship @pa.	metrocast.net					
<u> </u>	1 /2.	01000	Date: 3/28/11						
Community Official's Signature (required):	2 Am	chner	Date. 3/40/11	2500					
This certification is to be signed and sealed by a licensed elevation information data, hydrologic and hydraulic analy correct to the best of my knowledge. All analyses have beare designed in accordance with sound engineering pract provided, then the structure(s) has been built according to statement may be punishable by fine or imprisonment under	land surveyor, regis vsis, and any other s een performed corre tices to provide prote to the plans being ce	stered professional upporting data. All ectly and in accord ection from the 1% rtified, is in place,	engineer, or archited documents submitted ance with sound enging annual chance flood and is fully functioning	at authorized by law to certify d in support of this request are neering practices. All project works . If "as-built" conditions data/plan					
Certifier's Name: Benjamin J. Ehrhart		License No.: PE	062219	Expiration Date: 9/30/2011					
Company Name: LandStudies, Inc.		Telephone No.:	717-627-4440	Fax No.: 717-627-4660					
Signature:				Date: /-28-//					
Ensure the forms that are appropriate to your revision	n request are inclu	ded in your subm	ittal.						
Form Name and (Number)	Required if			Box and a					
☑ Riverine Hydrology and Hydraulics Form (Form 2)	New or revised dis	charges or water-s	surface elevations	3 2 Montage No.					
☑ Riverine Structures Form (Form 3)			n of bridge/culverts, ddition/revision of da	BENJAMIN J. ELARMART J					
☐ Coastal Analysis Form (Form 4)	Coastal Analysis Form (Form 4) New or revised coastal elevations								
☐ Coastal Structures Form (Form 5)	Addition/revision o	f coastal structure		Seal (Optional)					
☐ Alluvial Fan Flooding Form (Form 6)	Flood control meas	sures on alluvial fa	ins	562110					

U.S. DEPARTMENT OF HOMELAND SECURITY - FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B No. 1660-0016 Expires: 12/31/2010

PAPERWORK REDUCTION ACT

Public reporting burden for this form is estimated to average 3.25 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, U.S. Department of Homeland Security, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. Please do not send your completed survey to the above address.

	Flooding Source: Walker Run Note: Fill out one form for each flooding source studied										
		A. HYDROLOG	Y								
1.	Reason for New Hydrologic Analysis (check	all that apply)									
	■ Not revised (skip to section B)	☐ No existing analysis	☐ Impro	ved data							
	☐ Alternative methodology	☐ Proposed Conditions (CLOM	R) Chang	ged physical condition of watershed							
2.	2. Comparison of Representative 1%-Annual-Chance Discharges										
	Location Drai	nage Area (Sq. Mi.)	Effective/FIS (cfs)	Revised (cfs)							
3.	Methodology for New Hydrologic Analysis (o Statistical Analysis of Gage Records Regional Regression Equations Please enclose all relevant models in digital	Precipitation/Runoff Model Other (please attach descrip	·	nmeters) and documentation to support the							
	new analysis.										
4.	Review/Approval of Analysis			-Mhid							
_	If your community requires a regional, state,		rologic analysis, please	attach evidence of approval/review.							
J.	 Impacts of Sediment Transport on Hydrology Was sediment transport considered? ☐ Yes ☐ No If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation for why sediment transport was not considered. 										

B. HYDRAULICS

1.	Reach to be Revised				
		Description	Cross Section	Water-Surfac	e Elevations (ft.)
				Effective	Proposed/Revised
	Downstream Limit	Downstream Limit of Revised Flood Model	ВНЈ	652.54	653.29
	Upstream Limit	Upstream Limit of Revised Flood Model	BIA	672.31	671.55
2.	Hydraulic Method/Model Used				
	HEC-RAS			,	

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

DHS-FEMA has developed two review programs, CHECK-2 and CHECK-RAS, to aid in the review of HEC-2 and HEC-RAS hydraulic models, respectively. These review programs may help verify that the hydraulic estimates and assumptions in the model data are in accordance with NFIP requirements, and that the data are comparable with the assumptions and limitations of HEC-2/HEC-RAS. CHECK-2 and CHECK-RAS identify areas of potential error or concern. These tools do not replace engineering judgment. CHECK-2 and CHECK-RAS can be downloaded from http://www.fema.gov/plan/prevent/fhm/frm_soft.shtm. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS. Review of your submittal and resolution of valid modeling discrepancies may result in reduced review time.

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Plan
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☑ Digital Models Submitted? (Required) C. MAPPING REQUIREMENTS

A certified topographic map must be submitted showing the following information (where applicable): the boundaries of the effective, existing, and proposed conditions 1%-annual-chance floodplain (for approximate Zone A revisions) or the boundaries of the 1%- and 0.2%-annual-chance floodplains and regulatory floodway (for detailed Zone AE, AO, and AH revisions); location and alignment of all cross sections with stationing control indicated; stream, road, and other alignments (e.g., dams, levees, etc.); current community easements and boundaries; boundaries of the requester's property; certification of a registered professional engineer registered in the subject State; location and description of reference marks; and the referenced vertical datum (NGVD, NAVD, etc.).

□ Digital Mapping (GIS/CADD) Data Submitted

Note that the boundaries of the existing or proposed conditions floodplains and regulatory floodway to be shown on the revised FIRM and/or FBFM must tie-in with the effective floodplain and regulatory floodway boundaries. Please attach a copy of the effective FIRM and/or FBFM, annotated to show the boundaries of the revised 1%- and 0.2%-annual-chance floodplains and regulatory floodway that tie-in with the boundaries of the effective 1%- and 0.2%-annual-chance floodplain and regulatory floodway at the upstream and downstream limits of the area of revision.

Annotated FIRM and/or FBFM (Required)

D. COMMON REGULATORY REQUIREMENTS*

1.	For LOMR/CLOMR requests, do Base Flood Elevations (BFEs) increase?	☐ Yes ☑ No
	 a. For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section The proposed project encroaches upon a regulatory floodway and would result in increases above The proposed project encroaches upon a SFHA with or without BFEs established and would result 	0.00 foot.
	b. For LOMR requests, does this request require property owner notification and acceptance of BFE increas	ses? 🗌 Yes 🗌 No
	If Yes, please attach proof of property owner notification and acceptance (if available) . Elements on notification can be found in the MT-2 Form 2 Instructions.	of and examples of property owner
2.	Does the request involve the placement or proposed placement of fill?	⊠ Yes □ No
	If Yes, the community must be able to certify that the area to be removed from the special flood hazard proposed structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from NFIP regulations set forth at 44 CFR 60.3(a)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions	om flooding in accordance with the
3.	For LOMR requests, is the regulatory floodway being revised?	☐ Yes ☐ No
	If Yes, attach evidence of regulatory floodway revision notification . As per Paragraph 65.7(b)(1) of the NF required for requests involving revisions to the regulatory floodway. (Not required for revisions to approximate [studied Zone A designation] unless a regulatory floodway is being added. Elements and examples of regulators be found in the MT-2 Form 2 Instructions.)	e 1%-annual-chance floodplains
4.	For LOMR/CLOMR requests, does this request have the potential to impact an endangered species?	☐ Yes ☒ No
	If Yes, please submit documentation to the community to show that you have complied with Sections 9 and (ESA). Section 9 of the ESA prohibits anyone from "taking" or harming an endangered species. If an action material a permit is required from U.S. Fish and Wildlife Service or National Marine Fisheries Service under Section 10	might harm an endangered species,
	For actions authorized, funded, or being carried out by Federal or State agencies, please submit document compliance with Section 7(a)(2) of the ESA.	tation from the agency showing its

^{*} Not inclusive of all applicable regulatory requirements. For details, see 44 CFR parts 60 and 65.

U.S. DEPARTMENT OF HOMELAND SECURITY - FEDERAL EMERGENCY MANAGEMENT AGENCY RIVERINE STRUCTURES FORM

O.M.B No. 1660-0016 Expires: 12/31/2010

PAPERWORK REDUCTION ACT

Public reporting burden for this form is estimated to average 7 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, U.S. Department of Homeland Security, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. Please do not send your completed survey to the above address.

, <u> </u>	
Flooding Source: Walker Run	
Note: Fill out one form for each flooding source studied	

A GENERAL

Comp	Channelization Bridge/Culvert Dam/Basin Levee/Floodwall	complete Section C complete Section D								
Desci	iption Of Structure									
1.	Name of Structure: F	loodplain/ Channel Restora	ation							
	Type (check one):		☐ Bridge/Culvert	Levee/Floodwall	☐ Dam/Basin					
	Location of Structure:	Beach Grove Road,~3600 ft.	south to confluence with unnar	med tributary						
	Downstream Limit/Cros	ss Section: 1602								
	Upstream Limit/Cross \$	Section: 5198								
2.	Name of Structure: B	ridge # 4								
	Type (check one):	☐ Channelization	☑ Bridge/Culvert	☐ Levee/Floodwall	☐ Dam/Basin					
	Location of Structure:	~1300 ft. south of upper N. M	farket St. bridge		ſ					
	Downstream Limit/Cros	ss Section: 2497								
	Upstream Limit/Cross S	Section: 2730								
		•								
3.	Name of Structure:			,	,					
	Type (check one)	☐ Channelization	☐ Bridge/Culvert	Levee/Floodwall	☐ Dam/Basin					
	Location of Structure:				•					
	Downstream Limit/Cros	ss Section:								
	Upstream Limit/Cross \$	Section:								
			·							
NOT	NOTE: For more structures, attach additional pages as needed.									

B. CHANNELIZATION

Floo	Flooding Source: Walker Run				
Nan	Name of Structure: Walker Run Restoration				
1.	Accessory Structures				
	The channelization includes (check one): Levees [Attach Section E (Levee/Floodwall)]				
2.	Drawing Checklist				
	Attach the plans of the channelization certified by a registered professional engineer, as described in the instructions.				
3.	Hydraulic Considerations				
	The channel was designed to carry 16-35 (cfs) and/or the -year flood.				
	The design elevation in the channel is based on (check one):				
	☐ Subcritical flow ☐ Critical flow ☐ Supercritical flow ☐ Energy grade line				
	If there is the potential for a hydraulic jump at the following locations, check all that apply and attach an explanation of how the hydraulic jump is controlled without affecting the stability of the channel.				
	☐ Inlet to channel ☐ Outlet of channel ☐ At Drop Structures ☐ At Transitions ☐ Other locations (specify):				
4.	Sediment Transport Considerations				
	Was sediment transport considered?				
	C. BRIDGE/CULVERT				
Floo	ding Source: Walker Run				
Nam	ne of Structure: Bridge #4				
	1. This revision reflects (check one):				
	 ☑ Bridge/culvert not modeled in the FIS ☐ Modified bridge/culvert previously modeled in the FIS ☐ Revised analysis of bridge/culvert previously modeled in the FIS 				
	2. Hydraulic model used to analyze the structure (e.g., HEC-2 with special bridge routine, WSPRO, HY8): HEC-RAS If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structures. Attach justification.				
	Attach plans of the structures certified by a registered professional engineer. The plan detail and information should include the following (check the information that has been provided):				
	☑ Dimensions (height, width, span, radius, length) ☑ Erosion Protection ☑ Shape (culverts only) ☑ Low Chord Elevations – Upstream and Downstream ☑ Material ☑ Top of Road Elevations – Upstream and Downstream ☑ Beveling or Rounding ☑ Structure Invert Elevations – Upstream and Downstream ☑ Wing Wall Angle ☑ Stream Invert Elevations – Upstream and Downstream ☑ Skew Angle ☑ Cross-Section Locations ☑ Distances Between Cross Sections				
4.	Sediment Transport Considerations				
	Was sediment transport considered?				

D. DAM/BASIN

Flo	oding Source:							
Nar	Name of Structure:							
1.	This request is for (check one): Existing dam New dam Modification of existing dam							
2.	The dam was designed by (check one): Federal agency State agency Local government agency Private organization							
	Name of the agency or organization:							
3.	The Dam was permitted as (check one):							
	a.							
	Provide the permit or identification number (ID) for the dam and the appropriate permitting agency or organization							
	Permit or ID number Permitting Agency or Organization							
	b.							
	Provided related drawings, specification and supporting design information.							
4.	Does the project involve revised hydrology? ☐ Yes ☐ No							
	If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2).							
	Was the dam/basin designed using critical duration storm?							
	Yes, provide supporting documentation with your completed Form 2.							
	No, provide a written explanation and justification for not using the critical duration storm.							
5.	Does the submittal include debris/sediment yield analysis?							
	If yes, then fill out Section F (Sediment Transport). If No, then attach your explanation for why debris/sediment analysis was not considered.							
6.	Does the Base Flood Elevation behind the dam or downstream of the dam change?							
	☐ Yes ☐ No If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2) and complete the table below.							
	Stillwater Elevation Behind the Dam							
	FREQUENCY (% annual chance) FIS REVISED							
	10-year (10%) 50-year (2%) 100-year (1%) 500-year (0.2%) Normal Pool Elevation							
7.	Please attach a copy of the formal Operation and Maintenance Plan							

E. LEVEE/FLOODWALL

1.	Sys	stem Elements				
	a.	This Levee/Floodwall analysis is based on (check one):				
		□ upgrading of an existing levee/floodwall system □ a newly constructed levee/floodwall system □ reanalysis of an existing levee/floodwall system	,			
	b.	Levee elements and locations are (check one):			•	
		structural floodwall Sta	ition ition ition	to to to		
	c.	Structural Type (check one):				
		monolithic cast-in place reinforced concrete reinforced concrete masonry block sheet piling Other (describe):			,	
	d.	Has this levee/floodwall system been certified by a Federal agency to	provide p	rotection from the base flood?	,	
		Yes No				
		If Yes, by which agency?				
	e.	Attach certified drawings containing the following information (indicate	drawing s	sheet numbers):		
		Plan of the levee embankment and floodwall structures.	Sheet N	umbers:		
		A profile of the levee/floodwall system showing the Base Flood Elevation (BFE), levee and/or wall crest and foundation, and closure locations for the total levee system.	Sheet N	umbers:		
		A profile of the BFE, closure opening outlet and inlet invert elevations, type and size of opening, and kind of closure.	Sheet N	umbers:		
		4. A layout detail for the embankment protection measures.	Sheet N	umbers:		
	,	 Location, layout, and size and shape of the levee embankment features, foundation treatment, floodwall structure, closure structures, and pump stations. 	Sheet No	umbers:	·	
2.	Fre	eeboard				
	a.	The minimum freeboard provided above the BFE is:				
		Riverine				
		3.0 feet or more at the downstream end and throughout3.5 feet or more at the upstream end4.0 feet within 100 feet upstream of all structures and/or constrictions	s		☐ Yes ☐ Yes ☐ Yes	□ No □ No □ No
		Coastal				
		1.0 foot above the height of the one percent wave associated with the stillwater surge elevation or maximum wave runup (whichever is greater).		al-chance	☐ Yes	□No
		2.0 feet above the 1%-annual-chance stillwater surge elevation			☐ Yes	□No
					/	

E. LEVEE/FLOODWALL (CONTINUED)

2.	Freeboard (continued)									
	Please note, occasionally exceptions are made to the minimum freeboard requirement. If an exception is requested, attach documentation addressing Paragraph 65.10(b)(1)(ii) of the NFIP Regulations.									
	If No is answered to any of the above, please attach an explanation.									
	b. Is there an indication from historical records that ice-jamming can affect the BFE?									
	If Yes, provide ice-jam analysis profile and evidence that the minimum freeboard discussed above still exists.									
3.	<u>Closures</u>									
	a. Openings through the levee system (check one): ☐ exists ☐ does not exist									
	If opening exists, lis	st all closures:								
Cha	nnel Station	Left or Righ	nt Bank	Opening	Туре		evation for g Invert	Type of 0	Closure Device	
			_						·	
									,	
									,	
(Ext	end table on an added	d sheet as need	ed and refer	rence)						
Note	e: Geotechnical and g	eologic data								
	In addition to the re- design analysis for the Corps of Engineers	the following sy:	stem feature	es should be su	ned during fion bmitted in a fi	eld and labor tabulated sui	ratory inves mmary form	tigations and n. (Reference	used in the U.S. Army	
4.										
	a. The maximum le	vee slope lands	ide is:							
	b. The maximum le	vee slope floods	side is:							
	c. The range of velo	ocities along the	levee durin	g the base floo	d is:	min.) to	(max.)			
	d. Embankment ma	terial is protecte	ed by (descr	ibe what kind):					•	
	e. Riprap Design Parameters (check one):									
			Flow		Curve or		Stone Ripr	ар	Depth of	
	Reach	Sideslope	Depth	Velocity	Straight	D ₁₀₀	D ₅₀	Thickness	Toedown	
Sta	to									
Sta	to									
Sta	to									
Sta	to									
Sta	to									
Sta	to`									
(Ext	end table on an added	l sheet as need	ed and refer	ence each entr	γ)					

E. LEVEE/FLOODWALL (CONTINUED) Embankment Protection (continued) Is a bedding/filter analysis and design attached?

Yes

No Describe the analysis used for other kinds of protection used (include copies of the design analysis): Attach engineering analysis to support construction plans. **Embankment And Foundation Stability** Identify locations and describe the basis for selection of critical location for analysis: Overall height: Sta. ft. ; height ☐ Limiting foundation soil strength: , depth Sta. strength $\phi =$ degrees, c = psf slope: SS = (h) to (Repeat as needed on an added sheet for additional locations) Specify the embankment stability analysis methodology used (e.g., circular arc, sliding block, infinite slope, etc.): Summary of stability analysis results: Case **Loading Conditions** Critical Safety Factor Criteria (Min.) Τ End of construction 1.3 Ħ Sudden drawdown 1.0 Ш Critical flood stage 1.4 IV Steady seepage at flood stage 1.4 VΙ Earthquake (Case I) 1.0 (Reference: USACE EM-1110-2-1913 Table 6-1) ☐ Yes ☐ No d. Was a seepage analysis for the embankment performed?

Mas a seepage analysis for the embankment performed? Yes No If Yes, describe methodology used: e. Was a seepage analysis for the foundation performed? Yes No f. Were uplift pressures at the embankment landside toe checked? Yes No g. Were seepage exit gradients checked for piping potential? Yes No h. The duration of the base flood hydrograph against the embankment is hours. Attach engineering analysis to support construction plans.

E. LEVEE/FLOODWALL (CONTINUED) Floodwall And Foundation Stability a. Describe analysis submittal based on Code (check one): ☐ UBC (1988) or ☐ Other (specify): b. Stability analysis submitted provides for: ☐ Overturning ☐ Sliding If not, explain: c. Loading included in the analyses were: ☐ Lateral earth @ P_A = psf; P_p = psf ☐ Surcharge-Slope @ , \square surface psf ☐ Wind @ P_w = psf ☐ Seepage (Uplift); ☐ Earthquake @ P_{eq} = %g ☐ 1%-annual-chance significant wave height: ☐ 1%-annual-chance significant wave period: sec. Summary of Stability Analysis Results: Factors of Safety. Itemize for each range in site layout dimension and loading condition limitation for each respective reach. Criteria (Min) Sta То Sta To Loading Condition Overturn Sliding Overturn Sliding Overturn Sliding Dead & Wind 1.5 1.5 Dead & Soil 1.5 1.5 Dead, Soil, Flood, & 1.5 1.5 Impact Dead, Soil, & Seismic 1.3 1.3 (Ref: FEMA 114 Sept 1986; USACE EM 1110-2-2502)

(Note: Extend table on an added sheet as needed and reference)

e. Foundation bearing strength for each soil type:

Bearing Pressure	Sustained Load (psf)	Short Term Load (psf
Computed design maximum		
Maximum allowable		

E. LEVEE/FLOODWALL (CONTINUED)

7.	Set	tlement
	a.	Has anticipated potential settlement been determined and incorporated into the specified construction elevations to maintain the established freeboard margin?
	b.	The computed range of settlement is ft. to ft.
	C.	Settlement of the levee crest is determined to be primarily from :
		Foundation consolidation Embankment compression Other (Describe):
	d.	Differential settlement of floodwalls has has not been accommodated in the structural design and construction.
		Attach engineering analysis to support construction plans.
8.	Inte	rior Drainage
	a.	Specify size of each interior watershed:
		Draining to pressure conduit: acres Draining to ponding area: acres
	b.	Relationships Established
		Ponding elevation vs. storage
	c.	The river flow duration curve is enclosed:
	d.	Specify the discharge capacity of the head pressure conduit: cfs
	e.	Which flooding conditions were analyzed?
		 Gravity flow (Interior Watershed) Common storm (River Watershed) Historical ponding probability Coastal wave overtopping Yes No No No
		If No for any of the above, attach explanation.
	f.	Interior drainage has been analyzed based on joint probability of interior and exterior flooding and the capacities of pumping and outlet facilities to provide the established level of flood protection. Yes No
		If No, attach explanation.
	g.	The rate of seepage through the levee system for the base flood is cfs
	h.	The length of levee system used to drive this seepage rate in item g:

E. LEVEE/FLOODWALL (CONTINUED)

8.	Inte	rior Drainage (continued)				
	i.	Will pumping plants be used for interio	or drainage?	☐ Yes	□ No	
		If Yes, include the number of pumping For each pumping plant, list:	plants:			·
		,	Plant #1			Plant #2
The	num	ber of pumps				
The ponding storage capacity						
The	max	imum pumping rate				
The	maxi	imum pumping head				
The	pum	ping starting elevation				
The	pum	ping stopping elevation				
Is th	e dis	charge facility protected?				
Is th	ere a	a flood warning plan?				·
		ch time is available between warning ling?				
Will	the o	peration be automatic?			☐ Yes	□No
If the	pun	nps are electric, are there backup power	sources?		☐ Yes	□ No
(Ref	eren	ce: USACE EM-1110-2-3101, 3102, 310	03, 3104, and 3105)			
		copy of supporting documentation of da ratersheds that result in flooding.	ta and analysis. Provide a ma	p showing	the floode	d area and maximum ponding elevations for all
9.	<u>Oth</u>	ner Design Criteria				
	a.	The following items have been address	ed as stated:			
	Liquefaction ☐ is ☐ is not a problem Hydrocompaction ☐ is ☐ is not a problem Heave differential movement due to soils of high shrink/swell ☐ is ☐ is not a problem					
	b.	For each of these problems, state the b	easic facts and corrective action	n taken:		
		Attach supporting documentation				
	C.	If the levee/floodwall is new or enlarged ☐ Yes ☐ No	d, will the structure adversely in	npact flood	levels and	d/or flow velocities floodside of the structure?
		Attach supporting documentation				
	d.	Sediment Transport Considerations:				
	٠	Was sediment transport considered? If No, then attach your explanation for				(Sediment Transport).
			•			

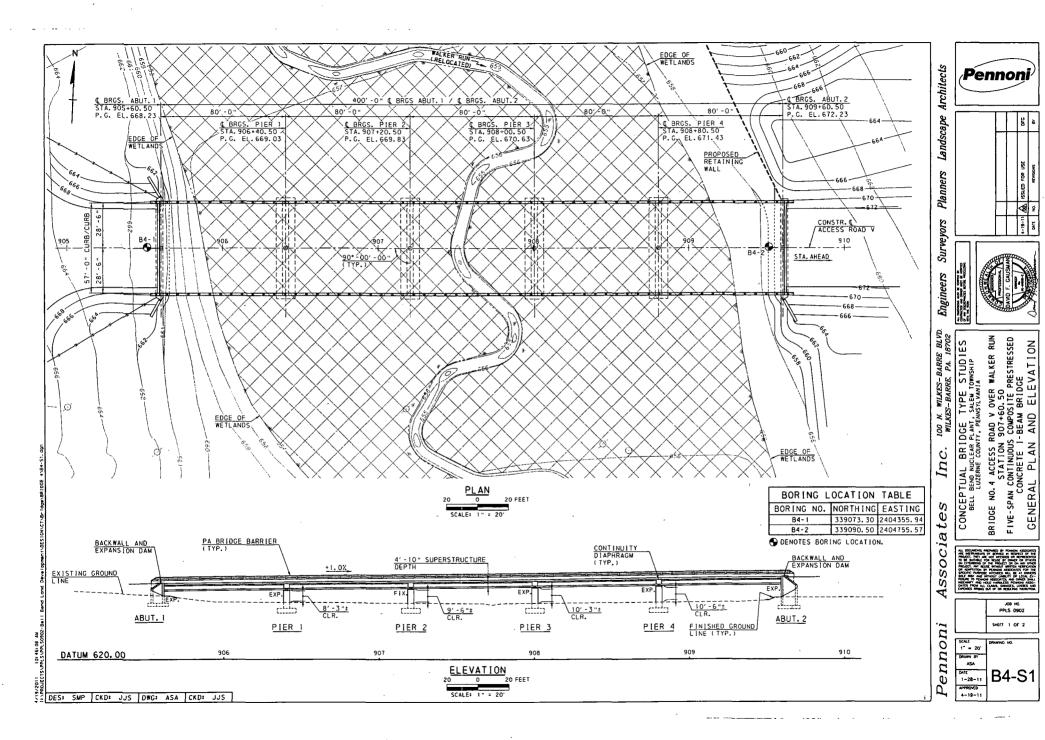
E. LEVEE/FLOODWALL (CONTINUED) Operational Plan And Criteria Are the planned/installed works in full compliance with Part 65.10 of the NFIP Regulations? ☐ Yes ☐ No Does the operation plan incorporate all the provisions for closure devices as required in Paragraph 65.10(c)(1) of the NFIP regulations? ☐ Yes ☐ No Does the operation plan incorporate all the provisions for interior drainage as required in Paragraph 65.10(c)(2) of the NFIP regulations? ☐ Yes ☐ No If the answer is No to any of the above, please attach supporting documentation. Maintenance Plan Are the planned/installed works in full compliance with Part 65.10 of the NFIP Regulations? ☐ Yes ☐ No If No, please attach supporting documentation. Operations and Maintenance Plan Please attach a copy of the formal Operations and Maintenance Plan for the levee/floodwall. E CEDIMENT TRANSPORT

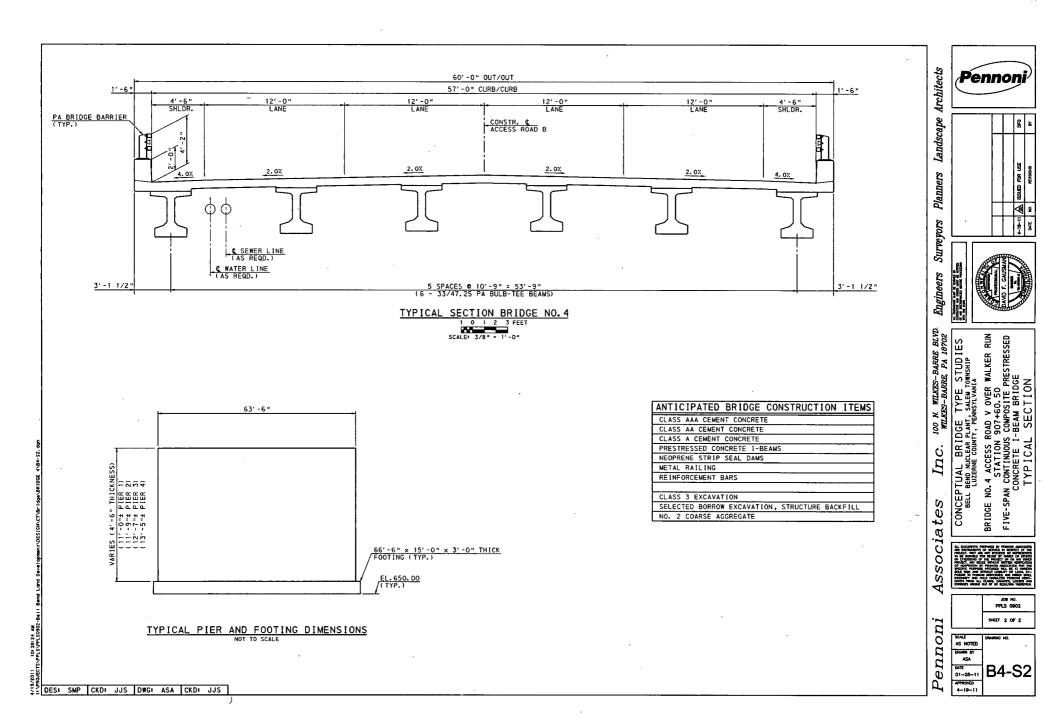
1. SEDIMENT TRANSPORT					
Flooding Source:					
Name of Structure:					
If there is any indication from historical records that sediment transport (including scour and deposition) can affect the Base Flood Elevation (BFE); and/or based on the stream morphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including scour and deposition) to affect the BFEs, then provide the following information along with the supporting documentation:					
Sediment load associated with the base flood discharge: Volume acre-feet					
Debris load associated with the base flood discharge: Volume acre-feet					
Sediment transport rate (percent concentration by volume)					
Method used to estimate sediment transport:					
Most sediment transport formulas are intended for a range of hydraulic conditions and sediment sizes; attach a detailed explanation for using the selected method.					
Method used to estimate scour and/or deposition:					
Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport: Please note that bulked flows are used to evaluate the performance of a structure during the base flood; however, FEMA does not map BFEs based on bulked flows.					
If a sediment analysis has not been performed, an explanation as to why sediment transport (including scour and deposition) will not affect the BFEs or structures must be provided.					

A sediment transport analysis in the terms requested above (ac-ft., % by volume) was not performed for individual structures. There is no indication from historical records that sediment transport significantly affects the BFE, and the sediment supply to the upstream limit of the project reach is insignificant. The channel and floodplain restoration design, which employes natural channel design principles, does consider sediment transport in order to create a stable dimension, pattern, and profile. The intent of the design is to minimize shear stresses in the system to avoid mobilization of sediment from within the project reach, correcting the currently unstable banks that are the primary sediment (sand and silt) source under existing conditions.

FEDERAL EMERGENCY MANAGEMENT AGENCY PAYMENT INFORMATION FORM

Community Name: Salem Township, Luzerne County, PA				
Project Identifier: Walker Run F	Restoration			
THIS FORM MUST BE MAILED	, ALONG WITH THE APPROPRIAT	TE FEE, TO THE ADDRESS BELOW OR FAXED TO THE FAX NUMBER BELOW.		
Type of Request:				
	MT-1 application MT-2 application	FEMA Fee Charge System Administrator 7390 Coca Cola Drive Suite 204 Hanover, MD 21076		
•	EDR application	FEMA Project Library 847 South Pickett St. Alexandria, VA 22304 FAX (703) 212-4090		
Request No.:	(if known)	Amount: <u>\$4,400</u>		
INITIAL FEE* FINA	L FEE FEE BALANCE** [☐ MASTER CARD ☐ VISA ☒ CHECK ☐ MONEY ORDER		
	r Alluvial Fan requests (as appropriat corrected fee for an ongoing request			
COMPLETE THIS SECTION ONL	Y IF PAYING BY CREDIT CARD			
	CARD NUMBER	EXP. DATE		
1 2 3 4 5	6 7 8 9 10 11	12		
Date		Signature		
, Dato		Organization .		
NAME (AS IT APPEARS ON CAR (please print or type)	RD):	-		
ADDRESS: (for your credit card receipt-please print or type)		-		
DAYTIME PHONE:				





Enclosure 2

Susquehanna River CLOMR Request

- a. Form 1 Overview and Concurrence Form
- b. Form 2 Riverine Hydrology & Hydraulics Form
 c. Form 7 Payment Information Form
- d. LandStudies, Inc. "Bell Bend Nuclear Power Plant Flood Study Report, Susquehanna River, Salem Township, Luzerne County, PA.", November 2010, Rev. 1.

Bell Bend Nuclear Power Plant Flood Study Report Susquehanna River

Salem Township, Luzerne County, PA









Prepared for:
PPL Bell Bend, LLC.
38 Bomboy Lane, Suite 2
Berwick, Pennsylvania 18603

Prepared by:



Lititz, PA 17543 717-627-4440

www.landstudies.com



Bell Bend Nuclear Power Plant

Susquehanna River Flood Study Report

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		Photographs of Existing and Proposed Site					
		Existing Structure Detail					

Details of Proposed Structure



1 Introduction

PPL is proposing a new facility, the Bell Bend Nuclear Power Plant (BBNPP), on a site near Berwick, PA. The site is located in Salem Township, Luzerne County, northeast of Berwick near the existing Susquehanna Steam Electric Station (SSES) nuclear power plant. The water intake structure for the proposed facility will be located directly east of the proposed site along the Susquehanna River, downstream of the intake structure of the existing plant. The location is approximately 22 miles downstream of Wilkes-Barre, PA and 5 miles upstream of Berwick, PA. A FEMA Flood Study exists for the section of the Susquehanna River that will be impacted by the proposed intake structure. The FEMA study cross-sections were used as a basis for the flood analysis.

The objectives of this study are to determine the hydraulic effect of the proposed intake structure on the Susquehanna River and to determine the extent of the 100-year floodplain. This report presents the existing (pre-construction) floodplain characteristics modeled in HEC-RAS and how they compare to both the original FEMA floodplain characteristics obtained from the US Army Corps of Engineers and to the proposed (post-construction) floodplain characteristics modeled in HEC-RAS.

2 Hydrology

Soils information and geology at the proposed BBNPP site and surrounding area were determined from Penn State University's online soil map tool (www.soilmap.psu.edu). Soils existing in the region of the proposed intake structure include Pope soils and Holly Silt Loams (hydrologic soil groups "B" and "D", respectively). A soils map is included in Appendix A.

The Hamilton Group geologic formation exists beneath the proposed intake structure site. It is an east to west trending band of the lower and middle Devonian-age Hamilton Group and is made up of two formations: the Mahantango Formation and the Marcellus Formation. The Mahantango Formation is composed of gray, brown and olive shale and siltstone while the Marcellus Formation is composed of black, carbonaceous shale. See the geologic map in Appendix A.

The Susquehanna River is 444 miles long, with its headwaters in New York. The entire Susquehanna River Basin covers 27,510 mi²; however, the drainage area to the location of the proposed intake structure equals approximately 10,600 mi². The 100-year peak flow



used in the FEMA Flood Insurance Study (FIS) for this drainage area is 266,049 cfs. The maximum recorded flow rate was 345,000 cfs at the Wilkes-Barre gauging station (24 miles upstream) and 363,000 cfs at the Danville gauging station (28 mi downstream) during Hurricane Agnes, which is similar to the 500 year flow rate (353,744 cfs) used in the FIS.

3 Hydraulics

3.1 General Description

The US Army Corps of Engineers HEC-RAS Version 4.0 software was used for the hydraulic analysis. HEC-RAS is intended for calculating water-surface profiles for steady or unsteady flow in natural or man-made channels. The computational procedure is based on the solution of the one-dimensional energy equation with energy loss due to friction computed using Manning's equation. The computational procedure is generally known as the Standard Step Method and can be used for subcritical as well as supercritical flow conditions. For this project, the water-surface profile for steady, subcritical flow was calculated.

3.2 FEMA Flood Insurance Study (FIS) (Duplicate Effective Model)

The most current FEMA FIS model of the Susquehanna River was conducted by the US Army Corps of Engineers in HEC-RAS. It was preliminarily released on October 30, 2009, and is currently in the appeals and protests period before becoming effective. The HEC-RAS data for this model was truncated to the study reach concerning the Bell Bend project for comparison with the existing and proposed models, to be discussed later. The truncated FEMA model includes cross-sections extending from "BT" at Station 166.72 (LandStudies (LSI) Station 1270+17), to "DA" at Station 169.246 (LSI Station 1399+88).

The 100-year flow rates used in the model are 264,320 cfs at the upstream end of the model and 266,049 cfs downstream from where the Little Wapwallopen Creek discharges into the Susquehanna River. The downstream boundary condition is the known water surface elevation from the complete FEMA FIS model. A subcritical flow regime was selected. The FEMA HEC-RAS data is located in Appendix E (FEMA Flood Insurance Study).

3.3 Existing Conditions (Corrected Effective Model)

The FEMA FIS model was used as the basis for the existing conditions geometry. The cross-sections extend from Station 1270+17 (FEMA FIS XS "BT") to 1399+88 (FEMA FIS XS "DA"). The river bottom of several FEMA cross-sections were enhanced with bathymetry data from the Ecology III report entitled "Ecological Studies of the Susquehanna River in the vicinity of the Susquehanna Steam Electric Station" (August, 1983). Cross-sections altered include those near the existing and proposed intake structures, ranging from Station 1270+17 ("BT") to Station 1379+90 ("CV"), to more accurately model the proposed changes associated with construction of the intake structure. The 1983 bathymetry data by Ecology III (formerly Ichthyological Associates, Inc.) was used in this flood study over other



bathymetry reports for its accuracy, detail and long span of studied river in the area of the SSES and proposed BBNPP facilities (see Appendix C).

An additional cross-section at Station 1327+77, where the proposed intake structure will be located, was input to the existing conditions geometry. To generate the cross-sectional geometry, the bounding cross-sections were first interpolated, and then the west side of the Susquehanna River was supplemented with one-foot contours from an aerial survey by Peters Consulting, Inc.

The existing intake structure was modeled in HEC-RAS as an obstruction in the floodplain. The structure dimensions were determined from PPL Drawing M-57-3, Rev. 4 (see Appendix H). Also dredging information and the water intake invert were used to modify the cross-section at the existing intake structure (Station 1330+27). For photographs of the existing intake structure, see Appendix H.

No bridges span the Susquehanna within the studied cross-sections; however, from Station 1391+96 to Station 1399+88 an island is characterized, though underwater for the 100-year storm event. Existing Manning's 'n' values were kept consistent with the FEMA FIS Manning's 'n' values. Similarly, the 100-year flow rate from the FEMA FIS (264,320 cfs) was used in the existing conditions model. The downstream boundary condition was the known 100-year water surface elevation taken from the FEMA FIS (511.82 ft). A subcritical flow regime was assumed in the HEC-RAS analysis, consistent with the original model. Based on the model output, the subcritical flow assumption was verified. The HEC-RAS data is located in Appendix F (Existing Hydraulics).

3.4 Proposed Conditions (Revised Conditions Model)

In the proposed conditions model, the existing conditions geometry was altered at Station 1327+77 to reflect the proposed intake structure conditions. The proposed structure was represented by an obstructed area within the cross-sectional geometry. The grading near the structure was also altered in the model; specifically the river bottom elevation was lowered to correctly represent the dredging to occur for the structure's intake invert and the grading was altered for the structure pad and access drive. For details of the proposed intake structure, see Appendix H. Manning's 'n' values were decreased from existing condition's values to reflect the parking lot/impervious surfaces in proposed conditions.

The same flow information and boundary condition used in the existing conditions model were used in proposed conditions ($Q_{100} = 264,320$ cfs, downstream WSEL₁₀₀ = 511.82 ft). Proposed HEC-RAS data can be found in Appendix G (Proposed Hydraulics).

4 Results and Conclusions

The existing conditions HEC-RAS model was first compared to the original FEMA FIS model. The existing conditions model contains more detail of the river bottom than the FEMA FIS model due to the bathymetric study data supplemented in the cross-sections. Specifically, in the area of the existing and proposed intake structures, the Susquehanna River bottom dips into a large pool, whereas the FEMA FIS model actually shows a rise in the river bottom in this area. The existing conditions model also examines the effect of the existing intake structure on the Susquehanna River, unlike the FEMA FIS model. Based upon the geometrical differences, the two models' water surface elevations differ from each other; specifically, the existing conditions water surface elevations are lower than the FEMA FIS water surface elevations. The difference between the two models is greater upstream of the existing intake structure, with a maximum difference of 1.33 ft at Station 1286+02.

The variation between the existing conditions and FEMA FIS models can be most attributed to the available detailed bathymetric data used in the existing conditions model. Due to the rise in river bottom in the FEMA FIS model within the pool at the existing and proposed intake structures, the water surface elevation rises higher than the existing conditions model. Also contributing to the variation between models is the additional cross section at the proposed intake structure and the additional existing intake structure information. Based on this comparison, LandStudies concludes that while the LSI existing conditions model is based upon the FEMA FIS model, due to the additional information used it has a higher level of accuracy and should be used for further comparison purposes. See Appendix D for a summary of FEMA and existing conditions output.

The proposed conditions model was compared directly to the existing conditions model to determine the effect of the proposed intake structure on the 100-year flood elevation. In the proposed conditions model, the 100-year water surface elevations remain consistent with the existing conditions 100-year water surface elevations at every cross section except for the cross section containing the proposed intake structure (Sta. 1327+77). At this cross section, the proposed water surface elevation drops 0.03 ft below the existing water surface elevation (see Appendix D). Since the proposed water surface elevations are equal to or lower than the existing water surface elevations, it can be concluded that the proposed intake structure for the proposed BBNPP has no negative hydraulic effect on the Susquehanna River and its floodplain. The elevation and extent of the 100-year floodplain will not be measurably increased at any location as a result of this project. The pad for the proposed intake structure is raised above the 100-year water surface elevation. The existing and proposed 100-year floodplain plan can be seen in Appendix B.

Appendix A: Maps



Source: Berwick, PA USGS 7.5-minute topographic quadrangle

Location 41°05'17" N, 76°07'54" W

Scale 1" = 2000'

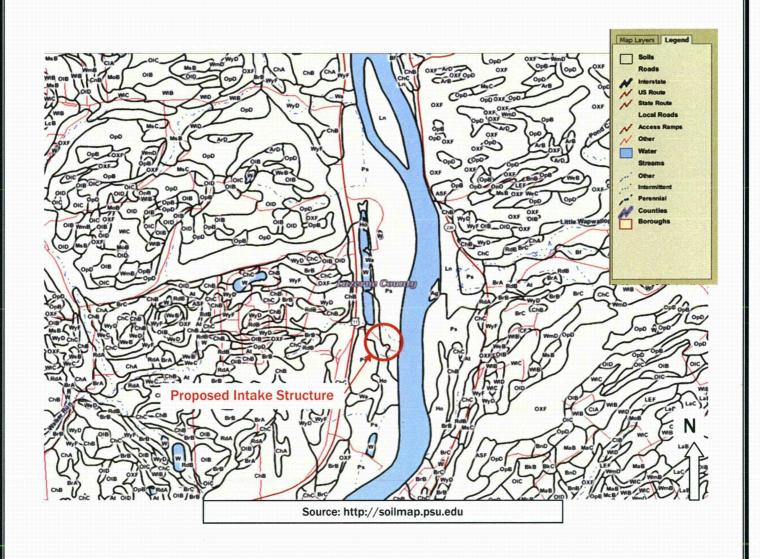
Project Location Map

BBNPP Intake Structure on the Susquehanna River



Susquehanna River Flood Study Report

Bell Bend Nuclear Power Plant Salem Township, Luzerne County, PA November 2010



Location

41°05'17" N, 76°07'54" W

Scale

1" = 2000'

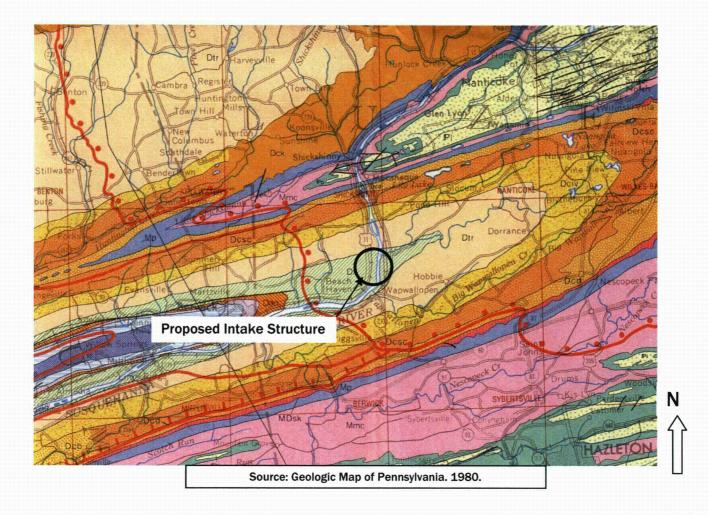
Soils Location Map

BBNPP Intake Structure on the Susquehanna River



Susquehanna River Flood Study Report

Bell Bend Nuclear Power Plant Salem Township, Luzerne County, PA November 2010



Geologic Formation

Dh = Hamilton Group

Location 41°05′17″ N, 76°07′54″ W

Scale 1:250,000

Geology Map

BBNPP Intake Structure on the Susquehanna River



Susquehanna River Flood Study Report

Bell Bend Nuclear Power Plant Salem Township, Luzerne County, PA November 2010

NOTES TO USERS

This map is for use in administrating the National Flood Insurance Program It does not recessarily identify all areas subject to flooding, particularly from total drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To other more detailed offermation in areas where Stee Field Bisvalies (PE) and the Recomplete have been determed, users are recovering to commit the Flood Profiles and Rocketty Data and/or Summary of Diffusion Elevations to these contention where the Flood insurance Subsylf (FS) upon that accompanies to these contentions and accompanies contention of the Rocketty Steep Subsylf (FS) and accompanies contention and advise bed intended to the Steep
Coasial: Base. Flood. Elevations shown on his map agity only tendent of 0 ff both American Merical Datum of 1988 MAVD 851. Users of FRMM should be severe that coasial flood elevations are also provided in the Semerary of Sithesian Elevations table in the Flood insurance State, report for the production. Devotors shown in the Semerary of Sithesian Elevations when they are higher than the elevations shown on the FRMM.

Boundaries of the **Boodways** were computed at cross sections and interpolates between cross sections. The Boodways were based on hydraufic consideration with regard to requirement of the National Rood Insurance Program. Roodway widths and other perfurent Boodway data are provided in the Flood Insurance Study report for this purisdiction.

Centain areas not in Special Flood Hazard Areas may be protected by **flood** centrol structures. Refer to Section 2.4 "Flood Protection Measures" of the Flood invariance Study report for information on flood control structures for the jurisdiction.

The projection used in the preparation of this map was. Phinniphuma State Plane north zone (FIPSZONE 2701) The horizontal datum sees MADIS GRS1900 spheroid Differences in datum spheroid, projection or State Plana canes used in the production of FIRMS for adoptine purisdiction sway result in sight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

Food develors on Pas map are inferenced to the North American Vertical Datam of 1086 These food develors must be compared to thickups are ground identification in the compared to the footh American Vertical Datam of 1086. It is the National Geodelic Survey selective at http://www.ngs.noas.gov/ or contact the National Geodelic Surveys at the Oblivious address:

NGAA, N/NGS12 National Geodetic Survey SSMC- 3, #9202 1315 East-West Highway

To obtain current elevation description, and/or location information for bench man shown on this map, please contact the information Services Branch of 8 National Geodetic Survey at (301) 713-3242, or visit its website http://www.ngs.noaa.gov/

Base map information shown on this FIRM was provided in a digital format by the PAMAP Program, PA Department of Conservation and Natural Resources, Bureau of Topographic and Geologic Survey. This information was photogrammetricallyconvolled at a scale of 1.2 400 from averal photography dated April 2005

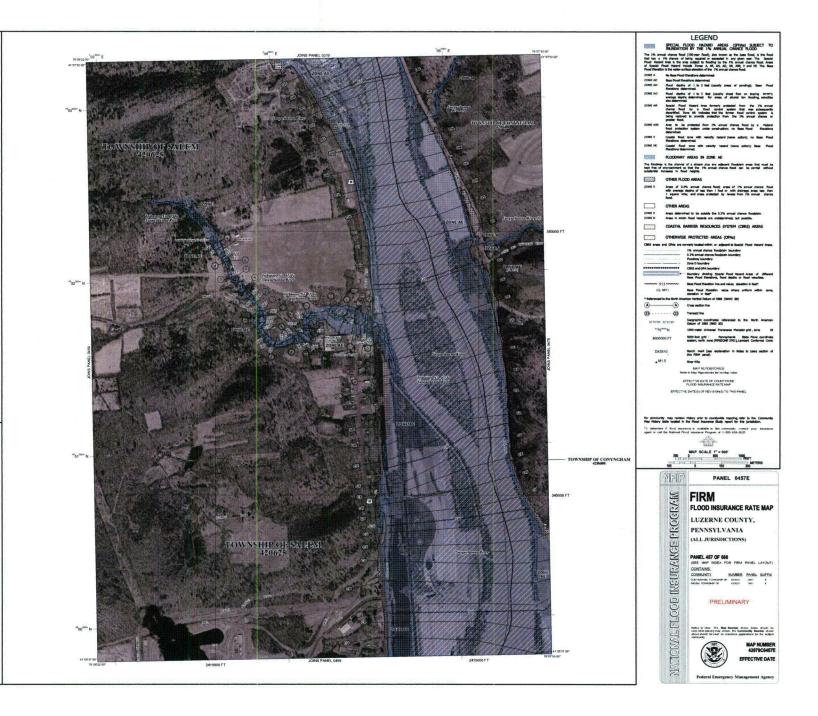
The map melos more delained and up-to-date stream channel configurations have been seen on the previous FRMR for this puriodicis. The floodings that were trensferred from the previous FRRR may be adjusted to configurations. As a displaced to configurations. As a displaced to configurations. As a flooding to the configuration of the configurati

Corporate limits shown on this map are based on the best data available at the time of publication Because changes due to americations or de-americations may, have occurred after this map was published may users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the esparately printed Map Index for an overview map of 8 county shreeing the layout of map pariets community map repository addresses and a Listing of Communities table containing National Flood Insurance Progra dates for each community as well as a leading of the panels on which see

Contact the FEMA Map Service Center at 1-800-358-9816 for information or available products associated with 9% FIRMA valiable products may include previously stassed Letters of Map Change, a Flood Instantance Study report

If you have questions about this map or questions concerning the National Flood Insurance Program in general, please call 1-877-PEMA MAP (1-877-336-2627 or wait the FEMA website at http://www.fema.gov/.



NOTES TO USERS

This map is for use in administering the National Flood Insurance Program to does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for necessarily instituted and forces flood from the consultance of the control of the consultance and
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Boundaries of the Readways were computed at cross sections and interpolated between cross sections. The floodways were based on hydractic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other perinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by flood central structures. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures to this instruction.

The projection used in the proporation of this map was Pennsylvarian State Plane north zone (FIPS20NE 3701) This horizontal disturt was NADSI GRS1805 spheroid. Differences in datum spheroid, projection or State Plane zones used in the production of FIRMs for adjacent prindictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRMs.

Flood elevations on this map are referenced to the North American Vertica Dollam of 1986. These Boot develocies must be compared to structure and ground elevations referenced to the same vertical detains. For information regarding convinciento between the National Geodelic Vertical Datam of 1026 and the North American Vertical Datam of 1086, visit the National Geodelic Survey website at 1982/newsergancea good or contact the National Geodelic Contact Datam of 1086 and the North American Vertical Datam of 1086, visit the National Geodelic Survey website at 1982/newsergancea good or contact the National Geodelic

NGS Information Services NOAA, NNGS12 National Geodetic Survey

To obtain current elevation, description, and/or location information for beach marks shown on this map, please contact the information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website a

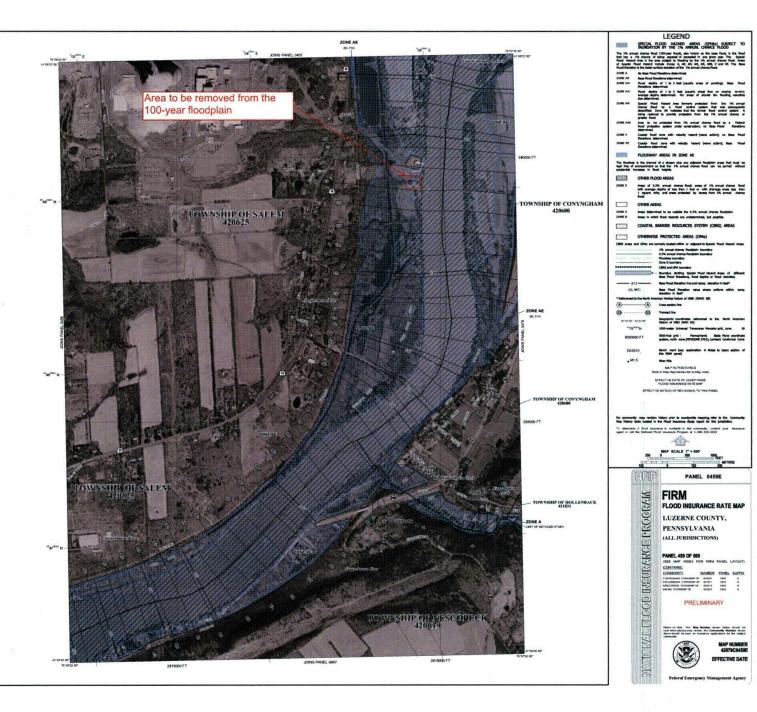
Base map information shown on this FIRM was provided in a digital format by the PAMAP Program. PA Department of Conservation and Netwart Resources, Burea of Topographic and Geologic Survey. This information was photogrammetrically of Topographic and Seologic Survey. This information was photogrammetrically

This map milecta more detailed and up to date stream channel configurations have from these benchmark RRMM for Se principlion. The Boodplains and Bloodways that were transferred from the previous FRMM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables or the Flood Instanton Study specified the Configuration of the Proof Instanton Study specified contains administration of the Proof Instanton.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map uses should contact appropriate community officials to verify current comprate limit locations.

Please refer to the separately printed **Nop** Index for an over-sev map of # county showing the layout of map panets community map repository addresse and a Listing of Communities table containing National Flood Insurance Progra dates for each community as well as a listing of the panets on which sex community is located.

Contact the FBMA Map Service Center at 1-500-358-9616 for information or available products associated with this FIRML valiable products may includ previously issued Letters of Map Change. a Flood insurance Study reporandor digital ventions of this map The FEMA Map Service Center may also be available to the Center of the Center of the Map Change of the Center may also be suited to the Center of the Center of the Map Center of the
If you have questions about this map or questions concerning the National Flood Insurance Program in general, please call 1-877-FESSA MAP (1-877-336-2827) or visit the FESSA velocits at http://www.fema.gov/.



Appendix B: Floodplain Map

