

INTRODUCTION

Dufresne Group completed a study of hydrology and hydraulics for the Brookside Cemetery Trail crossing over Lovers Lane Brook, a tributary to the Williams River Middle Branch. The site is shown in **Figure 1**. This report investigates the flow characteristics at the site during the 100-year storm event.

Site information was collected from a topographic survey completed by Daniels Survey, PC. Additional information was obtained from Federal Emergency Management Agency (FEMA) studies and output from the StreamStats USGS program. Data was analyzed using the stream flow analysis software program HEC-RAS.

The analysis was performed to assess the current flood elevations and the impact of a proposed pedestrian bridge structure on the flood elevations.

HYDROLOGY

The site is in Chester, Vermont and receives flow from a drainage area that includes mostly wooded, hilly areas, some rural residential properties and some fields. The total drainage area contributing to the flow at the proposed bridge crossing is 3.4 square miles.

The storm event analyzed for this study is the 100-year storm. Under local regulations, the proposed bridge construction (classified as development) must not increase the flood levels during the occurrence of the base flood (100 year) since a portion of the structure is in the floodway.

The StreamStats program modeling reported the flow rate associated with the 100-year storm event at this location as 701 cfs +/- 47.3%. The HEC-RAS model of existing conditions was developed to simulate the 100-year storm event with a base flood elevation (BFE) of 614' at the crossing location and flow of 1,405 cfs. The BFE value of 614' at the project site corresponds to cross section H, as shown in the FEMA Flood Insurance Study (FIS) dated September 28, 2007. The flow of 1,405 cfs is slightly below the FIS reported 100-year storm peak discharge of 1,440 cfs at the mouth of Lovers Lane Brook.

HYDRAULIC EVALUATION

The HEC-RAS model simulations were performed using stream channel alignment and channel cross section information obtained from the existing topographic mapping as input data. The existing conditions were modeled to simulate the 100-year base flood elevation. The proposed improvements were also modeled to assess changes in the BFE. **Figure 2** shows the bridge site plan and profile.

During the 100-year storm event, the base flood elevation varies from 610.5 to 614.7 ft along the stream channel within the study area, according to the FIS data and the HEC-RAS results for the existing conditions model.

For modeling proposed conditions, with a simulated bridge in the HEC-RAS program, the proposed bottom chord of the bridge deck was set at 615', which is 1' above the 100-year BFE. 3' wide supports at a 40 ft span over the stream channel and at 20 ft intervals north of the channel were included in the simulated bridge cross section. The bridge is proposed to ramp down to meet existing grade therefore the bridge modeling used the energy method. The Manning n roughness coefficient was reduced to account for the removal of existing trees for construction of the bridge and pathway. A minimum cleared width of 22 ft was used for the analysis.

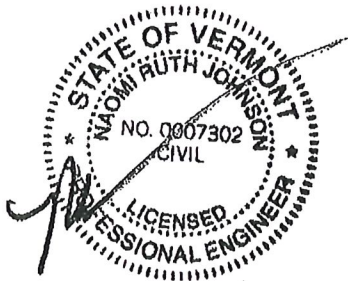
The effect of the proposed project is a decrease in the BFE of 0.03 ft at a flow of 1,405 cfs. Clearing a wider section will further reduce the flood elevation. A profile showing the water surface profile of the existing and proposed conditions is shown in Figure 3.

The proposed development will result in no increase in flood levels during the occurrence of the base flood.



3-12-2021

Naomi R. Johnson, PE



APPENDIX: HEC-RAS REPORTS

HEC-RAS HEC-RAS 5.0.7 March 2019
 U.S. Army Corps of Engineers
 Hydrologic Engineering Center
 609 Second Street
 Davis, California

```

X      X  XXXXXX   XXXX      XXXX      XX      XXXX
X      X  X       X      X      X  X      X  X      X
X      X  X       X       X      X  X      X  X      X
XXXXXXXX XXXX     X       XXX XXXX     XXXXXX     XXXX
X      X  X       X       X      X  X      X  X      X
X      X  X       X      X      X  X      X  X      X
X      X  XXXXXX   XXXX      X      X      X  X      XXXXX
  
```

PROJECT DATA

Project Title: Lovers brook
 Project File : Loversbrook.prj
 Run Date and Time: 3/12/2021 9:21:19 AM

Project in English units

PLAN DATA

Plan Title: Plan 02
 Plan File : p:\Chester VT\7121004 Brookside Cem
 Permit\Tech\HECRAS\Existing\Loversbrook.p02

Geometry Title: Geom 01
 Geometry File : p:\Chester VT\7121004 Brookside Cem
 Permit\Tech\HECRAS\Existing\Loversbrook.g01

Flow Title : Flow 01
 Flow File : p:\Chester VT\7121004 Brookside Cem
 Permit\Tech\HECRAS\Existing\Loversbrook.f01

Plan Summary Information:

Number of:	Cross Sections =	20	Multiple Openings =	0
	Culverts =	0	Inline Structures =	0
	Bridges =	0	Lateral Structures =	0

Computational Information

Water surface calculation tolerance = 0.01
 Critical depth calculation tolerance = 0.01
 Maximum number of iterations = 20

Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options

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

FLOW DATA

Flow Title: Flow 01
Flow File : p:\Chester VT\7121004 Brookside Cem
Permit\Tech\HECRAS\Existing\Loversbrook.f01

Flow Data (cfs)

River	Reach	RS	PF 1
Lovers Brook	Alignment - (14)	475	1405
Lovers Brook	Alignment - (14)	0	1405

Boundary Conditions

River	Reach	Profile	Upstream
Lovers Brook	Alignment - (14)	PF 1	Known WS = 611.5

Downstream
Normal S = 0.009

GEOMETRY DATA

Geometry Title: Geom 01
Geometry File : p:\Chester VT\7121004 Brookside Cem
Permit\Tech\HECRAS\Existing\Loversbrook.g01

CROSS SECTION

RIVER: Lovers Brook
REACH: Alignment - (14) RS: 475

INPUT

Description:

Station Elevation Data		num=		21					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	616.14	4.64	616.05	18.73	615.75	22.89	615.53	40.82	614.44
47.61	614.26	59.37	612.56	72	610.698	77.89	609.83	79.1	609.65
82.82	609.75	93.02	610.22	94.04	610.47	100.02	610.44	122.32	614.57
132.51	613.58	139.32	613.54	168.34	613.71	213.15	611.76	273.84	614.66
277.88	615.25								

Manning's n Values		num=		3	
Sta	n Val	Sta	n Val	Sta	n Val
0	.06	72	.05	94.04	.12

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	72	94.04		25	25		.1	.3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 450

INPUT

Description:

Station Elevation Data		num=		18					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	616.11	25.55	615.7	31.39	615.32	55	611.042	61.08	609.94
65.05	609.25	65.34	609.25	66.93	609.29	76.51	609.52	76.83	609.54
77.8	609.58	83.02	610.87	113.59	610.67	126.91	613.14	132.99	612.55
148.57	612.45	165.45	612.55	172.64	612.23				

Manning's n Values		num=		3	
Sta	n Val	Sta	n Val	Sta	n Val
0	.06	55	.05	83.02	.12

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	55	83.02		25	25		.1	.3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 425

INPUT

Description:

Station Elevation Data		num=		21					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	615.93	12.44	615.81	22.23	615.7	45.15	615.44	60.32	615.46
70.85	610.1	75.15	609.37	79.76	609.42	83.87	609.47	85.09	609.5

86.03	609.76	97.66	610.53	98.6	610.94	109.4	610.99	133.33	610.78
142.28	612.57	146.77	612.18	164.48	612.19	179	612.4	207.58	611.44
279.74	614.49								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	60.32	.05	98.6	.12

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	60.32	98.6		25	25	25		.1	.3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 400

INPUT

Description:

Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	615.51	3.01	615.51	32.2	615.16	35.72	615.13	38.42	615.13
56.75	615.65	58.83	615.34	61.31	615.11	63.01	614.97	64.06	614.47
67	612.041	69.76	609.76	69.78	609.53	74.16	609.57	76	609.44
84.14	608.86	86.21	609.35	91.21	609.7	93.86	610.86	122.42	611.01
128.8	610.95	131.36	611.47	132.69	611.36	156.66	611.45	162.73	611.55
175.83	611.16	275.7	615.15						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	67	.05	93.86	.12

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	67	93.86		25	25	25		.1	.3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 375

INPUT

Description:

Station Elevation Data num= 29

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	615.15	2.64	615.15	30.35	614.81	46.87	615.28	51.14	615.4
52.1	615.34	61.17	615.04	64.63	613.24	65.75	612.56	69.33	609.67
70.11	609.82	70.41	609.47	70.57	609.43	76.12	609.49	78.87	609.57
79.23	609.58	87.45	608.98	87.47	608.66	87.58	609.19	90.68	610.43
90.9	610.5	101.98	610.68	125.6	610.79	146.17	610.82	151.91	610.89
153.02	610.89	161.8	611.2	168.5	611.63	278.86	615.71		

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val
 0 .06 65.75 .05 90.68 .12

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 65.75 90.68 25 25 25 .1 .3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 350

INPUT

Description:

Station Elevation Data num= 28
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
 0 614.5 25.41 614.49 27.36 614.48 28.4 614.5 31.23 614.55
 49.14 614.85 56.57 614.12 59.12 613.94 59.94 613.47 66.94 611.15
 69.19 610.47 69.4 610.33 70.68 608.86 71.43 608.68 78.88 608.76
 82.04 608.79 86.41 608.74 86.99 608.89 87.6 609.45 100.49 610.03
 113.84 610.49 122.75 610.5 130.61 610.61 139.03 610.72 146.01 610.7
 198.89 612.55 236.91 615.03 278.84 616.55

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val
 0 .06 69.4 .05 87.6 .12

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 69.4 87.6 25 25 25 .1 .3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 325

INPUT

Description:

Station Elevation Data num= 29
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
 0 613.48 8.6 613.79 20.42 613.79 45.19 614.29 48 614.33
 48.27 614.34 56.16 613.75 57.31 613.59 60.05 612.75 66.71 610.61
 71.85 608.24 72.29 607.95 72.37 607.93 72.88 607.93 74.4 607.92
 79.35 608.02 85.9 608.15 86.28 608.12 86.66 608.32 88.1 608.88
 89.78 609.63 96.24 609.76 105.82 610.32 111.51 610.33 130.11 610.45
 135.77 610.52 139.45 610.52 229.26 613.64 279.31 617

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val

0 .06 66.71 .05 89.78 .12

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 66.71 89.78 25 25 25 .1 .3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 300

INPUT

Description:

Station Elevation Data num= 34

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	613	2.08	613.13	8.16	613.09	14.02	613.41	17.75	613.34
28.22	613.33	35.51	613.26	45.59	613.47	51.36	613.45	54.48	613.1
59.89	611.58	62.99	610.25	67.49	610	69.96	609.22	72.3	608.34
73.17	608.15	73.88	607.95	79.83	608.13	81.97	608.2	84.84	608.24
85.7	608.16	86.08	608.37	88.04	609.21	88.96	609.44	89.07	609.46
91.57	609.55	105.48	609.99	120.69	610.09	134.23	610.46	166.91	611.74
229.12	613.72	265.71	615	278.52	615.86	279.79	616.14		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	67.49	.05	91.57	.12

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 67.49 91.57 25 25 25 .1 .3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 275

INPUT

Description:

Station Elevation Data num= 28

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	613.34	7.45	613.26	16.9	613.24	21.45	613.22	38.43	613.18
39.95	613.15	46.61	613.15	46.62	612.99	56.74	612.18	60.49	611.65
65.35	611.45	73.28	609.48	75.8	608.53	75.84	607.9	80	607.94
80.98	607.96	84.69	607.99	85.67	607.99	86.18	608.36	100.74	609.58
125.74	610.31	137.09	610.52	160.11	612.13	214.55	613.9	260.45	615.75
272.67	618.58	273.42	618.74	279.75	619.75				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	73.28	.05	100.74	.12

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	73.28	100.74		25	25	25		.1	.3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 250

INPUT

Description:

Station Elevation Data	num=	24
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev		
0 612.94 5.45 612.89 20.43 612.94 25.62 612.83 31.23 612.77		
35.92 612.76 54.56 612.68 56.45 612.11 62.96 612.02 62.98 612		
73.41 607.77 78.25 607.66 79.46 607.67 83.94 607.71 84.34 607.71		
85.78 608.75 91.97 609.27 102.61 609.58 150.97 610.5 248.98 617.33		
265.68 617.88 268.27 618.46 278.35 620.63 279.44 620.85		

Manning's n Values	num=	3
Sta n Val Sta n Val Sta n Val		
0 .06 62.96 .05 91.97 .12		

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	62.96	91.97		25	25	25		.1	.3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 225

INPUT

Description:

Station Elevation Data	num=	20
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev		
0 612.83 25.05 612.5 55.41 612.44 56.89 612.41 58.34 612.39		
59.45 612.39 63.15 612.36 67.15 611.17 68.17 610.29 71.28 608.47		
72.61 607.9 79.4 607.17 79.6 607.17 83.52 607.01 84.11 607.33		
91.31 609.11 108.99 609.2 184.66 610.46 251.16 614.56 279.41 619.34		

Manning's n Values	num=	3
Sta n Val Sta n Val Sta n Val		
0 .06 68.17 .05 91.31 .12		

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	68.17	91.31		25	25	25		.1	.3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 200

INPUT

Description:

Station Elevation Data		num= 15								
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	
0	612.34	61.23	611.62	70.57	611.63	73.7	608.91	74.2	608.06	
74.85	607.76	78.83	607.57	79.97	607.48	85.63	607.06	87.46	608.77	
89.81	609.34	151.39	609.57	199.98	610.44	253.73	614.02	279.96	618.47	

Manning's n Values		num= 3			
Sta	n Val	Sta	n Val	Sta	n Val
0	.06	73.7	.05	89.81	.12

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	73.7	89.81		25	25		.1	.3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 175

INPUT

Description:

Station Elevation Data		num= 17								
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	
0	611.96	71.12	611.42	71.17	611.42	71.24	611.25	73.54	607.42	
74.05	607.19	76.87	607.06	79.63	607.05	84.69	607.05	86.15	608.48	
87.4	609	141.12	609.78	185.62	609.92	212.8	610.42	246.24	612.72	
269.24	616.62	279.59	618.55							

Manning's n Values		num= 3			
Sta	n Val	Sta	n Val	Sta	n Val
0	.06	71.12	.05	87.4	.12

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	71.12	87.4		25	25		.1	.3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 150

INPUT

Description:

Station Elevation Data		num= 17								
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	
0	611.58	60.77	610.49	70.47	610.41	70.64	610.4	70.71	610.29	

73.15	608.63	73.37	606.97	83.34	606.97	83.5	607.13	86.56	608.4
218.08	610.31	224.5	610.33	228.41	610.4	233.23	610.73	236.54	611.29
259.95	615.65	279.91	618.96						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	73.15	.05	86.56	.12

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	73.15	86.56		25	25		.1	.3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 125

INPUT

Description:

Station Elevation Data	num=	17							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	612.81	8.04	612.81	24.86	612.92	70.46	611.04	70.47	611.04
72.32	608.9	73.79	606.8	80	606.94	84.03	607.03	86.48	607.01
87.03	607.25	92.1	608.18	188.17	609.59	230.48	610.67	247.85	614
251.91	614.63	280	619.33						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	72.32	.05	92.1	.12

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	72.32	92.1		25	25		.1	.3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 100

INPUT

Description:

Station Elevation Data	num=	17							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	612.97	42.8	612.94	62.32	613.08	70.44	606.47	70.56	606.41
70.6	606.37	70.8	606.36	79.66	606.29	85.75	606.23	89.07	607.71
90.75	608.03	130.25	608.63	223	610.89	238.22	613.78	247.76	615.25
278.34	620.34	279.64	620.62						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	62.32	.05	90.75	.12

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	62.32	90.75		25	25	25		.1	.3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 75

INPUT

Description:

Station Elevation Data	num=		17							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	
0	613.01	48.99	612.85	59.78	612.48	64.53	611.41	64.82	611.26	
70.1	606	79.41	605.78	80.44	605.75	88.75	605.66	89.19	606.04	
91.32	607.67	118.78	608.85	220.26	611.44	229.28	613.17	254.5	617.11	
270.28	619.75	279.41	621.74							

Manning's n Values	num=		3		
Sta	n Val	Sta	n Val	Sta	n Val
0	.06	64.82	.05	91.32	.12

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	64.82	91.32		25	25	25		.1	.3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 50

INPUT

Description:

Station Elevation Data	num=		18							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	
0	612.51	21.09	612.47	38.4	611.93	62.27	611.97	63.56	611.23	
67.15	609.04	71.48	605.55	79.57	605.61	85.55	605.65	87.03	605.64	
88.75	607.08	88.88	607.18	153.1	610.04	219.94	611.63	227.04	612.97	
256.72	617.55	269.29	619.63	279.53	621.84					

Manning's n Values	num=		3		
Sta	n Val	Sta	n Val	Sta	n Val
0	.06	67.15	.05	88.75	.12

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	67.15	88.75		25	25	25		.1	.3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 25

INPUT

Description:

Station Elevation Data num= 24									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	611.78	29.22	611.84	51.84	611.49	56.88	611.64	60.75	611.63
66.72	608.04	70.02	605.63	77.05	605.56	79.18	605.54	82.05	605.47
82.28	606.7	82.58	607.09	88.64	606.2	89.3	606.87	96.93	608
108.49	607.91	145.33	609.56	177.06	611	215.45	611.86	220.11	612.73
255.71	618.13	263.91	619.46	271.22	621.01	276.93	621.83		

Manning's n Values num= 3					
Sta	n Val	Sta	n Val	Sta	n Val
0	.06	66.72	.05	82.58	.12

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	66.72	82.58		25	25		.1	.3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 0

INPUT

Description:

Station Elevation Data num= 23									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	610.52	26.48	610.26	34.96	610.52	47.62	610.84	64.68	606.64
68.11	605.86	68.93	605.5	70.77	605.46	78.94	605.39	79.69	605.38
89.97	605.3	91.31	606.07	91.81	606.58	106.79	608.82	127.72	608.57
182.95	611.1	195.19	611.66	214.22	612.04	216.95	612.53	257.36	618.47
263.02	619.36	268.49	620.48	278.82	621.94				

Manning's n Values num= 3					
Sta	n Val	Sta	n Val	Sta	n Val
0	.06	64.68	.05	91.81	.12

Bank Sta:	Left	Right	Coeff	Contr.	Expan.
	64.68	91.81		.1	.3

SUMMARY OF MANNING'S N VALUES

River:Lovers Brook

Reach	River Sta.	n1	n2	n3

Alignment - (14)	475	.06	.05	.12
Alignment - (14)	450	.06	.05	.12
Alignment - (14)	425	.06	.05	.12
Alignment - (14)	400	.06	.05	.12
Alignment - (14)	375	.06	.05	.12
Alignment - (14)	350	.06	.05	.12
Alignment - (14)	325	.06	.05	.12
Alignment - (14)	300	.06	.05	.12
Alignment - (14)	275	.06	.05	.12
Alignment - (14)	250	.06	.05	.12
Alignment - (14)	225	.06	.05	.12
Alignment - (14)	200	.06	.05	.12
Alignment - (14)	175	.06	.05	.12
Alignment - (14)	150	.06	.05	.12
Alignment - (14)	125	.06	.05	.12
Alignment - (14)	100	.06	.05	.12
Alignment - (14)	75	.06	.05	.12
Alignment - (14)	50	.06	.05	.12
Alignment - (14)	25	.06	.05	.12
Alignment - (14)	0	.06	.05	.12

SUMMARY OF REACH LENGTHS

River: Lovers Brook

Reach	River Sta.	Left	Channel	Right
Alignment - (14)	475	25	25	25
Alignment - (14)	450	25	25	25
Alignment - (14)	425	25	25	25
Alignment - (14)	400	25	25	25
Alignment - (14)	375	25	25	25
Alignment - (14)	350	25	25	25
Alignment - (14)	325	25	25	25
Alignment - (14)	300	25	25	25
Alignment - (14)	275	25	25	25
Alignment - (14)	250	25	25	25
Alignment - (14)	225	25	25	25
Alignment - (14)	200	25	25	25
Alignment - (14)	175	25	25	25
Alignment - (14)	150	25	25	25
Alignment - (14)	125	25	25	25
Alignment - (14)	100	25	25	25
Alignment - (14)	75	25	25	25
Alignment - (14)	50	25	25	25
Alignment - (14)	25	25	25	25
Alignment - (14)	0			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Lovers Brook

Reach	River Sta.	Contr.	Expan.
Alignment - (14)	475	.1	.3
Alignment - (14)	450	.1	.3
Alignment - (14)	425	.1	.3
Alignment - (14)	400	.1	.3
Alignment - (14)	375	.1	.3
Alignment - (14)	350	.1	.3
Alignment - (14)	325	.1	.3
Alignment - (14)	300	.1	.3
Alignment - (14)	275	.1	.3
Alignment - (14)	250	.1	.3
Alignment - (14)	225	.1	.3
Alignment - (14)	200	.1	.3
Alignment - (14)	175	.1	.3
Alignment - (14)	150	.1	.3
Alignment - (14)	125	.1	.3
Alignment - (14)	100	.1	.3
Alignment - (14)	75	.1	.3
Alignment - (14)	50	.1	.3
Alignment - (14)	25	.1	.3
Alignment - (14)	0	.1	.3

Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options

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

FLOW DATA

Flow Title: Flow 01

Flow File : p:\Chester VT\7121004 Brookside Cem Permit\Tech\HECRAS\Proposed Sloping Bridge\ProposedSlopingBr.f01

Flow Data (cfs)

River	Reach	RS	PF 1
Lovers Brook	Alignment - (14)	475	1405
Lovers Brook	Alignment - (14)	0	1405

Boundary Conditions

River	Reach	Profile	Upstream
Downstream			
Lovers Brook	Alignment - (14)	PF 1	Known WS = 611.5

Normal S = 0.009

GEOMETRY DATA

Geometry Title: Geom 01

Geometry File : p:\Chester VT\7121004 Brookside Cem Permit\Tech\HECRAS\Proposed Sloping Bridge\ProposedSlopingBr.g01

CROSS SECTION

RIVER: Lovers Brook

REACH: Alignment - (14) RS: 475

HEC-RAS HEC-RAS 5.0.7 March 2019
 U.S. Army Corps of Engineers
 Hydrologic Engineering Center
 609 Second Street
 Davis, California

```

X   X  XXXXXX   XXXX       XXXX       XX       XXXX
X   X  X       X   X       X   X       X   X       X
X   X  X       X           X   X       X   X       X
XXXXXXXX XXXX   X           XXX XXXX   XXXXXX   XXXX
X   X  X       X           X   X       X   X           X
X   X  X       X   X       X   X       X   X           X
X   X  XXXXXX   XXXX       X   X       X   X       XXXXX
  
```

PROJECT DATA

Project Title: Proposed Sloping Bridge
 Project File : ProposedSlopingBr.prj
 Run Date and Time: 3/12/2021 9:24:41 AM

Project in English units

PLAN DATA

Plan Title: Plan 02
 Plan File : p:\Chester VT\7121004 Brookside Cem Permit\Tech\HECRAS\Proposed Sloping Bridge\ProposedSlopingBr.p02

Geometry Title: Geom 01
 Geometry File : p:\Chester VT\7121004 Brookside Cem Permit\Tech\HECRAS\Proposed Sloping Bridge\ProposedSlopingBr.g01

Flow Title : Flow 01
 Flow File : p:\Chester VT\7121004 Brookside Cem Permit\Tech\HECRAS\Proposed Sloping Bridge\ProposedSlopingBr.f01

Plan Summary Information:

Number of: Cross Sections =	23	Multiple Openings =	0
Culverts =	0	Inline Structures =	0
Bridges =	1	Lateral Structures =	0

Computational Information

Water surface calculation tolerance =	0.01
Critical depth calculation tolerance =	0.01
Maximum number of iterations =	20

INPUT

Description:

Station Elevation Data		num= 21		Sta		Elev		Sta		Elev	
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	616.14	4.64	616.05	18.73	615.75	22.89	615.53	40.82	614.44		
47.61	614.26	59.37	612.56	69	611.14	77.89	609.83	79.1	609.65		
82.82	609.75	93.02	610.22	94.04	610.47	100.02	610.44	122.32	614.57		
132.51	613.58	139.32	613.54	168.34	613.71	213.15	611.76	273.84	614.66		
277.88	615.25										

Manning's n Values		num= 3		Sta		n Val	
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	69	.05	94.04	.12		

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	69	94.04		25	25		.1	.3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 450

INPUT

Description:

Station Elevation Data		num= 18		Sta		Elev		Sta		Elev	
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	616.11	25.55	615.7	31.39	615.32	55	611.042	61.08	609.94		
65.05	609.25	65.34	609.25	66.93	609.29	76.51	609.52	76.83	609.54		
77.8	609.58	83.02	610.87	113.59	610.67	126.91	613.14	132.99	612.55		
148.57	612.45	165.45	612.55	172.64	612.23						

Manning's n Values		num= 3		Sta		n Val	
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	55	.05	83.02	.12		

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	55	83.02		25	25		.1	.3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 425

INPUT

Description:

Station Elevation Data		num= 21		Sta		Elev		Sta		Elev	
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	615.93	12.44	615.81	22.23	615.7	45.15	615.44	60.32	615.46		
70.85	610.1	75.15	609.37	79.76	609.42	83.87	609.47	85.09	609.5		

86.03	609.76	97.66	610.53	98.6	610.94	109.4	610.99	133.33	610.78
142.28	612.57	146.77	612.18	164.48	612.19	179	612.4	207.58	611.44
279.74	614.49								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	60.32	.05	98.6	.12

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

60.32	98.6	25	25	25	.1	.3
-------	------	----	----	----	----	----

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 400

INPUT

Description:

Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	615.51	3.01	615.51	32.2	615.16	35.72	615.13	38.42	615.13
56.75	615.65	58.83	615.34	61.31	615.11	63.01	614.97	64.06	614.47
69.76	609.76	69.78	609.53	74.16	609.57	76	609.44	84.14	608.86
86.21	609.35	91.21	609.7	93.86	610.86	122.42	611.01	128.8	610.95
131.36	611.47	132.69	611.36	156.66	611.45	162.73	611.55	175.83	611.16
275.7	615.15								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	64.06	.05	93.86	.12

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

64.06	93.86	25	25	25	.1	.3
-------	-------	----	----	----	----	----

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 375

INPUT

Description:

Station Elevation Data num= 29

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	615.15	2.64	615.15	30.35	614.81	46.87	615.28	51.14	615.4
52.1	615.34	61.17	615.04	64.63	613.24	65.75	612.56	69.33	609.67
70.11	609.82	70.41	609.47	70.57	609.43	76.12	609.49	78.87	609.57
79.23	609.58	87.45	608.98	87.47	608.66	87.58	609.19	90.68	610.43
90.9	610.5	101.98	610.68	125.6	610.79	146.17	610.82	151.91	610.89
153.02	610.89	161.8	611.2	168.5	611.63	278.86	615.71		

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val
 0 .06 65.75 .05 90.68 .12

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 65.75 90.68 10 10 10 .1 .3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 365.00*

INPUT

Description:

Station Elevation Data num= 53
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
 0 614.82 2.5 614.83 11.03 614.79 26.2 614.63 28.76 614.61
 44.42 615.04 48.47 615.15 49.38 615.1 57.97 614.89 60.56 613.85
 60.81 613.75 61.51 613.45 62.66 612.89 66.31 610.51 67.11 610.62
 67.42 610.34 67.58 610.3 68.07 610.3 69.13 610.28 71.65 610.13
 73.25 610.03 76.07 609.9 76.43 609.88 77.78 609.71 82.51 608.96
 82.91 608.88 82.99 608.88 83.46 608.85 84.84 608.77 84.86 608.51
 85.05 608.94 86.67 609.25 89.08 609.71 89.22 609.73 89.36 609.8
 89.88 610.01 90.5 610.27 90.72 610.33 96.92 610.43 101.82 610.55
 106.45 610.63 112.11 610.65 125.47 610.72 130.6 610.73 136.23 610.75
 139.89 610.75 146.07 610.8 151.82 610.9 152.93 610.91 161.72 611.22
 168.43 611.61 229.19 613.83 278.95 615.97

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val
 0 .06 66.31 .05 90.5 .03

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 66.31 90.5 6 6 6 .1 .3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 359.00*

INPUT

Description:

Station Elevation Data num= 53
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
 0 614.62 2.42 614.64 10.67 614.64 25.33 614.51 27.81 614.5
 42.95 614.89 46.86 615 47.74 614.96 56.06 614.8 58.68 613.92
 58.93 613.83 59.64 613.57 60.8 613.08 64.51 611.02 65.31 611.1
 65.62 610.86 65.79 610.83 66.28 610.82 67.36 610.77 69.91 610.52

71.54	610.35	74.38	610.09	74.76	610.06	76.12	609.84	80.91	608.86
81.32	608.74	81.4	608.73	81.87	608.71	83.27	608.64	83.29	608.42
83.53	608.79	85.57	609.07	88.6	609.48	88.78	609.49	88.95	609.58
89.62	609.84	90.39	610.17	90.61	610.22	96.82	610.33	101.72	610.48
106.35	610.58	112.02	610.6	125.39	610.67	130.53	610.69	136.16	610.71
139.82	610.72	146.01	610.79	151.76	610.91	152.88	610.92	161.68	611.23
168.39	611.59	229.2	613.8	279	616.12				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	69.91	.05	90.39	.03

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	69.91	90.39		16	16	16		.1	.3

BRIDGE

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 351

INPUT

Description:

Distance from Upstream XS = 5
 Deck/Roadway Width = 6
 Weir Coefficient = 2.6
 Upstream Deck/Roadway Coordinates

num=		3												
Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord
55		616		615	95		616		615	170		612.25		611.25

Upstream Bridge Cross Section Data

Station Elevation Data		num=		53					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	614.62	2.42	614.64	10.67	614.64	25.33	614.51	27.81	614.5
42.95	614.89	46.86	615	47.74	614.96	56.06	614.8	58.68	613.92
58.93	613.83	59.64	613.57	60.8	613.08	64.51	611.02	65.31	611.1
65.62	610.86	65.79	610.83	66.28	610.82	67.36	610.77	69.91	610.52
71.54	610.35	74.38	610.09	74.76	610.06	76.12	609.84	80.91	608.86
81.32	608.74	81.4	608.73	81.87	608.71	83.27	608.64	83.29	608.42
83.53	608.79	85.57	609.07	88.6	609.48	88.78	609.49	88.95	609.58
89.62	609.84	90.39	610.17	90.61	610.22	96.82	610.33	101.72	610.48
106.35	610.58	112.02	610.6	125.39	610.67	130.53	610.69	136.16	610.71
139.82	610.72	146.01	610.79	151.76	610.91	152.88	610.92	161.68	611.23
168.39	611.59	229.2	613.8	279	616.12				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	69.91	.05	90.39	.03

Bank Sta:	Left	Right	Coeff	Contr.	Expan.
-----------	------	-------	-------	--------	--------

69.91 90.39 .1 .3

Downstream Deck/Roadway Coordinates

num= 3
Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord
55 616 615 95 616 615 170 612.25 611.25

Downstream Bridge Cross Section Data

Station Elevation Data num= 53
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
0 614.08 2.2 614.13 9.69 614.24 23.02 614.17 25.28 614.18
39.03 614.51 42.59 614.59 43.39 614.58 50.94 614.56 53.65 614.11
53.91 614.07 54.65 613.91 55.85 613.6 59.68 612.37 60.52 612.39
60.84 612.24 61.01 612.22 61.52 612.2 62.63 612.1 65.27 611.57
66.95 611.22 69.9 610.62 70.28 610.54 71.69 610.2 76.65 608.57
77.07 608.37 77.15 608.36 77.64 608.34 79.08 608.3 79.11 608.19
79.48 608.38 82.65 608.57 87.33 608.85 87.6 608.85 87.87 608.99
88.9 609.39 90.1 609.92 90.33 609.95 96.55 610.06 101.46 610.28
106.1 610.46 111.78 610.47 125.18 610.55 130.33 610.58 135.98 610.62
139.65 610.62 145.85 610.77 151.62 610.92 152.73 610.94 161.55 611.25
168.28 611.56 229.23 613.72 279.15 616.54

Manning's n Values

num= 3
Sta n Val Sta n Val Sta n Val
0 .06 71.69 .05 90.1 .03

Bank Sta: Left Right Coeff Contr. Expan.
71.69 90.1 .1 .3

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Piers = 6

Pier Data

Pier Station Upstream= 58 Downstream= 58
Upstream num= 2
Width Elev Width Elev
3 610 3 615
Downstream num= 2
Width Elev Width Elev
3 610 3 615

Pier Data

Pier Station Upstream= 76 Downstream= 76
Upstream num= 2

Width	Elev	Width	Elev
3	607	3	615
Downstream	num=	2	
Width	Elev	Width	Elev
3	607	3	615

Pier Data
Pier Station Upstream= 96 Downstream= 96
Upstream num= 2
Width Elev Width Elev
3 608 3 615
Downstream num= 2
Width Elev Width Elev
3 608 3 615

Pier Data
Pier Station Upstream= 116 Downstream= 116
Upstream num= 2
Width Elev Width Elev
3 610 3 615
Downstream num= 2
Width Elev Width Elev
3 610 3 615

Pier Data
Pier Station Upstream= 136 Downstream= 136
Upstream num= 2
Width Elev Width Elev
3 610 3 615
Downstream num= 2
Width Elev Width Elev
3 610 3 615

Pier Data
Pier Station Upstream= 156 Downstream= 156
Upstream num= 2
Width Elev Width Elev
3 610 3 615
Downstream num= 2
Width Elev Width Elev
3 610 3 615

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data

Energy

Selected Low Flow Methods = Highest Energy Answer

High Flow Method

Energy Only

Additional Bridge Parameters

Add Friction component to Momentum

Do not add Weight component to Momentum

Class B flow critical depth computations use critical depth
inside the bridge at the upstream end

Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT Profile #PF 1

E.G. US. (ft)	614.41	Element	Inside BR US
Inside BR DS			
W.S. US. (ft)	614.29	E.G. Elev (ft)	614.40
614.37			
Q Total (cfs)	1405.00	W.S. Elev (ft)	614.20
614.19			
Q Bridge (cfs)	991.09	Crit W.S. (ft)	612.58
612.49			
Q Weir (cfs)		Max Chl Dpth (ft)	5.78
6.00			
Weir Sta Lft (ft)		Vel Total (ft/s)	3.57
3.43			
Weir Sta Rgt (ft)		Flow Area (sq ft)	393.85
409.15			
Weir Submerg		Froude # Chl	0.26
0.25			
Weir Max Depth (ft)		Specif Force (cu ft)	824.83
870.64			
Min El Weir Flow (ft)	611.66	Hydr Depth (ft)	2.59
2.45			
Min El Prs (ft)	615.00	W.P. Total (ft)	276.09
295.54			
Delta EG (ft)	0.07	Conv. Total (cfs)	23835.8
25024.2			
Delta WS (ft)	0.06	Top Width (ft)	152.20
166.79			
BR Open Area (sq ft)	297.84	Frctn Loss (ft)	0.02
0.01			
BR Open Vel (ft/s)	3.71	C & E Loss (ft)	0.00
0.02			
BR Sluice Coef		Shear Total (lb/sq ft)	0.31
0.27			
BR Sel Method	Energy only	Power Total (lb/ft s)	1.10
0.94			

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

1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 343.00*

INPUT

Description:

Station Elevation Data		num=		53					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	614.08	2.2	614.13	9.69	614.24	23.02	614.17	25.28	614.18
39.03	614.51	42.59	614.59	43.39	614.58	50.94	614.56	53.65	614.11
53.91	614.07	54.65	613.91	55.85	613.6	59.68	612.37	60.52	612.39
60.84	612.24	61.01	612.22	61.52	612.2	62.63	612.1	65.27	611.57
66.95	611.22	69.9	610.62	70.28	610.54	71.69	610.2	76.65	608.57
77.07	608.37	77.15	608.36	77.64	608.34	79.08	608.3	79.11	608.19
79.48	608.38	82.65	608.57	87.33	608.85	87.6	608.85	87.87	608.99
88.9	609.39	90.1	609.92	90.33	609.95	96.55	610.06	101.46	610.28
106.1	610.46	111.78	610.47	125.18	610.55	130.33	610.58	135.98	610.62
139.65	610.62	145.85	610.77	151.62	610.92	152.73	610.94	161.55	611.25
168.28	611.56	229.23	613.72	279.15	616.54				

Manning's n Values		num=		3	
Sta	n Val	Sta	n Val	Sta	n Val
0	.06	71.69	.05	90.1	.03

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	71.69	90.1		8	8	8		.1	.3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 335.00*

INPUT

Description:

Station Elevation Data		num=		53					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	613.81	2.09	613.87	9.21	614.04	21.86	614	24.01	614.03
37.07	614.32	40.45	614.39	41.21	614.39	48.39	614.44	51.14	614.21
51.4	614.19	52.15	614.07	53.37	613.86	57.27	613.05	58.12	613.03
58.44	612.94	58.62	612.92	59.14	612.89	60.26	612.76	62.95	612.09
64.66	611.65	67.65	610.88	68.04	610.78	69.48	610.38	74.51	608.42
74.95	608.18	75.02	608.17	75.52	608.16	76.99	608.13	77.01	608.07
77.46	608.18	81.18	608.33	86.69	608.54	87.01	608.52	87.33	608.69
88.55	609.16	89.96	609.79	90.18	609.81	96.41	609.93	101.32	610.17
105.98	610.4	111.66	610.41	125.08	610.49	130.23	610.52	135.88	610.58
139.56	610.58	145.77	610.75	151.54	610.93	152.66	610.96	161.49	611.27
168.23	611.54	229.24	613.69	279.22	616.74				

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val
 0 .06 69.48 .05 89.96 .12

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 69.48 89.96 10 10 10 .1 .3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 325

INPUT

Description:

Station Elevation Data num= 29
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
 0 613.48 8.6 613.79 20.42 613.79 45.19 614.29 48 614.33
 48.27 614.34 56.16 613.75 57.31 613.59 60.05 612.75 66.71 610.61
 71.85 608.24 72.29 607.95 72.37 607.93 72.88 607.93 74.4 607.92
 79.35 608.02 85.9 608.15 86.28 608.12 86.66 608.32 88.1 608.88
 89.78 609.63 96.24 609.76 105.82 610.32 111.51 610.33 130.11 610.45
 135.77 610.52 139.45 610.52 229.26 613.64 279.31 617

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val
 0 .06 66.71 .05 89.78 .12

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 66.71 89.78 25 25 25 .1 .3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 300

INPUT

Description:

Station Elevation Data num= 34
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
 0 613 2.08 613.13 8.16 613.09 14.02 613.41 17.75 613.34
 28.22 613.33 35.51 613.26 45.59 613.47 51.36 613.45 54.48 613.1
 59.89 611.58 62.99 610.25 67.49 610 69.96 609.22 72.3 608.34
 73.17 608.15 73.88 607.95 79.83 608.13 81.97 608.2 84.84 608.24
 85.7 608.16 86.08 608.37 88.04 609.21 88.96 609.44 89.07 609.46
 91.57 609.55 105.48 609.99 120.69 610.09 134.23 610.46 166.91 611.74
 229.12 613.72 265.71 615 278.52 615.86 279.79 616.14

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val

0 .06 67.49 .05 91.57 .12

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
67.49 91.57 25 25 25 .1 .3

CROSS SECTION

RIVER: Lovers Brook
REACH: Alignment - (14) RS: 275

INPUT

Description:

Station Elevation Data num= 28

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	613.34	7.45	613.26	16.9	613.24	21.45	613.22	38.43	613.18
39.95	613.15	46.61	613.15	46.62	612.99	56.74	612.18	60.49	611.65
65.35	611.45	73.28	609.48	75.8	608.53	75.84	607.9	80	607.94
80.98	607.96	84.69	607.99	85.67	607.99	86.18	608.36	100.74	609.58
125.74	610.31	137.09	610.52	160.11	612.13	214.55	613.9	260.45	615.75
272.67	618.58	273.42	618.74	279.75	619.75				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	73.28	.05	100.74	.12

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
73.28 100.74 25 25 25 .1 .3

CROSS SECTION

RIVER: Lovers Brook
REACH: Alignment - (14) RS: 250

INPUT

Description:

Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	612.94	5.45	612.89	20.43	612.94	25.62	612.83	31.23	612.77
35.92	612.76	54.56	612.68	56.45	612.11	62.96	612.02	62.98	612
73.41	607.77	78.25	607.66	79.46	607.67	83.94	607.71	84.34	607.71
85.78	608.75	91.97	609.27	102.61	609.58	150.97	610.5	248.98	617.33
265.68	617.88	268.27	618.46	278.35	620.63	279.44	620.85		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	62.96	.05	91.97	.12

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
62.96 91.97 25 25 25 .1 .3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 225

INPUT

Description:

Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	612.83	25.05	612.5	55.41	612.44	56.89	612.41	58.34	612.39
59.45	612.39	63.15	612.36	67.15	611.17	68.17	610.29	71.28	608.47
72.61	607.9	79.4	607.17	79.6	607.17	83.52	607.01	84.11	607.33
91.31	609.11	108.99	609.2	184.66	610.46	251.16	614.56	279.41	619.34

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	68.17	.05	91.31	.12

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	68.17	91.31		25	25		.1	.3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 200

INPUT

Description:

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	612.34	61.23	611.62	70.57	611.63	73.7	608.91	74.2	608.06
74.85	607.76	78.83	607.57	79.97	607.48	85.63	607.06	87.46	608.77
89.81	609.34	151.39	609.57	199.98	610.44	253.73	614.02	279.96	618.47

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	73.7	.05	89.81	.12

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	73.7	89.81		25	25		.1	.3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 175

INPUT

Description:

Station Elevation Data										num=	17
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev		
0	611.96	71.12	611.42	71.17	611.42	71.24	611.25	73.54	607.42		
74.05	607.19	76.87	607.06	79.63	607.05	84.69	607.05	86.15	608.48		
87.4	609	141.12	609.78	185.62	609.92	212.8	610.42	246.24	612.72		
269.24	616.62	279.59	618.55								

Manning's n Values						num=	3
Sta	n Val	Sta	n Val	Sta	n Val		
0	.06	71.12	.05	87.4	.12		

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	71.12	87.4		25	25	25		.1	.3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 150

INPUT

Description:

Station Elevation Data										num=	17
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev		
0	611.58	60.77	610.49	70.47	610.41	70.64	610.4	70.71	610.29		
73.15	608.63	73.37	606.97	83.34	606.97	83.5	607.13	86.56	608.4		
218.08	610.31	224.5	610.33	228.41	610.4	233.23	610.73	236.54	611.29		
259.95	615.65	279.91	618.96								

Manning's n Values						num=	3
Sta	n Val	Sta	n Val	Sta	n Val		
0	.06	73.15	.05	86.56	.12		

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	73.15	86.56		25	25	25		.1	.3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 125

INPUT

Description:

Station Elevation Data										num=	17
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev		
0	612.81	8.04	612.81	24.86	612.92	70.46	611.04	70.47	611.04		
72.32	608.9	73.79	606.8	80	606.94	84.03	607.03	86.48	607.01		
87.03	607.25	92.1	608.18	188.17	609.59	230.48	610.67	247.85	614		
251.91	614.63	280	619.33								

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val
 0 .06 72.32 .05 92.1 .12

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 72.32 92.1 25 25 25 .1 .3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 100

INPUT

Description:

Station Elevation Data num= 17
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
 0 612.97 42.8 612.94 62.32 613.08 70.44 606.47 70.56 606.41
 70.6 606.37 70.8 606.36 79.66 606.29 85.75 606.23 89.07 607.71
 90.75 608.03 130.25 608.63 223 610.89 238.22 613.78 247.76 615.25
 278.34 620.34 279.64 620.62

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val
 0 .06 62.32 .05 90.75 .12

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 62.32 90.75 25 25 25 .1 .3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 75

INPUT

Description:

Station Elevation Data num= 17
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
 0 613.01 48.99 612.85 59.78 612.48 64.53 611.41 64.82 611.26
 70.1 606 79.41 605.78 80.44 605.75 88.75 605.66 89.19 606.04
 91.32 607.67 118.78 608.85 220.26 611.44 229.28 613.17 254.5 617.11
 270.28 619.75 279.41 621.74

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val
 0 .06 64.53 .05 91.32 .12

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 64.53 91.32 25 25 25 .1 .3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 50

INPUT

Description:

Station Elevation Data		num=		18					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	612.51	21.09	612.47	38.4	611.93	62.27	611.97	63.56	611.23
67.15	609.04	71.48	605.55	79.57	605.61	85.55	605.65	87.03	605.64
88.75	607.08	88.88	607.18	153.1	610.04	219.94	611.63	227.04	612.97
256.72	617.55	269.29	619.63	279.53	621.84				

Manning's n Values		num=		3	
Sta	n Val	Sta	n Val	Sta	n Val
0	.06	67.15	.05	88.75	.12

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	67.15	88.75		25	25	25		.1	.3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 25

INPUT

Description:

Station Elevation Data		num=		24					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	611.78	29.22	611.84	51.84	611.49	56.88	611.64	60.75	611.63
66.72	608.04	70.02	605.63	77.05	605.56	79.18	605.54	82.05	605.47
82.28	606.7	82.58	607.09	88.64	606.2	89.3	606.87	96.93	608
108.49	607.91	145.33	609.56	177.06	611	215.45	611.86	220.11	612.73
255.71	618.13	263.91	619.46	271.22	621.01	276.93	621.83		

Manning's n Values		num=		3	
Sta	n Val	Sta	n Val	Sta	n Val
0	.06	66.72	.05	82.58	.12

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	66.72	82.58		25	25	25		.1	.3

CROSS SECTION

RIVER: Lovers Brook
 REACH: Alignment - (14) RS: 0

INPUT

Description:

Station Elevation Data		num=		23							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	610.52	26.48	610.26	34.96	610.52	47.62	610.84	64.68	606.64		
68.11	605.86	68.93	605.5	70.77	605.46	78.94	605.39	79.69	605.38		
89.97	605.3	91.31	606.07	91.81	606.58	106.79	608.82	127.72	608.57		
182.95	611.1	195.19	611.66	214.22	612.04	216.95	612.53	257.36	618.47		
263.02	619.36	268.49	620.48	278.82	621.94						

Manning's n Values		num=		3	
Sta	n Val	Sta	n Val	Sta	n Val
0	.06	64.68	.05	91.81	.12

Bank Sta:	Left	Right	Coeff	Contr.	Expan.
	64.68	91.81		.1	.3

SUMMARY OF MANNING'S N VALUES

River:Lovers Brook

Reach	River Sta.	n1	n2	n3
Alignment - (14)	475	.06	.05	.12
Alignment - (14)	450	.06	.05	.12
Alignment - (14)	425	.06	.05	.12
Alignment - (14)	400	.06	.05	.12
Alignment - (14)	375	.06	.05	.12
Alignment - (14)	365.00*	.06	.05	.03
Alignment - (14)	359.00*	.06	.05	.03
Alignment - (14)	351	Bridge		
Alignment - (14)	343.00*	.06	.05	.03
Alignment - (14)	335.00*	.06	.05	.12
Alignment - (14)	325	.06	.05	.12
Alignment - (14)	300	.06	.05	.12
Alignment - (14)	275	.06	.05	.12
Alignment - (14)	250	.06	.05	.12
Alignment - (14)	225	.06	.05	.12
Alignment - (14)	200	.06	.05	.12
Alignment - (14)	175	.06	.05	.12
Alignment - (14)	150	.06	.05	.12
Alignment - (14)	125	.06	.05	.12
Alignment - (14)	100	.06	.05	.12
Alignment - (14)	75	.06	.05	.12
Alignment - (14)	50	.06	.05	.12
Alignment - (14)	25	.06	.05	.12
Alignment - (14)	0	.06	.05	.12

SUMMARY OF REACH LENGTHS

River: Lovers Brook

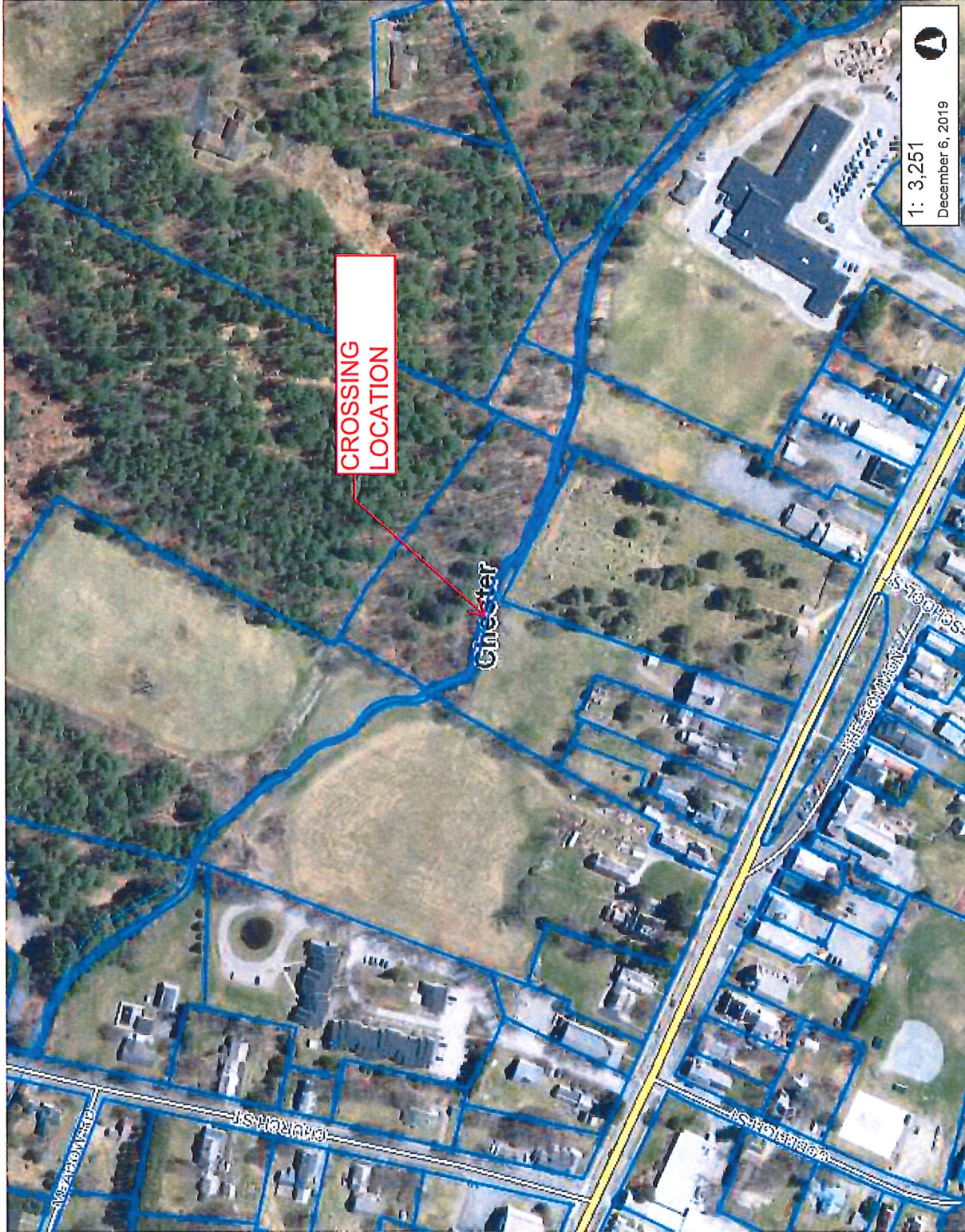
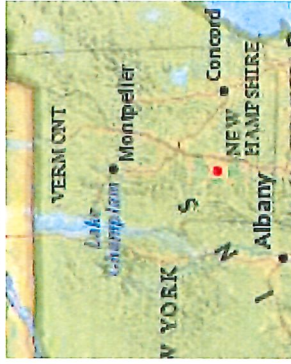
Reach	River Sta.	Left	Channel	Right
Alignment - (14)	475	25	25	25
Alignment - (14)	450	25	25	25
Alignment - (14)	425	25	25	25
Alignment - (14)	400	25	25	25
Alignment - (14)	375	10	10	10
Alignment - (14)	365.00*	6	6	6
Alignment - (14)	359.00*	16	16	16
Alignment - (14)	351	Bridge		
Alignment - (14)	343.00*	8	8	8
Alignment - (14)	335.00*	10	10	10
Alignment - (14)	325	25	25	25
Alignment - (14)	300	25	25	25
Alignment - (14)	275	25	25	25
Alignment - (14)	250	25	25	25
Alignment - (14)	225	25	25	25
Alignment - (14)	200	25	25	25
Alignment - (14)	175	25	25	25
Alignment - (14)	150	25	25	25
Alignment - (14)	125	25	25	25
Alignment - (14)	100	25	25	25
Alignment - (14)	75	25	25	25
Alignment - (14)	50	25	25	25
Alignment - (14)	25	25	25	25
Alignment - (14)	0			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

River: Lovers Brook

Reach	River Sta.	Contr.	Expan.
Alignment - (14)	475	.1	.3
Alignment - (14)	450	.1	.3
Alignment - (14)	425	.1	.3
Alignment - (14)	400	.1	.3
Alignment - (14)	375	.1	.3
Alignment - (14)	365.00*	.1	.3
Alignment - (14)	359.00*	.1	.3
Alignment - (14)	351	Bridge	

Alignment - (14)	343.00*	.1	.3
Alignment - (14)	335.00*	.1	.3
Alignment - (14)	325	.1	.3
Alignment - (14)	300	.1	.3
Alignment - (14)	275	.1	.3
Alignment - (14)	250	.1	.3
Alignment - (14)	225	.1	.3
Alignment - (14)	200	.1	.3
Alignment - (14)	175	.1	.3
Alignment - (14)	150	.1	.3
Alignment - (14)	125	.1	.3
Alignment - (14)	100	.1	.3
Alignment - (14)	75	.1	.3
Alignment - (14)	50	.1	.3
Alignment - (14)	25	.1	.3
Alignment - (14)	0	.1	.3



LEGEND

- Wetland - VSWI
 - Class 1 Wetland
 - Class 2 Wetland
 - Buffer
- Parcels (standardized)
- Parcels (non-standardized)
- Roads
 - Interstate
 - Principal Arterial
 - Minor Arterial
 - Major Collector
 - Minor Collector
 - Local
 - Not part of function Classification S
- Waterbody
 - Stream
 - Town Boundary

NOTES

Map created using ANR's Natural Resources Atlas

DISCLAIMER: This map is for general reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. ANR and the State of Vermont make no representations of any kind, including but not limited to, the warranties of merchantability, or fitness for a particular use, nor are any such warranties to be implied with respect to the data on this map.

165.0 0 82.00 165.0 Meters
 1" = 271 Ft. 1cm = 33 Meters
 THIS MAP IS NOT TO BE USED FOR NAVIGATION
 © Vermont Agency of Natural Resources