APPENDIX A

Land Use Distribution in the South Fork Holston River Watershed

Table A-1. MRLC Land Use Distribution of S. Fork Holston River Subwatersheds

Land Use	HUC-12 Subwatershed (06010102__) or Drainage Area					
	Waters Branch DA		Laurel Creek DA		Paint Springs Branch DA	
	[acres]	[%]	[acres]	[%]	[acres]	[%]
Bare Rock/Sand/Clay	0.0	0.0	1.3	0.0	0.0	0.0
Deciduous Forest	0.7	0.1	30.0	0.1	57.5	41.5
Emergent Herbaceous Wetlands	0.0	0.0	1.1	0.0	0.0	0.0
Evergreen Forest	0.0	0.0	3.3	0.0	25.2	18.2
High Intensity Commercial/Industrial/Transp.	0.2	0.0	4.4	0.0	0.0	0.0
High Intensity Residential	0.0	0.0	0.0	0.0	0.0	0.0
Low Intensity Residential	12.2	2.2	140.6	0.6	0.0	0.0
Mixed Forest	168.1	29.7	10,477.1	47.6	13.6	9.8
Open Water	103.9	18.4	3,528.1	16.0	0.0	0.0
Other Grasses (Urban/recreation; e.g. parks)	171.0	30.2	4,458.1	20.2	0.0	0.0
Pasture/Hay	97.2	17.2	2,656.3	12.1	38.8	28.0
Quarries/Strip Mines/Gravel Pits	12.0	2.1	705.0	3.2	0.0	0.0
Row Crops	0.4	0.1	6.4	0.0	3.5	2.5
Transitional	0.0	0.0	3.3	0.0	0.0	0.0
Woody Wetlands	0.0	0.0	1.6	0.0	0.0	0.0
Total	565.8	100.0	22,016.7	100.0	138.7	100.0

Note: Percent calculations were performed using a spreadsheet. Percentages and totals were rounded off and may differ slightly from values calculated by other means.

Table A-1 (Cont.). MRLC Land Use Distribution of S. Fork Holston River Subwatersheds

Land Use	HUC-12 Subwatershed (06010102__) or Drainage Area					
	0401		Big Arm Branch DA		Dry Creek DA	
	[acres]	[%]	[acres]	[%]	[acres]	[%]
Bare Rock/Sand/Clay	68.7	0.2	1.8	0.1	7.8	0.1
Deciduous Forest	11,507.2	36.8	1,343.5	66.0	2,735.9	49.3
Emergent Herbaceous Wetlands	12.9	0.0	0.0	0.0	0.0	0.0
Evergreen Forest	4,082.1	13.1	283.1	13.9	1,050.4	18.9
High Intensity Commercial/Industrial/Transp.	365.6	1.2	2.0	0.1	5.1	0.1
High Intensity Residential	86.3	0.3	0.0	0.0	1.3	0.0
Low Intensity Residential	1,818.1	5.8	26.0	1.3	68.3	1.2
Mixed Forest	3,649.1	11.7	303.8	14.9	1,092.6	19.7
Open Water	203.3	0.7	0.9	0.0	0.0	0.0
Other Grasses (Urban/recreation; e.g. parks)	274.2	0.9	4.7	0.2	3.6	0.1
Pasture/Hay	7,919.7	25.4	56.0	2.8	497.1	9.0
Quarries/Strip Mines/Gravel Pits	4.0	0.0	0.0	0.0	0.0	0.0
Row Crops	1,163.6	3.7	13.6	0.7	78.5	1.4
Transitional	0.9	0.0	0.0	0.0	0.0	0.0
Woody Wetlands	75.2	0.2	0.4	0.0	4.2	0.1
Total	31,230.8	100.0	2,035.8	100.0	5,544.8	100.0

Note: Percent calculations were performed using a spreadsheet. Percentages and totals were rounded off and may differ slightly from values calculated by other means.

Table A-1 (Cont.). MRLC Land Use Distribution of S. Fork Holston River Subwatersheds

Land Use	HUC-12 Subwatershed (06010102__) or Drainage Area					
	Woods Branch DA		UT2 to SFHOL DA		0403	
	[acres]	[%]	[acres]	[%]	[acres]	[%]
Bare Rock/Sand/Clay	0.7	0.1	1.6	0.3	145.9	0.4
Deciduous Forest	70.7	7.7	70.1	14.1	8,285.6	25.4
Emergent Herbaceous Wetlands	10.7	1.2	0.0	0.0	49.4	0.2
Evergreen Forest	28.7	3.1	77.4	15.6	3,794.1	11.7
High Intensity Commercial/Industrial/Transp.	9.6	1.0	1.1	0.2	669.0	2.1
High Intensity Residential	0.0	0.0	0.0	0.0	57.6	0.2
Low Intensity Residential	0.0	0.0	14.9	3.0	1,459.4	4.5
Mixed Forest	291.6	31.6	59.6	12.0	3,530.5	10.8
Open Water	107.2	11.6	0.2	0.0	1,288.6	4.0
Other Grasses (Urban/recreation; e.g. parks)	111.4	12.1	13.3	2.7	847.1	2.6
Pasture/Hay	184.4	20.0	236.2	47.6	10,708.4	32.9
Quarries/Strip Mines/Gravel Pits	89.0	9.6	0.0	0.0	0.0	0.0
Row Crops	11.8	1.3	20.2	4.1	1,554.1	4.8
Transitional	6.0	0.7	0.0	0.0	0.0	0.0
Woody Wetlands	2.0	0.2	1.1	0.2	173.0	0.5
Total	923.6	100.0	495.7	100.0	32,562.5	100.0

Note: Percent calculations were performed using a spreadsheet. Percentages and totals were rounded off and may differ slightly from values calculated by other means.

Table A-1 (Cont.). MRLC Land Use Distribution of S. Fork Holston River Subwatersheds

Land Use	HUC-12 Subwatershed (06010102__) or Drainage Area	
	0502	
	[acres]	[%]
Bare Rock/Sand/Clay	111.0	0.3
Deciduous Forest	14,712.6	36.6
Emergent Herbaceous Wetlands	27.1	0.1
Evergreen Forest	4,283.6	10.7
High Intensity Commercial/Industrial/Transp.	1,475.8	3.7
High Intensity Residential	670.5	1.7
Low Intensity Residential	4,942.1	12.3
Mixed Forest	4,432.1	11.0
Open Water	137.7	0.3
Other Grasses (Urban/recreation; e.g. parks)	1,212.3	3.0
Pasture/Hay	7,080.2	17.6
Quarries/Strip Mines/Gravel Pits	0.2	0.0
Row Crops	1,009.0	2.5
Transitional	0.0	0.0
Woody Wetlands	105.4	0.3
Total	40,199.6	100.0

Note: Percent calculations were performed using a spreadsheet. Percentages and totals were rounded off and may differ slightly from values calculated by other means.

APPENDIX B

Water Quality Monitoring Data

There are a number of water quality monitoring stations that provide data for waterbodies identified as impaired for E. coli in the South Fork Holston River Watershed. The location of these monitoring stations is shown in Figure 5. Monitoring data recorded by TDEC at these stations are tabulated in Table B-1.

Table B-1. TDEC Water Quality Monitoring Data – South Fork Holston River Subwatersheds

Monitoring Station	Date	E. Coli [cts./100 mL]
BACK000.5SU	7/17/02	>2419
	8/20/02	1300
	9/11/02	727
	10/23/02	1733
	11/13/02	1553
	12/3/02	866
	9/9/99	866
	1/15/03	548
	2/18/03	326
	3/12/03	29
	4/15/03	411
	5/12/03	816
	6/25/03	921
BACK003.1SU	7/17/02	921
	8/20/02	770
	9/11/02	236
	10/23/02	249
	11/13/02	613
	12/3/02	144
	1/15/03	40
	2/18/03	291
	3/12/03	91
	4/15/03	488
	5/12/03	344
	6/25/03	727
BARM000.1CT	9/19/02	>2420
	10/17/02	>2420
	11/26/02	71
	12/17/02	99

Table B-1 (Cont.). TDEC Water Quality Monitoring Data – South Fork Holston Subwatersheds

Monitoring Station	Date	E. Coli [cts./100 mL]
BARM000.1CT (cont'd)	1/22/03	118
	3/5/03	201
	3/25/03	40
	4/30/03	1300
	6/17/03	649
BEAVE001.0SU	3/3/98	299
	6/25/98	>2419
	9/17/98	24
	12/15/98	1120
	3/2/99	179
	6/15/99	249
	9/7/99	11
	12/2/99	166
	2/17/00	89
	5/11/00	152
	8/10/00	2419
	11/28/00	517
	3/7/01	249
	6/26/01	144
	7/17/01	5
	10/9/01	285
	4/16/02	299
	7/17/02	727
	8/20/02	1553
	9/11/02	185
	10/23/02	461
	11/13/02	>2419
	12/3/02	649
	1/15/03	17
	2/18/03	687
	3/12/03	345
	4/15/03	770
	5/12/03	1203
	6/25/03	866

Table B-1 (Cont.). TDEC Water Quality Monitoring Data – South Fork Holston Subwatersheds

Monitoring Station	Date	E. Coli [cts./100 mL]
BEAVE001.0SU (cont'd)	8/12/03	>2419
	11/4/03	130
	8/4/04	1414
	11/4/04	2000
BEAVE009.7JO	7/10/02	102
BEAVE011.0SU	7/17/02	921
	8/20/02	980
	9/11/02	613
	10/23/02	326
	11/13/02	1986
	12/3/02	980
	1/15/03	1553
	2/18/03	1986
	3/12/03	2419
	4/15/03	1300
	5/12/03	866
	6/25/03	1414
BEAVE014.0JO	7/10/02	96
BEAVE015.3SU	3/3/98	548
	6/25/98	1553
	9/17/98	>2419
	12/15/98	1046
	3/2/99	326
	6/15/99	1046
	9/7/99	1414
	12/2/99	461
	2/17/00	1046
	5/11/00	1553
	8/10/00	1986
	11/28/00	308
	3/7/01	1553
	6/26/01	1300
	7/17/01	613
	10/9/01	>2419
	4/16/02	>2419
	7/17/02	>2419

Table B-1 (Cont.). TDEC Water Quality Monitoring Data – South Fork Holston Subwatersheds

Monitoring Station	Date	E. Coli [cts./100 mL]
BEAVE015.3SU (cont'd)	8/20/02	>2419
	9/11/02	>2419
	10/23/02	>2419
	11/13/02	2419
	12/3/02	>2419
	1/15/03	144
	2/18/03	649
	3/12/03	1733
	4/15/03	1986
	5/12/03	>2419
	6/25/03	>2419
	8/12/03	>2419
	11/4/03	2419
	8/4/04	>2419
	11/4/04	2600
BEAVE015.7JO	7/10/02	6
BEAVE016.7JO	7/10/02	1
BOOHE000.3SU	9/19/02	1986
	10/17/02	1414
	11/26/02	546
	12/17/02	272
	1/22/03	99
	3/5/03	108
	3/25/03	166
	4/30/03	>2420
	6/17/03	1046
CANDY001.7SU	9/19/02	>2420
	10/17/02	517
	11/26/02	816
	12/17/02	1986
	1/22/03	387
	3/5/03	64
	3/25/03	649
	5/1/03	1733
	6/17/03	1553

Table B-1 (Cont.). TDEC Water Quality Monitoring Data – South Fork Holston Subwatersheds

Monitoring Station	Date	E. Coli [cts./100 mL]
CEDAR000.3SU	9/9/99	980
	7/17/02	548
	8/20/02	770
	9/11/02	770
	10/23/02	1414
	11/13/02	921
	12/3/02	387
	1/15/03	770
	2/18/03	1300
	3/12/03	31
	4/15/03	313
	5/12/03	687
	6/25/03	308
DRY000.2SU	10/24/02	>2420
	11/25/02	>2420
	12/16/02	>2420
	1/21/03	>2420
	3/4/03	>2420
	3/27/03	>2420
	4/30/03	>2420
	5/20/03	>2420
	10/8/03	>2420
DRY001.3SU	3/4/03	148
	3/27/03	>2420
	4/30/03	102
	5/20/03	52
	10/8/03	84
LAURE0007.0JO	9/11/02	38
	10/23/02	<1
	10/24/02	45
	11/25/02	49
	12/16/02	161
	1/21/03	387
	3/4/03	29
	3/26/03	385

Table B-1 (Cont.). TDEC Water Quality Monitoring Data – South Fork Holston Subwatersheds

Monitoring Station	Date	E. Coli [cts./100 mL]
LAURE0007.0JO (cont'd)	4/29/03	5
	5/20/03	87
	10/1/03	105
LAURE013.8JO	9/11/02	308
	10/16/02	1733
	10/24/02	613
	11/25/02	184
	12/16/02	125
	1/21/03	613
	3/4/03	980
	3/26/03	1046
	4/29/03	21
	5/20/03	435
	10/1/03	411
LAURE015.0JO	9/11/02	DRY
	10/16/02	1986
	10/24/02	308
	11/25/02	1553
	12/16/02	770
	1/21/03	>2420
	3/4/03	>2420
	3/26/03	>2420
	4/29/03	<1
	5/20/03	2420
	10/1/03	>2420
MORRE000.1SU	9/19/02	225
	10/17/02	770
	11/26/02	548
	12/3/02	679
	12/17/02	>2420
	1/22/03	2420
	3/5/03	816
	3/25/03	86
	4/30/03	179
	6/17/03	2419

Table B-1 (Cont.). TDEC Water Quality Monitoring Data – South Fork Holston Subwatersheds

Monitoring Station	Date	E. Coli [cts./100 mL]
PSPRI001.4SU	9/11/02	>2420
	10/24/02	1986
	11/25/02	205
	12/16/02	416
	1/21/03	>2420
	3/4/03	387
	3/27/03	921
	4/30/03	>2420
	5/20/03	167
	10/8/03	>2420
SFHOL2T0.6SU	10/17/02	613
	11/26/02	308
	12/17/02	411
	1/22/03	517
	3/5/03	179
	3/25/03	1203
	4/30/03	>2420
	6/17/03	1414
SFHOL3T0.7SU	9/19/02	>2420
	10/17/02	2420
	11/26/02	>2420
	12/3/02	>2420
	12/17/02	2420
	1/22/03	770
	3/5/03	65
	3/25/03	488
	4/30/03	1986
	6/17/03	1203
WAGNE001.9SU	9/19/02	1203
	10/17/02	770
	11/26/02	727
	12/17/02	1300

Table B-1 (Cont.). TDEC Water Quality Monitoring Data – South Fork Holston Subwatersheds

Monitoring Station	Date	E. Coli [cts./100 mL]
WAGNE001.9SU (cont'd)	1/22/03	219
	3/5/03	687
	3/25/03	2420
	5/1/03	>2420
	6/17/03	>2420
WATER000.1JO	10/16/02	727
	10/24/02	308
	11/25/02	345
	12/16/02	2420
	1/21/03	>2420
	3/4/03	2420
	3/26/03	291
	4/29/03	687
	5/20/03	2420
	10/1/03	66
WEAVE000.7SU	9/19/02	>2420
	10/17/02	1733
	11/26/02	548
	12/17/02	387
	1/22/03	548
	3/5/03	649
	3/25/03	167
	4/30/03	548
	6/17/03	687
WOODS000.5SU	9/19/02	770
	10/17/02	649
	11/26/02	1300
	12/17/02	1046
	1/22/03	47
	3/5/03	411
	3/25/03	770
	4/30/03	1203
	6/17/03	1986

APPENDIX C

Development of TMDLs, WLAs, & LAs

The TMDL process quantifies the amount of a pollutant that can be assimilated in a waterbody, identifies the sources of the pollutant, and recommends regulatory or other actions to be taken to achieve compliance with applicable water quality standards based on the relationship between pollution sources and in-stream water quality conditions. A TMDL can be expressed as the sum of all point source loads (Waste Load Allocations), nonpoint source loads (Load Allocations), and an appropriate margin of safety (MOS) that takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$$\text{TMDL} = \Sigma \text{ WLAs} + \Sigma \text{ LAs} + \text{MOS}$$

The objective of a TMDL is to allocate loads among all of the known pollutant sources throughout a watershed so that appropriate control measures can be implemented and water quality standards achieved. 40 CFR §130.2 (i) states that TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measure.

C.1 Development of TMDLs

E. coli TMDLs, WLAs, and LAs were developed for impaired subwatersheds and drainage areas in the South Fork Holston River Watershed using Load Duration Curves (LDCs) to determine the reduction in pollutant loading required to decrease existing, instream E. coli concentrations to target levels. TMDLs are expressed as required percent reductions in pollutant loading.

C.1.1 Development of Flow Duration Curves

A flow duration curve is a cumulative frequency graph, constructed from historic flow data at a particular location, that represents the percentage of time a particular flow rate is equaled or exceeded. Flow duration curves are developed for a waterbody from daily discharges of flow over a period of record. In general, there is a higher level of confidence that curves derived from data over a long period of record correctly represent the entire range of flow. The preferred method of flow duration curve computation uses daily mean data from USGS continuous-record stations located on the waterbody of interest. For ungaged streams, alternative methods must be used to estimate daily mean flow. These include: 1) regression equations (using drainage area as the independent variable) developed from continuous record stations in the same ecoregion; 2) drainage area extrapolation of data from a nearby continuous-record station of similar size and topography; and 3) calculation of daily mean flow using a dynamic computer model, such as the Loading Simulation Program C++ (LSPC).

Flow duration curves for impaired waterbodies in the South Fork Holston River Watershed were derived from LSPC hydrologic simulations based on parameters derived from calibrations at USGS Station No. 03479000, located on Watauga River near Sugar Grove, North Carolina, in the Watauga River watershed and USGS Station No. 03535000, located on Bullrun Creek near Halls Crossroads, Tennessee, in the Lower Clinch watershed (see Appendix D for details of calibration). For example, a flow-duration curve for Back Creek at RM 0.5 was constructed using simulated daily mean flow for the period from 10/1/94 through 9/31/04 (RM 0.5 corresponds to the location of monitoring station BACK000.5SU). This flow duration curve is shown in Figure C-1 and represents the cumulative distribution of daily discharges arranged to show percentage of time specific flows were exceeded during the period of record (the highest daily mean flow during this period is exceeded 0% of the time and the lowest daily mean flow is equaled or exceeded 100% of the time). Flow duration curves for other impaired waterbodies were derived using a similar procedure.

C.1.2 Development of Load Duration Curves and Determination of TMDLs

When a water quality target concentration is applied to the flow duration curve, the resulting load duration curve (LDC) represents the allowable pollutant loading in a waterbody over the entire range of flow. Pollutant monitoring data, plotted on the LDC, provides a visual depiction of stream water quality as well as the frequency and magnitude of any exceedances. Load duration curve intervals can be grouped into several broad categories or zones, in order to provide additional insight about conditions and patterns associated with the impairment. For example, the duration curve could be divided into five zones: high flows (exceeded 0-10% of the time), moist conditions (10-40%), median or mid-range flows (40-60%), dry conditions (60-90%), and low flows (90-100%). Impairments observed in the low flow zone typically indicate the influence of point sources, while those further left on the LDC (representing zones of higher flow) generally reflect potential nonpoint source contributions (Stiles, 2003). Data points representing greater than 50% stormflow (>50% SF) are highlighted to indicate the response to rainfall.

E. coli load duration curves for impaired waterbodies in the South Fork Holston River Watershed were developed from the flow duration curves developed in Section C.1.1, E. coli target concentrations, and available water quality monitoring data. Load duration curves and required load reductions were developed using the following procedure (Back Creek is shown as an example):

1. A target load-duration curve (LDC) was generated for Back Creek by applying the E. coli target concentration of 941 CFU/100 mL to each of the ranked flows used to generate the flow duration curve (ref.: Section D.1) and plotting the results. The E. coli target maximum load corresponding to each ranked daily mean flow is:

   $(\text{Target Load})_{\text{Back Creek}} = (941\ \text{CFU/100 mL}) \times (Q) \times (\text{UCF})$

   where: Q = daily mean flow
   UCF = the required unit conversion factor

2. Daily loads were calculated for each of the water quality samples collected at monitoring station BACK000.5SU (ref.: Table B-1) by multiplying the sample concentration by the daily mean flow for the sampling date and the required unit conversion factor. BACK000.5SU was selected for LDC analysis because it was the monitoring station on Back Creek with the most exceedances of the target concentration.

   Note: In order to be consistent for all analyses, the derived daily mean flow was used to compute sampling data loads, even if measured ("instantaneous") flow data was available for some sampling dates.

   Example – 8/20/02 sampling event:
   Modelled Flow = 1.11 cfs
   Concentration = 1300 CFU/100 mL
   Daily Load = $3.53\text{x}10^{10}$ CFU/day

3. Using the flow duration curves developed in C.1.1, the "percent of days the flow was exceeded" (PDFE) was determined for each sampling event. Each sample load was then plotted on the load duration curves developed in Step 1 according to the PDFE. The resulting E. coli load duration curve for is shown in Figure C-15.

4. For cases where the existing load exceeded the target maximum load at a particular PDFE, the reduction required to reduce the sample load to the target load was calculated.

   Example – 8/20/02 sampling event:
   Target Concentration = 941 CFU/100 mL
   Measured Concentration = 1300 CFU/100 mL
   Reduction to Target = 27.6%

5. The 90^{th} percentile value for all of the E. coli sampling data at BACK000.5SU monitoring site was determined. If the 90^{th} percentile value exceeded the target maximum E. coli concentration, the reduction required to reduce the 90^{th} percentile value to the target maximum concentration was calculated (Table C-14).

   Example: *Target Concentration = 941 CFU/100 mL*
   90^{th} Percentile Concentration = 1697 CFU/100 mL
   Reduction to Target = 44.6%

6. For cases where five or more samples were collected over a period of not more than 30 consecutive days, the geometric mean E. coli concentration was determined and compared to the target geometric mean E. coli concentration of 126 CFU/100 mL. If the sample geometric mean exceeded the target geometric mean concentration, the reduction required to reduce the sample geometric mean value to the target geometric mean concentration was calculated.

   Example: *Insufficient monitoring data was available for any monitoring station in the South Fork Holston River watershed*

7. The load reductions required to meet the target maximum (Step 5) and target 30-day geometric mean concentrations (Step 6) of E. coli were compared and the load reduction of the greatest magnitude selected as the TMDL for Back Creek.

Load duration curves, required load reductions, and TMDLs of other impaired waterbodies were derived in a similar manner and are shown in Figures C-2 through C-24 and Tables C-1 through C-17.

C.2 Development of WLAs & LAs

As previously discussed, a TMDL can be expressed as the sum of all point source loads (WLAs), nonpoint source loads (LAs), and an appropriate margin of safety (MOS) that takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$$\text{TMDL} = \Sigma \text{ WLAs} + \Sigma \text{ LAs} + \text{MOS}$$

Expanding the terms:

$$\text{TMDL} = [\Sigma\text{WLAs}]_{\text{WWTF}} + [\Sigma\text{WLAs}]_{\text{MS4}} + [\Sigma\text{WLAs}]_{\text{CAFO}} + [\Sigma\text{LAs}]_{\text{DS}} + [\Sigma\text{LAs}]_{\text{SW}} + \text{MOS}$$

For pathogen TMDLs in each impaired subwatershed or drainage area, WLA terms include:

- $[\sum WLAs]_{WWTF}$ is the allowable load associated with discharges of NPDES permitted WWTFs located in impaired subwatersheds or drainage areas. Since NPDES permits for these facilities specify that treated wastewater must meet instream water quality standards at the point of discharge, no additional load reduction is required. WLAs for WWTFs are calculated from the facility design flow and the Monthly Average permit limit.
- $[\sum WLAs]_{CAFO}$ is the allowable load for all CAFOs in an impaired subwatershed or drainage area. All wastewater discharges from a CAFO to waters of the state of Tennessee are prohibited, except when either chronic or catastrophic rainfall events cause an overflow of process wastewater from a facility properly designed, constructed, maintained, and operated to contain:
    - All process wastewater resulting from the operation of the CAFO (such as wash water, parlor water, watering system overflow, etc.); plus,
    - All runoff from a 25-year, 24-hour rainfall event for the existing CAFO or new dairy or cattle CAFOs; or all runoff from a 100-year, 24-hour rainfall event for a new swine or poultry CAFO.

  Therefore, a WLA of zero has been assigned to this class of facilities.
- $[\sum WLAs]_{MS4}$ is the required load reduction for discharges from MS4s. E. coli loading from MS4s is the result of buildup/wash-off processes associated with storm events.

LA terms include:

- $[\sum LAs]_{DS}$ is the allowable E. coli load from "other direct sources". These sources include leaking septic systems, illicit discharges, and animals access to streams. The LA specified for all sources of this type is zero CFU/day (or to the maximum extent practicable).
- $[\sum LAs]_{SW}$ represents the required reduction in E. coli loading from nonpoint sources indirectly going to surface waters from all land use areas (except areas covered by a MS4 permit) as a result of the buildup/wash-off processes associated with storm events.

Since WWTFs discharges must comply with instream water quality criteria (TMDL target) at the point of discharge, $[\sum WLAs]_{CAFO} = 0$, and $[\sum LAs]_{DS} = 0$, the expression relating TMDLs to precipitation-based point and nonpoint sources may be simplified to:

$$TMDL - MOS = [\sum WLAs]_{MS4} + [\sum LAs]_{SW}$$

WLAs for MS4s and LAs for precipitation-based nonpoint sources are equal and expressed as the percent reduction in loading required to decrease instream E. coli concentrations to TMDL target values minus MOS. As stated in Section 8.4, an explicit MOS, equal to 10% of the E. coli water quality targets (ref.: Section 5.0), was utilized for determination of the WLAs and LAs:

Instantaneous Maximum: Target – MOS = (941 CFU/100 ml) – 0.1(941 CFU/100 ml)

Target – MOS = 847 CFU/100 ml

30-Day Geometric Mean: Target – MOS = (126 CFU/100 ml) – 0.1(126 CFU/100 ml)

Target – MOS = 113 CFU/100 ml

C.2.1 Determination of WLAs for MS4s & LAs for Precipitation-Based Nonpoint Sources

WLAs for MS4s and LAs for precipitation-based nonpoint sources were developed using methods similar to those described in C.1.2 (again, using Back Creek as an example):

8. An allocation LDC was generated for Back Creek by applying the E. coli "target – MOS" concentration of 847 CFU/100 mL to each of the ranked flows used to generate the flow duration curve (ref.: Section D.1) and plotting the results on the target LDC developed in Step 1. The E. coli target maximum allocated load corresponding to each ranked daily mean flow is:

   $(\text{Target Load - MOS})_{\text{Back Creek}}$ = (847 CFU/100 mL) x (Q) x (UCF)

   where: Q = daily mean flow
   UCF = the required unit conversion factor

9. For cases where the existing load exceeded the "target maximum load – MOS" at a particular PDFE, the reduction required to reduce the sample load to the "target – MOS" load was calculated.

   Example – 8/20/02 sampling event:
   Target Concentration – MOS = 847 CFU/100 mL
   Measured Concentration = 1300 CFU/100 mL
   Reduction to Target – MOS = 34.8%

10. If the 90th percentile value for all of the E. coli sampling data at BACK000.5SU monitoring site (calculated in Step 5) exceeded the "target maximum – MOS" E. coli concentration, the reduction required to reduce the 90th percentile value to the "target maximum – MOS" concentration was calculated (Table C-14).

   Example: Target Concentration – MOS = 847 CFU/100 mL
   90th Percentile Concentration = 1697 CFU/100 mL
   Reduction to Target – MOS = 50.1%

11. For cases where five or more samples were collected over a period of not more than 30 consecutive days, the geometric mean E. coli concentration was determined and compared to the "target geometric mean E. coli concentration – MOS" of 113 CFU/100 mL. If the sample geometric mean exceeded the "target geometric mean – MOS" concentration, the reduction required to reduce the sample geometric mean value to the "target geometric mean – MOS" concentration was calculated.

Example: *Insufficient monitoring data was available for any monitoring station in the South Fork Holston River watershed*

12. The load reductions required to meet the “target maximum – MOS” (Step 10) and “target 30-day geometric mean – MOS” concentrations (Step 11) of E. coli were compared and the load reduction of the greatest magnitude selected as the WLA for MS4s and/or LA for precipitation-based nonpoint sources for Back Creek.

Load duration curves, required load reductions, WLAs for MS4s, and LAs for precipitation-based nonpoint sources of other impaired waterbodies were derived in a similar manner and are shown in Figures C-2 through C-18 and Tables C-1 through C-17. TMDLs, WLAs, & LAs for impaired subwatersheds and drainage areas in the South Fork Holston River Watershed are summarized in Table C-18.

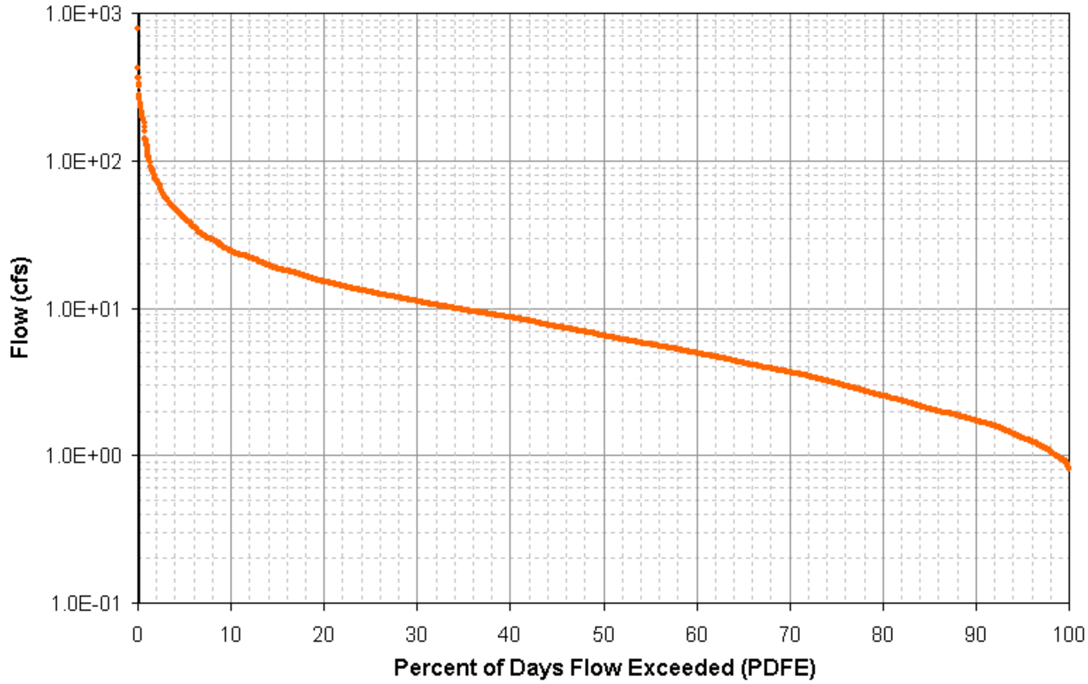

Figure C-1 Flow Duration Curve for Back Creek at BACK000.5SU

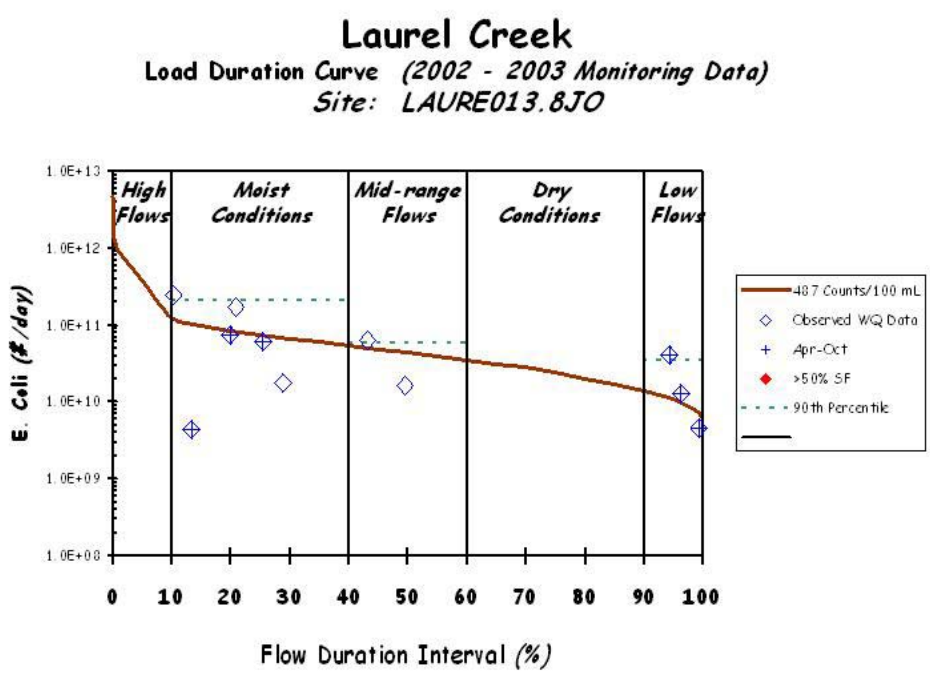

Figure C-2 E. Coli Load Duration Curve for Laurel Creek at LAURE013.8JO

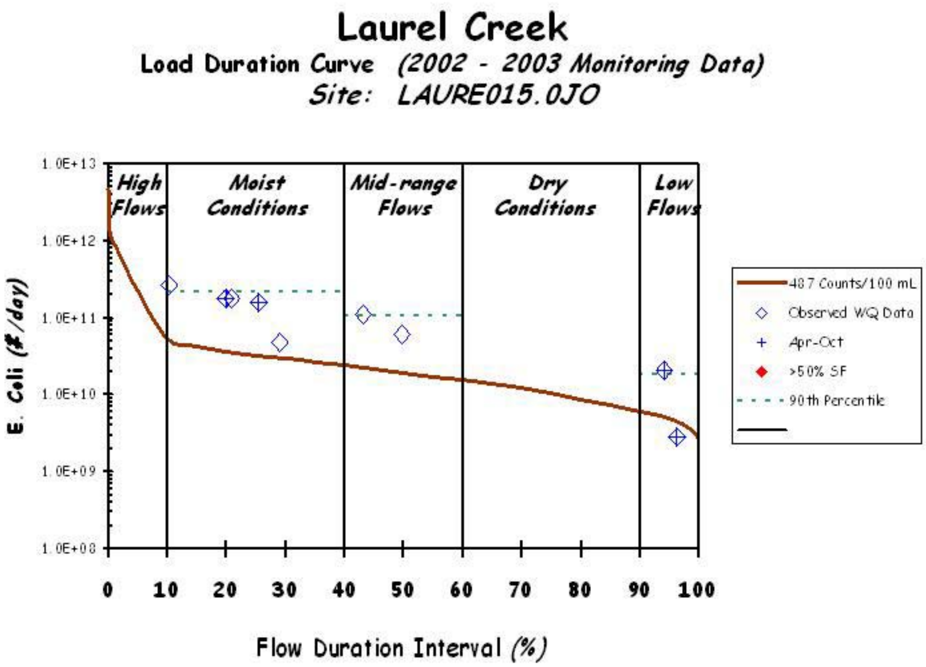

Figure C-3 E. Coli Load Duration Curve for Laurel Creek at LAURE015.0JO

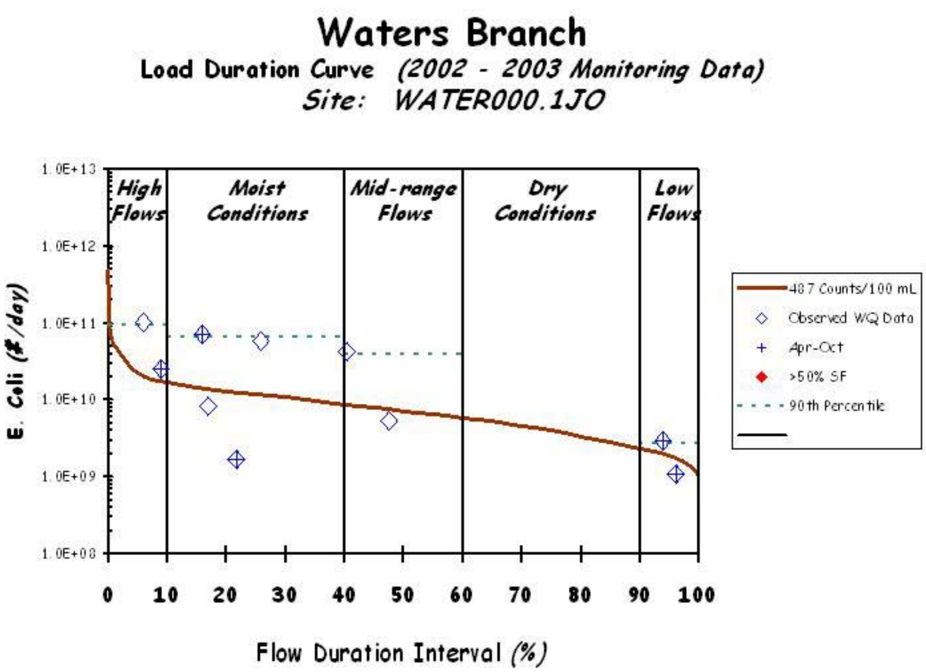

Figure C-4 E. Coli Load Duration Curve for Waters Branch

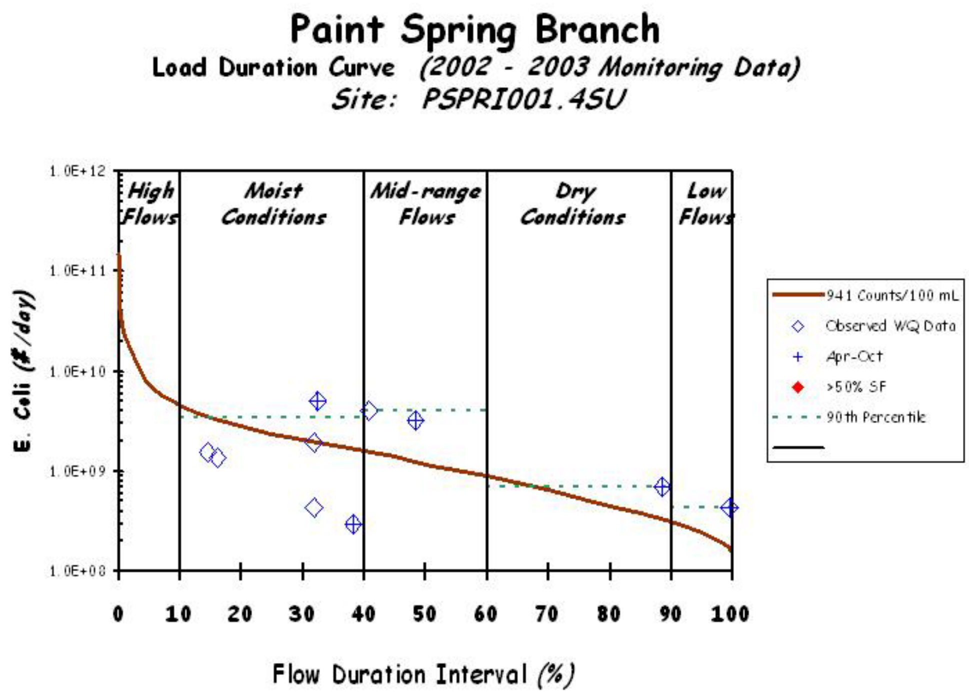

Figure C-5 E. Coli Load Duration Curve for Paint Spring Branch

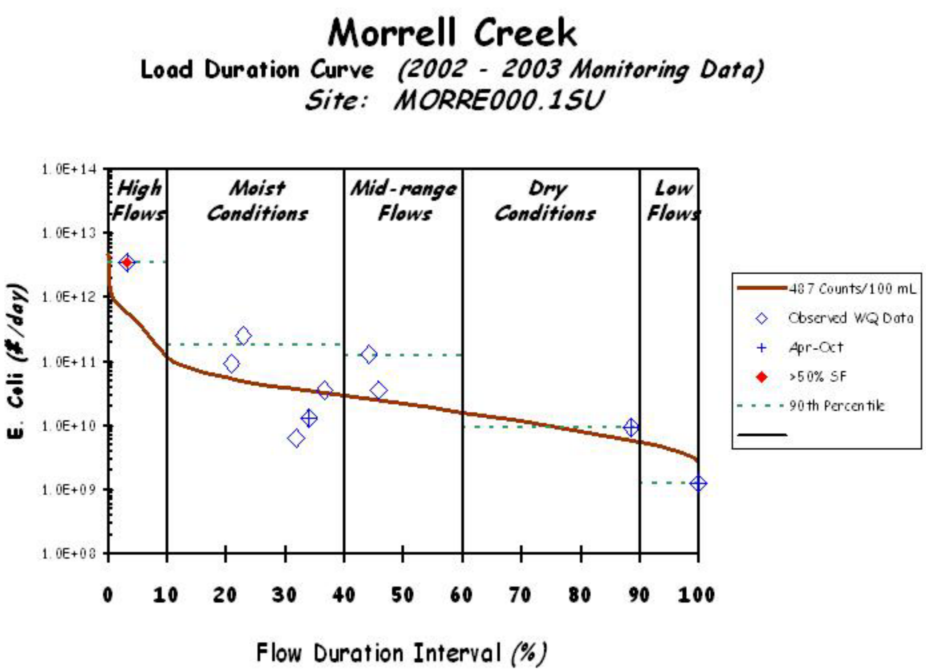

Figure C-6 E. Coli Load Duration Curve for Morrell Creek

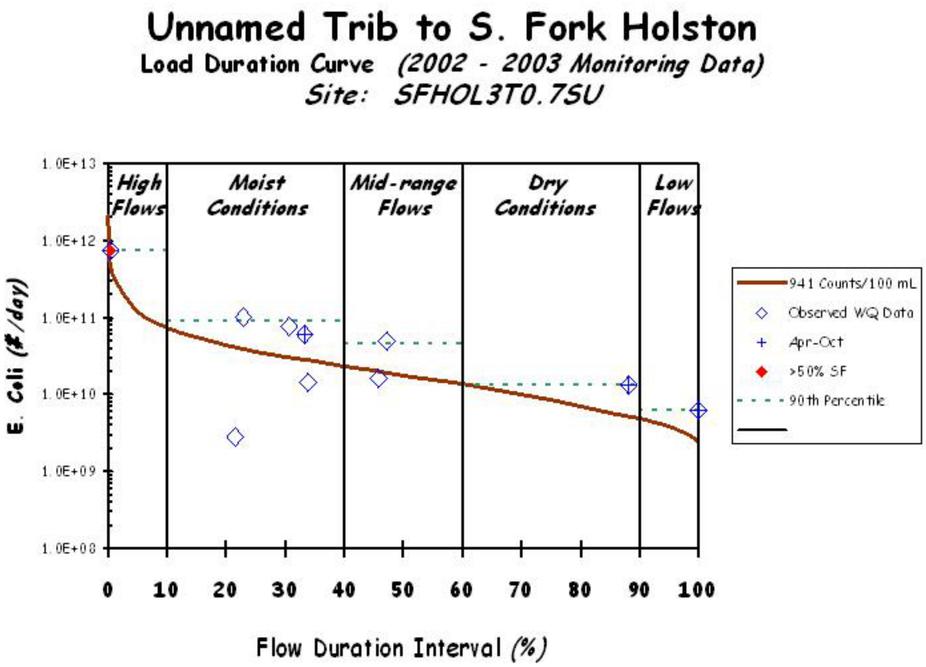

Figure C-7 E. Coli Load Duration Curve for Unnamed Trib to S. Fork Holston (SFHOL3T0.7SU)

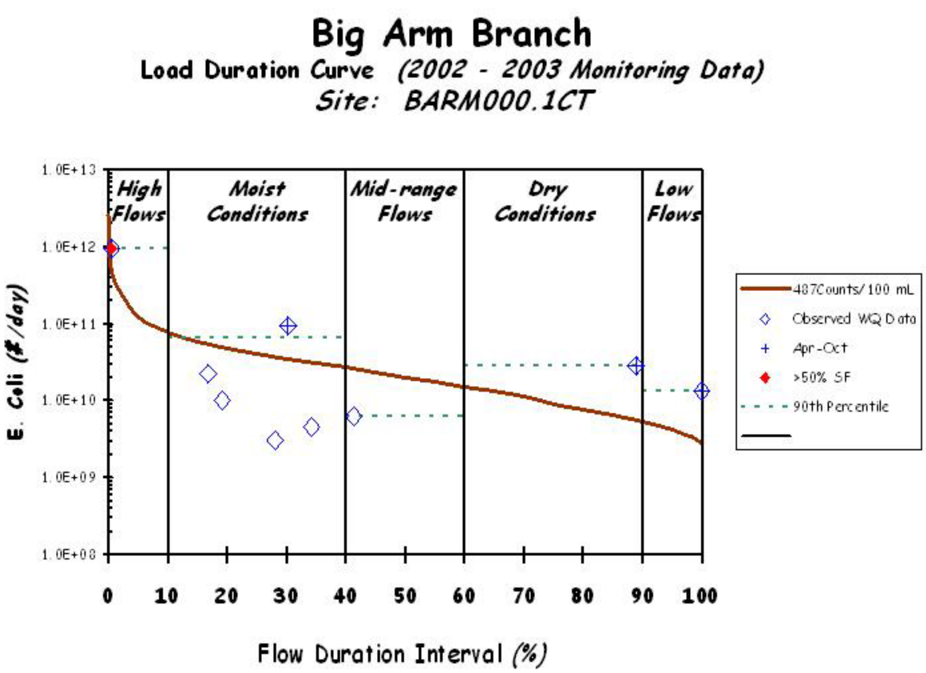

Figure C-8 E. Coli Load Duration Curve for Big Arm Branch

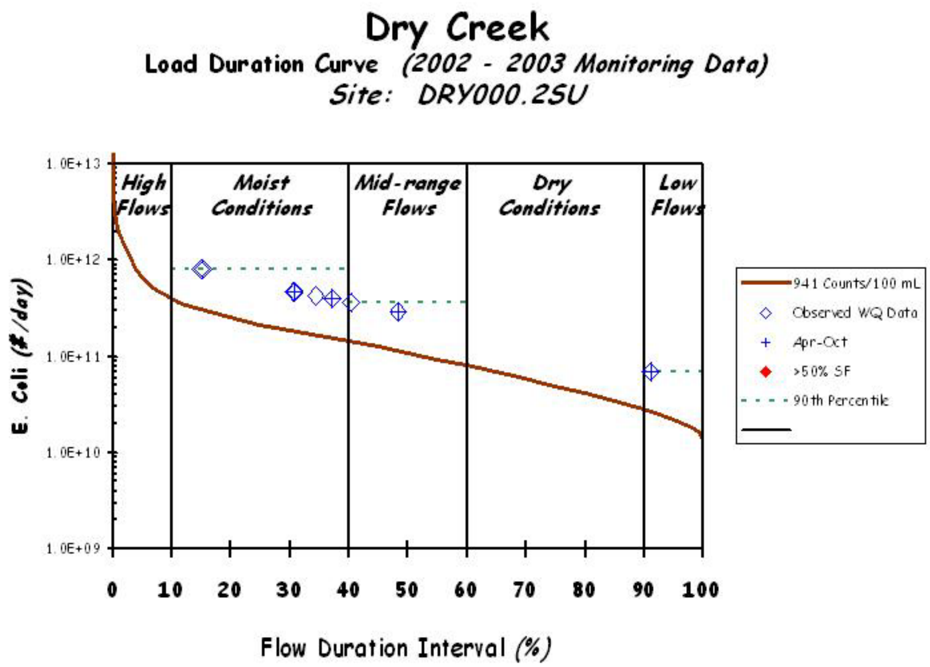

Figure C-9 E. Coli Load Duration Curve for Dry Creek at DRY000.2SU

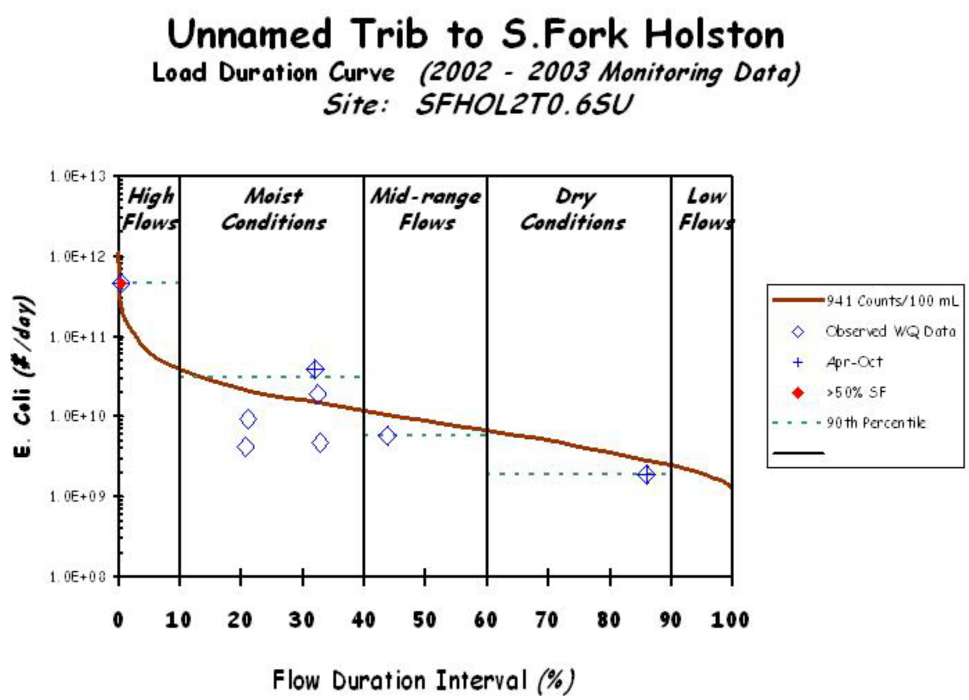

Figure C-10 E. Coli Load Duration Curve for Unnamed Trib to S. Fork Holston (SFHOL2T0.6SU)

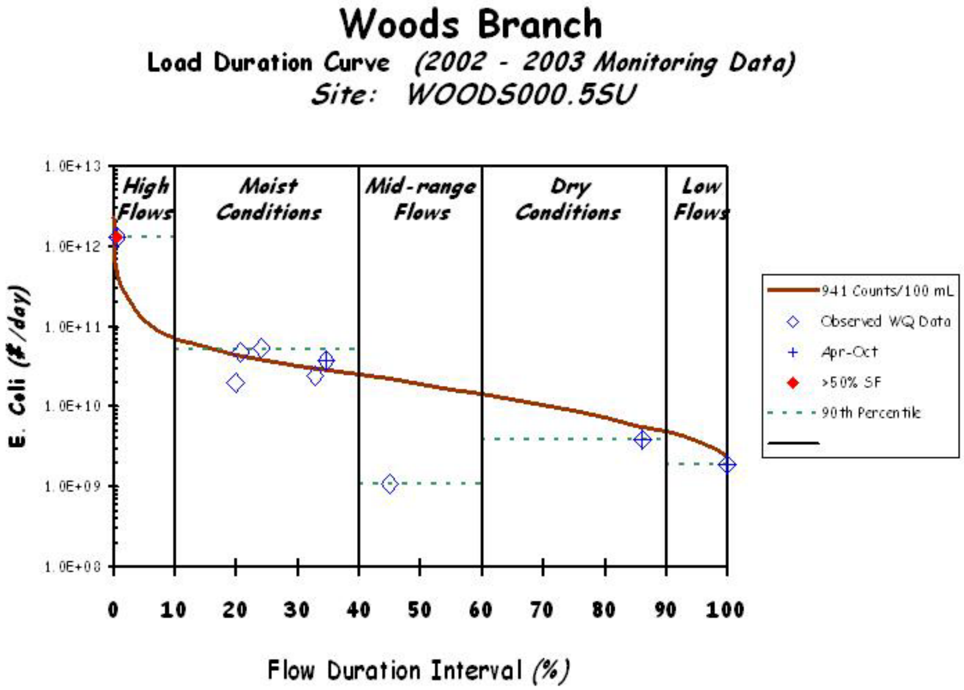

Figure C-11 E. Coli Load Duration Curve for Woods Branch

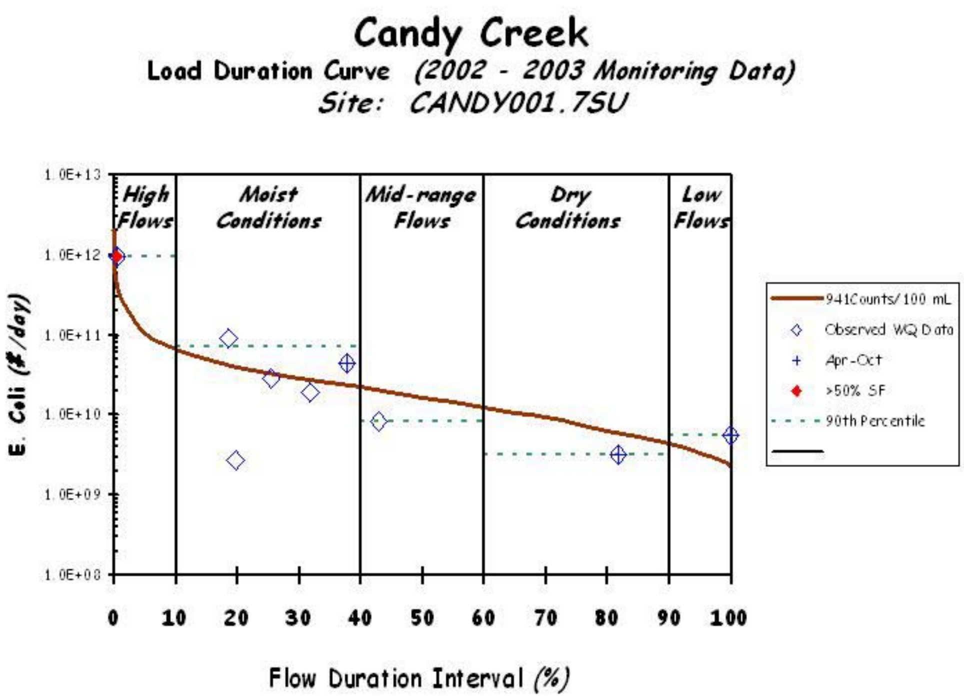

Figure C-12 E. Coli Load Duration Curve for Candy Creek

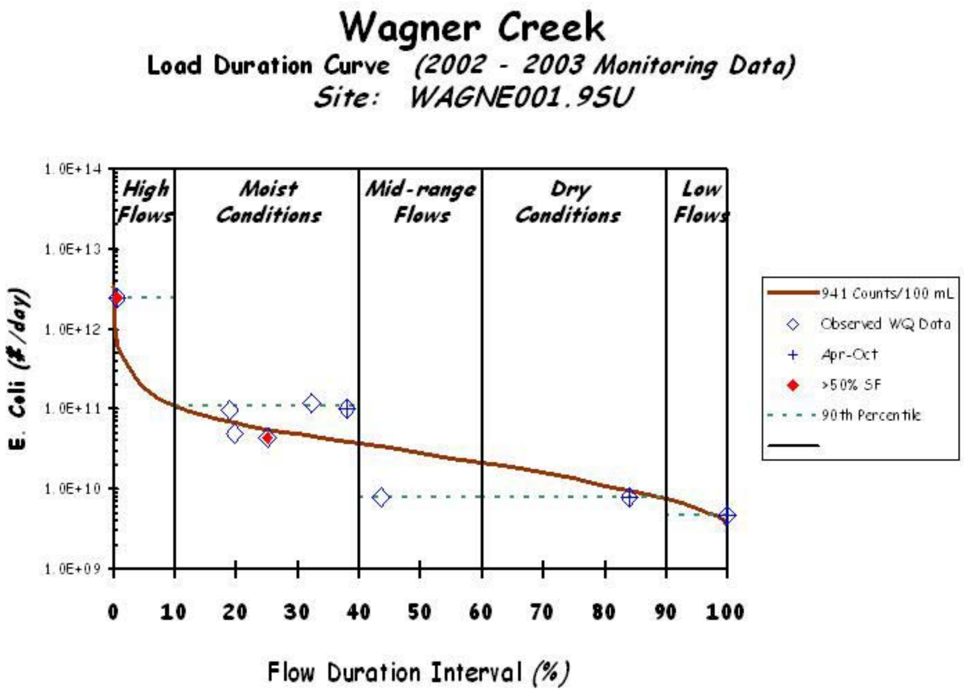

Figure C-13 E. Coli Load Duration Curve for Wagner Creek

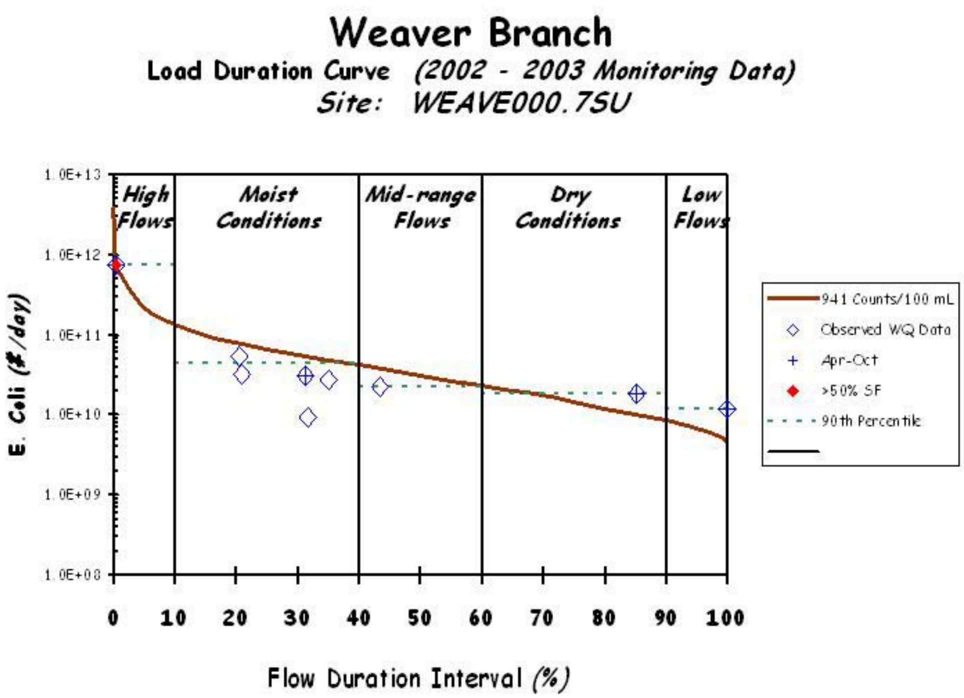

Figure C-14 E. Coli Load Duration Curve for Weaver Branch

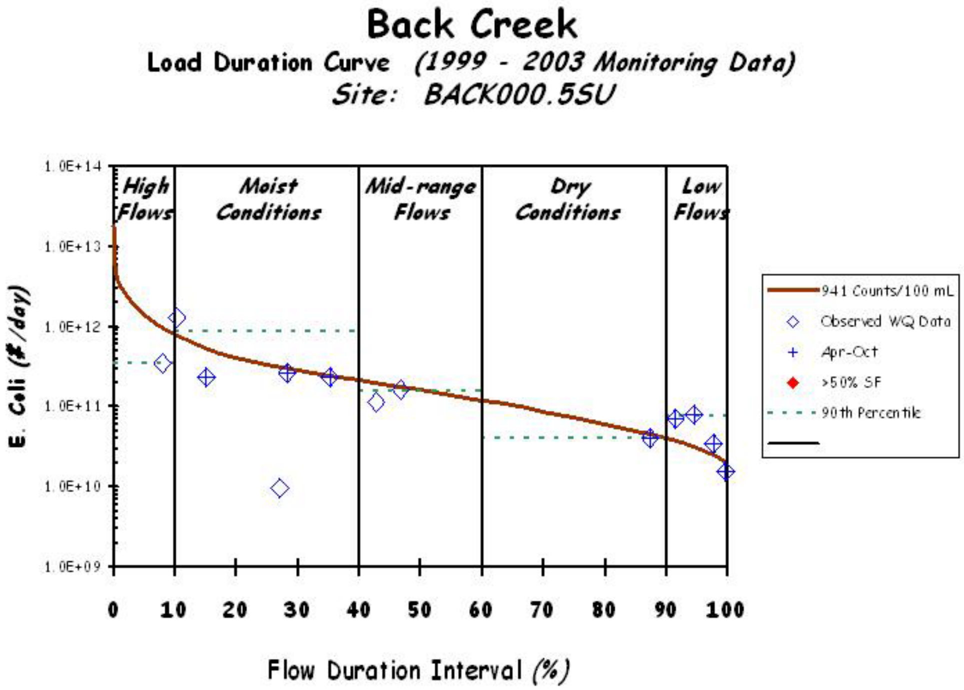

Figure C-15 E. Coli Load Duration Curve for Back Creek at BACK000.5SU

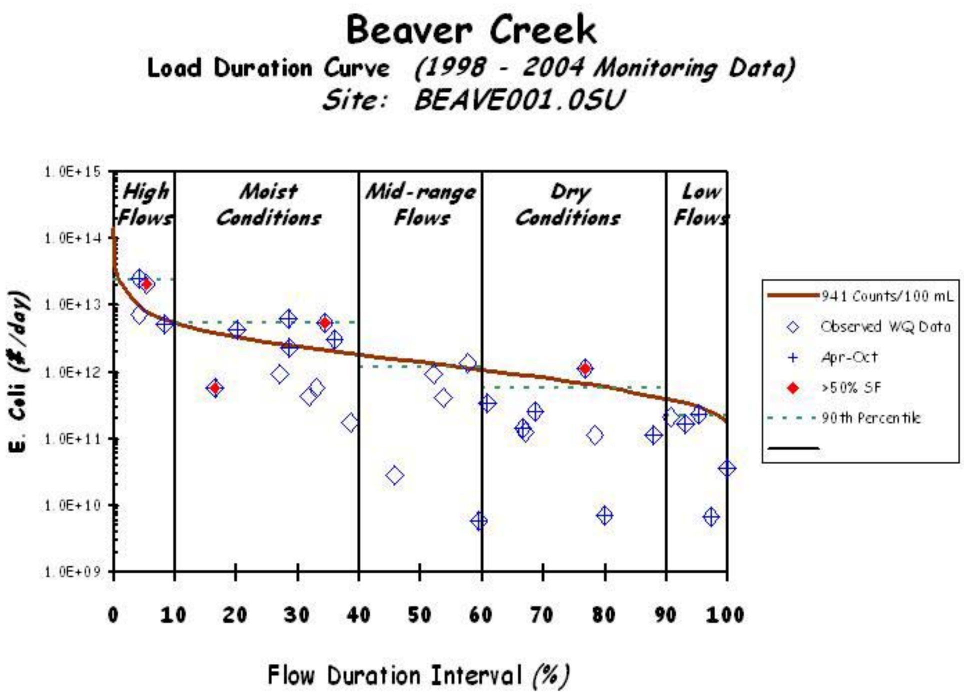

Figure C-16 E. Coli Load Duration Curve for Beaver Creek at BEAVE001.0SU

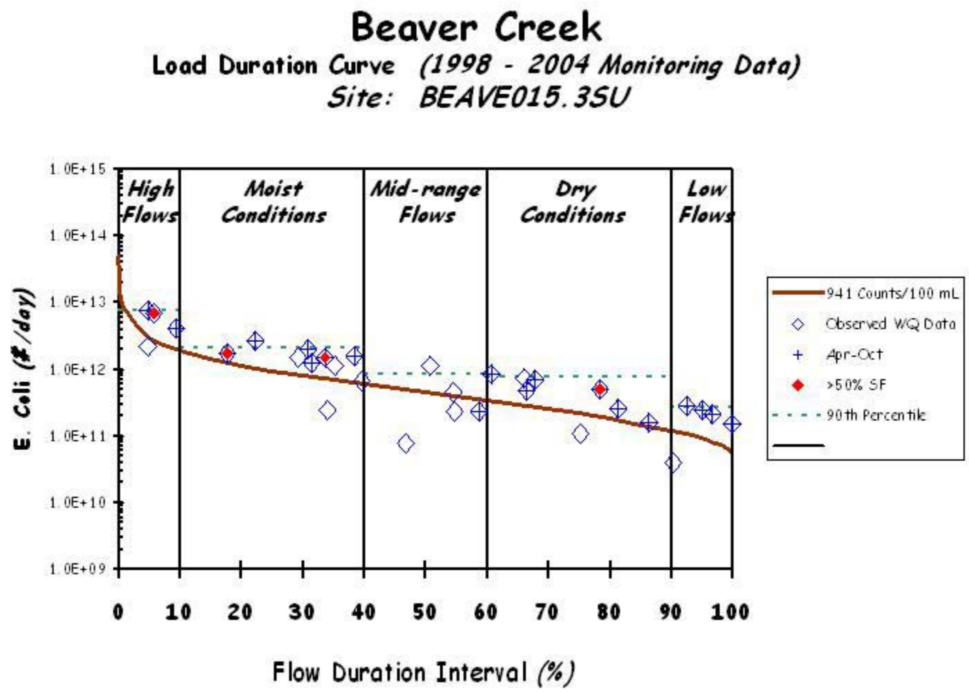

Figure C-17 E. Coli Load Duration Curve for Beaver Creek at BEAVE015.3SU

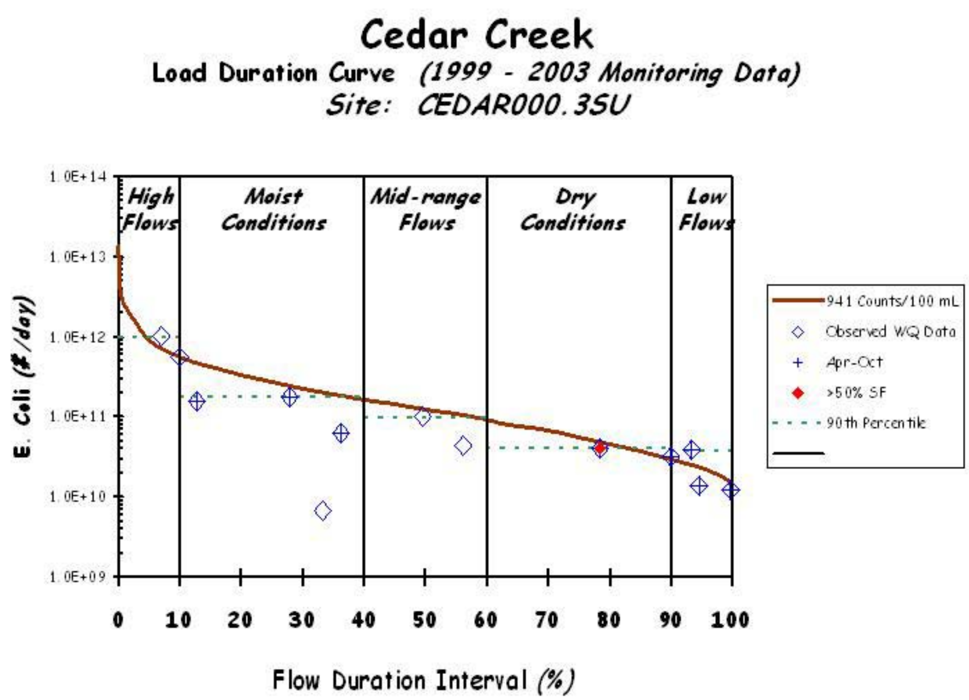

Figure C-18 E. Coli Load Duration Curve for Cedar Creek

Table C-1 Required Load Reduction for Laurel Creek at LAURE013.8JO

Sample Date	Flow	PDFE	E. Coli Sample Concentration	Required Reduction	
				Sample to Target (487 CFU/100 ml)	Sample to Target - MOS (438 CFU/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[%]	[%]
9/11/02	0.61	99.4	308	**NR**	**NR**
10/16/02	0.96	94.4	1733	**71.9**	**74.7**
10/24/02	0.85	96.5	613	**20.6**	**28.6**
11/25/02	3.68	49.7	184	**NR**	**NR**
12/16/02	5.77	28.8	125	**NR**	**NR**
1/21/03	4.26	43.2	613	**20.6**	**28.6**
3/4/03	10.12	10.3	980	**50.3**	55.3
3/26/03	6.80	20.9	1046	53.4	58.1
4/29/03	8.56	13.4	21	**NR**	**NR**
5/20/03	6.94	19.9	435	**NR**	**NR**
10/1/03	6.17	25.5	411	**NR**	**NR**
90th Percentile Concentration			**1046**	**53.4**	**58.1**

Notes: 1. NR = No reduction required.
2. 30-day Geometric Mean could not be calculated due to insufficient data.
3. Reductions for individual samples (shaded area) is included for reference only.

Table C-2 Required Load Reduction for Laurel Creek at LAURE015.0JO

Sample Date	Flow	PDFE	E. Coli Sample Concentration	Required Reduction	
				Sample to Target (487 CFU/100 ml)	Sample to Target - MOS (438 CFU/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[%]	[%]
10/16/02	0.42	94.3	1986	75.5	78.0
10/24/02	0.37	96.5	308	**NR**	**NR**
11/25/02	1.61	49.9	1553	68.6	71.8
12/16/02	2.53	29.1	770	36.8	43.1
1/21/03	1.87	43.2	>2420	>79.9	>81.9
3/4/03	4.45	10.3	>2420	>79.9	>81.9
3/26/03	2.99	20.9	>2420	>79.9	>81.9
4/29/03	3.77	13.3	<1	**NR**	**NR**
5/20/03	3.05	20.0	2420	79.9	81.9
10/1/03	2.71	25.5	>2420	>79.9	>81.9
90th Percentile Concentration			**>2420**	**>79.9**	**>81.9**

Notes: 1. NR = No reduction required.
2. 30-day Geometric Mean could not be calculated due to insufficient data.
3. Reductions for individual samples (shaded area) is included for reference only.

Table C-3 Required Load Reduction for Waters Branch

Sample Date	Flow	PDFE	E. Coli Sample Concentration	Required Reduction: Sample to Target (487 CFU/100 ml)	Required Reduction: Sample to Target - MOS (438 CFU/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[%]	[%]
10/16/02	0.17	94.0	727	**33.0**	**39.8**
10/24/02	0.15	96.3	308	**NR**	**NR**
11/25/02	0.63	47.6	345	**NR**	**NR**
12/16/02	0.99	25.8	2420	79.9	81.9
1/21/03	0.73	40.4	>2420	>79.9	>81.9
3/4/03	1.75	5.9	2420	79.9	81.9
3/26/03	1.18	17.0	291	**NR**	**NR**
4/29/03	1.48	8.9	687	**29.1**	**36.2**
5/20/03	1.20	15.9	2420	79.9	81.9
10/1/03	1.06	21.8	66	**NR**	**NR**
90th Percentile Concentration			**>2420**	**>79.9**	**>81.9**

Notes: 1. NR = No reduction required.
2. 30-day Geometric Mean could not be calculated due to insufficient data.
3. Reductions for individual samples (shaded area) is included for reference only.

Table C-4 Required Load Reduction for Paint Spring Branch

Sample Date	Flow	PDFE	E. Coli Sample Concentration	Required Reduction	
				Sample to Target (941 CFU/100 ml)	Sample to Target - MOS (847 CFU/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[%]	[%]
9/11/02	0.01	99.7	>2420	>61.1	>65.0
10/24/02	0.01	88.7	1986	52.6	57.4
11/25/02	0.09	31.8	205	**NR**	**NR**
12/16/02	0.15	14.5	416	**NR**	**NR**
1/21/03	0.07	40.8	>2420	>61.1	>65.0
3/4/03	0.15	16.1	387	**NR**	**NR**
3/27/03	0.09	31.8	921	**NR**	**8.0**
4/30/03	0.08	32.4	>2420	>61.1	>65.0
5/20/03	0.07	38.3	167	**NR**	**NR**
10/8/03	0.05	48.4	>2420	>61.1	>65.0
90th Percentile Concentration			**>2420**	**>61.1**	**>65.0**

Notes:
1. NR = No reduction required.
2. 30-day Geometric Mean could not be calculated due to insufficient data.
3. Reductions for individual samples (shaded area) is included for reference only.

Table C-5 Required Load Reduction for Morrell Creek

Sample Date	Flow	PDFE	E. Coli Sample Concentration	Required Reduction	
				Sample to Target (487 CFU/100 ml)	Sample to Target - MOS (438 CFU/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[%]	[%]
9/19/02	0.23	100.0	225	**NR**	**NR**
10/17/02	0.49	88.7	770	**36.8**	**43.1**
11/26/02	2.72	36.7	548	**11.1**	**20.1**
12/3/02	2.11	45.9	679	**28.3**	**35.5**
12/17/02	4.22	23.0	>2420	>79.9	>81.9
1/22/03	2.22	44.2	2420	79.9	81.9
3/5/03	4.57	21.0	816	**40.3**	**46.3**
3/25/03	3.11	31.9	86	**NR**	**NR**
4/30/03	2.94	34.0	179	**NR**	**NR**
6/17/03	59.68	3.1	2419	79.9	81.9
90th Percentile Concentration			**>2420**	**>79.9**	**>81.9**

Notes: 1. NR = No reduction required.
2. 30-day Geometric Mean could not be calculated due to insufficient data.
3. Reductions for individual samples (shaded area) is included for reference only.

Table C-6 Required Load Reduction for Unnamed Trib to S. Fork Holston (SFHOL3T0.7SU)

Sample Date	Flow	PDFE	E. Coli Sample Concentration	Required Reduction	
				Sample to Target (941 CFU/100 ml)	Sample to Target - MOS (847 CFU/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[%]	[%]
9/19/02	0.11	100.0	>2420	>61.1	>65.0
10/17/02	0.23	88.2	>2420	>61.1	>65.0
11/26/02	1.33	30.7	>2420	>61.1	>65.0
12/3/02	0.83	47.3	>2420	>61.1	>65.0
12/17/02	1.72	23.0	2420	61.1	65.0
1/22/03	0.87	45.8	770	**NR**	**NR**
3/5/03	1.81	21.6	65	**NR**	**NR**
3/25/03	1.22	33.8	488	**NR**	**NR**
4/30/03	1.24	33.3	1986	52.6	57.4
6/17/03	25.05	0.4	1203	59.5	63.6
90th Percentile Concentration			**>2420**	**>61.1**	**>65.0**

Notes: 1. NR = No reduction required.
2. 30-day Geometric Mean could not be calculated due to insufficient data.
3. Reductions for individual samples (shaded area) is included for reference only.

Table C-7 Required Load Reduction for Big Arm Branch

Sample Date	Flow	PDFE	E. Coli Sample Concentration	Required Reduction	
				Sample to Target (487 CFU/100 ml)	Sample to Target - MOS (438 CFU/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[%]	[%]
9/19/02	0.23	100.0	>2420	>79.9	>81.9
10/17/02	0.47	88.9	>2420	>79.9	>81.9
11/26/02	2.64	34.3	71	**NR**	**NR**
12/17/02	4.13	19.3	99	**NR**	**NR**
1/22/03	2.20	41.4	118	**NR**	**NR**
3/5/03	4.56	16.9	201	**NR**	**NR**
3/25/03	3.10	28.1	40	**NR**	**NR**
4/30/03	2.94	30.2	1300	62.5	66.3
6/17/03	59.43	0.5	649	**25.0**	**32.5**
90th Percentile Concentration			**>2420**	**>79.9**	**>81.9**

Notes:
1. NR = No reduction required.
2. 30-day Geometric Mean could not be calculated due to insufficient data.
3. Reductions for individual samples (shaded area) is included for reference only.

Table C-8 Required Load Reduction for Dry Creek at DRY000.2SU

Sample Date	Flow	PDFE	E. Coli Sample Concentration	Required Reduction	
				Sample to Target (941U/100 ml)	Sample to Target - MOS (847U/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[%]	[%]
10/24/02	1.19	91.2	>2420	>61.1	>65.0
11/25/02	7.21	34.5	>2420	>61.1	>65.0
12/16/02	13.62	14.9	>2420	>61.1	>65.0
1/21/03	6.20	40.4	>2420	>61.1	>65.0
3/4/03	13.42	15.3	>2420	>61.1	>65.0
3/27/03	7.98	30.7	>2420	>61.1	>65.0
4/30/03	7.90	30.9	>2420	>61.1	>65.0
5/20/03	6.78	37.2	>2420	>61.1	>65.0
10/8/03	4.86	48.5	>2420	>61.1	>65.0
90th Percentile Concentration			**>2420**	**>61.1**	**>65.0**

Notes: 1. NR = No reduction required.
2. 30-day Geometric Mean could not be calculated due to insufficient data.
3. Reductions for individual samples (shaded area) is included for reference only.

Table C-9 Required Load Reduction for Unnamed Trib to S. Fork Holston (SFHOL2T0.6SU)

Sample Date	Flow	PDFE	E. Coli Sample Concentration	Required Reduction	
				Sample to Target (941 CFU/100 ml)	Sample to Target - MOS (847 CFU/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[%]	[%]
10/17/02	0.13	86.0	613	**NR**	**NR**
11/26/02	0.64	32.8	308	**NR**	**NR**
12/17/02	0.94	21.2	411	**NR**	**NR**
1/22/03	0.47	43.8	517	**NR**	**NR**
3/5/03	0.95	20.8	179	**NR**	**NR**
3/25/03	0.65	32.4	1203	21.8	29.6
4/30/03	0.65	32.1	>2420	>61.1	>65.0
6/17/03	13.24	0.4	1414	33.5	40.1
90th Percentile Concentration			**>1716**	**>45.2**	**>50.6**

Notes: 1. NR = No reduction required.
2. 30-day Geometric Mean could not be calculated due to insufficient data.
3. Reductions for individual samples (shaded area) is included for reference only.

Table C-10 Required Load Reduction for Woods Branch

Sample Date	Flow	PDFE	E. Coli Sample Concentration	Required Reduction	
				Sample to Target (941 CFU/100 ml)	Sample to Target - MOS (847 CFU/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[%]	[%]
9/19/02	0.10	100.0	770	**NR**	**NR**
10/17/02	0.25	86.3	649	**NR**	**NR**
11/26/02	1.70	24.1	1300	27.6	34.9
12/17/02	1.89	20.7	1046	10.0	19.0
1/22/03	0.96	45.1	47	**NR**	**NR**
3/5/03	1.96	20.0	411	**NR**	**NR**
3/25/03	1.31	32.9	770	**NR**	**NR**
4/30/03	1.26	34.6	1203	21.8	29.6
6/17/03	26.98	0.5	1986	52.6	57.4
90th Percentile Concentration			**1437**	**34.5**	**41.1**

Notes: 1. NR = No reduction required.
2. 30-day Geometric Mean could not be calculated due to insufficient data.
3. Reductions for individual samples (shaded area) is included for reference only.

Table C-11 Required Load Reduction for Candy Creek

Sample Date	Flow	PDFE	E. Coli Sample Concentration	Required Reduction	
				Sample to Target (941 CFU/100 ml)	Sample to Target - MOS (847 CFU/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[%]	[%]
9/19/02	0.10	100.0	>2420	>61.1	>65.0
10/17/02	0.26	81.8	517	**NR**	**NR**
11/26/02	1.44	25.5	816	**NR**	**NR**
12/17/02	1.84	18.6	1986	52.6	57.4
1/22/03	0.90	42.9	387	**NR**	**NR**
3/5/03	1.77	19.8	64	**NR**	**NR**
3/25/03	1.20	31.8	649	**NR**	**NR**
5/1/03	1.03	37.8	1733	45.7	51.1
6/17/03	25.06	0.5	1553	39.4	45.5
90th Percentile Concentration			**>2073**	**>54.6**	**>59.1**

Notes: 1. NR = No reduction required.
2. 30-day Geometric Mean could not be calculated due to insufficient data.
3. Reductions for individual samples (shaded area) is included for reference only.

Table C-12 Required Load Reduction for Wagner Creek

Sample Date	Flow	PDFE	E. Coli Sample Concentration	Required Reduction	
				Sample to Target (941 CFU/100 ml)	Sample to Target - MOS (847 CFU/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[%]	[%]
9/19/02	0.16	100.0	1203	21.8	29.6
10/17/02	0.42	84.1	770	**NR**	**NR**
11/26/02	2.47	25.1	727	**NR**	**NR**
12/17/02	3.04	19.0	1300	27.6	34.8
1/22/03	1.49	43.7	219	**NR**	**NR**
3/5/03	2.97	19.7	687	**NR**	**NR**
3/25/03	2.00	32.3	2420	61.1	65.0
5/1/03	1.73	38.0	>2420	>61.1	>65.0
6/17/03	41.29	0.5	>2420	>61.1	>65.0
90th Percentile Concentration			**>2420**	**>61.1**	**>65.0**

Notes: 1. NR = No reduction required.
2. 30-day Geometric Mean could not be calculated due to insufficient data.
3. Reductions for individual samples (shaded area) is included for reference only.

Table C-13 Required Load Reduction for Weaver Branch

Sample Date	Flow	PDFE	E. Coli Sample Concentration	Required Reduction	
				Sample to Target (941 CFU/100 ml)	Sample to Target - MOS (847 CFU/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[%]	[%]
9/19/02	0.20	100.0	>2420	>61.1	>65.0
10/17/02	0.44	85.3	1733	45.7	51.1
11/26/02	2.09	35.0	548	**NR**	**NR**
12/17/02	3.35	20.9	387	**NR**	**NR**
1/22/03	1.65	43.5	548	**NR**	**NR**
3/5/03	3.38	20.5	649	**NR**	**NR**
3/25/03	2.30	31.7	167	**NR**	**NR**
4/30/03	2.32	31.3	548	**NR**	**NR**
6/17/03	44.76	0.4	687	**NR**	**NR**
90th Percentile Concentration			**>1870**	**>49.7**	**>54.7**

Notes: 1. NR = No reduction required.
2. 30-day Geometric Mean could not be calculated due to insufficient data.
3. Reductions for individual samples (shaded area) is included for reference only.

Table C-14 Required Load Reduction for Back Creek at BACK000.5SU

Sample Date	Flow	PDFE	E. Coli Sample Concentration	Required Reduction	
				Sample to Target (941 CFU/100 ml)	Sample to Target - MOS (847 CFU/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[%]	[%]
9/9/99	1.94	87.4	866	**NR**	**2.2**
7/17/02	1.36	94.7	>2419	>61.1	>65.0
8/20/02	1.11	97.8	1300	**27.6**	**34.8**
9/11/02	0.87	99.9	727	**NR**	**NR**
10/23/02	1.65	91.6	1733	45.7	51.1
11/13/02	33.79	10.4	1553	39.4	45.5
12/3/02	7.66	46.9	866	**NR**	**2.2**
1/15/03	8.68	42.8	548	**NR**	**NR**
2/18/03	43.16	8.0	326	**NR**	**NR**
3/12/03	13.40	27.1	29	**NR**	**NR**
4/15/03	23.02	15.2	411	**NR**	**NR**
5/12/03	13.02	28.2	816	**NR**	**NR**
6/25/03	10.52	35.3	921	**NR**	**8.0**
90th Percentile Concentration			**>1697**	**>44.6**	**>50.1**

Notes: 1. NR = No reduction required.
2. 30-day Geometric Mean could not be calculated due to insufficient data.
3. Reductions for individual samples (shaded area) is included for reference only.

Table C-15 Required Load Reduction for Beaver Creek at BEAVE001.0SU

Sample Date	Flow	PDFE	E. Coli Sample Concentration	Required Reduction	
				Sample to Target (941 CFU/100 ml)	Sample to Target - MOS (847 CFU/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[%]	[%]
3/3/98	55.66	53.8	299	**NR**	**NR**
6/25/98	107.65	28.5	>2419	>61.1	>65.0
9/17/98	11.34	97.4	24	**NR**	**NR**
12/15/98	50.07	57.8	1120	16.0	24.4
3/2/99	96.94	31.9	179	**NR**	**NR**
6/15/99	18.67	88.0	249	**NR**	**NR**
9/7/99	26.03	80.1	11	**NR**	**NR**
12/2/99	27.80	78.4	166	**NR**	**NR**
2/17/00	81.30	38.7	89	**NR**	**NR**
5/11/00	39.25	66.8	152	**NR**	**NR**
8/10/00	91.06	34.5	2419	61.1	65.0
11/28/00	16.51	90.9	517	**NR**	**NR**
3/7/01	94.78	33.0	249	**NR**	**NR**
6/26/01	167.86	16.6	144	**NR**	**NR**
7/17/01	47.81	59.5	5	**NR**	**NR**
10/9/01	37.30	68.8	285	**NR**	**NR**
4/16/02	45.90	61.0	299	**NR**	**NR**
7/17/02	12.91	95.4	727	**NR**	**NR**
8/20/02	29.27	76.8	1553	39.4	45.5
9/11/02	7.88	100.0	185	**NR**	**NR**
10/23/02	14.64	93.3	461	**NR**	**NR**
11/13/02	357.66	5.3	>2419	>61.1	>65.0
12/3/02	58.29	52.1	649	**NR**	**NR**
1/15/03	68.11	45.9	17	**NR**	**NR**
2/18/03	427.02	4.1	687	**NR**	**NR**
3/12/03	112.14	27.1	345	**NR**	**NR**
4/15/03	275.17	8.4	770	**NR**	**NR**
5/12/03	144.20	20.2	1203	21.8	29.6
6/25/03	107.38	28.6	866	**NR**	**2.2R**
8/12/03	425.06	4.1	>2419	>61.1	>65.0
11/4/03	38.87	67.1	130	**NR**	**NR**
8/4/04	87.30	36.0	1414	33.5	40.1
11/4/04			2000	53.0	57.7
90th Percentile Concentration			**>2335**	**>59.7**	**>63.7**

Notes: 1. NR = No reduction required.
2. 30-day Geometric Mean could not be calculated due to insufficient data.
3. Reductions for individual samples (shaded area) is included for reference only.

Table C-16 Required Load Reduction for Beaver Creek at BEAVE015.3SU

Sample Date	Flow	PDFE	E. Coli Sample Concentration	Required Reduction	
				Sample to Target (941 CFU/100 ml)	Sample to Target - MOS (847 CFU/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[%]	[%]
3/3/98	17.37	54.8	548	**NR**	**NR**
6/25/98	33.44	31.5	1553	39.4	45.5
9/17/98	3.65	96.9	>2419	>61.1	>65.0
12/15/98	17.45	54.6	1046	10.0	19.0
3/2/99	30.75	34.0	326	**NR**	**NR**
6/15/99	6.05	86.4	1046	10.0	19.0
9/7/99	7.37	81.5	1414	33.6	40.1
12/2/99	9.41	75.3	461	**NR**	**NR**
2/17/00	26.32	39.6	1046	10.0	19.0
5/11/00	12.41	66.5	1553	39.4	45.5
8/10/00	31.00	33.7	1986	52.6	57.4
11/28/00	5.15	90.4	308	**NR**	**NR**
3/7/01	29.93	35.2	1553	39.4	45.5
6/26/01	53.80	17.7	1300	27.6	34.8
7/17/01	15.44	58.7	613	**NR**	**NR**
10/9/01	11.92	68.0	>2419	>61.1	>65.0
4/16/02	14.55	60.8	>2419	>61.1	>65.0
7/17/02	4.05	95.3	>2419	>61.1	>65.0
8/20/02	8.40	78.5	>2419	>61.1	>65.0
9/11/02	2.56	100.0	>2419	>61.1	>65.0
10/23/02	4.75	92.6	>2419	>61.1	>65.0
11/13/02	119.04	5.7	2419	61.1	65.0
12/3/02	19.29	50.7	>2419	>61.1	>65.0
1/15/03	21.86	46.8	144	**NR**	**NR**
2/18/03	135.66	4.7	649	**NR**	**NR**
3/12/03	35.34	29.2	1733	45.7	51.1
4/15/03	85.71	9.3	1986	52.6	57.4
5/12/03	44.71	22.4	>2419	>61.1	>65.0
6/25/03	33.86	30.9	>2419	>61.1	>65.0
8/12/03	131.75	4.8	>2419	>61.1	>65.0
11/4/03	12.58	66.1	2419	61.1	65.0
8/4/04	27.17	38.5	>2419	>61.1	>65.0
11/4/04			2600	63.8	67.4
90th Percentile Concentration			**>2419**	**>61.1**	**>65.0**

Notes: 1. NR = No reduction required.
2. 30-day Geometric Mean could not be calculated due to insufficient data.
3. Reductions for individual samples (shaded area) is included for reference only.

Table C-17 Required Load Reduction for Cedar Creek

Sample Date	Flow	PDFE	E. Coli Sample Concentration	Required Reduction	
				Sample to Target (941 CFU/100 ml)	Sample to Target - MOS (847 CFU/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[%]	[%]
9/9/99	1.31	90.0	980	4.0	13.6
7/17/02	1.04	94.7	548	**NR**	**NR**
8/20/02	2.17	78.4	770	**NR**	**NR**
9/11/02	0.65	99.9	770	**NR**	**NR**
10/23/02	1.13	93.4	1414	33.6	40.1
11/13/02	25.38	9.9	921	**NR**	**8.0**
12/3/02	4.59	56.2	387	**NR**	**NR**
1/15/03	5.47	49.7	770	**NR**	**NR**
2/18/03	31.97	7.0	1300	27.6	34.8
3/12/03	8.91	33.2	31	**NR**	**NR**
4/15/03	20.83	12.8	313	**NR**	**NR**
5/12/03	10.71	27.8	687	**NR**	**NR**
6/25/03	8.25	36.2	308	**NR**	**NR**
90th Percentile Concentration			**1236**	**23.9**	**31.5**

Notes: 1. NR = No reduction required.
2. 30-day Geometric Mean could not be calculated due to insufficient data.
3. Reductions for individual samples (shaded area) is included for reference only.

Table C-18 TMDLs, WLAs, & LAs for South Fork Holston River Watershed

HUC-12 Subwatershed (06010102__) or Drainage Area	Impaired Waterbody Name	Impaired Waterbody ID	TMDL	WLAs				LAs [d]
				WWTFs [a]		Leaking Collection Systems [b]	MS4s [c]	
				Monthly Avg.	Daily Max.			
			[% Red.]	[CFU/day]	[CFU/day]	[CFU/day]	[% Red.]	[% Red.]
0104 (DA)	Waters Branch	TN060101020250 – 0900	>79.9	NA	NA	NA	>81.9	>81.9
0104 (DA)	Laurel Creek	TN060101020250 – 2000	>79.9	NA	NA	NA	>81.9	>81.9
0302 (DA)	Painter Springs Branch	TN060101020540 – 0800	>61.1	NA	NA	NA	>65.0	>65.0
0401	Unnamed Trib to South Fork Holston River	TN06010102012 – 0300	>61.1	NA	NA	NA	>65.0	>65.0
	Morrell Creek	TN06010102012 – 0400	>79.9	NA	NA	NA	>81.9	>81.9
0402 (DA)	Unnamed Trib to South Fork Holston River	TN06010102012 – 0100	>45.2	NA	NA	NA	>50.6	>50.6
0402 (DA)	Big Arm Branch	TN06010102012 - 0810	>79.9	NA	NA	NA	>81.9	>81.9
0402 (DA)	Dry Creek	TN06010102012 - 0700	>61.1	NA	NA	NA	>65.0	>65.0
0402 (DA)	Woods Branch	TN06010102012 - 0820	34.5	NA	NA	NA	41.1	41.1
0403	Candy Creek	TN06010102006T – 0300	>54.6	NA	NA	NA	>59.1	>59.1
	Wagner Creek	TN06010102006T – 0200	>61.1	1.669×10^{8}	1.247×10^{9}	NA	>65.0	>65.0
	Weaver Branch	TN06010102012 – 0900	>49.7	NA	NA	NA	>54.7	>54.7

Table C-18(cont'd) TMDLs, WLAs, & LAs for South Fork Holston River Watershed

HUC-12 Subwatershed (06010102__) or Drainage Area	Impaired Waterbody Name	Impaired Waterbody ID	TMDL	WLAs				LAs [d]
				WWTFs [a]		Leaking Collection Systems [b]	MS4s [c]	
				Monthly Avg.	Daily Max.			
			[% Red.]	[CFU/day]	[CFU/day]	[CFU/day]	[% Red.]	[% Red.]
0502	Back Creek	TN06010102042 – 0200	>44.6	$2.861x10^7$	$2.137x10^8$	0	>50.1	>50.1
	Beaver Creek	TN06010102042 – 1000	>59.7	$1.431x10^7$	$1.069x10^8$	0	>63.7	>63.7
	Beaver Creek	TN06010102042 – 2000[e]	>61.1	NA	NA	0	>65.0	>65.0
	Cedar Creek	TN06010102042 – 0500	23.9	NA	NA	0	31.5	31.5

Notes: NA = Not Applicable.

a. Future WWTFs must meet instream water quality standards at the point of discharge as specified in their NPDES permit.

b. Pathogen loading due to collection system failure is considered to be unpermitted point source loading from the municipal WWTF. With respect to pathogen loading from leaking collection systems, a WLA of zero is assigned. It is recognized, however, that a WLA of 0 CFU/day may not be practical. For these unpermitted sources, the WLA is interpreted to mean a reduction in pathogen loading to the maximum extent practicable, consistent with the requirement that these sources not contribute to a violation of the water quality standard for E. coli.

c. Applies to any MS4 discharge loading in the subwatershed or drainage area.

d. The load allocations (LAs) listed apply to precipitation induced nonpoint sources only. The objective for all "other direct sources" (leaking septic systems, illicit discharges, and animals access to streams) is a LA of zero. It is recognized, however, that for leaking septic systems a LA of 0 CFU/day may not be practical. For these unpermitted sources, the LA is interpreted to mean a reduction in E. coli loading to the maximum extent practicable, consistent with the requirement that these sources not contribute to a violation of the water quality standard for E. coli.

e. Portions of these waterbodies lie in another state. A TMDL for Fecal Coliform has been developed by the State of Virginia for those portions of the waterbodies lying within their jurisdiction. The required load reduction is for the Tennessee portion of the waterbodies.

APPENDIX D

Hydrodynamic Modeling Methodology

HYDRODYNAMIC MODELING METHOD

D.1 Model Selection

The Loading Simulation Program C++ (LSPC) was selected for flow simulation of pathogen-impaired waters in the subwatersheds of the South Fork Holston River Watershed. LSPC is a watershed model capable of performing flow routing through stream reaches. LSPC is a dynamic watershed model based on the Hydrologic Simulation Program - Fortran (HSPF)

D.2 Model Set Up

The South Fork Holston River Watershed was delineated into subwatersheds in order to facilitate model hydrologic calibration. Boundaries were constructed so that subwatershed "pour points" coincided with HUC-12 delineations, 303(d)-listed waterbodies, and water quality monitoring stations. Watershed delineation was based on the NHD stream coverage and Digital Elevation Model (DEM) data. This discretization facilitates simulation of daily flows at water quality monitoring stations.

Several computer-based tools were utilized to generate input data for the LSPC model. The Watershed Characterization System (WCS), a geographic information system (GIS) tool, was used to display, analyze, and compile available information to support hydrology model simulations for selected subwatersheds. This information includes land use categories, point source dischargers, soil types and characteristics, population data (human and livestock), and stream characteristics.

An important factor influencing model results is the precipitation data contained in the meteorological data files used in these simulations. Weather data from multiple meteorological stations were available for the time period from January 1970 through August 2004. Meteorological data for a selected 11-year period were used for all simulations. The first year of this period was used for model stabilization with simulation data from the subsequent 10-year period (10/1/94 – 9/30/04) used for TMDL analysis.

D.3 Model Calibration

Hydrologic calibration of the watershed model involves comparison of simulated streamflow to historic streamflow data from U. S. Geological Survey (USGS) stream gaging stations for the same period of time. Two USGS continuous record stations located near the South Fork Holston River Watershed with a sufficiently long and recent historical record was selected as the basis of the hydrology calibration. The USGS station was selected based on similarity of drainage area, Level IV ecoregion, land use, and topography. The calibration involved comparison of simulated and observed hydrographs until statistical stream volumes and flows were within acceptable ranges as reported in the literature (Lumb, et al., 1994).

Initial values for hydrologic variables were taken from an EPA developed default data set. During the calibration process, model parameters were adjusted within reasonable constraints until acceptable agreement was achieved between simulated and observed streamflow. Model parameters adjusted include: evapotranspiration, infiltration, upper and lower zone storage, groundwater storage, recession, losses to the deep groundwater system, and interflow discharge.

The results of the hydrologic calibration for Watauga River near Sugar Grove, North Carolina, USGS Station 03479000, ecoregion 66, are shown in Table D-1 and Figures D-1 and D-2. The results of the hydrologic calibration for Bullrun Creek near Halls Crossroads, Tennessee, USGS Station 03535000, ecoregion 67, are shown in Table D-2 and Figure D-3 and D-4.

Table D-1. Hydrologic Calibration Summary: Watauga River (USGS 03479000)

		90.03685086	
Simulation Name:	USGS034679000	**Simulation Period:**	
		Watershed Area (ac):	57642.03
Period for Flow Analysis			
Begin Date:	**10/01/90**	**Baseflow PERCENTILE:**	2.5
End Date:	**09/30/00**	*Usually 1%-5%*	
Total Simulated In-stream Flow:	**279.14**	Total Observed In-stream Flow:	**287.45**
Total of highest 10% flows:	**112.83**	Total of Observed highest 10% flows:	**119.65**
Total of lowest 50% flows:	**51.31**	Total of Observed Lowest 50% flows:	**52.05**
Simulated Summer Flow Volume (months 7-9):	**38.04**	Observed Summer Flow Volume (7-9):	**37.10**
Simulated Fall Flow Volume (months 10-12):	**57.06**	Observed Fall Flow Volume (10-12):	**54.65**
Simulated Winter Flow Volume (months 1-3):	**109.31**	Observed Winter Flow Volume (1-3):	**115.74**
Simulated Spring Flow Volume (months 4-6):	**74.73**	Observed Spring Flow Volume (4-6):	**79.96**
Total Simulated Storm Volume:	**240.50**	Total Observed Storm Volume:	**245.38**
Simulated Summer Storm Volume (7-9):	**28.28**	Observed Summer Storm Volume (7-9):	**26.59**
Errors (Simulated-Observed)		*Recommended Criteria*	Last run
Error in total volume:	**-2.89**	10	
Error in 50% lowest flows:	**-1.43**	10	
Error in 10% highest flows:	**-5.70**	15	
Seasonal volume error - Summer:	**2.54**	30	
Seasonal volume error - Fall:	**4.40**	30	
Seasonal volume error - Winter:	**-5.56**	30	
Seasonal volume error - Spring:	**-6.53**	30	
Error in storm volumes:	**-1.99**	20	
Error in summer storm volumes:	**6.38**	50	

Criteria for Median Monthly Flow Comparisons	
Lower Bound (Percentile):	25
Upper Bound (Percentile):	75

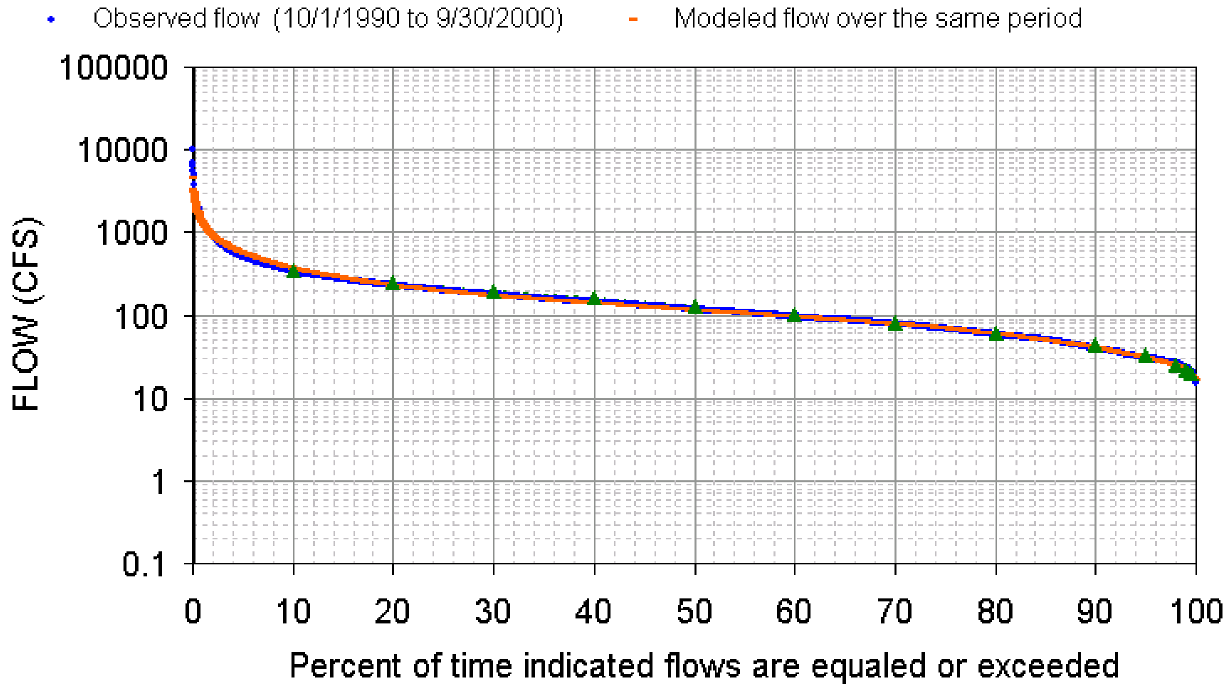

Figure D-1. Hydrologic Calibration: Watauga River, USGS 03479000)

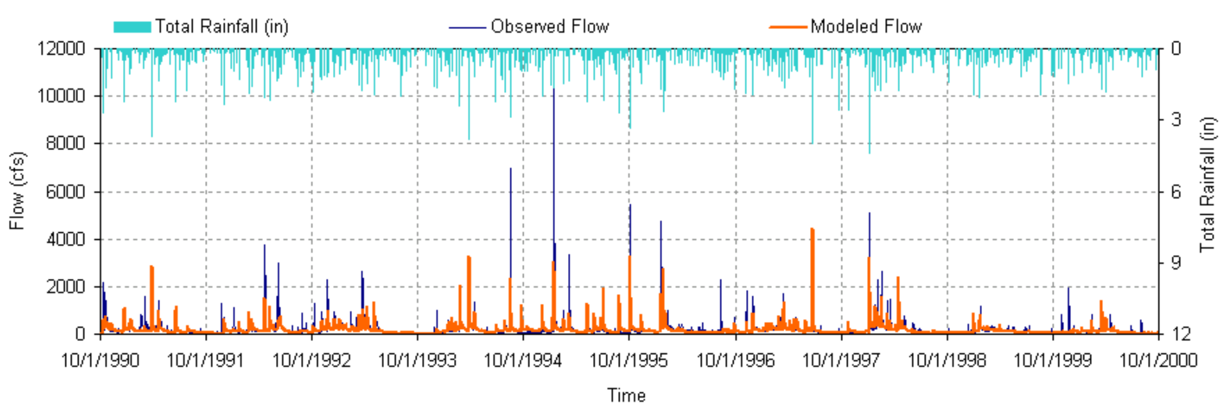

Figure D-2. 10-Year Hydrologic Comparison: Watauga River at Belleview, USGS 03479000

Table D-2. Hydrologic Calibration Summary: Bullrun Creek (USGS 03535000)

Simulation Name:	USGS03535000	**Simulation Period:**	
		Watershed Area (ac):	43607.17
Period for Flow Analysis			
Begin Date:	**10/01/80**	**Baseflow PERCENTILE:**	2.5
End Date:	**09/30/86**	*Usually 1%-5%*	
Total Simulated In-stream Flow:	**82.36**	Total Observed In-stream Flow:	**91.27**
Total of highest 10% flows:	**42.83**	Total of Observed highest 10% flows:	**47.36**
Total of lowest 50% flows:	**9.68**	Total of Observed Lowest 50% flows:	**10.06**
Simulated Summer Flow Volume (months 7-9):	**9.30**	Observed Summer Flow Volume (7-9):	**7.91**
Simulated Fall Flow Volume (months 10-12):	**14.00**	Observed Fall Flow Volume (10-12):	**15.95**
Simulated Winter Flow Volume (months 1-3):	**31.45**	Observed Winter Flow Volume (1-3):	**35.49**
Simulated Spring Flow Volume (months 4-6):	**27.61**	Observed Spring Flow Volume (4-6):	**31.92**
Total Simulated Storm Volume:	**76.18**	Total Observed Storm Volume:	**83.16**
Simulated Summer Storm Volume (7-9):	**7.76**	Observed Summer Storm Volume (7-9):	**5.88**
Errors (Simulated-Observed)		*Recommended Criteria*	Last run
Error in total volume:	**-9.76**	10	
Error in 50% lowest flows:	**-3.75**	10	
Error in 10% highest flows:	**-9.57**	15	
Seasonal volume error - Summer:	**17.59**	30	
Seasonal volume error - Fall:	**-12.22**	30	
Seasonal volume error - Winter:	**-11.39**	30	
Seasonal volume error - Spring:	**-13.50**	30	
Error in storm volumes:	**-8.39**	20	
Error in summer storm volumes:	**31.99**	50	

Criteria for Median Monthly Flow Comparisons	
Lower Bound (Percentile):	25
Upper Bound (Percentile):	75

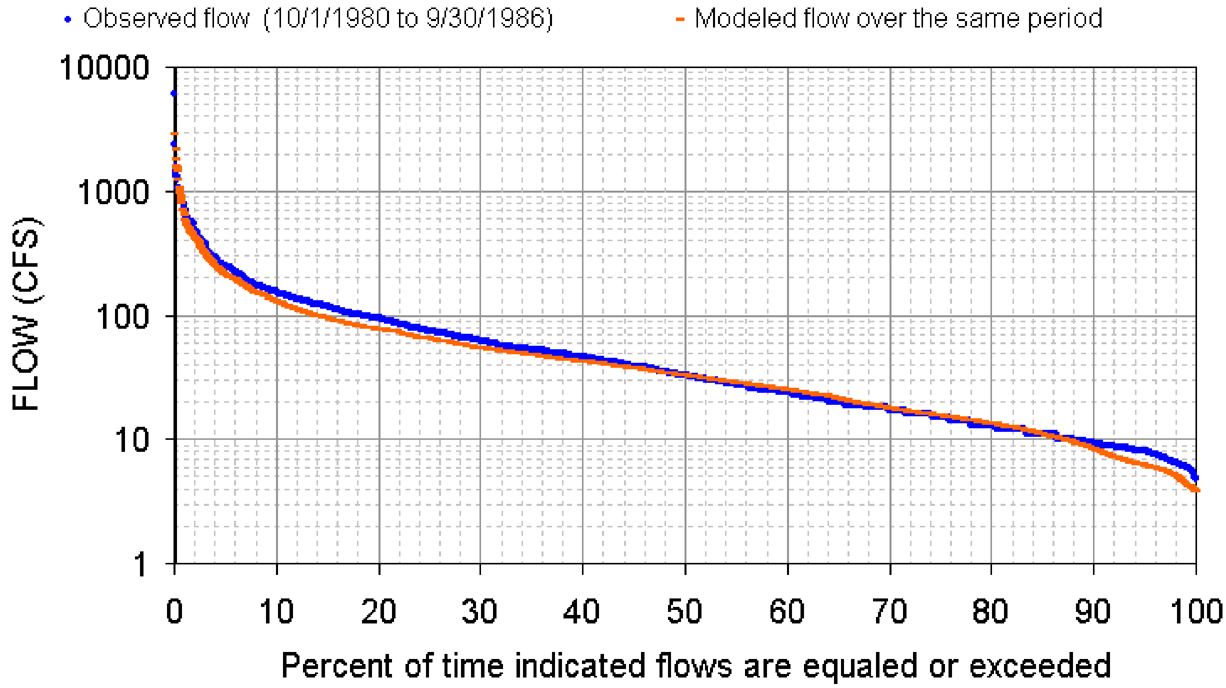

Figure D-3. Hydrologic Calibration: Bullrun Creek, USGS 03535000

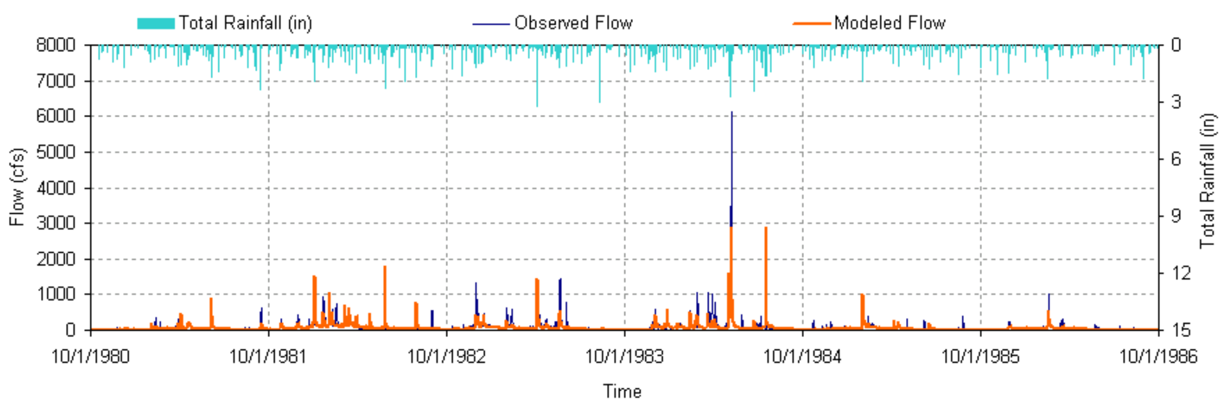

Figure D-4. 6-Year Hydrologic Comparison: Bullrun Creek, USGS 03535000

APPENDIX E

Public Notice Announcement

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER POLLUTION CONTROL

PUBLIC NOTICE OF AVAILABILITY OF PROPOSED TOTAL MAXIMUM DAILY LOAD (TMDL) FOR E. COLI IN SOUTH FORK HOLSTON RIVER WATERSHED (HUC 06010102), TENNESSEE

Announcement is hereby given of the availability of Tennessee's proposed Total Maximum Daily Load (TMDL) for E. coli in the South Fork Holston River watershed, located in eastern Tennessee. Section 303(d) of the Clean Water Act requires states to develop TMDLs for waters on their impaired waters list. TMDLs must determine the allowable pollutant load that the water can assimilate, allocate that load among the various point and nonpoint sources, include a margin of safety, and address seasonality.

A number of waterbodies in the South Fork Holston River watershed are listed on Tennessee's Final 2004 303(d) list as not supporting designated use classifications due, in part, to discharge of pathogens from MS4 areas and pasture land. The TMDL utilizes Tennessee's general water quality criteria, continuous flow data from a USGS discharge monitoring station located in proximity to the watershed, site specific water quality monitoring data, a calibrated hydrologic model, load duration curves, and an appropriate Margin of Safety (MOS) to establish allowable loadings of pathogens which will result in the reduced in-stream concentrations and attainment of water quality standards. The TMDL requires reductions of pathogen loading on the order of 24-80% in the listed waterbodies.

The proposed South Fork Holston River E. coli TMDL may be downloaded from the Department of Environment and Conservation website:

http://www.state.tn.us/environment/wpc/tmdl/

Technical questions regarding this TMDL should be directed to the following members of the Division of Water Pollution Control staff:

Vicki S. Steed, P.E., Watershed Management Section
Telephone: 615-532-0707
e-mail: Vicki.Steed@state.tn.us

Sherry H. Wang, Ph.D., Watershed Management Section
Telephone: 615-532-0656
e-mail: Sherry.Wang@state.tn.us

Persons wishing to comment on the proposed TMDLs are invited to submit their comments in writing no later than September 11, 2006 to:

Division of Water Pollution Control
Watershed Management Section
6th Floor, L & C Annex
401 Church Street
Nashville, TN 37243-1534

All comments received prior to that date will be considered when revising the TMDL for final submittal to the U.S. Environmental Protection Agency.

The TMDL and supporting information are on file at the Division of Water Pollution Control, 6th Floor, L & C Annex, 401 Church Street, Nashville, Tennessee. They may be inspected during normal office hours. Copies of the information on file are available on request.

APPENDIX F

Public Notice Comments Received

ENSAFE
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September 8, 2006

Sherry H. Wang, Ph. D.
Division of Water Pollution Control
Watershed Management Section
6th Floor, L & C Annex
401 Church Street
Nashville, TN 37243-1534

Re: Proposed Total Maximum Daily Load (TMDL)
For Pathogens
South Fork Holston River Watershed (HUC 06010102)

Dear Ms. Wang:

We are writing this letter on behalf of the Cities of Bristol, Tennessee, and Bristol, Virginia, to present the Cities' comments relating to the above referenced TMDL. The comments are as follows:

1. Page ix: Only Johnson and Sullivan Counties are listed in this table. It appears from the text and associated graphics that Carter County also has impaired waterbodies.
2. Page 8 of 41, Section 5.0: The last sentence of the second paragraph relates to "the Watauga Watershed". It appears this should relate to the South Fork Holston River Watershed.
3. Page 12 of 41, Section 6.0: The listing of monitoring stations does not include BEAVE001.0SU.
4. Page 15 of 41, Section 6.0, Table 3: The table does not include monitoring stations LAURE007.0JO or BACK003.1SU.
5. Page 17 of 41, Table 5: Since the TMDL relates only to E. coli, the reference to permit information on fecal coliform should be omitted. However, if this information must remain in the report, please provide a footnote indicating that all but one of the fecal coliform permit limit exceedances occurred prior to April of 2003 when Bristol STP completed its surge basin installation following the 1999 disinfection system improvements. Also, data points for the daily maximum Fecal Coliform limit should list number of days (2,890), not 95 months (January 1999 through November 2005).

6. Page 19 of 41, Section 7.1.1: The first paragraph indicates that the collection system of Bristol, TN and Bristol, VA "has historically been a significant source to coliform loading to the Beaver Creek watershed." There appears to be no data to support that the sewer system overflows that periodically occur in the watershed are "significant" contributors to coliform impairment. Many of the overflows occur during wet weather events when the overflow is diluted and flows in Beaver Creek are already elevated. In fact, studies of Beaver Creek performed by the cities in the early 80's indicated that even combined system overflows (that are now eliminated) were difficult to isolate as significant coliform contributors. The word "significant" should be omitted from this sentence.

7. Page 20 of 41, Section 7.2.1 Wildlife: This section indicates that wildlife contributes coliform bacteria to the waterbodies in the basin. The Virginia Department of Environmental Quality in its approved TMDL for Beaver Creek indicates that bacterial source tracking data shows wildlife contributions ranging from under 10% to over 60% of the coliform bacterial sampled. However, the draft TMDL does not attempt to quantify or provide a waste load allocation for the wildlife contribution.

8. Page 27 of 41, Section 8.7: This section is listing a single load allocation (LAs) for all precipitation induced nonpoint sources in Table 9 in terms of % reduction. It states that "all 'other direct sources' (leaking septic systems, illicit discharges, and animals access to streams) is a LA of zero". Although confusing, this appears to mean all of these "other direct sources" are expected to be reduced by 100%. The contribution of wildlife does not appear to be considered in this allocation since it is implausible to expect wildlife contribution to be reduced to a load allocation of zero. The report should include a quantified estimate of these identified sources.

9. Page 34 of 41, Figure 12: There is no identification of the definition of the term in the legend ">50% SF". Please define.

10. In April 2004 the Virginia Department of Environmental Quality completed a TMDL for Beaver Creek which was subsequently approved by EPA. There is only one reference to this report in the draft TMDL in the footnotes of Table C-18 in Appendix C. Since the flow from Virginia is approximately one third of the total flow in Beaver Creek, more consideration should be given to the impacts of current and proposed E. coli concentrations in the Tennessee TMDL.

Sincerely,
EnSafe Inc.

By: R. Scott Heflinger, P.E.

pc: Mr. Bill Sorah
Mr. Matthew Dake
Mr. John Bowling

APPENDIX G

Response to Public Comments

Note: responses correspond to numbered comments (see Appendix F).

1. This oversight has been corrected. Big Arm Creek and its associated monitoring station are located in Carter County. All other waterbodies and monitoring stations are located in Johnson and Sullivan counties.

2. The reference to the Watauga Watershed has been removed.

3. BEAVE001.0SU has been added to the list of monitoring stations.

4. As stated on Page 13 of 41, Table 3 only includes monitoring stations with 10% or more of samples exceeding water quality maximum criteria. LAURE007.0JO and BACK003.1SU did not have any exceedances of their respective water quality maximum criteria.

5. Table 5 was constructed using a summary of DMR data. Daily maximum values are reported on a monthly basis in DMRs. Upon further investigation, MOR data was located. Daily maximum values are reported on a daily basis in MORs. Therefore, the number of data points has been revised from 95 monthly values to 2,890 daily values. TDEC has been unable to confirm the completion date for the surge basin. However, a footnote has been added as suggested.

6. Actually, the data support the presumption that overflows are significant contributors to loading and subsequent exceedances of maximum daily (instantaneous) in-stream pathogen standards during wet weather overflow events. As documented in the TMDL for Pathogens in the South Fork Holston River Watershed (approved by USEPA on September 23, 2004), a plot of fecal coliform vs. flow for the period July 1989 – July 2001 (see Figure G-1) indicates a direct relationship between flow and concentration: as flow increases, concentration increases. In addition, when hydrograph separation is conducted on Beaver Creek simulated flow data, analyses of samples indicates that most exceedances occur during stormflow events (see Figure G-2).

   In Figure G-3, a plot of E. coli vs. flow for the period March 1998 – August 2004 indicates a similar relationship between flow and concentration: as flow increases, concentration increases. In Figure G-4, analyses of samples indicates that most exceedances occur during storm events. The trends may not be as pronounced as the relationship between fecal coliform and flow due to the smaller body of historical monitoring data.

   The language remains unchanged.

7. The Virginia TMDL for Beaver Creek included bacterial source tracking data collected at the Virginia/Tennessee state line. Bacterial source tracking data was not available for the Tennessee portion of the Beaver Creek watershed. Therefore, the contribution from wildlife has not been quantified. The Division of Water Pollution Control encourages the Cities of Bristol, Tennessee and Bristol, Virginia to conduct BSP and/or other source identification activities to support appropriate BMP implementations to reduce E. coli loading in Beaver Creek.

8. The reference to "animals access to streams" is a reference to agricultural animals rather than to wildlife. Access to streams by grazing livestock is typically resolved by application of appropriate best management practices (BMPs). Therefore, the contribution from this source can be reduced to zero.

9. An explanation of the term ">50% SF" has been added to Section C.1.2.

10. In addition to the footnotes of Table C-18, there are references to the Virginia TMDL in the Summary section of the Draft TMDL (pages ix and xiii). The TMDL developed by the Virginia DEQ only applies to those portions of the waterbody lying within their jurisdiction. In the same way, the TMDL developed by TDEC only applies to those portions of the waterbody lying within the State of Tennessee. Evaluation of the geomean of all monitoring data at the stateline (GM=1359) and at mile 1.0 (GM=315) suggests that sources in Virginia are a major contributor to the impairment of Beaver Creek.

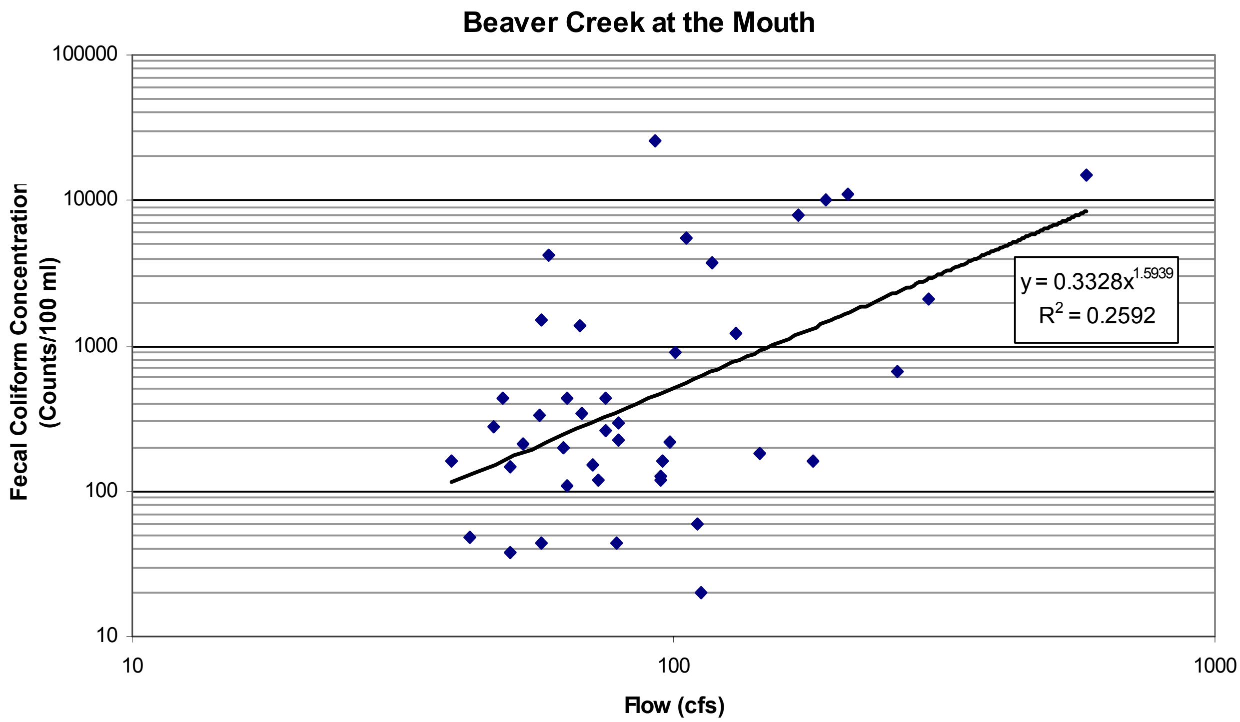

Figure G-1. Fecal coliform vs Flow – Beaver Creek at Mile 1.0

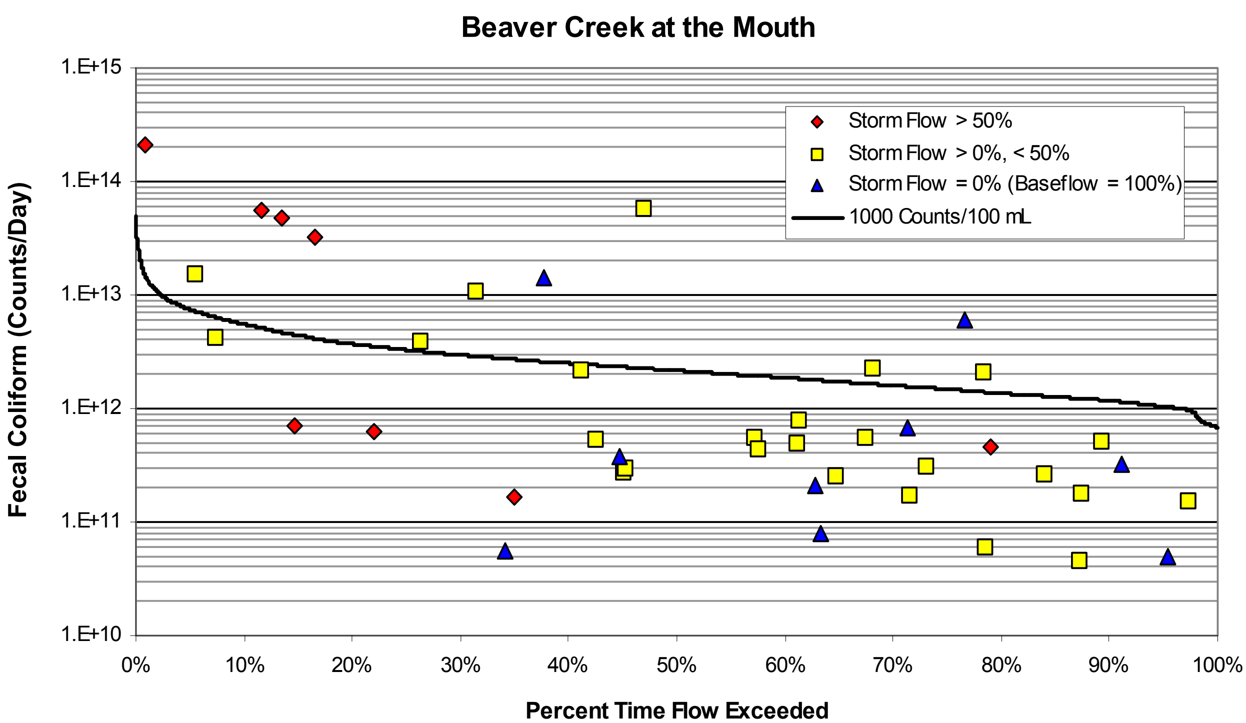

Figure G-2. Load Duration Curve – Fecal Coliform – Beaver Creek at Mile 1.0

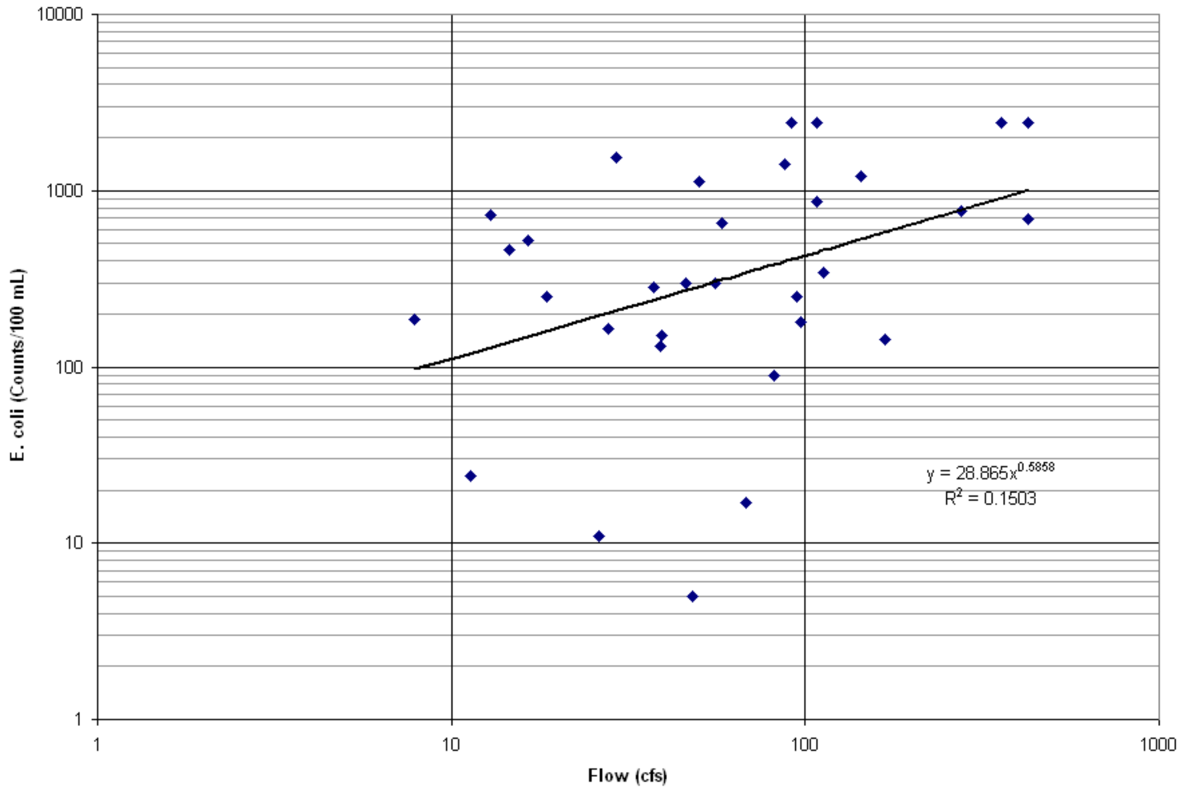

Figure G-3. E. coli vs Flow – Beaver Creek at Mile 1.0

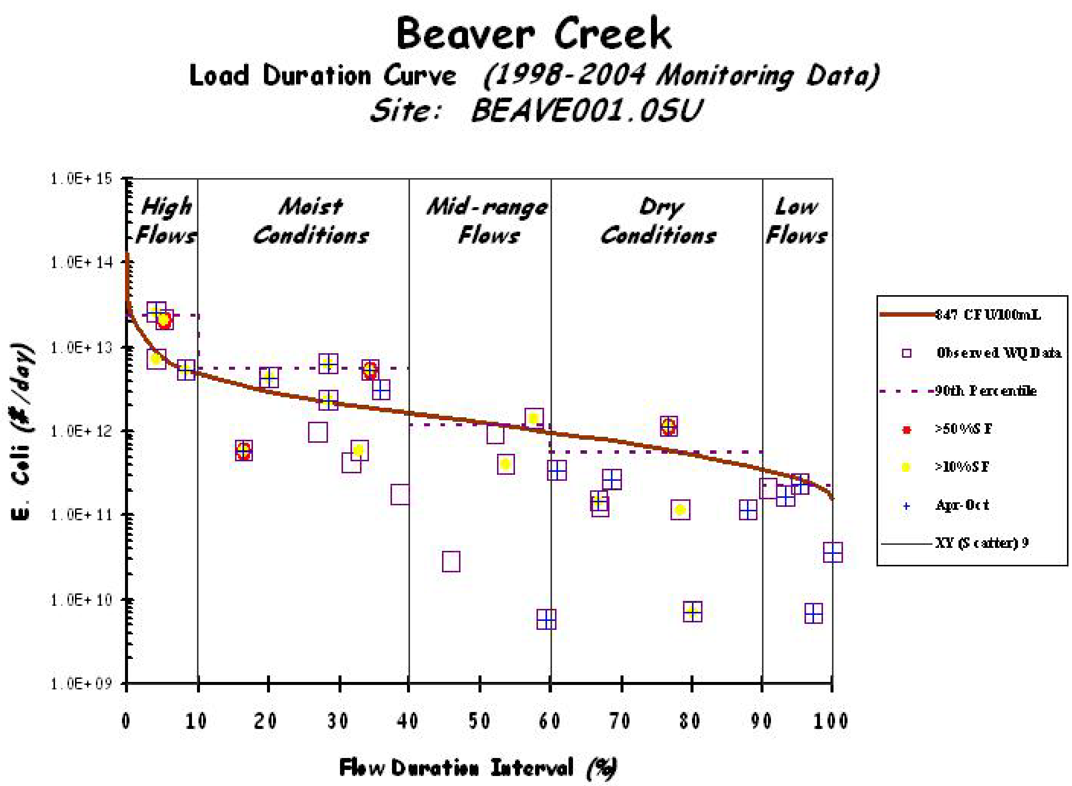

Figure G-4. Load Duration Curve -- E. coli – Beaver Creek at Mile 1.0