

## Appendix A. Reach and Watershed Characteristics.

**Table A1. Reach characteristics.**

Site*	Exclusion practice	Livestock type and density	Grazing area (ha)	Animal units (AU) <sup>†</sup>	Grazing density (AU/ha)	Grazing category
TC	None	30 head of cattle	26.86	27.6	1.03	heavy
	Fenced 2 years	4 horses	---	5.0	---	reference
SCA	None	20 head of cattle	23.46	18.4	0.78	rotational
	CREP 2 years	4 head of cattle	---	3.7	---	reference
SCB	None	15 head of cattle	18.19	13.8	0.76	light rotational
	CREP 4 years	20 cattle, 60 sheep, 3 horses, 2 turkeys, 13 chickens	---	34.2	---	reference
NF	None	60 head of cattle	30.33	55.2	1.82	heavy
	CREP 14 years	32 cows, 2 horses, 6 turkeys	---	32.0	---	reference
JC	None Forested	40 head of cattle none	39.51	36.8	0.93	heavy reference

\* TC – Tom’s Creek, SCA – Sinking Creek A, SCB – Sinking Creek B, NF – North Fork of the Roanoke River, JC – Johns Creek

<sup>†</sup> Values for animal units from National Range and Pasture Handbook (USDA-NRCS, 2003)

**Table A2. General watershed and location information for each reach (USGS, 1982; WBD, 2007).**

Site*	Paired Reaches	Stream Order <sup>†</sup>	Drainage area (km <sup>2</sup> )	Latitude °N	Longitude °W	Elevation (m)	Watershed slope (%)
TC	Grazed	3	25.69	37.2502	80.4485	586.4	4.0
	Exclusion	3	26.38	37.2492	80.4482	595.6	4.0
	% diff.	---	2.7	---	---	1.6	0.0
SCA	Grazed	3	40.46	37.4042	80.3103	699.8	1.2
	Exclusion	3	38.23	37.4075	80.3064	698.3	1.3
	% diff.	---	-5.5	---	---	-0.2	8.3
SCB	Grazed	4	107.20	37.3414	80.4162	629.4	0.9
	Exclusion	4	97.44	37.3441	80.4053	644.4	0.9
	% diff.	---	-9.1	---	---	2.4	0.0
NF	Grazed	4	105.78	37.2363	80.3588	446.2	1.4
	Exclusion	4	109.27	37.2321	80.3622	452.6	1.4
	% diff.	---	3.3	---	---	1.4	0.0
JC	Grazed	5	170.95	37.4845	80.2644	506.0	2.5
	Forested	5	166.53	37.4746	80.2640	500.8	2.5
	% diff.	---	-2.6	---	---	-1.0	0.0

\* TC – Tom’s Creek, SCA – Sinking Creek A, SCB – Sinking Creek B, NF – North Fork of the Roanoke River, JC – Johns Creek

<sup>†</sup>USGS (1:24,000) quad sheets were used to determine stream order. Blue line stream were considered 1<sup>st</sup> order.

**Table A3. Percent of general soil types for each study watershed (STATSGO, 2007)**

<b>Soil Type</b>	<b>TC*</b>	<b>SCA</b>	<b>SCB</b>	<b>NF</b>	<b>JC</b>
Berks-Weikert-Laidig	59.37	---	---	11.15	17.74
Carbo-Chilhowie-Frederick	---	---	---	61.25	---
Frederick-Carbo-Timberville	40.63	90.77	80.74	19.12	0.85
Moomaw-Jefferson-Alonzville	---	---	---	---	15.57
Shottower-Laidig-Weikert	---	---	---	---	9.34
Wallen-Dekalb-Drypond	---	9.23	19.26	8.48	56.49

\* TC – Tom’s Creek, SCA – Sinking Creek A, SCB – Sinking Creek B, NF – North Fork of the Roanoke River, JC – Johns Creek

**Table A4. Percent land use for each reach's watershed (RESAC, 2007)**

Site*	Grazed vs. Exclusion	Forest	Urban areas/ roads	Natural Grass	Open water/ Wetlands	Residential/ Developed	Pasture/ Hay	Croplands	Other
TC	Grazed	43.1	18.5	1.9	0.5	18.3	6.4	10.2	1.0
	Exclusion	43.8	18.3	2.1	0.5	17.9	6.3	10.1	1.0
	% diff.	1.6	-1.3	10.8	-2.6	-2.0	-2.1	-0.9	-2.6
SCA	Grazed	56.2	5.7	0.6	0.4	0.9	9.4	26.9	0.0
	Exclusion	56.7	5.8	0.6	0.4	0.8	9.0	26.7	0.0
	% diff.	0.9	2.0	5.8	5.8	-9.9	-4.1	-0.7	0.0
SCB	Grazed	58.3	8.1	1.6	0.2	1.2	8.6	21.8	0.1
	Exclusion	57.2	8.0	1.7	0.2	1.2	8.7	22.8	0.1
	% diff.	-1.8	-1.9	5.5	10.0	0.8	1.1	4.4	-3.6
NF	Grazed	60.9	6.3	1.6	0.2	4.9	7.9	18.0	0.1
	Exclusion	60.5	6.5	1.6	0.2	5.2	7.9	18.0	0.1
	% diff.	-0.7	3.5	-2.4	0.3	6.1	0.1	-0.4	-3.2
JC	Grazed	78.0	6.2	11.1	3.2	1.0	0.0	0.0	0.4
	Forested	78.0	6.4	10.9	3.3	1.1	0.0	0.0	0.4
	% diff.	0.0	1.8	-1.6	1.5	2.7	2.7	0.0	-6.1

\* TC – Tom’s Creek, SCA – Sinking Creek A, SCB – Sinking Creek B, NF – North Fork of the Roanoke River, JC – Johns Creek

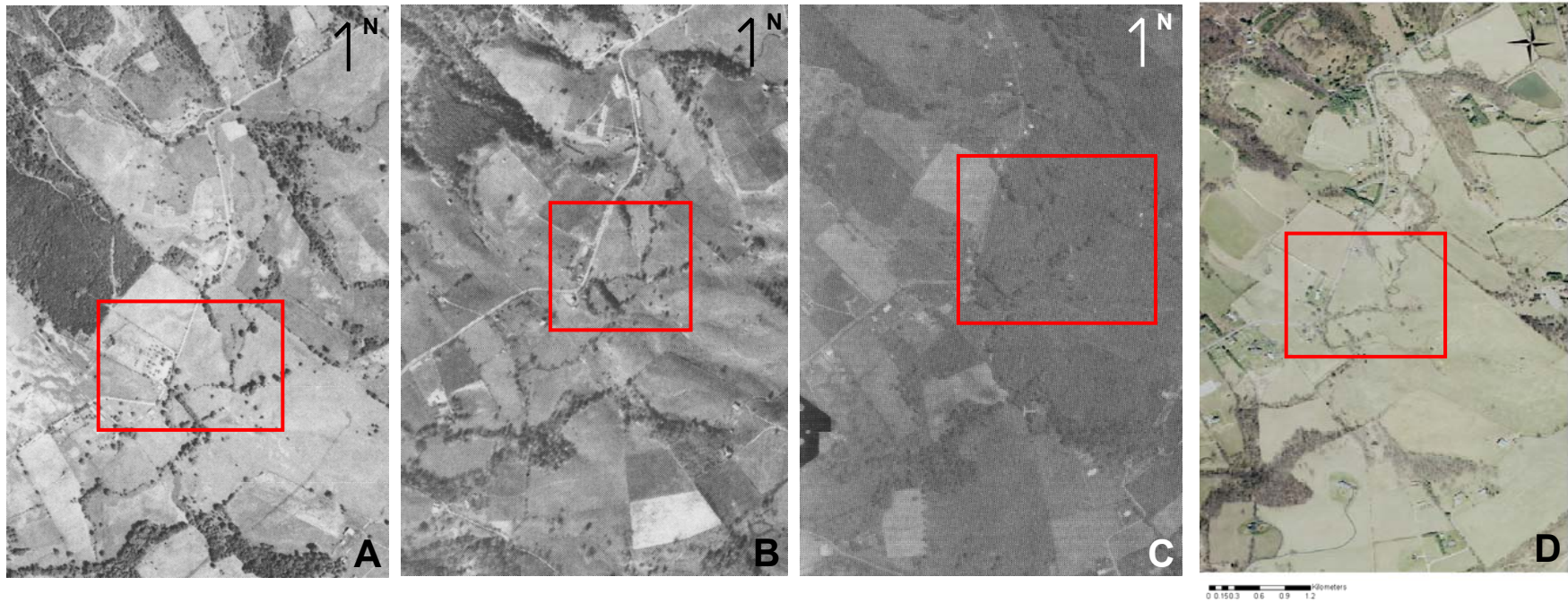
**Table A5. Percent land use for the 30.5-meter stream buffer in each reach's watershed (RESAC, 2007)**

Site*	Land use	Forest	Urban areas/ roads	Natural Grass	Open water/ Wetlands	Residential/ Developed	Pasture/ Hay	Croplands	Other
TC	Grazed	52.3	12.8	3.7	4.6	7.3	3.7	14.7	0.9
	Exclusion	52.2	12.4	3.5	4.4	7.1	3.5	15.9	0.9
	% diff.	-0.2	-3.5	-3.5	-3.5	-3.5	-3.5	8.5	-3.5
SCA	Grazed	45.4	11.3	0.7	1.4	1.4	7.1	32.6	0.0
	Exclusion	46.6	10.7	0.8	1.5	1.5	6.1	32.8	0.0
	% diff.	2.6	-5.8	7.6	7.6	7.6	-13.9	0.6	0.0
SCB	Grazed	58.6	9.7	2.0	0.9	0.7	5.3	22.9	0.0
	Exclusion	52.8	11.0	2.5	1.1	0.8	6.8	24.9	0.0
	% diff.	-9.8	13.0	28.2	28.2	28.2	28.2	8.7	0.0
NF	Grazed	57.8	10.3	1.4	0.0	5.7	6.9	17.8	0.0
	Exclusion	58.3	10.0	1.4	0.0	5.6	6.7	18.1	0.0
	% diff.	1.0	-3.3	-3.3	0.0	-3.3	-3.3	1.3	0.0
JC	Grazed	72.4	4.7	13.6	7.8	1.2	0.0	0.0	0.4
	Forested	73.1	4.9	12.2	8.2	1.2	0.0	0.0	0.4
	% diff.	1.0	4.9	-10.1	4.9	4.9	0.0	0.0	4.9

\* TC – Tom’s Creek, SCA – Sinking Creek A, SCB – Sinking Creek B, NF – North Fork of the Roanoke River, JC – Johns Creek

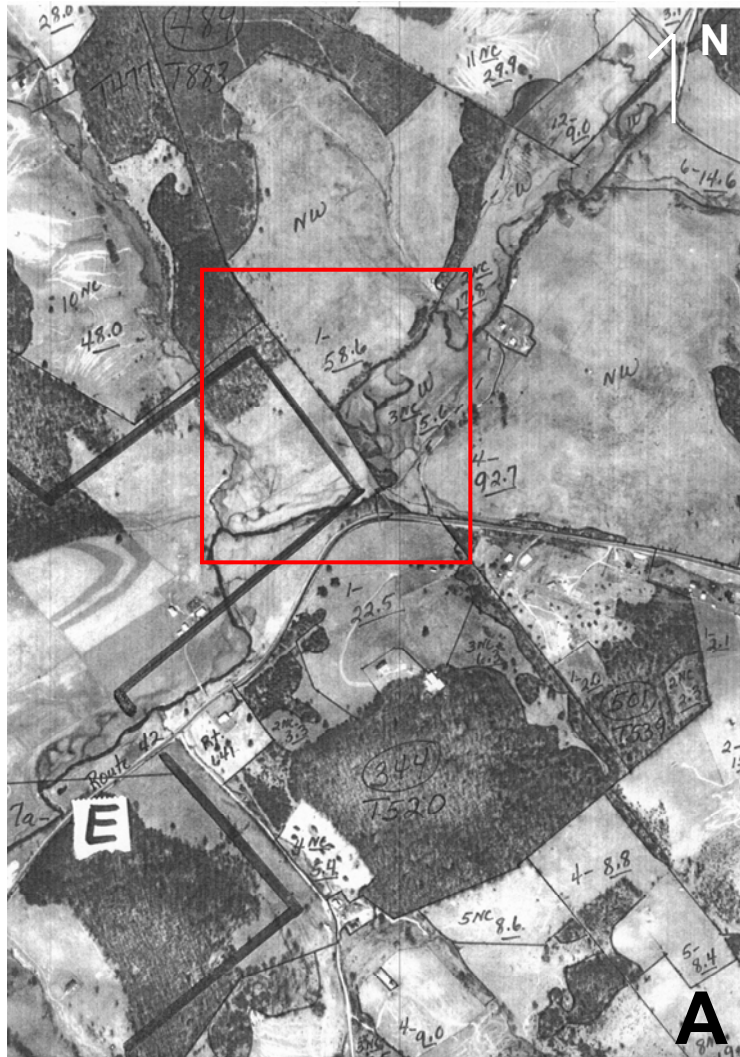
**Figure A1**

Historical aerial photos for the Tom's Creek site from 1954 (A), 1962 (B), 1971 (C), and 2004 (D) (USDA-NRCS, 2007)



**Figure A2**

Historical aerial photos for Upper Sinking Creek (A) site from 1988 (A) and 2004 (B) (USDA-NRCS, 2007)

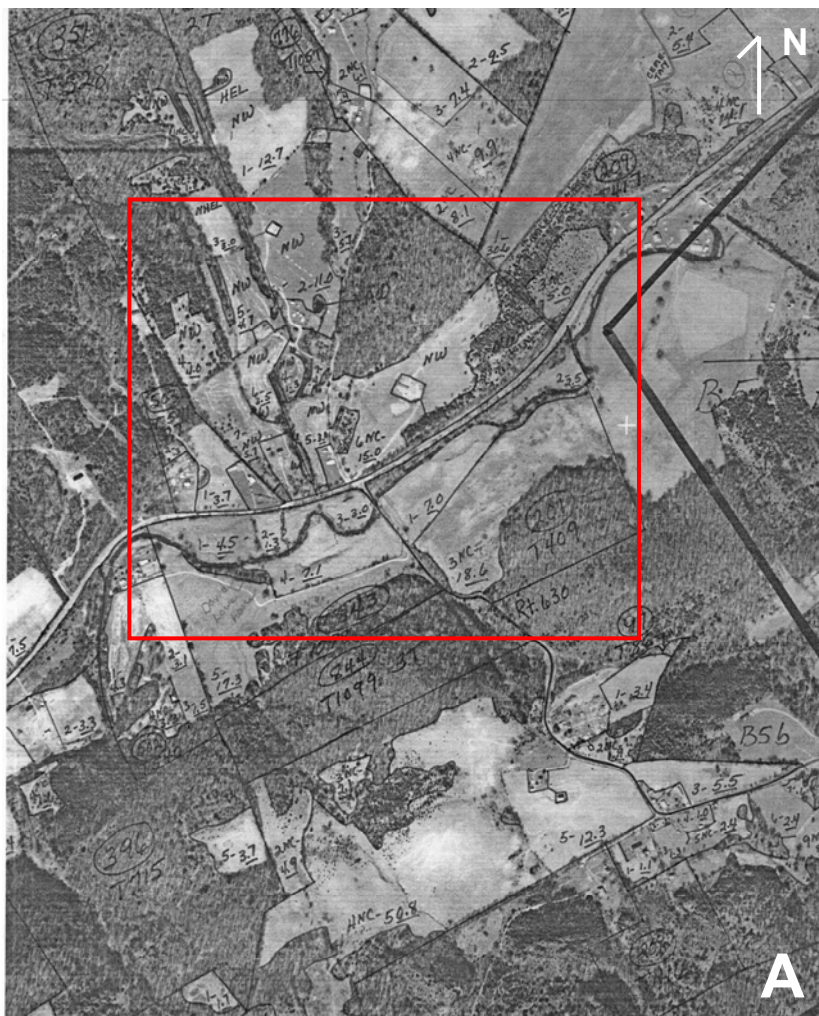


0 0.2 0.4 0.8 1.2 1.6 Kilometers

**Figure A3**

Historical aerial photos for the Lower Sinking Creek (B) site from 1988 (A) and 2004 (B) (USDA-NRCS, 2007)

87

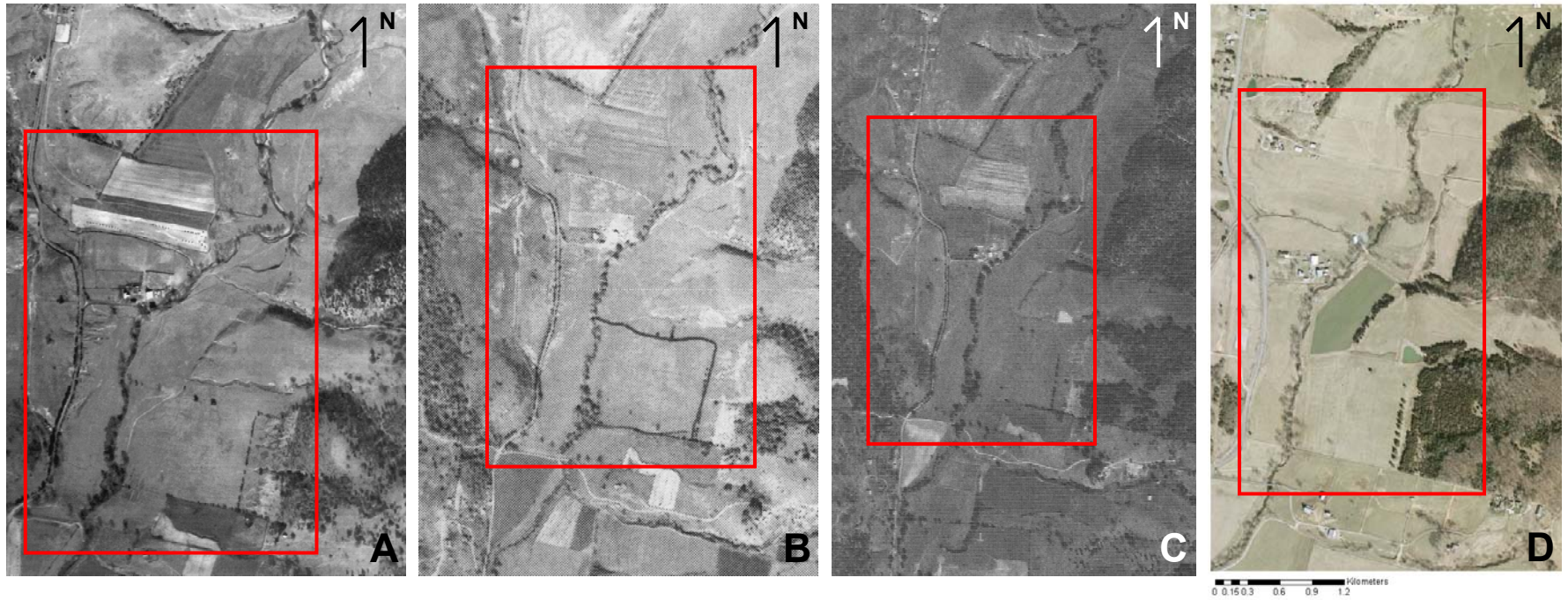


0 0.2 0.4 0.8 1.2 1.6 Kilometers



**Figure A4**

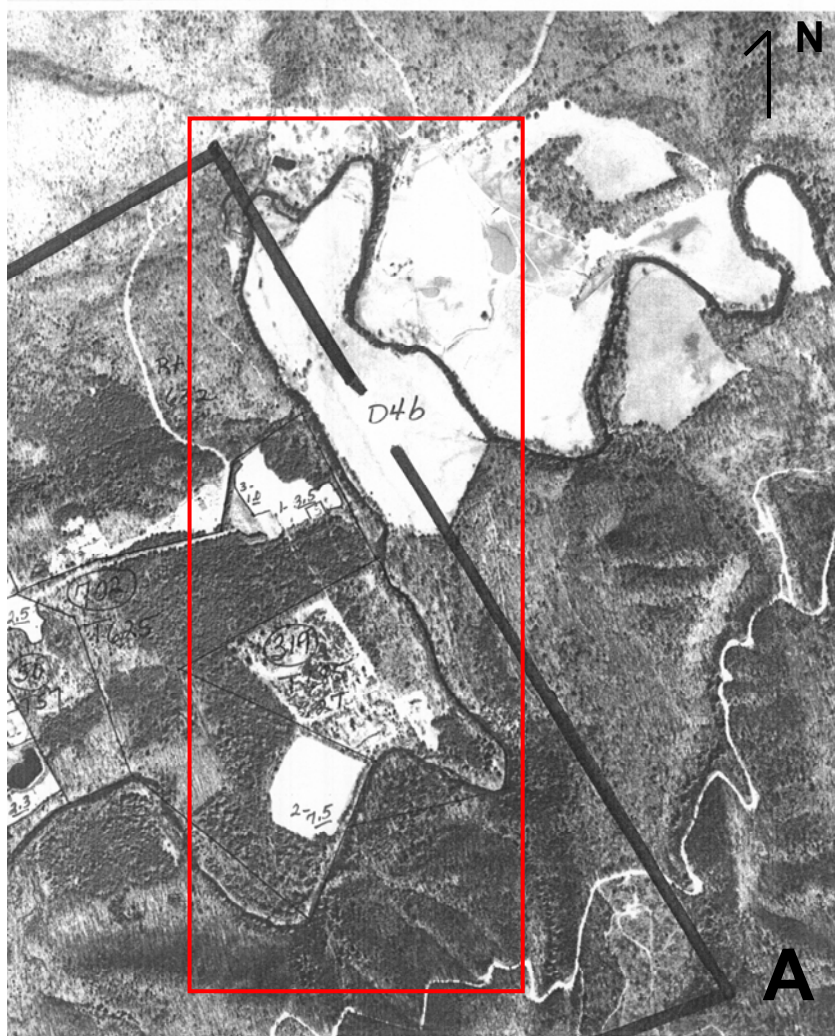
Historical aerial photos for the North Fork of the Roanoke River site from 1954 (A), 1962 (B), 1971 (C), and 2004 (D) (USDA-NRCS, 2007)



**Figure A5**

Historical aerial photos for Johns Creek from 1988 (A) and 2004 (B) (USDA-NRCS, 2007)

89



0 0.3 0.6 1.2 1.8 2.4 Kilometers

## **Appendix B. Rapid Geomorphic Assessment Field Data Sheets**

## Stream Assessment Field Form (Form 1)

Project Name and JPA Number:	
Stream ID: <u>TC1</u>	Date: <u>11/16/06</u>
Reach ID: <u>TC1</u>	HUC:
Reach Length:	Locality:
Evaluators:	

**A Man-Made Channels.** (Circle the assigned SQF)

- |   |                            |   |
|---|----------------------------|---|
| 1. Culvert (except bottomless) → 0        | 4. Open Channel – riprap → | <b>Apply<br/>Natural<br/>Channel<br/>Assessment<br/>Methodology</b> |
| 2. Open Channel - concrete → 0.25         | 5. No hardened bottom →    |   |
| 3. Open Channel – gabions or blocks → 0.5 | 6. Naturalized →           |   |

**B Natural Channel Methodology**

Evaluate the following parameters using the definitions provided in Sections 1.2.1 - 1.2.4.

**1. Channel Condition**

**2. Riparian Buffer**

	<u>L Inner</u>	<u>L Outer</u>	<u>L Bank</u>	<u>R Inner</u>	<u>R Outer</u>	<u>R Bank</u>	<u>Overall</u>
<input type="radio"/> Severe							
<input checked="" type="radio"/> Poor <u>0.5</u>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Poor
<input type="radio"/> Marginal	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/> Marginal <u>0.5</u>
<input type="radio"/> Suboptimal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Suboptimal
<input type="radio"/> Optimal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Optimal

**3. In-Stream Habitat**

- High Gradient
- Low Gradient
- Poor
- Marginal 0.8
- Optimal

**4. Channel Alteration**

- Severe
- Moderate 0.5
- Minor
- Negligible

**C Calculations** After evaluating the parameters, use the RCI Flow Charts to determine the RCI, & Table 3 to determine the Stream Quality & SQF.

Reach Condition Index (RCI) (0 - 7) = 2.1  
 Stream Quality = marginal  
 Stream Quality Factor (SQF) = 1.2

*Pg. 32*

**D** Attach properly labeled, representative photos of the assessment reach.

**Notes:**

*Summarize the information for all assessment reaches on FORM 2*

## Stream Assessment Field Form (Form 1)

Project Name and JPA Number:	
Stream ID: TC2	Date: 11/17/00
Reach ID:	HUC:
Reach Length:	Locality:
Evaluators:	

**A Man-Made Channels.** (Circle the assigned SQF)

- |   |                            |   |
|---|----------------------------|---|
| 1. Culvert (except bottomless) → 0        | 4. Open Channel – riprap → | <b>Apply<br/>Natural<br/>Channel<br/>Assessment<br/>Methodology</b> |
| 2. Open Channel - concrete → 0.25         | 5. No hardened bottom →    |   |
| 3. Open Channel – gabions or blocks → 0.5 | 6. Naturalized →           |   |

**B Natural Channel Methodology**

Evaluate the following parameters using the definitions provided in Sections 1.2.1 - 1.2.4.

**1. Channel Condition**

**2. Riparian Buffer**

	<i>L Inner</i>	<i>L Outer</i>	<u><i>L Bank</i></u>	<i>R Inner</i>	<i>R Outer</i>	<u><i>R Bank</i></u>	<u><b>Overall</b></u>
<input type="radio"/> Severe							<input type="radio"/> Poor
<input type="radio"/> Poor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Poor
<input checked="" type="radio"/> Marginal	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/> Marginal
<input type="radio"/> Suboptimal	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/> Suboptimal
<input type="radio"/> Optimal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Optimal

**3. In-Stream Habitat**

- High Gradient
- Low Gradient
- Poor
- Marginal
- Optimal

**4. Channel Alteration**

- Severe
- Moderate
- Minor
- Negligible

**C Calculations** After evaluating the parameters, use the RCI Flow Charts to determine the RCI, & Table 3 to determine the Stream Quality & SQF.

Reach Condition Index (RCI) ( 0 - 7 ) = 3.4  
 Stream Quality = marginal  
 Stream Quality Factor (SQF) = 1.2

**D** Attach properly labeled, representative photos of the assessment reach.

**Notes:**

Summarize the information for all assessment reaches on FORM 2

## Stream Assessment Field Form (Form 1)

Project Name and JPA Number:	
Stream ID:	Date: 11/19/06
Reach ID: SCA1	HUC:
Reach Length:	Locality:
Evaluators:	

**A Man-Made Channels.** (Use the assigned SQF)

- |   |   |
|---|---|
| 1. Culvert (except bottomless) → 0        | 4. Open Channel – riprap → <b>Apply</b> |
| 2. Open Channel - concrete → 0.25         | 5. No hardened bottom → <b>Natural</b>  |
| 3. Open Channel – gabions or blocks → 0.5 | 6. Naturalized → <b>Assessment</b>      |
|   | <b>Methodology</b>                      |

**B Natural Channel Methodology**

Evaluate the following parameters using the definitions provided in Sections 1.2.1 - 1.2.4.

**1. Channel Condition**

**2. Riparian Buffer**

	L Inner	L Outer	L Bank	R Inner	R Outer	R Bank	<b>Overall</b>
<input type="radio"/> Severe							
<input type="radio"/> Poor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Poor
<input checked="" type="radio"/> Marginal	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/> Marginal
<input type="radio"/> Suboptimal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Suboptimal
<input type="radio"/> Optimal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Optimal

**3. Instream Habitat**

High Gradient

Low Gradient

Poor

Marginal

Optimal

**4. Channel Alteration**

Severe

Moderate

Minor

Negligible/None

**C Calculations** After evaluating the parameters, use the RCI Flow Charts to determine the RCI, & Table 3 to determine the Stream Quality & SQF.

Reach Condition Index (RCI) (0 - 7) = 2.9

Stream Quality = marginal

Stream Quality Factor (SQF) = 1.2

**D** Attach properly labeled, representative photos of the assessment reach.

Notes:

Summarize the information for all assessment reaches on FORM 2

## Stream Assessment Field Form (Form 1)

Project Name and JPA Number:	
Stream ID:	Date: 11/19/06
Reach ID: SCAZ	HUC:
Reach Length:	Locality:
Evaluators:	

**A Man-Made Channels.** (Use the assigned SQF)

- |   |   |
|---|---|
| 1. Culvert (except bottomless) → 0        | 4. Open Channel – riprap → <b>Apply</b> |
| 2. Open Channel - concrete → 0.25         | 5. No hardened bottom → <b>Natural</b>  |
| 3. Open Channel – gabions or blocks → 0.5 | 6. Naturalized → <b>Channel</b>         |
|   | <b>Assessment</b>                       |
|   | <b>Methodology</b>                      |

**B Natural Channel Methodology**

Evaluate the following parameters using the definitions provided in Sections 1.2.1 - 1.2.4.

**1. Channel Condition**

**2. Riparian Buffer**

	<i>L Inner</i>	<i>L Outer</i>	<u><i>L Bank</i></u>	<i>R Inner</i>	<i>R Outer</i>	<u><i>R Bank</i></u>	<b><u>Overall</u></b>
<input type="radio"/> Severe							
<input type="radio"/> Poor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Poor
<input type="radio"/> Marginal	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Marginal
<input checked="" type="radio"/> Suboptimal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/> Suboptimal
<input type="radio"/> Optimal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Optimal

**3. Instream Habitat**

- High Gradient
- Low Gradient
- Poor
- Marginal
- Optimal

**4. Channel Alteration**

- Severe
- Moderate
- Minor
- Negligible/None

**C Calculations** After evaluating the parameters, use the RCI Flow Charts to determine the RCI, & Table 3 to determine the Stream Quality & SQF.

Reach Condition Index (RCI) (0 - 7) = 4.2  
 Stream Quality = suboptimal  
 Stream Quality Factor (SQF) = 1.3

**D** Attach properly labeled, representative photos of the assessment reach.

Notes:

Summarize the information for all assessment reaches on FORM 2

## Stream Assessment Field Form (Form 1)

Project Name and JPA Number:	
Stream ID: <u>30B1</u>	Date: <u>11/21/06</u>
Reach ID:	HUC:
Reach Length:	Locality:
Evaluators:	

**A Man-Made Channels.** (Circle the assigned SQF)

- |   |                            |   |
|---|----------------------------|---|
| 1. Culvert (except bottomless) → 0        | 4. Open Channel – riprap → | <b>Apply<br/>Natural<br/>Channel<br/>Assessment<br/>Methodology</b> |
| 2. Open Channel - concrete → 0.25         | 5. No hardened bottom →    |   |
| 3. Open Channel – gabions or blocks → 0.5 | 6. Naturalized →           |   |

**B Natural Channel Methodology**

Evaluate the following parameters using the definitions provided in Sections 1.2.1 - 1.2.4.

**1. Channel Condition**

**2. Riparian Buffer**

	L Inner	L Outer	L Bank	R Inner	R Outer	R Bank	<b>Overall</b>
<input type="radio"/> Severe							<input type="radio"/> Severe
<input type="radio"/> Poor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Poor
<input checked="" type="radio"/> Marginal <u>1.3</u>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/> Marginal <u>0.5</u>
<input type="radio"/> Suboptimal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Suboptimal
<input type="radio"/> Optimal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Optimal

**3. In-Stream Habitat**

- High Gradient
- Low Gradient
- Poor
- Marginal 0.8
- Optimal

**4. Channel Alteration**

- Severe
- Moderate 0.3
- Minor
- Negligible

**C Calculations** After evaluating the parameters, use the RCI Flow Charts to determine the RCI, & Table 3 to determine the Stream Quality & SQF.

Reach Condition Index (RCI) ( 0 - 7) = 29  
 Stream Quality = marginal  
 Stream Quality Factor (SQF) = 1.2

**D** Attach properly labeled, representative photos of the assessment reach.

**Notes:**

*Summarize the information for all assessment reaches on FORM 2*



## Stream Assessment Field Form (Form 1)

Project Name and JPA Number:	
Stream ID: <u>SCB2</u>	Date: <u>11/20/06</u>
Reach ID:	HUC:
Reach Length:	Locality:
Evaluators:	

**A Man-Made Channels.** (Circle the assigned SQF)

- |   |                            |   |
|---|----------------------------|---|
| 1. Culvert (except bottomless) → 0        | 4. Open Channel – riprap → | <b>Apply<br/>Natural<br/>Channel<br/>Assessment<br/>Methodology</b> |
| 2. Open Channel - concrete → 0.25         | 5. No hardened bottom →    |   |
| 3. Open Channel – gabions or blocks → 0.5 | 6. Naturalized →           |   |

**B Natural Channel Methodology**

Evaluate the following parameters using the definitions provided in Sections 1.2.1 - 1.2.4.

**1. Channel Condition**

**2. Riparian Buffer**

	<i>L Inner</i>	<i>L Outer</i>	<u><i>L Bank</i></u>	<i>R Inner</i>	<i>R Outer</i>	<u><i>R Bank</i></u>	<u><b>Overall</b></u>
<input type="radio"/> Severe							
<input type="radio"/> Poor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Poor
<input type="radio"/> Marginal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Marginal
<input checked="" type="radio"/> Suboptimal	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/> Suboptimal
<input type="radio"/> Optimal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/> Optimal

**3. In-Stream Habitat**

- High Gradient
- Low Gradient
- Poor
- Marginal
- Optimal

**4. Channel Alteration**

- Severe
- Moderate
- Minor
- Negligible

**C Calculations** After evaluating the parameters, use the RCI Flow Charts to determine the RCI, & Table 3 to determine the Stream Quality & SQF.

Reach Condition Index (RCI) (0 - 7) = 4.2  
 Stream Quality = Suboptimal  
 Stream Quality Factor (SQF) = 1.3

**D** Attach properly labeled, representative photos of the assessment reach.

Notes:

Summarize the information for all assessment reaches on FORM 2

## Stream Assessment Field Form (Form 1)

Project Name and JPA Number:	
Stream ID:	Date: 11/20/06
Reach ID: NFI	HUC:
Reach Length:	Locality:
Evaluators:	

**A Man-Made Channels.** (Circle the assigned SQF)

- |   |                            |   |
|---|----------------------------|---|
| 1. Culvert (except bottomless) → 0        | 4. Open Channel – riprap → | <b>Apply<br/>Natural<br/>Channel<br/>Assessment<br/>Methodology</b> |
| 2. Open Channel - concrete → 0.25         | 5. No hardened bottom →    |   |
| 3. Open Channel – gabions or blocks → 0.5 | 6. Naturalized →           |   |

**B Natural Channel Methodology**

*Evaluate the following parameters using the definitions provided in Sections 1.2.1 - 1.2.4.*

**1. Channel Condition**

**2. Riparian Buffer**

	<i>L Inner</i>	<i>L Outer</i>	<u><i>L Bank</i></u>	<i>R Inner</i>	<i>R Outer</i>	<u><i>R Bank</i></u>	<b><u>Overall</u></b>
<input type="radio"/> Severe							
<input checked="" type="radio"/> Poor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Poor
<input type="radio"/> Marginal	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/> Marginal
<input type="radio"/> Suboptimal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Suboptimal
<input type="radio"/> Optimal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Optimal

**3. In-Stream Habitat**

- High Gradient
- Low Gradient
- Poor
- Marginal
- Optimal

**4. Channel Alteration**

- Severe
- Moderate
- Minor
- Negligible

**C Calculations** After evaluating the parameters, use the RCI Flow Charts to determine the RCI, & Table 3 to determine the Stream Quality & SQF.

Reach Condition Index (RCI) ( 0 - 7 ) = 1.3  
 Stream Quality = Poor  
 Stream Quality Factor (SQF) = 1.1

**D** Attach properly labeled, representative photos of the assessment reach.

**Notes:**

*Summarize the information for all assessment reaches on FORM 2*

## Stream Assessment Field Form (Form 1)

Project Name and JPA Number:	
Stream ID:	Date: 11/20/06
Reach ID: NF2	HUC:
Reach Length:	Locality:
Evaluators:	

**A Man-Made Channels.** (Circle the assigned SQF)

- |   |                            |   |
|---|----------------------------|---|
| 1. Culvert (except bottomless) → 0        | 4. Open Channel – riprap → | <b>Apply<br/>Natural<br/>Channel<br/>Assessment<br/>Methodology</b> |
| 2. Open Channel - concrete → 0.25         | 5. No hardened bottom →    |   |
| 3. Open Channel – gabions or blocks → 0.5 | 6. Naturalized →           |   |

**B Natural Channel Methodology**

Evaluate the following parameters using the definitions provided in Sections 1.2.1 - 1.2.4.

**1. Channel Condition**

**2. Riparian Buffer**

	L Inner	L Outer	<u>L Bank</u>	R Inner	R Outer	<u>R Bank</u>	<u>Overall</u>
<input type="radio"/> Severe							<input type="radio"/> Poor
<input type="radio"/> Poor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Marginal
<input type="radio"/> Marginal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/> Suboptimal
<input checked="" type="radio"/> Suboptimal	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/> Optimal
<input type="radio"/> Optimal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

**3. In-Stream Habitat**

- High Gradient
- Low Gradient
- Poor
- Marginal
- Optimal

**4. Channel Alteration**

- Severe
- Moderate
- Minor
- Negligible

**C Calculations** After evaluating the parameters, use the RCI Flow Charts to determine the RCI, & Table 3 to determine the Stream Quality & SQF.

Reach Condition Index (RCI) (0 - 7) = 4.2  
 Stream Quality = suboptimal  
 Stream Quality Factor (SQF) = 1.3

**D** Attach properly labeled, representative photos of the assessment reach.

**Notes:**

Summarize the information for all assessment reaches on FORM 2

## Stream Assessment Field Form (Form 1)

Project Name and JPA Number:	
Stream ID:	Date: 11/21/06
Reach ID: JCI	HUC:
Reach Length:	Locality:
Evaluators:	

**A Man-Made Channels.** (Circle the assigned SQF)

- |   |                            |
|---|----------------------------|
| 1. Culvert (except bottomless) → 0        | 4. Open Channel – riprap → |
| 2. Open Channel - concrete → 0.25         | 5. No hardened bottom →    |
| 3. Open Channel – gabions or blocks → 0.5 | 6. Naturalized →           |
- Apply Natural Channel Assessment Methodology**

**B Natural Channel Methodology**

Evaluate the following parameters using the definitions provided in Sections 1.2.1 - 1.2.4.

**1. Channel Condition**

**2. Riparian Buffer**

	L Inner	L Outer	L Bank	R Inner	R Outer	R Bank	Overall
<input type="radio"/> Severe							
<input checked="" type="radio"/> Poor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Poor
<input type="radio"/> Marginal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/> Marginal
<input type="radio"/> Suboptimal	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Suboptimal
<input type="radio"/> Optimal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Optimal

**3. In-Stream Habitat**

- High Gradient
- Low Gradient
- Poor
- Marginal
- Optimal

**4. Channel Alteration**

- Severe
- Moderate
- Minor
- Negligible

**C Calculations** After evaluating the parameters, use the RCI Flow Charts to determine the RCI, & Table 3 to determine the Stream Quality & SQF.

Reach Condition Index (RCI) (0 - 7) = 2.1  
 Stream Quality = marginal  
 Stream Quality Factor (SQF) = 1.2

**D** Attach properly labeled, representative photos of the assessment reach.

**Notes:**

*Summarize the information for all assessment reaches on FORM 2*

## Stream Assessment Field Form (Form 1)

Project Name and JPA Number:	
Stream ID:	Date: 11/21/06
Reach ID: JCA	HUC:
Reach Length:	Locality:
Evaluators:	

**A Man-Made Channels.** (Circle the assigned SQF)

- |   |                            |   |
|---|----------------------------|---|
| 1. Culvert (except bottomless) → 0        | 4. Open Channel – riprap → | <b>Apply<br/>Natural<br/>Channel<br/>Assessment<br/>Methodology</b> |
| 2. Open Channel - concrete → 0.25         | 5. No hardened bottom →    |   |
| 3. Open Channel – gabions or blocks → 0.5 | 6. Naturalized →           |   |

**B Natural Channel Methodology**

Evaluate the following parameters using the definitions provided in Sections 1.2.1 - 1.2.4.

**1. Channel Condition**

**2. Riparian Buffer**

		L Inner	L Outer	<u>L Bank</u>	R Inner	R Outer	<u>R Bank</u>	<u>Overall</u>
<input type="radio"/> Severe				<input type="radio"/>			<input type="radio"/>	<input type="radio"/> Poor
<input type="radio"/> Poor		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Marginal
<input type="radio"/> Marginal		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Suboptimal
<input type="radio"/> Suboptimal		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Suboptimal
<input checked="" type="radio"/> Optimal		<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/> Optimal

**3. In-Stream Habitat**

- High Gradient
- Low Gradient
- Poor
- Marginal
- Optimal

**4. Channel Alteration**

- Severe
- Moderate
- Minor
- Negligible

**C Calculations** After evaluating the parameters, use the RCI Flow Charts to determine the RCI, & Table 3 to determine the Stream Quality & SQF.

Reach Condition Index (RCI) (0 - 7) = 5.8  
 Stream Quality = optimal  
 Stream Quality Factor (SQF) = 1.5

**D** Attach properly labeled, representative photos of the assessment reach.

Notes:

*Summarize the information for all assessment reaches on FORM 2*

## Appendix C. Survey and Pebble Count Data Analysis

**Table C1. Meander width, wavelength, entrenchment category, Rosgen stream type (Rosgen, 1998), and Reach Condition Index (USEPA and VDEQ 2006).**

Site*	Grazed vs. Exclusion	Meander width (m)	Wavelength (m)	Entrenchment Category	Rosgen stream type	RCI
TC	Grazed	15.7	65.6	slightly entrenched	C4	2.1
	Exclusion	174.0	471.8	slightly entrenched	E4	3.4
	% diff.	1011.2	619.4	---	---	61.9
SCA	Grazed	18.8	207.1	slightly entrenched	C4	2.9
	Exclusion	64.7	217.1	slightly entrenched	C4	4.2
	% diff.	243.5	4.8	---	---	44.8
SCB	Grazed	93.0	403.7	entrenched	F4	2.9
	Exclusion	37.4	157.2	slightly entrenched	C4	4.2
	% diff.	-59.7	-61.1	---	---	44.8
NF	Grazed	410.0	246.2	slightly entrenched	C4	1.3
	Exclusion	26.0	158.2	slightly entrenched	C4	4.2
	% diff.	-93.6	-35.7	---	---	223.1
JC	Grazed	139.1	217.1	slightly entrenched	C4	2.1
	Exclusion	295.1	564.0	slightly entrenched	C4	5.8
	% diff.	112.1	159.8	---	---	176.2

\* TC – Tom’s Creek, SCA – Sinking Creek A, SCB – Sinking Creek B, NF – North Fork of the Roanoke River, JC – Johns Creek

Summary of Longitudinal Survey data

**Table C2. Water surface and bed slope, straight line distance, thalweg length, sinuosity, and large woody debris count (LWD) for each study reach.**

Site*	Grazed vs. Exclusion	Water Surface Slope (%)	Bed Slope (%)	Straight Line distance (m)	Thalweg length (m)	Sinuosity	LWD
TC	Grazed	0.15	0.17	147.53	237.02	1.61	11
	Exclusion	0.27	0.31	110.76	159.81	1.44	8
	% diff.	88	87	-25	-33	-10	-27
SCA	Grazed	0.15	0.17	186.22	201.33	1.08	5
	Exclusion	0.20	0.19	106.00	116.97	1.10	7
	% diff.	34	13	-43	-42	2	40
SCB	Grazed	0.32	0.33	130.70	142.93	1.09	7
	Exclusion	0.24	0.30	170.20	198.65	1.17	0
	% diff.	-24	-10	30	39	7	-100
NF	Grazed	0.34	0.30	112.57	174.23	1.55	12
	Exclusion	0.33	0.30	233.56	267.20	1.14	4
	% diff.	-2	0	107	53	-26	-67
JC	Grazed	0.24	0.26	202.72	420.99	2.08	26
	Exclusion	0.18	0.21	168.36	184.25	1.09	8
	% diff.	-26	-18	-17	-56	-47	-69

\* TC – Tom’s Creek, SCA – Sinking Creek A, SCB – Sinking Creek B, NF – North Fork of the Roanoke River, JC – Johns Creek

**Table C3. Length, average, percent, and number of riffles and pools in each study reach.**

Site*	Grazed vs. Exclusion	Total length of riffles (m)	Total length of pools (m)	Average length of riffles (m)	Average length of pools (m)	Percent riffles (%)	Percent pools (%)	No. of riffles	No. of pools
TC	Grazed	50.9	186.1	10.2	37.2	21.5	78.5	5	5
	Exclusion	104.5	53.2	26.1	17.7	66.3	33.7	3	4
	% diff.	105	-71	157	-52	209	-57	-40	-20
SCA	Grazed	58.7	142.6	19.6	47.5	29.2	70.8	3	3
	Exclusion	64.8	52.2	21.6	17.4	55.4	44.6	3	3
	% diff.	10	-63	10	-63	90	-37	0	0
SCB	Grazed	64.6	78.3	21.5	26.1	45.2	54.8	3	3
	Exclusion	106.1	92.6	26.5	30.9	53.4	46.6	4	3
	% diff.	64	18	23	18	18	-15	33	0
NF	Grazed	81.6	92.6	20.0	2.7	46.8	53.2	3	3
	Exclusion	120.9	146.3	40.3	48.8	45.2	54.8	3	3
	% diff.	48	58	102	1680	-3	3	0	0
JC	Grazed	102.3	318.7	34.1	106.2	24.3	75.7	3	3
	Forested	101.8	82.4	50.9	41.2	55.3	44.7	2	2
	% diff.	-0	-74	49	-61	128	-41	-33	-33

\* TC – Tom’s Creek, SCA – Sinking Creek A, SCB – Sinking Creek B, NF – North Fork of the Roanoke River, JC – Johns Creek



**Table C4. Average and standard deviation of thalweg depth, average and maximum pool depth, and average bed slope of riffles in each study reach.**

Site*	Grazed vs. Exclusion	Average thalweg depth (m)	Standard deviation thalweg depth	Average pool depth (m)	Maximum pool depth (m)	Average bed slope of riffles (%)
TC	Grazed	0.21	0.12	0.43	0.52	2.08
	Exclusion	0.20	0.09	0.42	0.50	1.29
	% diff.	-4	-22	-3	-5	-38
SCA	Grazed	0.29	0.11	0.36	0.43	0.89
	Exclusion	0.24	0.09	0.45	0.67	0.84
	% diff.	-16	-21	24	57	-5
SCB	Grazed	0.34	0.13	0.49	0.66	1.72
	Exclusion	0.26	0.16	6.30	0.67	-0.47
	% diff.	-23	21	1191	2	-127
NF	Grazed	0.43	0.31	0.73	0.92	1.84
	Exclusion	0.34	0.34	0.73	0.85	0.73
	% diff.	-20	8	-0	-8	-60
JC	Grazed	0.61	0.30	1.03	1.49	0.95
	Exclusion	0.41	0.24	0.79	0.80	0.91
	% diff.	-32	-19	-23	-46	-4

\* TC – Tom’s Creek, SCA – Sinking Creek A, SCB – Sinking Creek B, NF – North Fork of the Roanoke River, JC – Johns Creek

Summary of cross-sectional data for each reach

**Table C5. Average bankfull cross-section data for two riffles and two pools in each study reach.**

Site*	Grazed vs. Exclusion	Cross-section area (m <sup>2</sup> )	Width (m)	Mean depth (m)	Max depth (m)	Wetted perimeter (m)	Hyd. radius (m)	Width-depth ratio
TC	Grazed	6.40	8.95	0.70	0.97	9.54	0.65	13.1
	Exclusion	4.23	5.38	0.79	0.97	6.32	0.67	7.0
	% diff.	-34	-40	13	0	-34	3	-46
SCA	Grazed	3.90	9.07	0.44	0.73	9.44	0.42	21.8
	Exclusion	2.65	5.62	0.47	0.64	6.06	0.43	12.2
	% diff.	-32	-38	6	-12	-36	3	-44
SCB	Grazed	9.44	15.23	0.62	0.87	15.48	0.60	25.0
	Exclusion	8.26	13.60	0.63	0.87	13.97	0.61	23.5
	% diff.	-13	-11	2	0	-10	1	-6
NF	Grazed	8.12	12.17	0.69	1.26	12.94	0.64	19.7
	Exclusion	10.33	13.40	0.80	1.18	13.92	0.76	19.4
	% diff.	27	10	15	-6	8	18	-1
JC	Grazed	10.12	12.45	0.90	1.32	13.53	0.77	16.9
	Forested	17.95	17.06	1.05	1.32	18.02	0.99	16.5
	% diff.	77	37	17	0	33	28	-2

\* TC – Tom’s Creek, SCA – Sinking Creek A, SCB – Sinking Creek B, NF – North Fork of the Roanoke River, JC – Johns Creek

**Table C6. Average bankfull cross-section data for two riffles in each study reach.**

<b>Site*</b>	<b>Grazed vs. Exclusion</b>	<b>Cross-section area (m<sup>2</sup>)</b>	<b>Width (m)</b>	<b>Mean depth (m)</b>	<b>Max depth (m)</b>	<b>Wetted perimeter (m)</b>	<b>Hyd. radius (m)</b>	<b>Width -depth ratio</b>
TC	Grazed	5.99	9.84	0.59	0.81	10.18	0.57	16.39
	Exclusion	3.59	5.43	0.66	0.83	6.13	0.59	8.21
	% diff.	-40	-45	12	3	-40	2	-50
SCA	Grazed	3.46	9.46	0.37	0.65	9.75	0.36	26.13
	Exclusion	2.04	4.93	0.41	0.55	5.30	0.38	12.00
	% diff.	-41	-48	10	-15	-46	6	-54
SCB	Grazed	8.88	15.74	0.55	0.73	15.91	0.54	28.39
	Exclusion	8.09	14.39	0.56	0.67	14.72	0.55	25.65
	% diff.	-9	-9	3	-9	-7	2	-10
NF	Grazed	7.92	14.14	0.55	1.08	14.84	0.53	26.80
	Exclusion	8.67	14.75	0.59	0.85	15.13	0.58	26.72
	% diff.	9	4	7	-21	2	10	0
JC	Grazed	9.05	14.65	0.59	0.85	15.40	0.57	24.05
	Forested	15.23	16.82	0.91	1.16	17.63	0.86	18.59
	% diff.	68	15	52	36	15	53	-23

\* TC – Tom’s Creek, SCA – Sinking Creek A, SCB – Sinking Creek B, NF – North Fork of the Roanoke River, JC – Johns Creek

Summary of bed substrate particles

**Table C7. Summary of percent substrate type for riffle and pool cross-sections combined.**

Site*	Grazed vs. Exclusion	silt/clay	sand	gravel	cobble	boulder	bedrock
TC	Grazed	0.0	24.3	74.3	1.3	0.3	0.0
	Exclusion	0.0	8.1	67.8	15.4	2.8	5.9
	% diff.	0.0	-66.6	-8.6	1133.9	1000.3	0.0
SCA	Grazed	0.0	1.0	63.8	32.2	1.3	1.8
	Exclusion	0.0	0.7	79.8	16.7	0.0	2.7
	% diff.	0.0	-24.1	25.2	-48.0	-100.0	48.8
SCB	Grazed	0.0	1.5	69.0	21.3	0.3	7.9
	Exclusion	0.0	1.0	61.4	35.9	1.0	0.7
	% diff.	0.0	-35.0	-11.1	68.6	276.0	-90.6
NF	Grazed	0.0	9.7	65.9	17.4	3.0	4.1
	Exclusion	0.0	2.2	67.6	25.3	1.2	3.7
	% diff.	0.0	-77.1	2.5	45.7	-58.9	-9.0
JC	Grazed	0.0	2.1	60.2	24.7	1.8	11.3
	Forested	0.0	3.5	48.0	18.0	1.3	29.2
	% diff.	0.0	69.9	-20.2	-27.0	-29.1	158.4

\* TC – Tom’s Creek, SCA – Sinking Creek A, SCB – Sinking Creek B, NF – North Fork of the Roanoke River, JC – Johns Creek

**Table C8. Summary of percent fines (bed substrate diameter below < 2 mm) for the riffle cross-sections and the overall reach.**

<b>Site*</b>	<b>Grazed vs. Exclusion</b>	<b>overall % fines</b>	<b>riffle % fines</b>
TC	Grazed	24.3	9.0
	Exclusion	8.6	0.0
	% diff.	-65	-100
SCA	Grazed	1.0	2.0
	Exclusion	0.8	0.5
	% diff.	-23	-75
SCB	Grazed	1.7	2.0
	Exclusion	1.0	1.5
	% diff.	-40	-25
NF	Grazed	10.1	4.5
	Exclusion	2.3	1.5
	% diff.	-77	-67
JC	Grazed	2.3	4.0
	Forested	5.0	0.5
	% diff.	113	-88

\* TC – Tom’s Creek, SCA – Sinking Creek A, SCB – Sinking Creek B, NF – North Fork of the Roanoke River, JC – Johns Creek

**Table C9. Summary of substrate size for riffle and pool cross-sections combined.**

Site*	Grazed vs. Exclusion	D <sub>16</sub> (mm)	D <sub>50</sub> (mm)	D <sub>84</sub> (mm)	Geometric Standard Deviation ( $\sigma_g$ )
TC	Grazed	1.6	7.3	17.0	3.3
	Exclusion	4.1	18.0	73.0	4.2
	% diff.	156	147	329	30
SCA	Grazed	15.0	42.0	94.0	2.5
	Exclusion	7.7	17.0	67.0	2.9
	% diff.	-49	-60	-29	18
SCB	Grazed	8.0	19.0	81.0	3.2
	Exclusion	13.0	49.0	110.0	2.9
	% diff.	63	158	36	-9
NF	Grazed	7.1	26.0	78.0	3.3
	Exclusion	13.0	41.0	87.0	2.6
	% diff.	83	58	12	-22
JC	Grazed	19.0	45.0	85.0	2.1
	Forested	13.0	40.0	84.0	2.5
	% diff.	-32	-11	-1	20

\* TC – Tom’s Creek, SCA – Sinking Creek A, SCB – Sinking Creek B, NF – North Fork of the Roanoke River, JC – Johns Creek

**Table C10. Summary of substrate size for riffle cross-sections.**

Site*	Grazed vs. Exclusion	D <sub>16</sub> (mm)	D <sub>50</sub> (mm)	D <sub>84</sub> (mm)	Geometric Standard Deviation ( $\sigma_g$ )
TC	Grazed	5.3	11.0	19.0	1.9
	Exclusion	13.0	37.0	86.0	2.6
	% diff.	145	236	353	36
SCA	Grazed	12.0	38.0	91.0	2.8
	Exclusion	8.7	24.0	85.0	3.1
	% diff.	-28	-37	-7	14
SCB	Grazed	7.8	17.0	82.0	3.2
	Exclusion	10.0	49.0	100.0	3.2
	% diff.	28	188	22	-3
NF	Grazed	8.9	27.0	66.0	2.7
	Exclusion	16.0	39.0	70.0	2.1
	% diff.	80	44	6	-23
JC	Grazed	13.0	36.0	71.0	2.3
	Forested	26.0	53.0	93.0	1.9
	% diff.	100	47	31	-19

\* TC – Tom’s Creek, SCA – Sinking Creek A, SCB – Sinking Creek B, NF – North Fork of the Roanoke River, JC – Johns Creek

**Table C11. Summary of substrate size for pool cross-sections.**

Site*	Grazed vs. Exclusion	D <sub>16</sub> (mm)	D <sub>50</sub> (mm)	D <sub>84</sub> (mm)	Geometric Standard Deviation ( $\sigma_g$ )
TC	Grazed	5.3	11.0	19.0	3.0
	Exclusion	13.0	37.0	86.0	3.9
	% diff.	145	236	353	29
SCA	Grazed	12.0	38.0	91.0	2.4
	Exclusion	8.7	24.0	85.0	2.3
	% diff.	-28	-37	-7	-1
SCB	Grazed	7.8	17.0	82.0	3.2
	Exclusion	10.0	49.0	100.0	2.5
	% diff.	28	188	22	-20
NF	Grazed	8.9	27.0	66.0	5.2
	Exclusion	16.0	39.0	70.0	2.9
	% diff.	80	44	6	-45
JC	Grazed	13.0	36.0	71.0	1.9
	Forested	26.0	53.0	93.0	2.9
	% diff.	100	47	31	50

\* TC – Tom’s Creek, SCA – Sinking Creek A, SCB – Sinking Creek B, NF – North Fork of the Roanoke River, JC – Johns Creek



## Appendix D. Soils and Vegetation Data

**Table D1. Aboveground vegetation identification (USDA-NRCS, 2001).**

Site*	Site Specifications	Groundcover Species	Shrub Species	Tree Types
TC1	Grazed	Cool season grasses	None	Hops Hornbeam ( <i>Carpinus caroliniana</i> ), Black Willow ( <i>Salix nigra</i> ), Sycamore ( <i>Platanus occidentalis</i> )
TC2	Livestock exclusion 2 years	Cool season grasses, Pokeberry ( <i>Phytolaccaceae</i> ), Bar Berry ( <i>Berberis julianae</i> ), Poison Ivy ( <i>Toxicodendron radicans</i> ), Dock ( <i>Polygonum sp.</i> ), Jewel Weed ( <i>Impatiens capensis</i> ), Smartweed ( <i>Polygonum sp.</i> ), Wingstem ( <i>Verbesina alternifolia</i> ), golden rod ( <i>Solidago sp.</i> ), Common Evening Primrose ( <i>Oenothera biennis</i> ), mint ( <i>Mentha sp.</i> )	Multi-flora rose ( <i>Rosa multiflora</i> ), Blackberry ( <i>Rubus sp.</i> ), Privet ( <i>Ligustrum sp.</i> )	Sugar Maple ( <i>Acer saccharum</i> ), Cherry Tree ( <i>Prunus sp.</i> ), hops hornbeam ( <i>Carpinus caroliniana</i> ), Box Elder ( <i>Acer negundo</i> ), Red Cedar ( <i>Juniperus virginiana</i> ), Black Willow ( <i>Salix nigra</i> ), Sycamore ( <i>Platanus occidentalis</i> ), Walnut ( <i>Juglans nigra</i> ), Catalpa ( <i>Catalpa speciosa</i> )
SCA1	Grazed	Cool season grasses, mint ( <i>Mentha sp.</i> ), wingstem ( <i>Verbesina alternifolia</i> ), poison ivy ( <i>Toxicodendron radicans</i> ), horse nettle ( <i>Solanum carolinense</i> ), boneset ( <i>Eupatorium cannabinum</i> )	Box Elder ( <i>Acer negundo</i> ), multiflora rose ( <i>Rosa multiflora</i> ), spicebush ( <i>Lindera benzoin</i> )	Sycamore ( <i>Platanus occidentalis</i> ), Black Willow ( <i>Salix nigra</i> ), Red Maple ( <i>Acer rubrum</i> )
SCA2	CREP 2 years	Cool season grasses, wingstem ( <i>Verbesina alternifolia</i> ), horse nettle ( <i>Solanum carolinense</i> ), catnip mint ( <i>Mentha sp.</i> )	Multiflora rose ( <i>Rosa multiflora</i> ), Box elder ( <i>Acer negundo</i> )	Black Willow ( <i>Salix nigra</i> ), Red Maple ( <i>Acer rubrum</i> )

\* TC1 – grazed Tom’s Creek reach, TC2- livestock exclusion Tom’s Creek reach, SCA1 – grazed Sinking Creek A reach, SCA2 – livestock exclusion Sinking Creek A reach

**Table D1, continued. Aboveground vegetation identification continued (USDA-NRCS, 2001).**

Site*	Site Specifications	Groundcover Species	Shrub Species	Tree Types
SCB1	Grazed	Cool Season Grasses, iron weed ( <i>Vernonia baldwinii</i> )	Multi-flora rose ( <i>Rosa multiflora</i> ), wingstem ( <i>Verbesina alternifolia</i> ), boneset ( <i>Eupatorium cannabinum</i> )	Sycamore ( <i>Platanus occidentalis</i> ), Black Walnut ( <i>Juglans nigra</i> ), Sugar Maple ( <i>Acer saccharum</i> ), Red Cedar ( <i>Juniperus virginiana</i> ), Black Willow ( <i>Salix nigra</i> ), Elm ( <i>Ulmus americana</i> )
SCB2	CREP 4 years	Cool Season Grasses, Horse Nettle ( <i>Solanum carolinense</i> ), Jewel weed ( <i>Impatiens capensis</i> ), Iron weed ( <i>Vernonia baldwinii</i> ), Dock ( <i>Polygonaceae</i> ), Golden rod (solidago sp.), Aster sp., Boneset ( <i>Eupatorium cannabinum</i> ), Teasel ( <i>Dipsacus fullonum</i> ), Horsetail (eqsedum), Agrimony ( <i>Agrimonia eupatoria</i> ), Pokeberry ( <i>Phytolaccaceae</i> )	Red Ocea Dogwood ( <i>Cornus</i> sp.), Japanese honeysuckle ( <i>Lonicera japonica</i> ), Multi-flora rose ( <i>Rosa multiflora</i> ), Alder	Sycamore ( <i>Platanus occidentalis</i> ), Northern Red Oak ( <i>Quercus rubra</i> ), Tulip Poplar ( <i>Liriodendron tulipifera</i> ), Sugar Maple ( <i>Acer saccharum</i> ), White Oak ( <i>Quercus alba</i> ), Red Cedar ( <i>Juniperus virginiana</i> ), Cherry Tree ( <i>Prunus</i> sp.), Willow ( <i>Salix</i> sp.), Ash ( <i>Fraxinus Americana</i> ), Walnut ( <i>Juglans nigra</i> ), Hops Hornbeam ( <i>Carpinus caroliniana</i> )
NF1	Grazed	Cool season grasses, Wingstem ( <i>Verbesina alternifolia</i> ), Catnip mint ( <i>Mentha</i> sp.)	None	Sycamore ( <i>Platanus occidentalis</i> )

\* SCB1 – grazed Sinking Creek reach, SCB2- livestock exclusion Sinking Creek B reach, NF1 – grazed North Fork of the Roanoke River reach

**Table D1, continued. Aboveground vegetation identification continued (USDA-NRCS, 2001).**

Site*	Site Specifications	Groundcover Species	Shrub Species	Tree Types
NF2	CREP 14 years	Cool season grasses, Vetch sp., wingstem ( <i>Verbesina alternifolia</i> ), Jewel weed ( <i>Impatiens capensis</i> ), catnip mint ( <i>Mentha</i> sp.), Autumn olive ( <i>Elaeagnus umbellate</i> ), Horse nettle ( <i>Solanum carolinense</i> ), Common ragweed ( <i>Ambrosia artemisiifolia</i> ), Ambrosia ( <i>Artemisifolia</i> ), Smartweed ( <i>polygonum</i> sp.), False buckwheat ( <i>polygonum</i> sp.), Bittersweet ( <i>Solanum dulcamara</i> ), Golden rod ( <i>solidago</i> sp.)	Box elder ( <i>Acer negundo</i> ), Red osier dogwood ( <i>Cornus</i> sp.)	Black walnut ( <i>Juglans Nigra</i> ), Williwow ( <i>salix</i> sp.), Sycamore ( <i>Platanus occidentalis</i> ), Cherry Tree ( <i>Prunus</i> sp.)
JC1	Grazed	Cool season grasses, Wingstem ( <i>Verbesina alternifolia</i> ), Boneset ( <i>Eupatorium cannabinum</i> ), Horse nettle ( <i>Solanum carolinense</i> )	Rhododendron	Elm ( <i>Ulmus americana</i> ), Red Maple ( <i>Acer rubrum</i> ), Red Cedar ( <i>Juniperus virginiana</i> ), Sycamore ( <i>Platanus occidentalis</i> ), Black Walnut ( <i>Juglans nigra</i> )
JC2	Forested	Cool season grasses, Poison ivy ( <i>Toxicodendron radicans</i> ), Wingstem ( <i>Verbesina alternifolia</i> )	Multi-flora rose ( <i>Rosa multiflora</i> )	Sycamore ( <i>Platanus occidentalis</i> ), Northern Red Oak ( <i>Quercus rubra</i> ), White Oak ( <i>Quercus alba</i> ), Red Cedar ( <i>Juniperus virginiana</i> )

\*NF2 – livestock exclusion North Fork of the Roanoke River reach, JC1 – grazed Johns Creek reach, JC2- livestock exclusion Johns Creek reach

**Table D2. Soil bulk densities for each reach.**

<b>Site*</b>	<b>Grazed vs. Exclusion</b>	<b>Median (g/cm<sup>3</sup>)</b>	<b>Min (g/cm<sup>3</sup>)</b>	<b>Max (g/cm<sup>3</sup>)</b>
TC	Grazed	1.44	0.97	1.52
	Exclusion	1.49	0.88	1.38
	% diff.	4	-10	-9
SCA	Grazed	1.33	0.97	1.73
	Exclusion	1.36	0.66	1.29
	% diff.	2	-32	-25
SCB	Grazed	1.22	1.22	1.39
	Exclusion	1.08	0.97	1.46
	% diff.	-11	-21	5
NF	Grazed	1.57	0.89	1.44
	Exclusion	0.98	0.98	1.54
	% diff.	-38	9	8
JC	Grazed	1.13	1.34	1.58
	Exclusion	1.14	1.16	1.64
	% diff.	1	-13	4

\* TC – Tom’s Creek, SCA – Sinking Creek A, SCB – Sinking Creek B, NF – North Fork of the Roanoke River, JC – Johns Creek

**Table D3. Soil texture, type, and median particle size (D<sub>50</sub>) for streambank soils (MCSS, 1980; Freyman, 2007).**

Site*	Grazed vs. Exclusion	Soil texture	Reach soil type (MCSS, 1980; Freyman, 2007)
TC	Grazed	sandy clay loam	Weaver
	Exclusion	sandy loam	Weaver
	% diff.	---	---
SCA	Grazed	sandy clay loam	Pope
	Exclusion	sandy clay loam	Pope
	% diff.	---	---
SCB	Grazed	sandy loam	Pope
	Exclusion	sandy loam	Pope
	% diff.	---	---
NF	Grazed	sandy clay loam	Ross
	Exclusion	sandy clay loam	Ross
	% diff.	---	---
JC	Grazed	sandy loam	Pope
	Exclusion	sandy loam	Pope
	% diff.	---	---

\* TC – Tom’s Creek, SCA – Sinking Creek A, SCB – Sinking Creek B, NF – North Fork of the Roanoke River, JC – Johns Creek

**Table D4. Percent sand, silt, and clay for each reach.**

<b>Site*</b>	<b>Grazed vs. Exclusion</b>	<b>Sand (%)</b>	<b>Silt (%)</b>	<b>Clay (%)</b>	<b>Silt and Clay (%)</b>
TC	Grazed	51.5	22.0	26.5	48.5
	Exclusion	64.0	18.0	18.0	36.0
	% diff.	24	-18	-32	-26
SCA	Grazed	58.0	21.5	20.5	42.0
	Exclusion	56.3	22.5	21.1	43.7
	% diff.	-3	5	3	4
SCB	Grazed	73.7	10.0	16.3	26.3
	Exclusion	74.3	13.5	12.1	25.7
	% diff.	1	35	-26	-3
NF	Grazed	54.3	23.1	22.6	45.7
	Exclusion	50.3	23.0	26.6	49.7
	% diff.	-7	0	18	9
JC	Grazed	66.3	17.6	16.1	33.7
	Forested	74.7	14.5	10.8	25.3
	% diff.	13	-17	-33	-25

\* TC – Tom’s Creek, SCA – Sinking Creek A, SCB – Sinking Creek B, NF – North Fork of the Roanoke River, JC – Johns Creek