

## Appendix 3. Photographs for each geomorphology monitoring site, Roanoke, Virginia

Appendix 3 contains photographs of geomorphology-monitoring cross sections. Site numbers are referenced to figure 1 and table 1 of the main report, Fluvial geomorphology and suspended-sediment transport during construction of the Roanoke River Flood Reduction Project in Roanoke, Virginia, 2005-2012, by John D. Jastram, Jennifer L. Krstolic, Douglas L. Moyer, and Kenneth E. Hyer, U.S. Geological Survey Scientific Investigations Report 2015-5111, available at <http://dx.doi.org/10.3133/sir20155111>. Photographs were taken by Jennifer Krstolic unless otherwise noted in the captions.



Site 1. Roanoke River near Front Street at Salem, Virginia, summer 2005. View upstream.



Site 1. Roanoke River near Front Street at Salem, Virginia, summer 2005. View right to left bank.

## 2 Fluvial Geomorphology and Suspended-Sediment Transport, Roanoke, Virginia



Site 1. Roanoke River near Front Street at Salem, Virginia, summer 2007. View right to left bank.



Site 1. Roanoke River near Front Street at Salem, Virginia, summer 2007. View right to left bank.



Site 1. Roanoke River near Front Street at Salem, Virginia, summer 2008. View downstream.



Site 1. Roanoke River near Front Street at Salem, Virginia, summer 2008. View upstream and the right bank.





Site 1. Roanoke River near Front Street at Salem, Virginia, summer 2008. View right to left bank.



Site 1. Roanoke River near Front Street at Salem, Virginia, summer 2014. View right to left bank.



#### 4 Fluvial Geomorphology and Suspended-Sediment Transport, Roanoke, Virginia



Site 2. Roanoke River above Eddy Street Bridge at Salem, Virginia, summer 2005. View upstream.



Site 2. Roanoke River above Eddy Street Bridge at Salem, Virginia, summer 2005. View downstream.



Site 2. Roanoke River above Eddy Street Bridge at Salem, Virginia, summer 2005. View right to left bank.



Site 2. Roanoke River above Eddy Street Bridge at Salem, Virginia, summer 2007. View downstream.





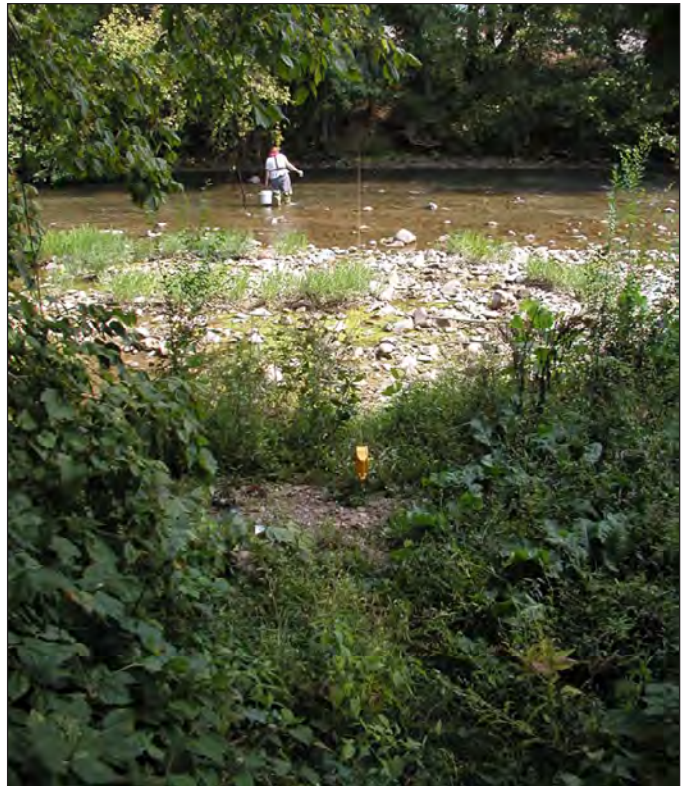
Site 2. Pre-construction monitoring photo summer 2007. View upstream. Monitoring site location on the Roanoke River in Salem, Virginia. Site local numbers shown in figure 1 and defined in table 1.



Site 2. Pre-construction monitoring photo summer 2007. View downstream. Monitoring site location on the Roanoke River in Salem, Virginia. Site local numbers shown in figure 1 and defined in table 1.



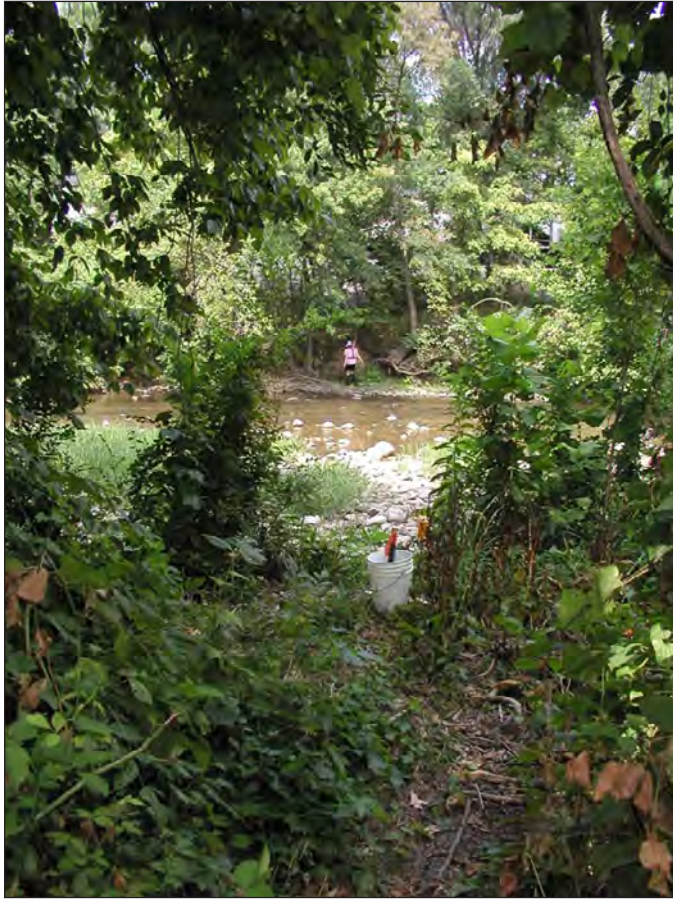
Site 2. Pre-construction monitoring photo summer 2007. View right to left bank. Monitoring site location on the Roanoke River in Salem, Virginia. Site local numbers shown in figure 1 and defined in table 1.



Site 2. Pre-construction monitoring photo summer 2007. View right to left bank. Monitoring site location on the Roanoke River in Salem, Virginia. Site local numbers shown in figure 1 and defined in table 1.



**6 Fluvial Geomorphology and Suspended-Sediment Transport, Roanoke, Virginia**



Site 2. Roanoke River above Eddy Street Bridge at Salem, Virginia, summer 2008. View left to right bank.



Site 2. Roanoke River above Eddy Street Bridge at Salem, Virginia, summer 2009. View left to right bank.



Site 2. Roanoke River above Eddy Street Bridge at Salem, Virginia, winter 2014. View left to right bank.





Site 3. Roanoke River along Riverside Drive at Salem, Virginia, summer 2005. View right to left bank.



Site 3. Roanoke River along Riverside Drive at Salem, Virginia, summer 2005. View downstream.



Site 3. Roanoke River along Riverside Drive at Salem, Virginia, summer 2005. View upstream.



Site 3. Roanoke River along Riverside Drive at Salem, Virginia, summer 2005. View right to left bank.



**8 Fluvial Geomorphology and Suspended-Sediment Transport, Roanoke, Virginia**



Site 3. Roanoke River along Riverside Drive at Salem, Virginia, summer 2007.  
View right to left bank.



Site 3. Roanoke River along Riverside Drive at Salem, Virginia, summer 2007.  
View downstream.

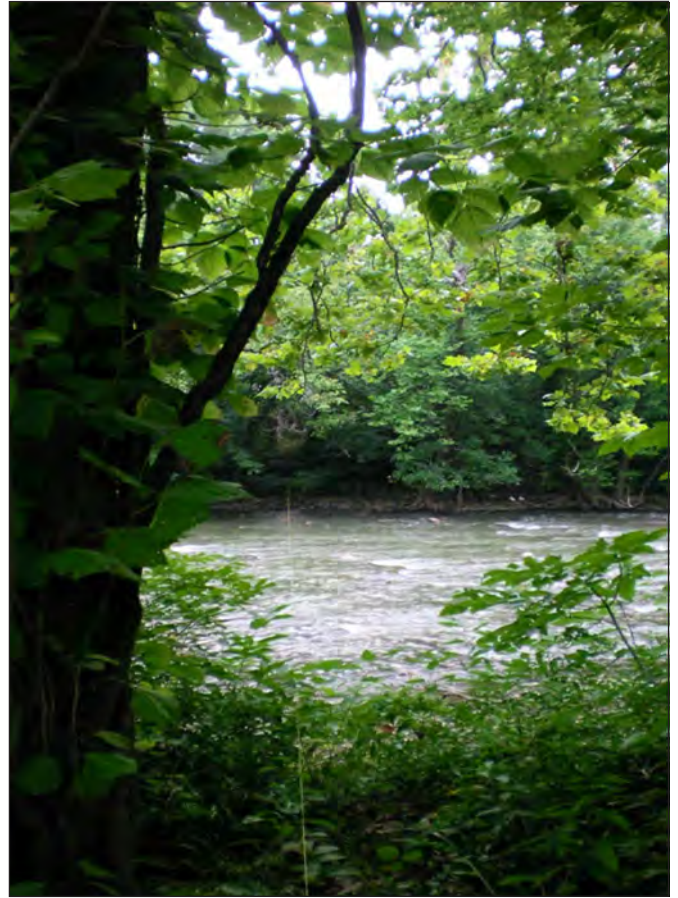


Site 3. Roanoke River along Riverside Drive at Salem, Virginia, summer 2005.  
View upstream.





Site 3. Roanoke River along Riverside Drive at Salem, Virginia, summer 2008. View right to left bank.



Site 3. Roanoke River along Riverside Drive at Salem, Virginia, summer 2009. View right to left bank.



Site 3. Roanoke River along Riverside Drive at Salem, Virginia, winter 2014. View right to left bank.





Site 4. Roanoke River above Apperson Drive Bridge at Salem, Virginia, summer 2005. View right to left bank.



Site 4. Roanoke River above Apperson Drive Bridge at Salem, Virginia, summer 2005. View downstream.



Site 4. Roanoke River above Apperson Drive Bridge at Salem, Virginia, summer 2005. View right to left bank.



Site 4. Roanoke River above Apperson Drive Bridge at Salem, Virginia, summer 2007. View downstream.





Site 4. Roanoke River above Apperson Drive Bridge at Salem, Virginia, summer 2007. View right to left bank.



Site 4. Roanoke River above Apperson Drive Bridge at Salem, Virginia, summer 2007. View left to right bank.



Site 4. Roanoke River above Apperson Drive Bridge at Salem, Virginia, summer 2007. View downstream.



Site 4. Roanoke River above Apperson Drive Bridge at Salem, Virginia, summer 2007. View upstream.





Site 4. Roanoke River above Apperson Drive Bridge at Salem, Virginia, summer 2008. View right to left bank.



Site 4. Roanoke River above Apperson Drive Bridge at Salem, Virginia, summer 2008. View right to left bank.



Site 4. Roanoke River above Apperson Drive Bridge at Salem, Virginia, winter 2014. View right to left bank.





Site 4. Roanoke River above Apperson Drive Bridge at Salem, Virginia, winter 2014. View right to left bank.



Site 4. Roanoke River above Apperson Drive Bridge at Salem, Virginia, winter 2014. View downstream.



Site 4. Roanoke River above Apperson Drive Bridge at Salem, Virginia, winter 2014. View right to left bank.





Site 5. Roanoke River above Mason Creek at Salem, Virginia, summer 2005. View downstream.



Site 5. Roanoke River above Mason Creek at Salem, Virginia, summer 2005. View left to right bank.



Site 5. Roanoke River above Mason Creek at Salem, Virginia, summer 2005. View downstream.



Site 5. Roanoke River above Mason Creek at Salem, Virginia, summer 2007. View left to right bank.





Site 5. Roanoke River above Mason Creek at Salem, Virginia, summer 2007.  
View left to right bank.



Site 5. Roanoke River above Mason Creek at Salem, Virginia, winter 2007.  
View left to right bank.





Site 5. Roanoke River above Mason Creek at Salem, Virginia, summer 2007.  
View upstream.



Site 5. Roanoke River above Mason Creek at Salem, Virginia, summer 2007.  
View downstream.



Site 5. Roanoke River above Mason Creek at Salem, Virginia, summer 2008.  
View downstream.





Site 5. Roanoke River above Mason Creek at Salem, Virginia, summer 2008. View upstream.



Site 5. Roanoke River above Mason Creek at Salem, Virginia, summer 2008. View left to right bank.



Site 5. Roanoke River above Mason Creek at Salem, Virginia, summer 2009. View left to right bank. Jennifer Krstolic with survey rod for scale, at the cross section. Photograph by Carlos Rodriguez.



Site 5. Roanoke River above Mason Creek at Salem, Virginia, summer 2007. View downstream.



**18 Fluvial Geomorphology and Suspended-Sediment Transport, Roanoke, Virginia**



Site 6. Roanoke River below Barnhardt Creek at Roanoke, Virginia, summer 2005. View upstream.



Site 6. Roanoke River below Barnhardt Creek at Roanoke, Virginia, summer 2005. View downstream.



Site 6. Roanoke River below Barnhardt Creek at Roanoke, Virginia, summer 2005. View downstream.





Site 6. Roanoke River below Barnhardt Creek at Roanoke, Virginia, winter 2007. View upstream.



Site 6. Roanoke River below Barnhardt Creek at Roanoke, Virginia, winter 2007. View downstream.



Site 6. Roanoke River below Barnhardt Creek at Roanoke, Virginia, summer 2007. View of left bank at low flow.



Site 6. Roanoke River below Barnhardt Creek at Roanoke, Virginia, winter 2007. View right to left.





Site 6. Roanoke River below Barnhardt Creek at Roanoke, Virginia, winter 2007. View upstream at right bank.



Site 6. Roanoke River below Barnhardt Creek at Roanoke, Virginia, winter 2007. View upstream at left bank.

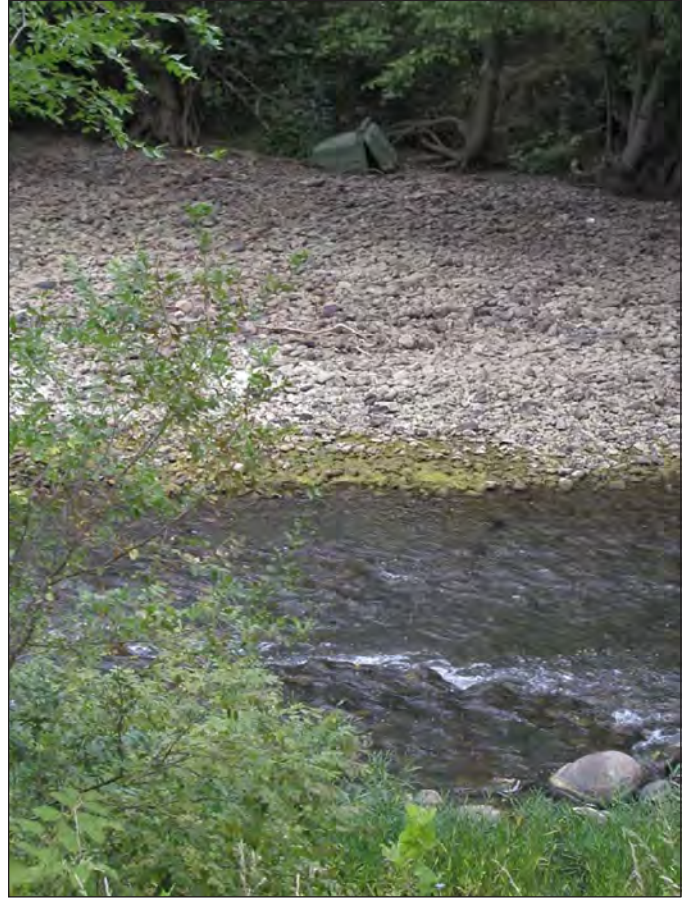


Site 6. Roanoke River below Barnhardt Creek at Roanoke, Virginia, summer 2007. View upstream.





Site 6. Roanoke River below Barnhardt Creek at Roanoke, Virginia, summer 2008. View right to left bank.



Site 6. Roanoke River below Barnhardt Creek at Roanoke, Virginia, summer 2008. View right to left bank, up close.



Site 6. Roanoke River below Barnhardt Creek at Roanoke, Virginia, winter 2014. View right to left bank.





Site 7. Roanoke River above Bridge Street Bridge at Roanoke, Virginia, summer 2005. View left to right bank.



Site 7. Roanoke River above Bridge Street Bridge at Roanoke, Virginia, summer 2005. View left to right bank.



Site 7. Roanoke River above Bridge Street Bridge at Roanoke, Virginia, winter 2007. View left to right bank.





Site 7. Roanoke River above Bridge Street Bridge at Roanoke, Virginia, summer 2007. View left to right bank.



Site 7. Roanoke River above Bridge Street Bridge at Roanoke, Virginia, summer 2007. View of left bank.



Site 7. Roanoke River above Bridge Street Bridge at Roanoke, Virginia, summer 2007. View downstream.





Site 7. Roanoke River above Bridge Street Bridge at Roanoke, Virginia, summer 2008. View left to right bank.



Site 7. Roanoke River above Bridge Street Bridge at Roanoke, Virginia, summer 2008. View upstream.

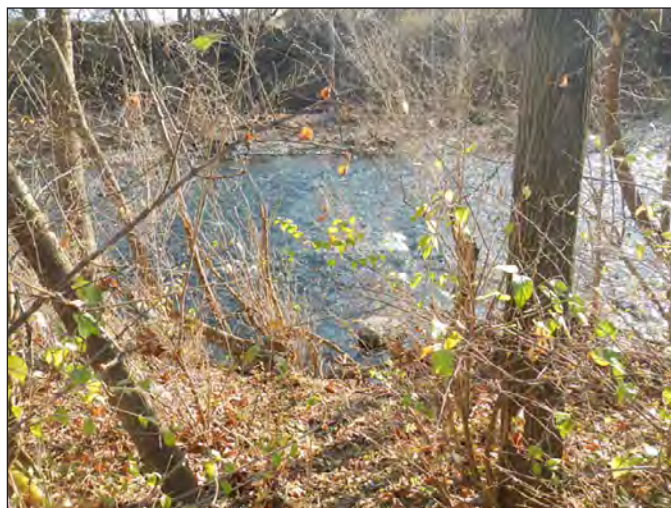


Site 7. Roanoke River above Bridge Street Bridge at Roanoke, Virginia, summer 2009. View left to right bank.

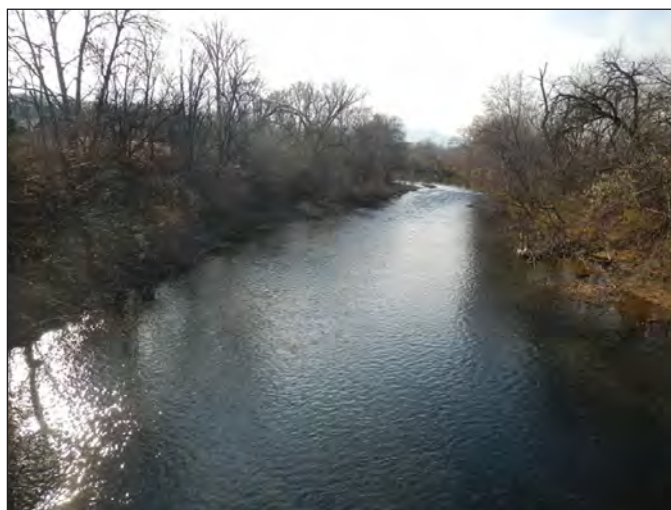




Site 7. Roanoke River above Bridge Street Bridge at Roanoke, Virginia, summer 2009. View left to right bank.



Site 7. Roanoke River above Bridge Street Bridge at Roanoke, Virginia, winter 2014. View left to right bank.



Site 7. Roanoke River above Bridge Street Bridge at Roanoke, Virginia, winter 2014. View from Bridge Street upstream.





Site 8. Roanoke River along Wiley Drive below dam at Roanoke, Virginia, summer 2005. View upstream.



Site 8. Roanoke River along Wiley Drive below dam at Roanoke, Virginia, summer 2005. View downstream.



Site 8. Roanoke River along Wiley Drive below dam at Roanoke, Virginia, summer 2005. View left to right bank.



Site 8. Roanoke River along Wiley Drive below dam at Roanoke, Virginia, summer 2005. View right to left bank.





Site 8. Roanoke River along Wiley Drive below dam at Roanoke, Virginia, summer 2007. View upstream.



Site 8. Roanoke River along Wiley Drive below dam at Roanoke, Virginia, summer 2007. View downstream.



Site 8. Roanoke River along Wiley Drive below dam at Roanoke, Virginia, summer 2008. View upstream. Photo taken from bedrock below cross section.



Site 8. Roanoke River along Wiley Drive below dam at Roanoke, Virginia, summer 2008. View downstream. Photo taken from cross section. Bedrock in view.





Site 8. Roanoke River along Wiley Drive below dam at Roanoke, Virginia, winter 2014. View downstream from walking bridge.



Site 8. Roanoke River along Wiley Drive below dam at Roanoke, Virginia, winter 2014. View downstream from greenway-trail bridge. (See figure 16 for location.)





Wasena Dam upstream of Site 8 in Roanoke, Virginia, winter 2009. View left to right bank with dam construction.



Wasena Dam upstream of Site 8 in Roanoke, Virginia, winter 2009. View left to right bank with dam construction.



Wasena Dam post-survey, upstream of Site 8 in Roanoke, Virginia, summer 2009. View left to right bank with dam construction.



Wasena Dam upstream of Site 8 in Roanoke, Virginia, winter 2014. View left to right bank at previous dam location. Cedar trees in 2014 picture are also visible in 2009, above.





Site 9. Roanoke River above Main Street Bridge at Roanoke, Virginia, summer 2005. View right to left bank.



Site 9. Roanoke River above Main Street Bridge at Roanoke, Virginia, summer 2007. View right to left bank.



Site 9. Roanoke River above Main Street Bridge at Roanoke, Virginia, summer 2008. View from bench cut right to left bank.





Site 9. Roanoke River above Main Street Bridge at Roanoke, Virginia, summer 2007. View right to left bank.



Site 9. Roanoke River above Main Street Bridge at Roanoke, Virginia, summer 2008. View left to right bank.

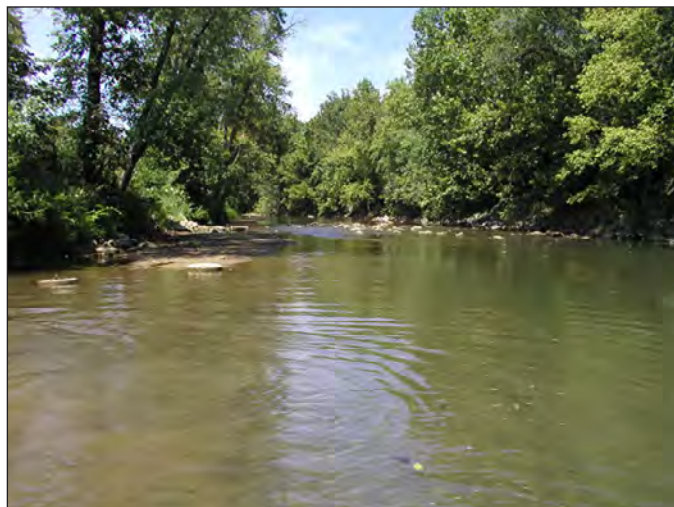


Site 9. Roanoke River above Main Street Bridge at Roanoke, Virginia, summer 2008. View downstream.





Site 9. Roanoke River above Main Street Bridge at Roanoke, Virginia, winter 2008. View left to right bank.



Site 9. Roanoke River above Main Street Bridge at Roanoke, Virginia, winter 2008. View upstream.



Site 9. Roanoke River above Main Street Bridge at Roanoke, Virginia, winter 2014. View left to right bank.



Site 9. Roanoke River above Main Street Bridge at Roanoke, Virginia, winter 2014. View downstream.





Site 9. Roanoke River above Main Street Bridge at Roanoke, Virginia, winter 2014.  
View upstream.





Site 10. Roanoke River at Smith Park at Roanoke, Virginia, summer 2005. View upstream.



Site 10. Roanoke River at Smith Park at Roanoke, Virginia, summer 2005. View downstream.

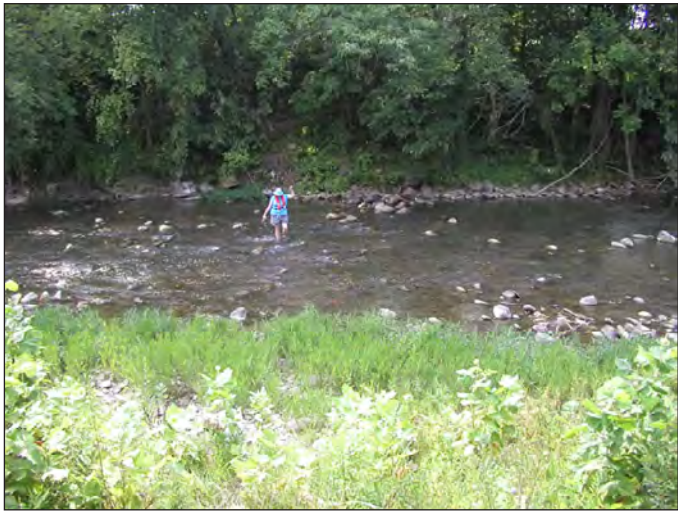


Site 10. Roanoke River at Smith Park at Roanoke, Virginia, summer 2005. View left to right bank.



Site 10. Roanoke River at Smith Park at Roanoke, Virginia, summer 2005. View left to right bank.





Site 10. Roanoke River at Smith Park at Roanoke, Virginia, summer 2007.  
View left to right bank.



Site 10. Roanoke River at Smith Park at Roanoke, Virginia, summer 2008.  
View left to right bank.



Site 10. Roanoke River at Smith Park at Roanoke, Virginia, winter 2014.  
View left to right bank.



Site 10. Roanoke River at Smith Park at Roanoke, Virginia, winter 2014.  
View left to right bank.





Site 11. Roanoke River above Walnut Street Bridge at Roanoke, Virginia, summer 2005. View downstream along right bank.



Site 11. Roanoke River above Walnut Street Bridge at Roanoke, Virginia, summer 2005. View right to left bank.



Site 11. Roanoke River above Walnut Street Bridge at Roanoke, Virginia, winter 2007. View right to left bank.





Site 11. Roanoke River above Walnut Street Bridge at Roanoke, Virginia, summer 2008. View right to left bank.



Site 11. Roanoke River above Walnut Street Bridge at Roanoke, Virginia, summer 2008. View at water edge right to left bank.



Site 11. Roanoke River above Walnut Street Bridge at Roanoke, Virginia, summer 2008. View upstream from Walnut Street Bridge.



Site 11. Roanoke River above Walnut Street Bridge at Roanoke, Virginia, summer 2009. View right to left bank.





Site 11. Roanoke River above Walnut Street Bridge at Roanoke, Virginia, summer 2009. View right to left bank and surveyor in canoe.



Site 11. Roanoke River above Walnut Street Bridge at Roanoke, Virginia, winter 2014. View right to left bank.



Site 11. Roanoke River above Walnut Street Bridge at Roanoke, Virginia, winter 2014. View right to left bank and surveyor canoe.





Site 12. Roanoke River Whitman Street at Roanoke, Virginia, summer 2005. View right to left bank.



Site 12. Roanoke River Whitman Street at Roanoke, Virginia, summer 2005. View downstream.



Site 12. Roanoke River Whitman Street at Roanoke, Virginia, summer 2005. View upstream.



Site 12. Roanoke River Whitman Street at Roanoke, Virginia, summer 2005. View right to left bank at edge of water.





Site 12. Roanoke River at Whitman Street at Roanoke, Virginia, summer 2007. View upstream.



Site 12. Roanoke River at Whitman Street at Roanoke, Virginia, summer 2007. View downstream.



Site 12. Roanoke River at Whitman Street at Roanoke, Virginia, summer 2007. View right to left bank from flood plain. Trail construction visible in lower portion of the image.





Site 12. Roanoke River at Whitman Street at Roanoke, Virginia, winter 2007. View left to right.



Site 12. Roanoke River at Whitman Street at Roanoke, Virginia, winter 2007. View right to left.



Site 12. Roanoke River at Whitman Street at Roanoke, Virginia, summer 2007. View left to right after riprap and trail construction.





Site 12. Roanoke River at Whitman Street at Roanoke, Virginia, summer 2007. View left to right.



Site 12. Roanoke River at Whitman Street at Roanoke, Virginia, summer 2007. View right to left.



Site 12. Roanoke River at Whitman Street at Roanoke, Virginia, summer 2008. View right to left.





Site 12. Roanoke River Whitman Street at Roanoke, Virginia, summer 2008. View downstream.



Site 12. Roanoke River Whitman Street at Roanoke, Virginia, summer 2009. View right to left.



Site 12. Roanoke River Whitman Street at Roanoke, Virginia, summer 2008. View right to left.



Site 12. Roanoke River Whitman Street at Roanoke, Virginia, winter 2014. View right to left bank from flood plain near trail.

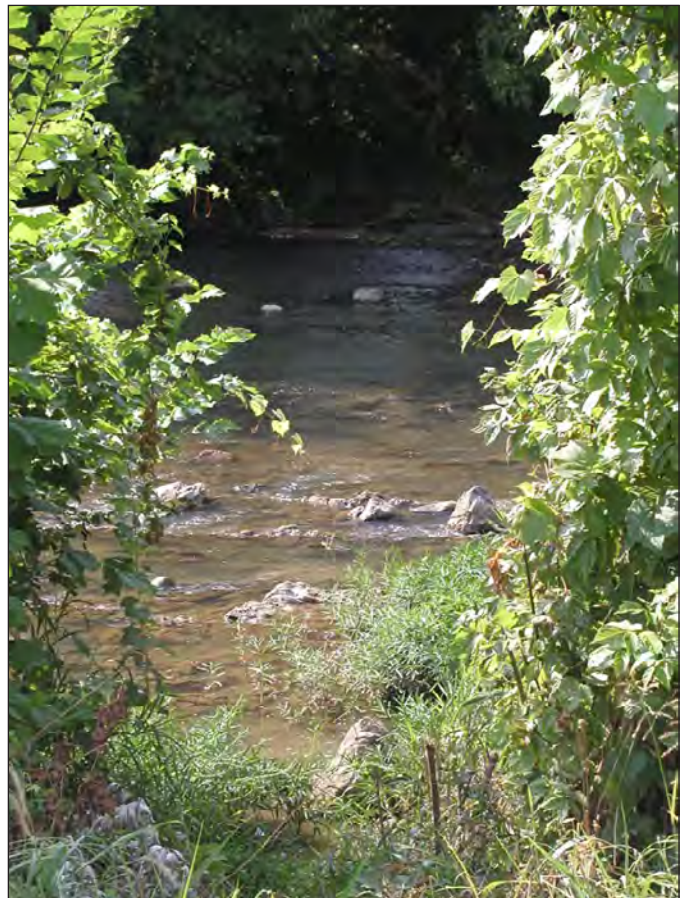




Site 13. Roanoke River below Garnand Branch at Roanoke, Virginia, summer 2005. View right to left bank.



Site 13. Roanoke River below Garnand Branch at Roanoke, Virginia, summer 2005. View right to left bank near edge of water.



Site 13. Roanoke River below Garnand Branch at Roanoke, Virginia, summer 2007. View right to left bank near edge of water.



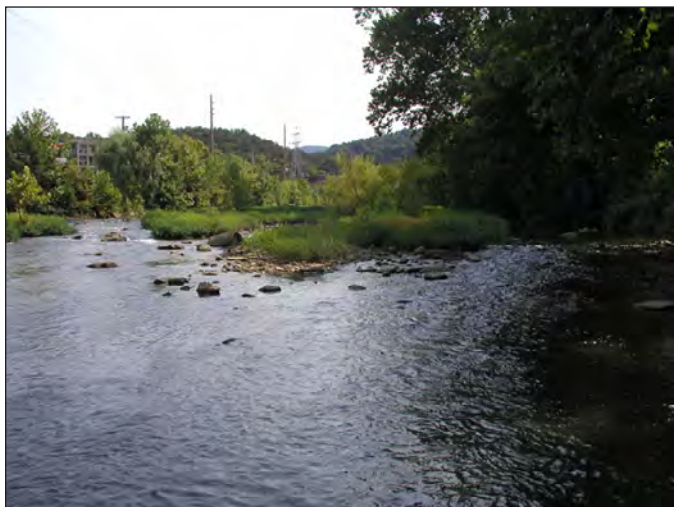


Site 13. Roanoke River below Garnand Branch at Roanoke, Virginia, summer 2007. View of bedrock in channel near right bank.



Site 13. Roanoke River below Garnand Branch at Roanoke, Virginia, summer 2007. View downstream.





Site 13. Roanoke River below Garnand Branch at Roanoke, Virginia, summer 2007. View upstream.



Site 13. Roanoke River below Garnand Branch at Roanoke, Virginia, summer 2007. View downstream.



Site 13. Roanoke River below Garnand Branch at Roanoke, Virginia, summer 2007. View right to left bank.



Site 13. Roanoke River below Garnand Branch at Roanoke, Virginia, summer 2007. View of bedrock in channel near right bank.





Site 13. Roanoke River below Garnand Branch at Roanoke, Virginia, summer 2008. View right to left bank.



Site 13. Roanoke River below Garnand Branch at Roanoke, Virginia, summer 2009. View right to left bank.



Site 13. Roanoke River below Garnand Branch at Roanoke, Virginia, winter 2014. View right to left bank.



Site 13. Roanoke River below Garnand Branch at Roanoke, Virginia, winter 2014. View right to left bank near edge of water.





Site 14. Roanoke River at Riverdale Road at Roanoke, Virginia, summer 2005.  
View right to left bank.



Site 14. Roanoke River at Riverdale Road at Roanoke, Virginia, summer 2007.  
View upstream.



Site 14. Roanoke River at Riverdale Road at Roanoke, Virginia, summer 2009.  
View downstream.





Site 14. Roanoke River at Riverdale Road at Roanoke, Virginia, summer 2007. View left to right bank.



Site 14. Roanoke River at Riverdale Road at Roanoke, Virginia, summer 2007. View right to left bank.



Site 14. Roanoke River at Riverdale Road at Roanoke, Virginia, summer 2007. View right to left bank.





Site 14. Roanoke River at Riverdale Road at Roanoke, Virginia, summer 2008. View right to left bank.



Site 14. Roanoke River at Riverdale Road at Roanoke, Virginia, summer 2008. USGS employees conducting pebble counts.



Site 14. Roanoke River at Riverdale Road at Roanoke, Virginia, winter 2014. View right to left bank.



Site 14. Roanoke River at Riverdale Road at Roanoke, Virginia, winter 2014. View right to left bank.





Site 15. Roanoke River at Carlisle Avenue at Roanoke, Virginia, summer 2005, pre-construction. View right to left bank near edge of water.

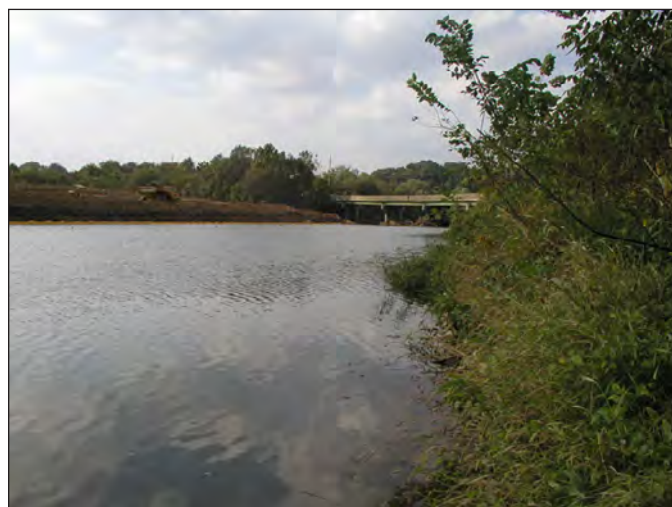


Site 15. Roanoke River at Carlisle Avenue at Roanoke, Virginia, summer 2005, post-construction. View right to left bank.





Site 15. Roanoke River at Carlisle Avenue at Roanoke, Virginia, summer 2005. View upstream, construction on left bank.



Site 15. Roanoke River at Carlisle Avenue at Roanoke, Virginia, summer 2005. View downstream, bench cut visible on left bank.



Site 15. Roanoke River at Carlisle Avenue at Roanoke, Virginia, summer 2006. View right to left bank.



Site 15. Roanoke River at Carlisle Avenue at Roanoke, Virginia, summer 2007. View right to left bank.





Site 15. Roanoke River at Carlisle Avenue at Roanoke, Virginia, summer 2008. View right to left bank.



Site 15. Roanoke River at Carlisle Avenue at Roanoke, Virginia, summer 2008. View right upstream.



Site 15. Roanoke River at Carlisle Avenue at Roanoke, Virginia, summer 2008. View right downstream.





Site 15. Roanoke River at Carlisle Avenue at Roanoke, Virginia, summer 2008. View right to left bank.



Site 15. Roanoke River at Carlisle Avenue at Roanoke, Virginia, summer 2009. View right to left bank.



Site 15. Roanoke River at Carlisle Avenue at Roanoke, Virginia, winter 2014. View right to left bank, close to water.



Site 15. Roanoke River at Carlisle Avenue at Roanoke, Virginia, winter 2014. View right to left bank.