Rapidan River watershed riparian restoration assessment

Friends of the Rappahannock

Center for Coastal Resources Management, Virginia Institute of Marine Science

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Rapidan River Watershed
Riparian Restoration Assessment

Prepared By:
Friends of the Rappahannock and the Center for Coastal Resources Management, Virginia Institute of Marine Science, College of William and Mary

Funded in part by the Chesapeake Bay Restoration Fund through the sale of "Friend of the Chesapeake" license plates, with support from the Center for Coastal Resources Management, Virginia Institute of Marine Science

August, 2000
Rapidan River Watershed
Riparian Restoration Assessment

Supported By:
Chesapeake Bay Restoration Fund, and the Comprehensive Coastal Inventory Program

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Executive Summary

A canoe based GPS survey was conducted of 111 miles of the Rapidan River and its major tributaries. The purpose of the survey was to collect the necessary baseline data to support the prioritization of stream reaches in the Rapidan River watershed for future streambank and/or riparian corridor restoration projects.

The data were post-processed and overlaid onto digital color orthophoto quarter quad images at a scale of 1:12,000 (resolution = 2 meters). Areas with critical erosion and/or riparian restoration needs were prioritized based on the analyzed features.

This survey is the first phase in a three-phase project designed to take a whole-watershed approach to identifying and prioritizing potential riparian restoration sites.

Acknowledgements

The preparation of this assessment was made possible by funding from the Commonwealth of Virginia's Chesapeake Bay Restoration Fund and the VIMS Comprehensive Coastal Inventory Program.

The authors would like to specifically acknowledge several individuals who assisted in the development of this assessment. Richard Kiehna, Celia Williams, Brian Hyde, Mike Snow, Jennifer Snow, John Whitfield, and Dave Hoffman of the Friends of the Rappahannock assisted with data collection logistics. Elizabeth Mountz of VIMS-CCRM assisted in the processing of the data. Layout and production was performed by Ruth Hershner, Harold Burrell and Eileen Horn of the VIMS Publication Center.

Background and Purpose

Eroding streambanks and the lack of sufficient forested buffers have been identified throughout the Chesapeake Bay watershed as significant causes of high sediment and nutrient loading. This problem has been particularly apparent in Virginia's Rapidan River watershed. In 1995 and 1996, extensive flooding greatly exacerbated the problem in the Rapidan River and its tributaries.

Survey Methodology

Prior to the initiation of data collection, F.O.R. and VIMS staff held meetings with local, state, and federal agency staff, as well as private interest groups, to solicit input on the most useful types and levels of data to collect in the survey. These recommendations were compiled and assessed in light of the capabilities of available technology and their feasibility via a canoe-based assessment. Table 1 lists the survey features and attributes chosen for the Assessment.

Data collection began in the summer of 1998 and was completed in the spring of 2000. For consistency, one individual collected all the field data. The data were collected via canoe-based visual assessments. Two GPS units were mounted in a canoe, one for each bank of the river. As the operator floated downstream, the pre-programmed menus on the GPS units were used to record the bank and riparian attributes.

<table>
<thead>
<tr>
<th>Bank Cover</th>
<th>Bank Erosion</th>
<th>Bank Height</th>
<th>Riparian Cover</th>
<th>Buffer</th>
<th>Points of Interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bare</td>
<td>Low</td>
<td>0-5 ft</td>
<td>Cropland</td>
<td>Marginal or nonexistant vegetated buffer</td>
<td>Streambank Blowout</td>
</tr>
<tr>
<td>Grass</td>
<td>Moderate</td>
<td>5-10 ft</td>
<td>Pasture (fenced)</td>
<td>Vegetated buffer (default)</td>
<td>Livestock Access Point</td>
</tr>
<tr>
<td>Scrub Shrub</td>
<td>Severe</td>
<td>&gt; 10 ft</td>
<td>Pasture (unfenced)</td>
<td></td>
<td>Human Disturbance</td>
</tr>
<tr>
<td>Forest</td>
<td></td>
<td></td>
<td>Forest (high density)</td>
<td></td>
<td>Waterbody Outflow</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Forest (low density)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Scrub Shrub</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Undefined Agriculture</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Several agencies and private organizations are involved in various aspects of streambank and riparian corridor restoration in the Rapidan watershed. However, no comprehensive assessment has existed to guide the prioritization and selection of sites for restoration. The need became apparent to take a whole-watershed approach to prioritizing potential restoration sites. By identifying and prioritizing the critical sites in the watershed, the restoration community can provide a higher level of cost-effectiveness in the use of funds for riparian restoration. The "Rapidan River Watershed Riparian Restoration Assessment" was conceived in order to address this need. In 1998, Friends of the Rappahannock, Inc. (F.O.R.) and the Virginia Institute of Marine Science (VIMS) received a grant from the Chesapeake Restoration Fund to conduct the survey and to prioritize stream reaches for bank stabilization and/or riparian forest restoration.
Table 2. Selection Criteria for High Priority Reaches

<table>
<thead>
<tr>
<th>Streambank Restoration</th>
<th>Erosion Level</th>
<th>Bank Cover</th>
<th>Bank Height</th>
<th>Riparian Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe</td>
<td>Bare or Grass</td>
<td>0-10 ft</td>
<td>Any</td>
<td></td>
</tr>
<tr>
<td>Moderate or Severe</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
<td></td>
</tr>
</tbody>
</table>

Riparian Corridor Restoration

Any

Water Quality

Meets priority criteria for both streambank and riparian corridor restoration.

OR

Has severe bank erosion with any bank cover or height

How to Use this Assessment

The Rapidan River Watershed was divided into thirty-four (34) plates, each at a scale of 1:12,000 for illustration purposes. Three (3) individual map compositions are included for each plate. They are identified by the plate number and the letter "A", "B", or "C" (ex: Plate 1a, 1b, and 1c). Each composition geographically illustrates a different set of attributes described previously in this report. Plate "A" delineates the land use along the riparian corridor, and includes notable point features delineated during field work. Plate "B" delineates conditions surveyed along the adjacent streambank. Plate "C" illustrates the location of priority restoration reaches defined by protocols applied in this study (refer to Table 2).

An index map is provided to identify the location of each plate in the watershed. All plates use digital images to create the final map compositions. A table summarizes the occurrence of features surveyed on each plate.

CD ROM

The data presented in this atlas and additional supporting data are available on CD ROM.

The CD ROM contains the following information:

- ArcView files containing all spatial data and imagery presented in this portfolio.
- Digital photos corresponding to the photo point numbers on the maps.
- An electronic version of this report.
- A metadata file, which meets standards established by the Federal Geographic Data Commission (FGDC). This file includes information pertaining to the development of the digital GIS coverages.

For additional information, contact the Friends of the Rappahannock at (540) 373-3448 or cleannriver@pobox.com.
Glossary

Severe Erosion - Banks which exhibit mass movement, such as slumping of bare soil or vegetation. May include banks with exposed root systems and/or active undercutting of the bank (see photo).

Moderate Erosion - Banks which exhibit erosion, but no apparent signs of mass movement. May be partially vegetated (see photo).

Low Erosion - Banks which are stable and show no signs of erosion (see photo).

Marginal or No Buffer - This term was used to indicate a condition common in the Rapidan watershed where a very narrow and sparse row of trees exist at the top of the bank, or no vegetation (apart from grass) exists at all. These areas are typically only one or two trees "deep" (5-10 feet from top of bank), and were bounded on the upland side by pasture or cropland (see photo).

Undefined Agriculture - From the vantage point of a canoe, the riparian land use was determined to be agricultural, but it was not possible to discern whether it was cropland or pasture.

Fenced / Unfenced - This modifier was used only with pasture land in order to indicate areas of potential livestock access. The "fenced" attribute was selected only when a fence was visible from the vantage point of a canoe.

High and Low Density - This modifier was used only with forest cover. High density forest cover denotes areas where visibility into the forest was limited to less than 30 feet at full leaf cover.

Blow Out - A blow out is an area on the streambank with an indented pocket of severe erosion, typically 10 to 30 feet in width. These areas are holes that remain from the root masses of large trees that were washed out during flood events. Blow outs that had become stabilized and vegetated were not inventoried.

Photo Point - Marks the location where a photograph was taken. The adjoining number indicates the number of the photo on the Rapidan Survey CD.

Livestock - Indicates the location of a livestock access point to the water, verified by either the presence of livestock or a livestock trail.

Outflow - Indicates the location of a pipe discharge.

Human Disturbance - Indicates the location of a human disturbance along the river's edge, such as a landing, stairs, or a bridge crossing. The numbers referenced on the maps refer to descriptive remarks in Appendix I.
### Human Disturbance Index

<table>
<thead>
<tr>
<th>Human Disturbance Point</th>
<th>Waterbody</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rapidan</td>
<td>Viewscape</td>
</tr>
<tr>
<td>1 C</td>
<td>Conway</td>
<td>Bridge</td>
</tr>
<tr>
<td>1 R</td>
<td>Robinson</td>
<td>Bridge</td>
</tr>
<tr>
<td>2</td>
<td>Rapidan</td>
<td>Outfall</td>
</tr>
<tr>
<td>2 C</td>
<td>Conway</td>
<td>Bridge</td>
</tr>
<tr>
<td>2 R</td>
<td>Robinson</td>
<td>Bridge</td>
</tr>
<tr>
<td>3</td>
<td>Rapidan</td>
<td>Bridge</td>
</tr>
<tr>
<td>3 C</td>
<td>Conway</td>
<td>Ford</td>
</tr>
<tr>
<td>3 R</td>
<td>Robinson</td>
<td>Bridge</td>
</tr>
<tr>
<td>4</td>
<td>Rapidan</td>
<td>Viewscape</td>
</tr>
<tr>
<td>4 R</td>
<td>Robinson</td>
<td>Bridge</td>
</tr>
<tr>
<td>5</td>
<td>Rapidan</td>
<td>Debris</td>
</tr>
<tr>
<td>5 R</td>
<td>Robinson</td>
<td>Bridge</td>
</tr>
<tr>
<td>6</td>
<td>Rapidan</td>
<td>Bridge</td>
</tr>
<tr>
<td>6 R</td>
<td>Robinson</td>
<td>Ford</td>
</tr>
<tr>
<td>7</td>
<td>Rapidan</td>
<td>Pipeline</td>
</tr>
<tr>
<td>7 R</td>
<td>Robinson</td>
<td>Ford</td>
</tr>
<tr>
<td>8</td>
<td>Rapidan</td>
<td>Junk (Debris)</td>
</tr>
<tr>
<td>8 R</td>
<td>Robinson</td>
<td>Bridge</td>
</tr>
<tr>
<td>9</td>
<td>Rapidan</td>
<td>Bridge</td>
</tr>
<tr>
<td>9 R</td>
<td>Robinson</td>
<td>Bridge</td>
</tr>
<tr>
<td>10</td>
<td>Rapidan</td>
<td>Bridge</td>
</tr>
<tr>
<td>11</td>
<td>Rapidan</td>
<td>Bridge</td>
</tr>
<tr>
<td>12</td>
<td>Rapidan</td>
<td>Beidge</td>
</tr>
<tr>
<td>13</td>
<td>Rapidan</td>
<td>Dam</td>
</tr>
<tr>
<td>14</td>
<td>Rapidan</td>
<td>Bridge</td>
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<tr>
<td>15</td>
<td>Rapidan</td>
<td>Bridge</td>
</tr>
<tr>
<td>16</td>
<td>Rapidan</td>
<td>Dam remains</td>
</tr>
<tr>
<td>17</td>
<td>Rapidan</td>
<td>Bridge</td>
</tr>
<tr>
<td>18</td>
<td>Rapidan</td>
<td>Bridge</td>
</tr>
<tr>
<td>19</td>
<td>Rapidan</td>
<td>Bridge</td>
</tr>
</tbody>
</table>
Appendix II

Remarks From Photo Points
(see the Rapidan Survey CD-ROM for Photos)
<table>
<thead>
<tr>
<th>Photo Point</th>
<th>Date</th>
<th>Waterbody</th>
<th>Location</th>
<th>River Side</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (1 of 3)</td>
<td>10/27/99</td>
<td>Rapidan</td>
<td>Graves Mill to Rt. 230</td>
<td>River Left</td>
<td>Stored gravel from river bottom</td>
</tr>
<tr>
<td>1 (2 of 3)</td>
<td>10/27/99</td>
<td>Rapidan</td>
<td>Graves Mill to Rt. 230</td>
<td>River Left</td>
<td>Channelization effort in progress</td>
</tr>
<tr>
<td>1 (3 of 3)</td>
<td>10/27/99</td>
<td>Rapidan</td>
<td>Graves Mill to Rt. 230</td>
<td>River Right</td>
<td>Channelization with dozer working</td>
</tr>
<tr>
<td>1 C</td>
<td>10/22/99</td>
<td>Conway River</td>
<td>Rt. 613 to Confluence</td>
<td>River Right</td>
<td>Upstream from Kinderhook Bridge</td>
</tr>
<tr>
<td>1 R</td>
<td>11/16/99</td>
<td>Robinson River</td>
<td>Robinson to Rt. 29</td>
<td>River Left</td>
<td>Dump on bank</td>
</tr>
<tr>
<td>2 (1 of 2)</td>
<td>4/12/99</td>
<td>Rapidan</td>
<td>Rt. 230 to Rt. 29</td>
<td>River Right</td>
<td>Cows in river</td>
</tr>
<tr>
<td>2 (2 of 2)</td>
<td>4/12/99</td>
<td>Rapidan</td>
<td>Rt. 230 to Rt. 29</td>
<td>River Right</td>
<td>Root ball revetment blown out</td>
</tr>
<tr>
<td>2 C</td>
<td>10/22/99</td>
<td>Robinson River</td>
<td>Robinson to Rt. 29</td>
<td>River Left</td>
<td>VDOT concrete bank</td>
</tr>
<tr>
<td>2 R</td>
<td>11/16/99</td>
<td>Rapidan</td>
<td>Rt. 230 to Rt. 29</td>
<td>River Left</td>
<td>Outfall at old pipeline</td>
</tr>
<tr>
<td>3 C</td>
<td>10/22/99</td>
<td>Conway River</td>
<td>Rt. 613 to Confluence</td>
<td>River Right</td>
<td>Channelization below 230 Bridge</td>
</tr>
<tr>
<td>3 R</td>
<td>11/16/99</td>
<td>Robinson River</td>
<td>Robinson to Rt. 29</td>
<td>River Left</td>
<td>Abandoned concrete structure</td>
</tr>
<tr>
<td>4 C</td>
<td>11/16/99</td>
<td>Robinson River</td>
<td>Robinson to Rt. 29</td>
<td>River Left</td>
<td>Old 12' dam</td>
</tr>
<tr>
<td>4 R</td>
<td>11/16/99</td>
<td>Robinson River</td>
<td>Robinson to Rt. 29</td>
<td>River Left</td>
<td>Tree planting in buffer zone between fence and riverbank</td>
</tr>
<tr>
<td>5 C</td>
<td>11/16/99</td>
<td>Robinson River</td>
<td>Robinson to Rt. 29</td>
<td>River Left</td>
<td>Channelization Left bank eroded</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td>River Right</td>
<td>Failed rootwad revetment</td>
</tr>
<tr>
<td>6 R (1 of 2)</td>
<td>4/12/99</td>
<td>Robinson River</td>
<td>Robinson to Rt. 29</td>
<td>River Left</td>
<td>Concrete slabs as bank armour</td>
</tr>
<tr>
<td>6 R (2 of 2)</td>
<td>4/12/99</td>
<td>Robinson River</td>
<td>Robinson to Rt. 29</td>
<td>River Left</td>
<td>Concrete slabs as bank armour</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td>River Left</td>
<td>Channelization</td>
</tr>
<tr>
<td>7 R (1 of 2)</td>
<td>4/12/99</td>
<td>Robinson River</td>
<td>Robinson to Rt. 29</td>
<td>River Left</td>
<td>Concrete slabs, showing overlap</td>
</tr>
<tr>
<td>7 R (2 of 2)</td>
<td>4/12/99</td>
<td>Robinson River</td>
<td>Robinson to Rt. 29</td>
<td>River Left</td>
<td>Rootwad revetment being installed incorrectly</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td>River Right</td>
<td>Rootwad revetment</td>
</tr>
<tr>
<td>8 R</td>
<td></td>
<td></td>
<td></td>
<td>River Left</td>
<td>Erosion and failed rootwad revetment</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td>River Right</td>
<td>Confluence of South and Rapidan River</td>
</tr>
<tr>
<td>9 R (1 of 2)</td>
<td>4/26/99</td>
<td>Robinson River</td>
<td>Rt. 29 to Confluence</td>
<td>River Left</td>
<td>12' broken dam</td>
</tr>
<tr>
<td>9 R (2 of 2)</td>
<td>4/26/99</td>
<td>Robinson River</td>
<td>Rt. 29 to Confluence</td>
<td>River Right</td>
<td>12' broken dam, back side</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td>River Left</td>
<td>Dairy cows in river</td>
</tr>
<tr>
<td>10 R</td>
<td></td>
<td></td>
<td></td>
<td>River Right</td>
<td>Low water bridge</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td>River Left</td>
<td>Low head dam</td>
</tr>
<tr>
<td>12 R</td>
<td></td>
<td></td>
<td></td>
<td>River Right</td>
<td>River wide strainer</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td>River Right</td>
<td>Downed fence, livestock access</td>
</tr>
<tr>
<td>13 R</td>
<td></td>
<td></td>
<td></td>
<td>River Right</td>
<td>Severe erosion</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td>River Right</td>
<td>Unmarked ford</td>
</tr>
<tr>
<td>14 R</td>
<td></td>
<td></td>
<td></td>
<td>River Left</td>
<td>Abandoned vehicle on bank</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td>River Right</td>
<td>Livestock access, fence down</td>
</tr>
<tr>
<td>15 R</td>
<td></td>
<td></td>
<td></td>
<td>River Right</td>
<td>Abandoned vehicle on bank #2</td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td>River Right</td>
<td>Outfall? Uptake?</td>
</tr>
<tr>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td>River Left</td>
<td>Severe erosion, recent grass clumps</td>
</tr>
<tr>
<td>18 (1 of 2)</td>
<td>4/3/99</td>
<td>Rapidan</td>
<td>Rt. 29 to Confluence</td>
<td>River Right</td>
<td>Log jam blockade</td>
</tr>
<tr>
<td>18 (2 of 2)</td>
<td>4/3/99</td>
<td>Rapidan</td>
<td>Rt. 29 to Confluence</td>
<td>River Left</td>
<td>Abandoned vehicle on bank</td>
</tr>
<tr>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td>River Right</td>
<td>Severe erosion</td>
</tr>
<tr>
<td>20 (1 of 2)</td>
<td>4/3/99</td>
<td>Rapidan</td>
<td>Rt. 29 to Confluence</td>
<td>River Right</td>
<td>Old building material</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>River Right</td>
<td>Livestock with access</td>
</tr>
<tr>
<td>Photo Point</td>
<td>Date</td>
<td>Waterbody</td>
<td>Location</td>
<td>River Side</td>
<td>Comment</td>
</tr>
<tr>
<td>------------</td>
<td>-----------</td>
<td>-----------</td>
<td>------------------------</td>
<td>------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>20 (2 of 2)</td>
<td>4/3/99</td>
<td>Rapidan</td>
<td>Rt. 231 to Rt. 15</td>
<td>River Right</td>
<td>Livestock with access</td>
</tr>
<tr>
<td>21</td>
<td>4/26/99</td>
<td>Rapidan</td>
<td>On Rapidan below confluence</td>
<td>River Right</td>
<td>Root ball dumping</td>
</tr>
<tr>
<td>22</td>
<td>3/31/99</td>
<td>Rapidan</td>
<td>Rt. 615 to Rt. 522</td>
<td>River Left</td>
<td>Old conduit 6' diameter</td>
</tr>
<tr>
<td>23</td>
<td>3/31/99</td>
<td>Rapidan</td>
<td>Rt. 615 to Rt. 522</td>
<td>River Left</td>
<td>Old conduit 6' diameter</td>
</tr>
<tr>
<td>24</td>
<td>3/31/99</td>
<td>Rapidan</td>
<td>Rt. 615 to Rt. 522</td>
<td>River Left</td>
<td>Livestock access-mannmade?</td>
</tr>
<tr>
<td>25</td>
<td>3/31/99</td>
<td>Rapidan</td>
<td>Rt. 614 to Rt. 522</td>
<td>River Left</td>
<td>Fencing down</td>
</tr>
<tr>
<td>26</td>
<td>3/31/99</td>
<td>Rapidan</td>
<td>Rt. 615 to Rt. 522</td>
<td>River Right</td>
<td>Dump site above Rt. 522</td>
</tr>
<tr>
<td>27</td>
<td>3/24/99</td>
<td>Rapidan</td>
<td>Rt. 522 to Rt. 3</td>
<td>River Left</td>
<td>Dairy cows in tributary of Rapidan</td>
</tr>
<tr>
<td>28</td>
<td>3/24/99</td>
<td>Rapidan</td>
<td>Rt. 522 to Rt. 3</td>
<td>River Left</td>
<td>Severe erosion</td>
</tr>
<tr>
<td>29 (1 of 2)</td>
<td>5/3/99</td>
<td>Rapidan</td>
<td>Rt. 3 to Confluence of Rapp.</td>
<td>River Right</td>
<td>Outfall, treated sewage</td>
</tr>
<tr>
<td>29 (2 of 2)</td>
<td>5/3/99</td>
<td>Rapidan</td>
<td>Rt. 3 to Confluence of Rapp.</td>
<td>River Right</td>
<td>Outfall, treated sewage</td>
</tr>
<tr>
<td>30</td>
<td>5/3/99</td>
<td>Rapidan</td>
<td>Rt. 3 to Confluence of Rapp.</td>
<td>River Right</td>
<td>Clearcut viewscape</td>
</tr>
<tr>
<td>31</td>
<td>5/3/99</td>
<td>Rapidan</td>
<td>Rt. 3 to Confluence of Rapp.</td>
<td>River Right</td>
<td>Outfall from home</td>
</tr>
<tr>
<td>32 (1 of 2)</td>
<td>5/3/99</td>
<td>Rapidan</td>
<td>Rt. 3 to Confluence of Rapp.</td>
<td>River Right</td>
<td>Vehicle tracks, driving in river</td>
</tr>
<tr>
<td>32 (2 of 2)</td>
<td>5/3/99</td>
<td>Rapidan</td>
<td>Rt. 3 to Confluence of Rapp.</td>
<td>River Left</td>
<td>Vehicle tracks leading into river</td>
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<tr>
<td>33</td>
<td>5/3/99</td>
<td>Rapidan</td>
<td>Rt. 3 to Confluence of Rapp.</td>
<td>River Left</td>
<td>Campground, marked trees</td>
</tr>
<tr>
<td>X</td>
<td>10/22/99</td>
<td>Conway River</td>
<td>Rt. 613 to Confluence</td>
<td>River Right</td>
<td>Upstream from Fletcher Bridge</td>
</tr>
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</table>
Appendix III
Map Portfolio
<table>
<thead>
<tr>
<th>PLATE NUMBER</th>
<th>TOTAL SURVEYED</th>
<th>BANK COVER (miles of shore)</th>
<th>BANK (bank height and erosion status - miles of shore)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>low mod*</td>
<td>mod*</td>
</tr>
<tr>
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<td>0.00</td>
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<td>0.00</td>
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<tr>
<td>34</td>
<td>5.20</td>
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<tr>
<td><strong>Total</strong></td>
<td>223.26</td>
<td>10.25</td>
<td>59.28</td>
</tr>
</tbody>
</table>

* moderate erosion  ** livestock disturbance
** blow outs  *** human disturbance (bridges, viewscapes, debris, dams, etc)
**** for streamside surveyed. They cannot be reached by adding down the columns for each plate since there is plate overlap.
RAPIDAN RIVER WATERSHED
PLATE 1a
Riparian Land Use and Points of Interest

Legend

- Agriculture- undefined
- Agriculture- undefined/marginal-no buffer
- Cropland
- Cropland/marginal-no buffer
- Pasture (fenced)
- Pasture (fenced)/marginal-no buffer
- Pasture (unfenced)
- Pasture (unfenced)/marginal-no buffer
- Forest (high density)
- Forest (high density)/marginal-no buffer
- Forest (low density)
- Forest (low density)/marginal-no buffer
- Scrub-shrub
- Scrub-shrub/marginal-no buffer

- Blow Out
- Out Flow
- Livestock
- Photo Point
- Human Disturbance
- Flow direction

Scale

1,000
0
1:12,000

Feet

Comprehensive Coastal Inventory
Center for Coastal Resources Management
Virginia Institute of Marine Science
RAPIDAN RIVER
WATERSHED
PLATE 3c
Critical Targeting
Priority Reaches

Legend

- Riparian Restoration
- Bank Restoration
- Water Quality Restoration
- Flow direction

Comprehensive Coastal Inventory
Center for Coastal Resource Management
Virginia Institute of Marine Science
RAPIDAN RIVER WATERSHED

PLATE 6c

Critical Targeting Priority Reaches

Legend

- Riparian Restoration
- Bank Restoration
- Water Quality Restoration
- Flow direction

Comprehensive Coastal Inventory
Center for Coastal Resources Management
Virginia Institute of Marine Science
RAPIDAN RIVER
WATERSHED
PLATE 7b
Bank Conditions

Legend

- 0-5 ft/low erosion
- 0-5 ft/moderate erosion
- 0-5 ft/severe erosion
- 5-10 ft/low erosion
- 5-10 ft/moderate erosion
- 5-10 ft/severe erosion
- >10 ft/low erosion
- >10 ft/moderate erosion
- >10 ft/severe erosion

Bare bank
Grass bank
Scrub-shrub bank
Forest bank

Flow direction

Scale

0 1,000 Feet
1:12,000

Comprehensive Coastal Inventory
Center for Coastal Resource Management
Virginia Institute of Marine Science
RAPIDAN RIVER WATERSHED PLATE 8a
Riparian Land Use and Points of Interest

Legend
- Agriculture-undefined
- Agriculture-undefined/marginal-no buffer
- Cropland
- Cropland/marginal-no buffer
- Pasture (fenced)
- Pasture (fenced)/marginal-no buffer
- Pasture (unfenced)
- Pasture (unfenced)/marginal-no buffer
- Forest (high density)
- Forest (high density)/marginal-no buffer
- Forest (low density)
- Forest (low density)/marginal-no buffer
- Scrub-shrub
- Scrub-shrub/marginal-no buffer
- Blow Out
- Out Flow
- Livestock
- Human Disturbance
- Photo Point

Flow direction

Scale
1,000 0 1,000 Feet
1:12,000

Comprehensive Coastal Inventory
Center for Coastal Resources Management
Virginia Institute of Marine Science
RAPIDAN RIVER
WATERSHED
PLATE 8c

Critical Targeting
Priority Reaches

Legend

- Riparian Restoration
- Bank Restoration
- Water Quality Restoration
- Flow direction

Comprehensive Coastal Inventory
Center for Coastal Resources Management
Virginia Institute of Marine Science
RAPIDAN RIVER WATERSHED
PLATE 9a
Riparian Land Use and Points of Interest
Legend

- Agriculture- undefined
- Agriculture- undefined/marginal-no buffer
- Cropland
- Cropland/marginal-no buffer
- Pasture (fenced)
- Pasture (fenced)/marginal-no buffer
- Pasture (unfenced)
- Pasture (unfenced)/marginal-no buffer
- Forest (high density)
- Forest (high density)/marginal-no buffer
- Forest (low density)
- Forest (low density)/marginal-no buffer
- Scrub-shrub
- Scrub-shrub/marginal-no buffer
- Blow Out
- Out Flow
- Livestock
- Photo Point
- Human Disturbance
- Flow direction

Scale

0
1,000
1:12,000
1,000

Comprehensive Coastal Inventory
Center for Coastal Resources Management
Virginia Institute of Marine Science
RAPIDAN RIVER WATERSHED
PLATE 10a
Riparian Land Use and Points of Interest

Legend
- Agriculture - undefined
- Agriculture - undefined/marginal-no buffer
- Cropland
- Cropland/marginal-no buffer
- Pasture (fenced)
- Pasture (fenced)/marginal-no buffer
- Pasture (unfenced)
- Pasture (unfenced)/marginal-no buffer
- Forest (high density)
- Forest (high density)/marginal-no buffer
- Forest (low density)
- Forest (low density)/marginal-no buffer
- Scrub-shrub
- Scrub-shrub/marginal-no buffer

- Blow Out
- Out Flow
- Livestock
- Photo Point
- Human Disturbance
- Flow direction

Scale
0 1,000 1,000
0 1:12,000

Comprehensive Coastal Inventory
Center for Coastal Resource Management
Virginia Institute of Marine Science
RAPIDAN RIVER
WATERSHED
PLATE 10c

Critical Targeting
Priority Reaches

Legend

- Riparian Restoration
- Bank Restoration
- Water Quality Restoration
- Flow direction

Comprehensive Coastal Inventory
Center for Coastal Resources Management
Virginia Institute of Marine Science
RAPIDAN RIVER WATERSHED PLATE 11b

Bank Conditions

Legend

- 0-5 ft/low erosion
- 5-10 ft/moderate erosion
- 5-10 ft/severe erosion
- >10 ft/severe erosion
- Bare bank
- Grass bank
- Scrub-shrub bank
- Forest bank
- Flow direction

1:12,000 Scale

Comprehensive Coastal Inventory
Center for Coastal Resource Management
Virginia Institute of Marine Science
RAPIDAN RIVER WATERSHED
PLATE 11c
Critical Targeting Priority Reaches

Legend

- Riparian Restoration
- Bank Restoration
- Water Quality Restoration
- Flow direction

Comprehensive Coastal Inventory
Center for Coastal Resources Management
Virginia Institute of Marine Science
RAPIDAN RIVER
WATERSHED
PLATE 12b
Bank Conditions
Legend

- 0-5 ft/low erosion
- 0-5 ft/moderate erosion
- 0-5 ft/severe erosion
- 5-10 ft/low erosion
- 5-10 ft/moderate erosion
- 5-10 ft/severe erosion
- >10 ft/low erosion
- >10 ft/moderate erosion
- >10 ft/severe erosion

Bare bank
Grass bank
Scrub-shrub bank
Forest bank
Flow direction

Scale
0 1,000
1:12,000 1,000

Comprehensive Coastal Inventory
Center for Coastal Resources Management
Virginia Institute of Marine Science
RAPIDAN RIVER WATERSHED
PLATE 12c
Critical Targeting Priority Reaches
Legend

- Riparian Restoration
- Bank Restoration
- Water Quality Restoration
- Flow direction

Scale
0 1,000 1:12,000 1,000 Feet

Comprehensive Coastal Inventory
Center for Coastal Resources Management
Virginia Institute of Marine Science
RAPIDAN RIVER
WATERSHED
PLATE 13c
Critical Targeting
Priority Reaches

Legend

- Riparian Restoration
- Bank Restoration
- Water Quality Restoration
- Flow direction

Comprehensive Coastal Inventory
Center for Coastal Resource Management
Virginia Institute of Marine Science
RAPIDAN RIVER
WATERSHED
PLATE 15b
Bank Conditions

Legend

- 0-5 ft/low erosion
- 0-5 ft/moderate erosion
- 0-5 ft/severe erosion
- 5-10 ft/low erosion
- 5-10 ft/moderate erosion
- 5-10 ft/severe erosion
- >10 ft/low erosion
- >10 ft/moderate erosion
- >10 ft/severe erosion

Bare bank
Grass bank
Scrub-shrub bank
Forest bank
Flow direction

Scale
1,000
0
1:12,000
1,000

Comprehensive Coastal Inventory
Center for Coastal Resources Management
Virginia Institute of Marine Science
RAPIDAN RIVER WATERSHED
PLATE 18a
Riparian Land Use
and Points of Interest
Legend

Legend

Agriculture
Agriculture
Cropland
Cropland
Pasture (fenced)
Pasture (fenced)
Pasture (unfenced)
Pasture (unfenced)
Forest (high density)
Forest (high density)
Forest (low density)
Forest (low density)
Scrub-shrub
Scrub-shrub
Blow Out
Out Flow
Livestock
Human Disturbance
Flow direction

Scale

1,000
0
1,000

Feet

Comprehensive Coastal Inventory
Center for Coastal Resources Management
Virginia Institute of Marine Science
RAPIDAN RIVER WATERSHED
PLATE 21a

Riparian Land Use
and Points of Interest

Legend

- Agriculture-undefined
- Agriculture-undefined/marginal-no buffer
- Cropland
- Cropland/marginal-no buffer
- Pasture (fenced)
- Pasture (fenced)/marginal-no buffer
- Pasture (unfenced)
- Pasture (unfenced)/marginal-no buffer
- Forest (high density)
- Forest (high density)/marginal-no buffer
- Forest (low density)
- Forest (low density)/marginal-no buffer
- Scrub-shrub
- Scrub-shrub/marginal-no buffer

- Blow Out
- Out Flow
- Livestock
- Photo Point
- Human Disturbance

Flow direction

Scale

0
1,000
1:12,000
1,000 Feet

Comprehensive Coastal Inventory
Center for Coastal Resource Management
Virginia Institute of Marine Science
Bank Conditions

Legend

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•••••

•••••

.....

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1,000

0-5 ft/low erosion
0-5 ft/moderate erosion
0-5 ft/severe erosion
5-10 ft/low erosion
5-10 ft/moderate erosion
5-10 ft/severe erosion
>10 ft/low erosion
>10 ft/moderate erosion
>10 ft/severe erosion

Bare bank
Grass bank
Scrub-shrub bank
Forest bank

Flow direction

Scale

1,000
0
1:12,000
1,000

Comprehensive Coastal Inventory
Center for Coastal Resources Management
Virginia Institute of Marine Science
RAPIDAN RIVER WATERSHED PLATE 23b
Bank Conditions

Legend

- 0-5 ft/low erosion
- 0-5 ft/moderate erosion
- 0-5 ft/severe erosion
- 5-10 ft/low erosion
- 5-10 ft/moderate erosion
- 5-10 ft/severe erosion
- >10 ft/low erosion
- >10 ft/moderate erosion
- >10 ft/severe erosion

Bare bank
Grass bank
Scrub-shrub bank
Forest bank

Flow direction

Scale

0 1:12,000 1,000

MADISON COUNTY

Comprehensive Coastal Inventory
Center for Coastal Resources Management
Virginia Institute of Marine Science
RAPIDAN RIVER
WATERSHED
PLATE 24b
Bank Conditions

Legend

- 0-5 ft/low erosion
- 0-5 ft/moderate erosion
- 0-5 ft/severe erosion
- 5-10 ft/low erosion
- 5-10 ft/moderate erosion
- 5-10 ft/severe erosion
- >10 ft/low erosion
- >10 ft/moderate erosion
- >10 ft/severe erosion

- Bare bank
- Grass bank
- Scrub-shrub bank
- Forest bank
- Flow direction

Scale

1,000 0 1,000
1:12,000

Comprehensive Coastal Inventory
Center for Coastal Resources Management
Virginia Institute of Marine Science
RAPIDAN RIVER WATERSHED
PLATE 25a

Riparian Land Use and Points of Interest

Legend

- Agriculture - undefined
- Agriculture - undefined/marginal-no buffer
- Cropland
- Cropland/marginal-no buffer
- Pasture (fenced)
- Pasture (fenced)/marginal-no buffer
- Pasture (unfenced)
- Pasture (unfenced)/marginal-no buffer
- Forest (high density)
- Forest (high density)/marginal-no buffer
- Forest (low density)
- Forest (low density)/marginal-no buffer
- Scrub-shrub
- Scrub-shrub/marginal-no buffer
- Blow Out
- Out Flow
- Livestock
- Photo Point
- Human Disturbance
- Flow direction

Scale

1,000 feet
1:12,000
Bank Conditions

Legend

- 0-5 ft/low erosion
- 0-5 ft/moderate erosion
- 0-5 ft/severe erosion
- 5-10 ft/low erosion
- 5-10 ft/moderate erosion
- 5-10 ft/severe erosion
- >10 ft/low erosion
- >10 ft/moderate erosion
- >10 ft/severe erosion
- Bare bank
- Grass bank
- Scrub-shrub bank
- Forest bank
- Flow direction

Scale

0 1,000 1:12,000 1,000 Feet

Comprehensive Coastal Inventory
Center for Coastal Resources Management
Virginia Institute of Marine Science
RAPIDAN RIVER
WATERSHED
PLATE 25c
Critical Targeting
Priority Reaches

Legend

- Riparian Restoration
- Bank Restoration
- Water Quality Restoration
- Flow direction

1,000
Scale
Feet
1:12,000

Comprehensive Coastal Inventory
Center for Coastal Resources Management
Virginia Institute of Marine Science
RAPIDAN RIVER
WATERSHED
PLATE 27b
Bank Conditions
Legend
- 0-5 ft/low erosion
- 0-5 ft/moderate erosion
- 0-5 ft/severe erosion
- 5-10 ft/low erosion
- 5-10 ft/moderate erosion
- 5-10 ft/severe erosion
- >10 ft/low erosion
- >10 ft/moderate erosion
- >10 ft/severe erosion
- Bare bank
- Grass bank
- Scrub-shrub bank
- Forest bank
- Flow direction

0-5 ft
5-10 ft
>10 ft

Legend

Comprehensive Coastal Inventory
Center for Coastal Resource Management
Virginia Institute of Marine Science
Bank Conditions

Legend

- 0-5 ft/low erosion
- 0-5 ft/moderate erosion
- 0-5 ft/severe erosion
- 5-10 ft/low erosion
- 5-10 ft/moderate erosion
- 5-10 ft/severe erosion
- >10 ft/low erosion
- >10 ft/moderate erosion
- >10 ft/severe erosion

- Bare bank
- Grass bank
- Scrub-shrub bank
- Forest bank
- Flow direction

Comprehensive Coastal Inventory
Center for Coastal Resources Management
Virginia Institute of Marine Science
RAPIDAN RIVER WATERSHED
PLATE 29c

Critical Targeting Priority Reaches

Legend

- **Riparian Restoration**
- **Bank Restoration**
- **Water Quality Restoration**
- **Flow direction**

Comprehensive Coastal Inventory
Center for Coastal Resource Management
Virginia Institute of Marine Science
RAPIDAN RIVER
WATERSHED
PLATE 30c

Critical Targeting
Priority Reaches

Legend

- Riparian Restoration
- Bank Restoration
- Water Quality Restoration
- Flow direction

Comprehensive Coastal Inventory
Center for Coastal Resources Management
Vermont Institute of Natural Science
RAPIDAN RIVER
WATERSHED
PLATE 31a
Riparian Land Use
and Points of Interest
Legend

- Agriculture- undefined
- Agriculture- undefined/marginal-no buffer
- Cropland
- Cropland/marginal-no buffer
- Pasture (fenced)
- Pasture (fenced)/marginal-no buffer
- Pasture (unfenced)
- Pasture (unfenced)/marginal-no buffer
- Forest (high density)
- Forest (high density)/marginal-no buffer
- Forest (low density)
- Forest (low density)/marginal-no buffer
- Scrub-shrub
- Scrub-shrub/marginal-no buffer
- Blow Out
- Out Flow
- Livestock
- Human Disturbance
- Flow direction

Scale
0
1,000
1:12,000
1,000 Feet

Comprehensive Coastal Inventory
Center for Coastal Resources Management
Virginia Institute of Marine Science
RAPIDAN RIVER WATERSHED
PLATE 31b
Bank Conditions

Legend

- 0-5 ft/low erosion
- 0-5 ft/moderate erosion
- 0-5 ft/severe erosion
- 5-10 ft/low erosion
- 5-10 ft/moderate erosion
- 5-10 ft/severe erosion
- >10 ft/low erosion
- >10 ft/moderate erosion
- >10 ft/severe erosion

- Bare bank
- Grass bank
- Scrub-shrub bank
- Forest bank
- Flow direction

Scale

1,000 0 1,000 1:12,000 Feet

Comprehensive Coastal Inventory
Center for Coastal Resources Management
Virginia Institute of Marine Science
RAPIDAN RIVER
WATERSHED
PLATE 31c
Critical Targeting
Priority Reaches

Legend

- Riparian Restoration
- Bank Restoration
- Water Quality Restoration
- Flow direction

Comprehensive Coastal Inventory
Center for Coastal Resources Management
Virginia Institute of Marine Science
RAPIDAN RIVER
WATERSHED
PLATE 32b

Bank Conditions

Legend

- 0-5 ft/low erosion
- 0-5 ft/moderate erosion
- 0-5 ft/severe erosion
- 5-10 ft/low erosion
- 5-10 ft/moderate erosion
- 5-10 ft/severe erosion
- >10 ft/low erosion
- >10 ft/moderate erosion
- >10 ft/severe erosion
- Bare bank
- Grass bank
- Scrub-shrub bank
- Forest bank
- Flow direction

Scale

1,000
0
1:12,000
1,000

Comprehensive Coastal Inventory
Center for Coastal Resource Management
Virginia Institute of Marine Science
RAPIDAN RIVER WATERSHED PLATE 33b

Bank Conditions

Legend

- 0-5 ft/low erosion
- 0-5 ft/moderate erosion
- 0-5 ft/severe erosion
- 5-10 ft/low erosion
- 5-10 ft/moderate erosion
- 5-10 ft/severe erosion
- >10 ft/low erosion
- >10 ft/moderate erosion
- >10 ft/severe erosion

- Bare bank
- Grass bank
- Scrub-shrub bank
- Forest bank

Flow direction

Scale

Feet

Comprehensive Coastal Inventory Center for Coastal Resource Management
Virginia Institute of Marine Science