Stroubles Creek: A Local Implementation Plan in Progress

Town of Blacksburg

Kafi Howard
Town Engineer
Background of Stroubles Creek Watershed

- Stroubles Creek is a freshwater, spring-fed stream that flows for approximately 9.2 miles.
- Drains to the New River, Ohio River, Mississippi, and Gulf of Mexico.
- Town of Blacksburg incorporated in 1798.
- Virginia Tech founded in 1872 as an agricultural land grant college.
Causes of Stream Degradation

- Livestock access to streams
- Poor Erosion and Sediment Controls
Causes of Stream Degradation

- Urban storm water runoff
- Sanitary Sewer Overflows

Additional Causes:
- Erosion of stream banks
- Agricultural runoff
Listed on the 303(d) list in 1998 and 2002
Regulatory Process

• In 2003, a TMDL for Troubles Creek was completed by the Center for Watershed Studies
• Sediment was considered the “Surrogate Stressor”
• Impacts from the three possible stressors – nutrients, organic matter, and sediment – are probably inter-related.
• Best management practices (BMPs) employed to control sediment would result in decreases in the other possible stressors as well.
• The ultimate criteria for judging the success of the TMDL will be the restoration of the benthic community itself.
## Allowable Loads

<table>
<thead>
<tr>
<th>Source Category</th>
<th>Future Upper Stroubles Creek (t/yr)</th>
<th>Reference Toms Creek (t/yr)</th>
<th>Upper Stroubles Creek Sediment TMDL Allocation (% reduction)</th>
<th>TMDL (t/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>3,469.1</td>
<td>1,192.6</td>
<td>77%</td>
<td>803</td>
</tr>
<tr>
<td>Urban</td>
<td>623.7</td>
<td>376.7</td>
<td>54%</td>
<td>289</td>
</tr>
<tr>
<td>Forestry</td>
<td>100.6</td>
<td>241.5</td>
<td>0%</td>
<td>101</td>
</tr>
<tr>
<td>Channel Erosion</td>
<td>2,181.4</td>
<td>334.8</td>
<td>77%</td>
<td>505</td>
</tr>
<tr>
<td>MS4</td>
<td>454.6</td>
<td>0.0</td>
<td>54%</td>
<td>211</td>
</tr>
<tr>
<td>Point Sources</td>
<td>22.3</td>
<td>0.0</td>
<td></td>
<td>22</td>
</tr>
<tr>
<td>Total</td>
<td>6,851.7</td>
<td>2,145.6</td>
<td>71.8%</td>
<td>1,931</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TMDL (t/yr)</th>
<th>WLA (t/yr)</th>
<th>LA (t/yr)</th>
<th>MOS (t/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,145.6</td>
<td>233.2</td>
<td>1,697.9</td>
<td>214.6</td>
</tr>
</tbody>
</table>

- VAR050441 - Litton Systems Inc Poly Scientific Div : 2.7
- VAR050508 - VT - Central Heating Plt: 0.46
- VAR10042 - VT - Dairy Science Center: 2.37
- VAR10267 - VT - Campus: 15.43
- VAR10275 - Hawthorne Ridge Town Houses: 0.77
- VAR10282 - Carriage Court II: 0.54
- VPG120011 - VT - Dairy Science Center: 0
- MS4s (VAR040019, VAR040049, VAR040016): 210.88
Implementation Plan Process

- **Stakeholders**
  - Virginia Tech
  - Town of Blacksburg
  - Montgomery County
  - VDOT.

- **Focus Groups**
  - Agricultural/Rural
  - Residential/Urban
  - Public Works

- **Steering Committee**

- **Project Teams**

- **Plan completed in 2006**
### Troubles Creek IP Steering Committee

- Ron Bonnema
- John Bush
- Mary Dail
- David Dent
- Curtis Elswick
- Cynthia Hancock
- Justin Laughlin
- Stuart Lynde
- Mike Rosenzweig
- Adele Schirmer

### Agriculture/Rural Focus Group

- Chris Barbour
- Lowell Bowman
- Theresa Carter
- Abi Convery
- Mary Dail
- Dean Gall
- Justin Laughlin
- Lori Lester
- Susan Mirlohi
- Craig Nessler
- Dwight Paulette
- Elizabeth Reed
- Barry Robinson
- Andrew Schenker

### Residential/Urban Focus Group

- Chris Barbour
- Phil Beever
- Brian Benham
- John Bush
- Theresa Carter
- John Chermak
- Abi Convery
- Mary Dail
- David Darnell
- George Devlin
- Bill Elvey
- Jason Hill
- Mike & Tana Matzuk
- Steve Mouras
- T. J. Murphy
- Don Packard
- Barry Robinson
- Mike Rosenzweig
- Adele Schirmer
- Llyn Sharp

### Public Works Focus Group

- Greg Anderson
- Brian Benham
- Lowell Bowman
- Theresa Carter
- John Chermak
- Mary Dail
- David Dent
- Jason Hill
- Kelly Mattingly
- Charlie Maus
- Susan Mirlohi
- Steve Mouras
- John Novak
- Eric Smith

- Matt Stolte
- Sharyl Walker
- Andrew Warren
- Lindsay West
- Tess Wynn
- Gene Yagow
- Tamim Younos

- Julie Still
- Matt Stolte
- Tess Wynn
- Gene Yagow
- Tamim Younos
Problems Addressed in IP

1. Lack of streamside forest
2. Livestock access to streams
3. Agricultural runoff
4. Increasing development and peak flows from stormwater runoff
5. Stream channel modifications
6. Sewer overflows
7. Downtown business wastewater disposal
8. Pollutant buildup on impervious surfaces
9. Enforcement of Erosion & Sediment regulations at construction sites
10. Improper disposal of grass clippings and trash
TMDL Implementation Measures

• Agricultural BMPs
• Stream Channel BMPs
• Urban Storm water Management BMPs
• Sanitary Sewer System Improvements
• Urban/Residential Education Program
## Analysis of Cost and Estimated Reductions

<table>
<thead>
<tr>
<th>Implementation BMPs</th>
<th>IP Reductions</th>
<th>Implementation Costs</th>
<th>Cost/Load Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N (lbs/yr)</td>
<td>P (lbs/yr)</td>
<td>Sed (tons/yr)</td>
</tr>
<tr>
<td>Riparian forest buffer - agr</td>
<td>4,323.9</td>
<td>2,894.6</td>
<td>766.7</td>
</tr>
<tr>
<td>Livestock exclusion + limited access</td>
<td>1,042.92</td>
<td>199.13</td>
<td>56.54</td>
</tr>
<tr>
<td>Loafing lot management + diversion</td>
<td>37.02</td>
<td>28.48</td>
<td>0.00</td>
</tr>
<tr>
<td>Stream channel restoration</td>
<td>280.1</td>
<td>506.7</td>
<td>213.8</td>
</tr>
<tr>
<td>Riparian forest buffer - urban</td>
<td>581.7</td>
<td>186.2</td>
<td>16.4</td>
</tr>
<tr>
<td>Infiltration practices (additional)</td>
<td>66.46</td>
<td>11.42</td>
<td>2.25</td>
</tr>
<tr>
<td>Bioretention areas (additional)</td>
<td>57.15</td>
<td>13.21</td>
<td>1.88</td>
</tr>
<tr>
<td>Street sweeping (additional)</td>
<td>778.95</td>
<td>58.09</td>
<td>16.15</td>
</tr>
<tr>
<td>Hydrodynamic separator</td>
<td>192.76</td>
<td>10.54</td>
<td>1.54</td>
</tr>
<tr>
<td>Increase E&amp;S program efficiency</td>
<td>382.92</td>
<td>715.92</td>
<td>90.00</td>
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</tbody>
</table>
# Agriculture and Stream BMP Costs

## Agricultural BMP’s

<table>
<thead>
<tr>
<th>Problem Addressed</th>
<th>Agricultural BMPs</th>
<th>Total Extent</th>
<th>Units</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Agricultural riparian forest buffers</td>
<td>29.63 acres</td>
<td></td>
<td>$16,208</td>
</tr>
<tr>
<td>2</td>
<td>Livestock exclusion</td>
<td>13,937 lin. ft.</td>
<td></td>
<td>$33,589</td>
</tr>
<tr>
<td>2</td>
<td>Limited access crossing</td>
<td>100 lin. ft.</td>
<td></td>
<td>$2,200</td>
</tr>
<tr>
<td>3</td>
<td>Loafing lot management</td>
<td>3.64 acres</td>
<td></td>
<td>- TBD -</td>
</tr>
<tr>
<td>3</td>
<td>Diversion</td>
<td>1,476 lin. ft.</td>
<td></td>
<td>$3,263</td>
</tr>
<tr>
<td></td>
<td><strong>TAA (Technical Assistance / Administration)</strong></td>
<td></td>
<td></td>
<td>$11,052</td>
</tr>
<tr>
<td></td>
<td><strong>Total Cost Estimate</strong></td>
<td></td>
<td></td>
<td><strong>$66,311</strong></td>
</tr>
</tbody>
</table>

## Stream Channel BMP’s

<table>
<thead>
<tr>
<th>Problem Addressed</th>
<th>Stream Channel BMPs</th>
<th>Total Extent</th>
<th>Units</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>2, 5</td>
<td>Stream channel restoration</td>
<td>6,881 lin. ft.</td>
<td></td>
<td>$1,066,555</td>
</tr>
<tr>
<td>5</td>
<td>Relocate riparian gravel road (Horse Farm to Rt. 460)</td>
<td>1,360 lin. ft.</td>
<td></td>
<td>$510,000</td>
</tr>
<tr>
<td>5</td>
<td>Restore culvert capacity (Kabrich St.)</td>
<td></td>
<td></td>
<td>- TBD -</td>
</tr>
<tr>
<td>5</td>
<td>Upgrade Rt. 460 culverts</td>
<td></td>
<td></td>
<td>$712,500</td>
</tr>
<tr>
<td></td>
<td><strong>TAA (Technical Assistance / Administration)</strong></td>
<td></td>
<td></td>
<td>$143,985</td>
</tr>
<tr>
<td></td>
<td><strong>Total Cost Estimate</strong></td>
<td></td>
<td></td>
<td><strong>$2,433,040</strong></td>
</tr>
</tbody>
</table>

---
## Stormwater & Sanitary BMP Costs

### Stormwater Management BMP’s

<table>
<thead>
<tr>
<th>Problem Addressed</th>
<th>Stormwater BMPs</th>
<th>Total Extent</th>
<th>Units</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Urban riparian forest buffers</td>
<td>7.20</td>
<td>acres</td>
<td>$3,938</td>
</tr>
<tr>
<td>1</td>
<td>Wetland development</td>
<td></td>
<td>acres</td>
<td>- TBD -</td>
</tr>
<tr>
<td>4</td>
<td>Infiltration trench retrofits</td>
<td>55,386</td>
<td>cu.ft.</td>
<td>$969,255</td>
</tr>
<tr>
<td>4</td>
<td>Infiltration level spreaders</td>
<td>0.00</td>
<td>acres</td>
<td>$0</td>
</tr>
<tr>
<td>4</td>
<td>Additional infiltration BMPs</td>
<td>9.83</td>
<td>acres</td>
<td>$142,784</td>
</tr>
<tr>
<td>4</td>
<td>Bioretention area</td>
<td>0.89</td>
<td>acres</td>
<td>$164,790</td>
</tr>
<tr>
<td>4</td>
<td>Additional bioretention BMPs</td>
<td>11.60</td>
<td>acres</td>
<td>$223,242</td>
</tr>
<tr>
<td>4</td>
<td>Sediment pond stabilization</td>
<td></td>
<td>acres</td>
<td>- TBD -</td>
</tr>
<tr>
<td>7</td>
<td>Eliminate improper downtown business wastewater disposal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Street sweeping (additional)</td>
<td>58.47</td>
<td>curb miles</td>
<td>$12,746</td>
</tr>
<tr>
<td>8</td>
<td>Hydrodynamic solids separator</td>
<td></td>
<td>systems</td>
<td>$100,000</td>
</tr>
<tr>
<td>9</td>
<td>Increase E&amp;S program efficiency</td>
<td></td>
<td></td>
<td>$50,000</td>
</tr>
<tr>
<td>10</td>
<td>Reduce improper disposal of grass clippings and trash</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TAA</td>
<td>Technical Assistance / Administration</td>
<td>27%</td>
<td>of all except VT and TOB expenditures</td>
<td>$99,890</td>
</tr>
<tr>
<td><strong>Total Cost Estimate</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>$1,766,647</strong></td>
</tr>
</tbody>
</table>

Sanitary System Improvements = $ 2,775,000
Urban/Residential Education Program

- Encourage smart development,
- Encourage protection of existing riparian buffers and the use of low impact development (LID) practices,
- Conduct erosion and sedimentation workshops,
- Conduct workshops to promote homeowner use of LID practices, and
- Encourage citizen stewardship of our streams.
## Total Estimated Program Cost

### Total Estimated Program Costs

<table>
<thead>
<tr>
<th>Implementation Action Type</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural BMPs</td>
<td>$66,311</td>
</tr>
<tr>
<td>Stream Channel BMPs</td>
<td>$2,433,040</td>
</tr>
<tr>
<td>Stormwater Management BMPs</td>
<td>$1,766,647</td>
</tr>
<tr>
<td>Sanitary Sewer System Improvements</td>
<td>$2,475,000</td>
</tr>
<tr>
<td>Urban/Residential Education Program</td>
<td>$200,000 (included in various TAA)</td>
</tr>
<tr>
<td><strong>Total Implementation Cost</strong></td>
<td><strong>$6,740,997</strong></td>
</tr>
</tbody>
</table>
Virginia Tech’s STREAM Lab

A Stream Restoration Project

- Natural Channel Design
- Reduces Stream-bank erosion
- Reconnects Floodplain
- Fence-out Livestock
- Uses Student Volunteers
- Creates a Study Environment
Implementation

Urban Stormwater Management BMP’s
- Bioretention Retrofits
- Pervious Pavement & Pervious Concrete Applications
- Environmental Site Design
- Regional Stormwater Detention to Protect Streams from Urban Impacts
- Street Sweeping
- Sanitary Sewer Modeling
How did these Measures Impact Stroubles Creek?

- Some improvement in sampling scores.
- Stream is still categorized as impaired.
- Flooding is reduced.
- Citizen awareness is improved.
What is next?

• Continue to remove excessive sediment loads and related pollutant inputs,
• Continue to monitor benthic community for additional signs of improvement,
• More education and enforcement of erosion and sediment controls as well as permanent stormwater management,
• And the installation of a variety of BMPs to achieve full restoration of the benthic community.
Questions and Comments

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khoward@blacksburg.gov (540) 961-1124
What are Benthic Macroinvertebrates?

- Stream-inhabiting organisms
  - **Benthic**: Bottom dwelling
  - **Macro**: Large enough to see with naked eye
  - **Invertebrates**: Without backbones
TOM’S CREEK WATERSHED

STRoubles CREEK WATERSHED

ROANOKE RIVER WATERSHED

SLATE BRANCH WATERSHED

CEDAR RUN WATERSHED

Drains to New River then to Gulf of Mexico
Drains to Roanoke River then to Atlantic Ocean
Continental Divide
Watershed Boundaries
Underground Piped Streams
Creeks

November 27, 2001

Town of Blacksburg

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