

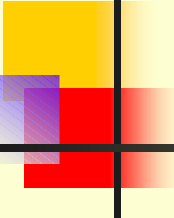
Center for TMDL and Watershed Studies at Virginia Tech

Brian L. Benham

USDA-CSREES
National Water Quality Meeting

February 8, 2005





What is a TMDL?

- Required by 1972 Clean Water Act — Section 303(d)
- The maximum amount of pollutant that can enter a water body without negatively affecting its beneficial uses
 - Fishing, swimming, wildlife habitat, aquatic life, shellfish habitat

TMDL = point sources + nonpoint sources + margin of safety

= WLA + LA + MOS



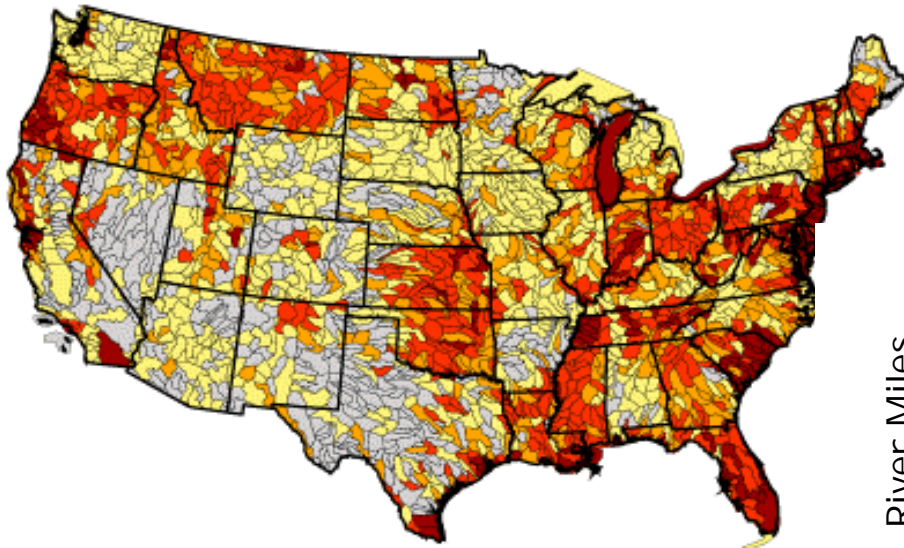
What does developing a TMDL involve?

- Identifying and quantifying pollutant sources, accounting for temporal and spatial distribution
 - Existing and future conditions
- Linking pollutant sources with in-stream WQ
- Defining maximum allowable pollutant load (TMDL)
- Developing pollutant allocation scenarios

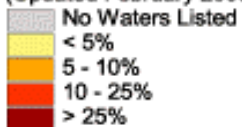
Top Sources of Water Quality Impairment

Streams and Rivers	Lakes	Estuaries
Agriculture	Agriculture	Urban Runoff
Point Sources	Point Sources	Point Sources
Habitat Modification	Urban Runoff	Agriculture

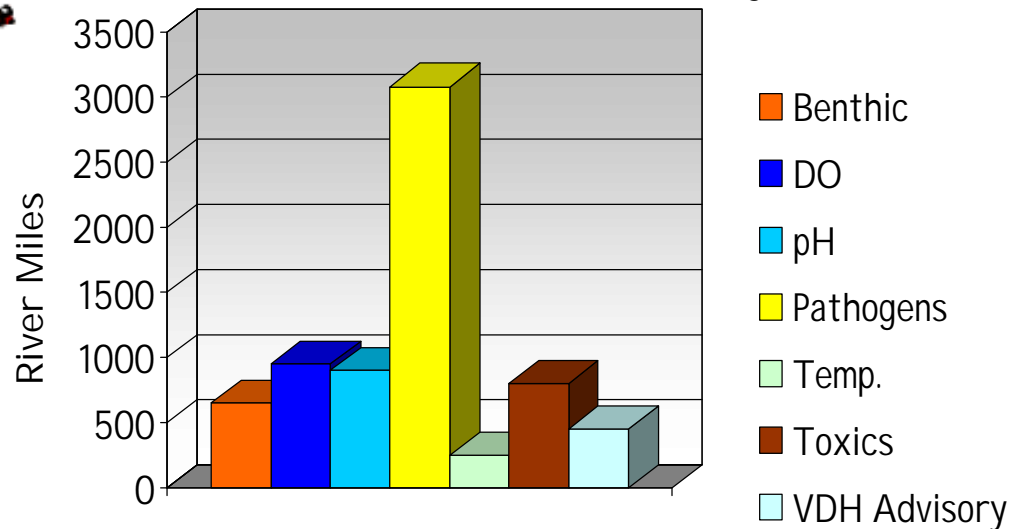
EPA Fact sheet No. 841-F-96-004A



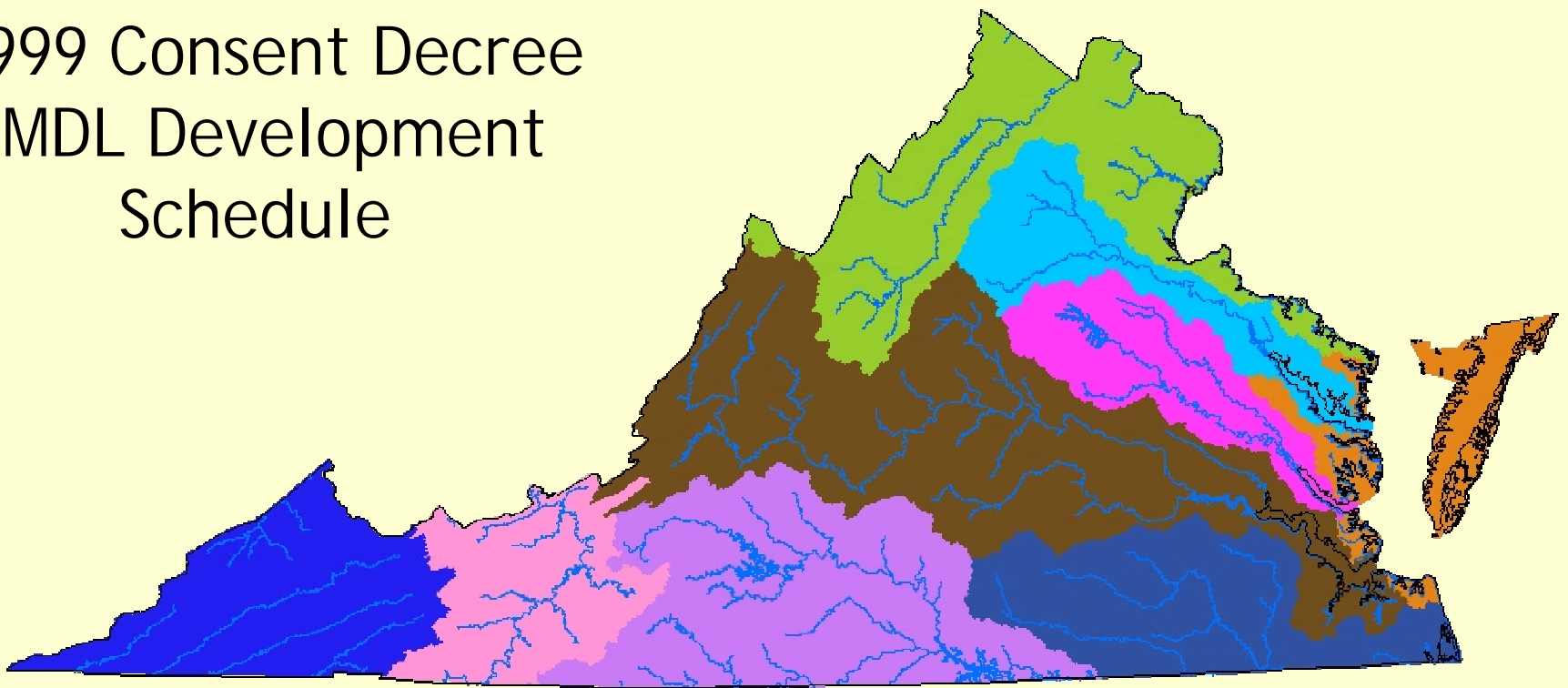
Percent of Impaired Waters - 1998
(Updated February 2000)



Top Causes of Impairments
on Streams & Rivers in Virginia



1999 Consent Decree TMDL Development Schedule



Biennial TMDL Schedule by River Basin							
River Basin	2000	2002	2004	2006	2008	2010	Totals
Potomac-Shenandoah	2	15	9	15	21	4	66
James	0	5	5	6	26	12	54
Rappahannock	1	1	11	0	1	0	14
Roanoke	6	3	6	9	8	8	40
Chowan & Dismal Swamp	0	0	0	5	1	0	6
Tennessee & Big Sandy	4	4	6	10	8	4	36
Small Coastal & Chesapeake Bay	0	0	6	5	0	0	11
York	0	0	4	2	0	2	8
New	0	2	0	7	3	0	12
Totals	13	30	47	59	68	30	247

Based on 1998 303d list and 1999 Consent Decree



EPA Estimated TMDL Funding Needs (Aug. 01)

- Total: \$16 to \$66 billion thru 2015
 - Required monitoring: \$17 million per year
 - TMDL Development: \$1 billion over 15 years
(for known impairments)
 - TMDL Implementation: \$1 to 4.4 billion per year

Source: "The National Costs of the Total Maximum Daily Load Program (Draft Report)"
<http://www.epa.gov/owow/tmdl/coststudy/costfact.html>



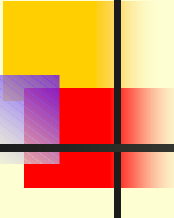
Mission Statement

To conduct interdisciplinary research, teaching, and outreach to improve the integrity of the Nation's waters and watersheds by advancing the science, tools, and expertise available for developing, evaluating, and implementing watershed planning and management processes.



Objectives

- Address watershed management and planning issues by
 - conducting basic and applied research to improve the science and procedures for developing, evaluating, and implementing watershed management plans,
 - providing training in the development and implementation of accurate, effective, achievable TMDLs, and
 - facilitating participation in the TMDL process by increasing awareness and understanding of NPS pollution and water quality issues.



Targeted clientele

- Policy and decision makers
- Scientists and engineers
- Consulting professionals
- Stakeholders
- Students

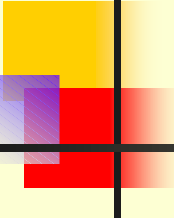
National and international opportunities



Services and products

The Center's services and products reflect the Land-Grant missions

- Teaching
- Research
- Extension/Outreach



Teaching

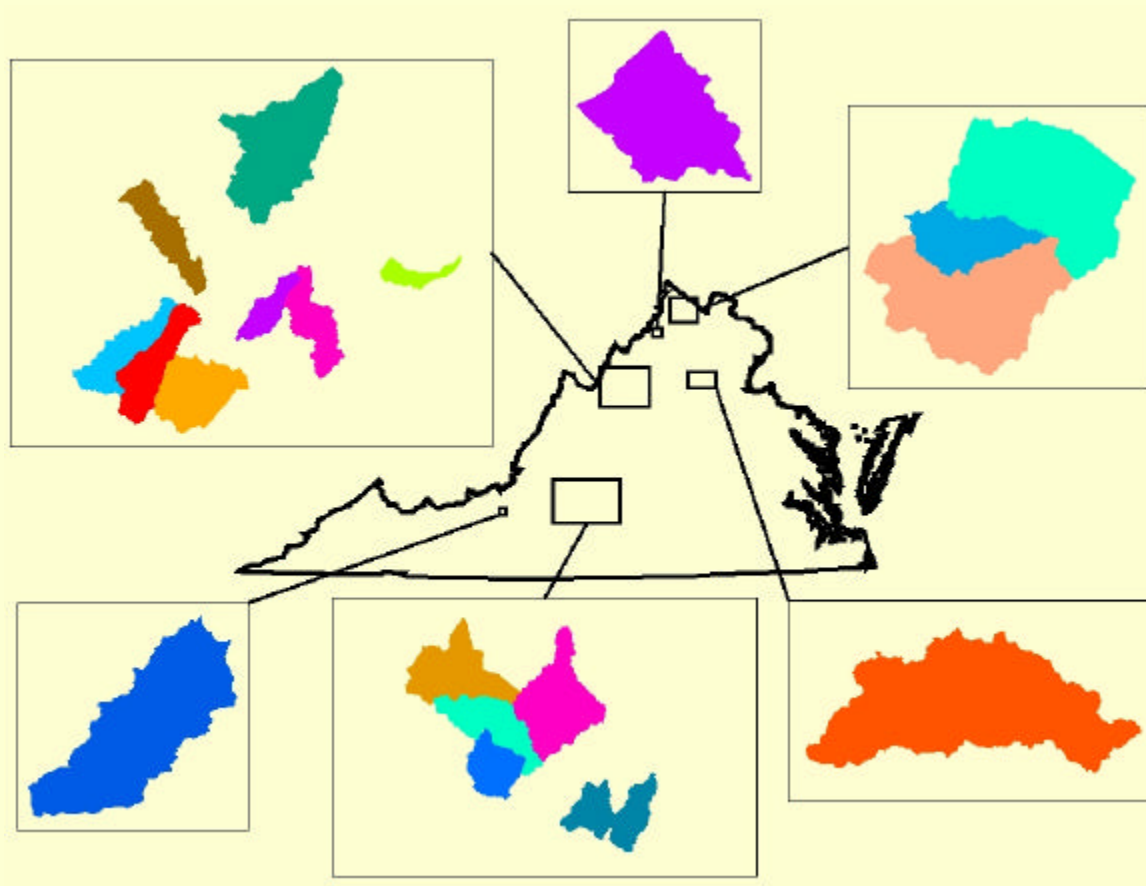
- Graduate level course
 - BSE 5324 – TMDL Development and Implementation
 - Goals
 - Educate engineering students in the basic technical skills/knowledge
 - Educate non-engineers about components/process
 - Course delivery:
 - On campus – Fall semesters
 - Via distance learning outlets – beginning 2005



Teaching cont.

- Graduate students
 - MS, PhD, and postdoc
 - Project funded
- Undergrad internships (Center Fellows)
 - Computer Science
 - Engineering
 - English – technical writing

Actively developing TMDLs



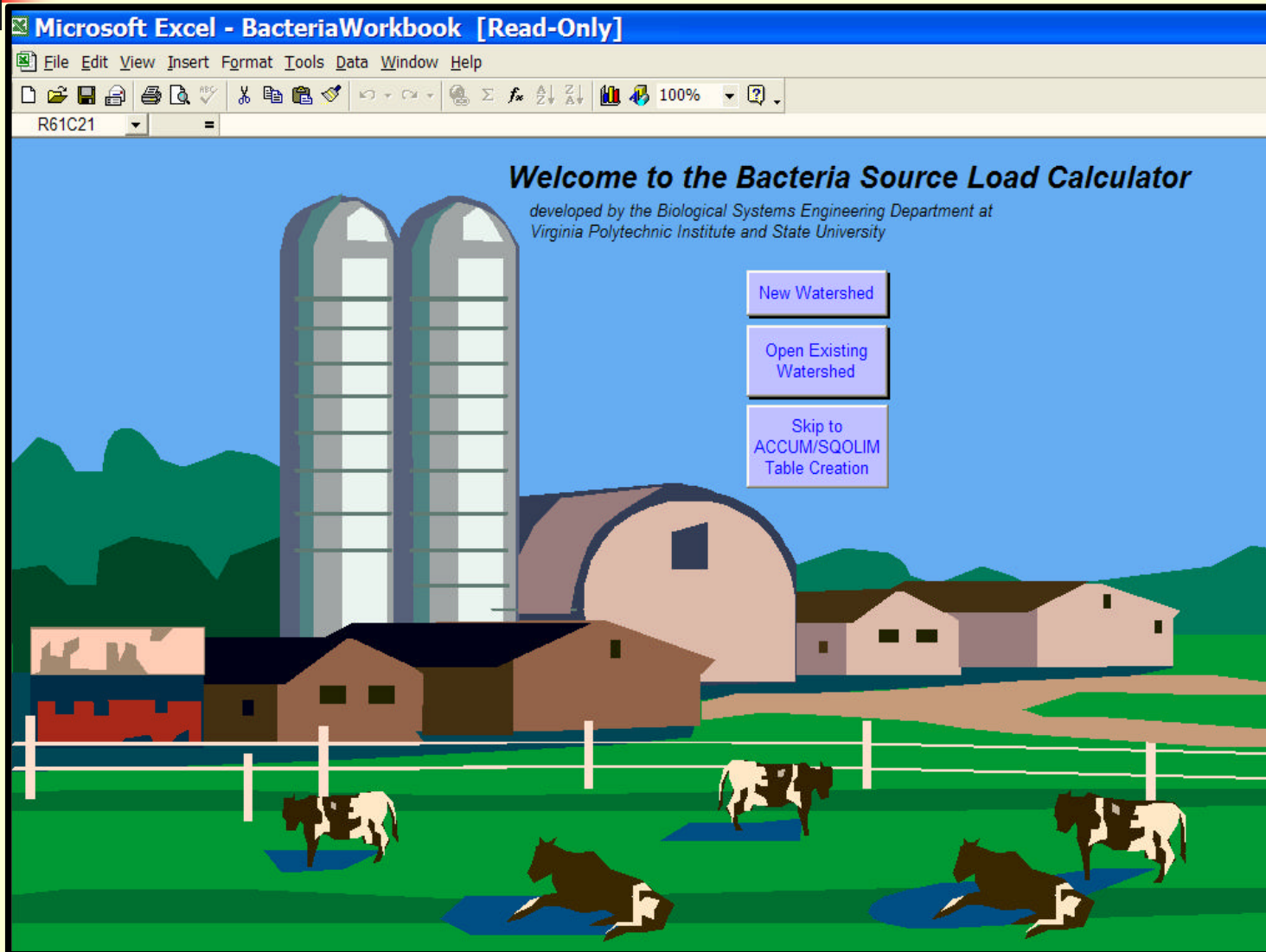
- Developed 25 TMDLs, currently developing 16
- Biological and benthic impairments



Research

- Improve watershed and water quality modeling
- Improve information on BMP effectiveness and related process of aquatic ecosystem recovery
- Improve monitoring systems and technology
- Provide technical support and information transfer
- Develop web-based national TMDL knowledgebase Clearinghouse

Software created to assist in developing TMDLs



Software created to assist in developing TMDLs

Microsoft Excel - FecalColiformWorkbook [Read-Only]

File Edit View Insert Format Tools Data Window Help

Click on one of the buttons below to preview the associated report

Deposition

- Streams
- Forests
- Crop Land
- Pastures
- Loafing Lots
- Residential

Microsoft Excel - FecalColiformWorkbook [Read-Only]

File Edit View Insert Format Tools Data Window Help

Stream Loading Results

(all values listed in cfu/month)

Return to Results Summary Page

B08-1

Month	Milk Cows	Dry Cows	Heifers	Beef Cows	Sheep	Deer	Raccoons	Muskrats	Beavers	Geese	Wild Turkeys	Ducks	Straight Pipes	Total
January	0	0	0	0	0	2.17E+08	3.1E+08	2.33E+09	0	1.24E+10	0	3.72E+10	0	5.25E+10
February	0	0	0	0	0	1.98E+08	2.83E+08	2.12E+09	0	1.13E+10	0	3.39E+10	0	4.78E+10
March	0	0	0	0	0	2.17E+08	3.1E+08	2.33E+09	0	1.24E+10	0	1.86E+10	0	3.39E+10
April	0	0	0	0	0	2.1E+08	3E+08	2.25E+09	0	1.2E+10	0	1.8E+10	0	3.28E+10
May	0	0	0	0	0	2.17E+08	3.1E+08	2.33E+09	0	1.24E+10	0	1.86E+10	0	3.39E+10
June	0	0	0	0	0	2.1E+08	3E+08	2.25E+09	0	1.2E+10	0	1.8E+10	0	3.28E+10
July	0	0	0	0	0	2.17E+08	3.1E+08	2.33E+09	0	1.24E+10	0	1.86E+10	0	3.39E+10
August	0	0	0	0	0	2.17E+08	3.1E+08	2.33E+09	0	1.24E+10	0	1.86E+10	0	3.39E+10
September	0	0	0	0	0	2.1E+08	3E+08	2.25E+09	0	1.2E+10	0	3.6E+10	0	5.08E+10
October	0	0	0	0	0	2.17E+08	3.1E+08	2.33E+09	0	1.24E+10	0	3.72E+10	0	5.25E+10
November	0	0	0	0	0	2.1E+08	3E+08	2.25E+09	0	1.2E+10	0	3.6E+10	0	5.08E+10
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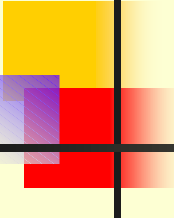
B08-2

Month	Milk Cows	Dry Cows	Heifers	Beef Cows	Sheep	Deer	Raccoons	Muskrats	Beavers	Geese	Wild Turkeys	Ducks	Straight Pipes	Total
January	0	0	0	0	0	3.04E+09	2.17E+09	1.09E+10	3100000	4.96E+10	1.73E+08	1.3E+11	0	1.96E+11
February	0	0	0	0	0	2.77E+09	1.98E+09	9.89E+09	2825000	4.52E+10	1.58E+08	1.19E+11	0	1.79E+11
March	0	0	0	0	0	3.04E+09	2.17E+09	1.09E+10	3100000	3.1E+10	1.73E+08	7.44E+10	0	1.22E+11
April	0	0	0	0	0	2.94E+09	2.1E+09	1.05E+10	3000000	3E+10	1.67E+08	7.2E+10	0	1.18E+11



Outreach

- Develop and deliver educational programs
 - Workshops
 - Short courses
 - Conferences
- Develop resource materials:
 - Fact sheets
 - Multi-media resource materials
 - Web-based resources
 - Scholarly publications



Outreach programs

- Educational Programs
 - “ABC’s of TMDLs”
 - “TMDL Modeling Workshop”
 - “TMDLs: What, Why, and How”
 - TMDL Public Meetings
- Audiences
 - Professional conferences – academics, practitioners
 - State and federal agency staff
 - Civic organizations
 - Local – Soil and Water Conservation Districts

Animated multi-media education modules

● Home ● Introduction ● Objectives ● Sources and Distribution ● BMP

Fate and Transport of Fecal Bacteria in the Environment

Brian Benham, Assistant Professor and
Rebecca Zeckoski, Research /
Department of Biological Systems

Carl Estes, Instructional Technology
Belinda Carroll, Distance Learning Fac
Photos courtesy of USDA Natural Resources
<http://photogallery.nrcs.usda.gov>



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AND STATE UNIVERSITY

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● Home ● Introduction ● Objectives ● Sources and Distribution ● BMP

BMP-Livestock-Pasture

Bacteria Sources: ● Livestock ● Humans and Pets

Fate and Transport: ● Pasture ● Cropland ● Direct Deposit

To reduce nonpoint source (NPS) pollution (bacteria, sediment, and nutrients) from pastures, rotational grazing is often used. Rotational grazing involves subdividing a pasture into units called 'paddocks.' Livestock are moved to fresh paddocks periodically, providing time for pasture re-growth. Rotational



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Fate and Transport of Fecal Bacteria in the Environment



Center membership

- Faculty from four colleges at Virginia Tech
 - College of Agriculture and Life Sciences
 - College of Engineering
 - College of Natural Resources
 - College of Architecture & Urban Studies
 - More than a dozen disciplines
- University of Virginia, West Virginia University, and Penn State involved in ongoing Center projects.



Requirements for 319 funding mirror TMDL process

- Identify the sources of pollutants
- Estimate load reductions expected to achieve WQS
- Describe NPS management measures to achieve load reductions
- Estimate the amounts of technical and financial assistance needed
- Provide information component
- Encourage public participation
- Provide a schedule for implementing the NPS management measures
- Describe interim, measurable milestones to assess implementation progress
- Identify a set of criteria for determining if loading reductions are being achieved
- Establish a monitoring component to evaluate implementation efforts

*Addressing ambient water quality will
involve TMDL or similar watershed
planning process for the foreseeable future*

Questions or Comments



Brian Benham 209 Seitz Hall, Virginia Tech
voice: 540.231.5705, www.tmdl.net