

TMDL Liabilities, and Cost of Implementation

Greer City Hall
Greer, South Carolina
November 19, 2010

WOOLPERT

TMDL Liabilities, and Cost of Implementation

Presented by: Flint Holbrook, PE PH

Senior Vice President

WOOLPERT

TMDL Liabilities

- There are usually two categories of pollutant load reductions required for compliance with a TMDL.
  - Waste Load Allocations – reductions applied to anyone who has an existing NPDES discharge permit
    - MS4's
      - City
      - County
      - SCDOT
      - Universities
      - Others as designated by SDHEC
    - POTW's
    - Industrial dischargers
    - Construction activities
    - Landfills

TMDL Liabilities

- Load Allocations- applied to anyone who does not have an NPDES discharge permit
  - Agricultural activities
  - Forestry activities
  - Septic systems
  - Non regulated industrial activities
  - Others

TMDL Liabilities

- Liabilities for WLA activities
  - TMDL enforced through NPDES permits
    - Subject to CWA penalties
    - Consent decree's
  - Riparian water rights claims
  - Clean Water Act third party lawsuits
  - Political concerns

TMDL Liabilities

- Liabilities related to LA's
  - Possible CWA enforcement if proof is given discharge causes or contributes to violation of water quality standards
  - Little action for non compliance
  - Possible designation requiring NPDES permit
  - Loss of federal program support for agricultural activities

TMDL Compliance Costs

- Some variables of implementation that affect cost
  - Watershed size
  - Watershed location
  - Urbanization/imperviousness
  - Land use
  - Pollutant of concern
  - Climate
  - Available pollutant trading
  - Others

TMDL Compliance Costs

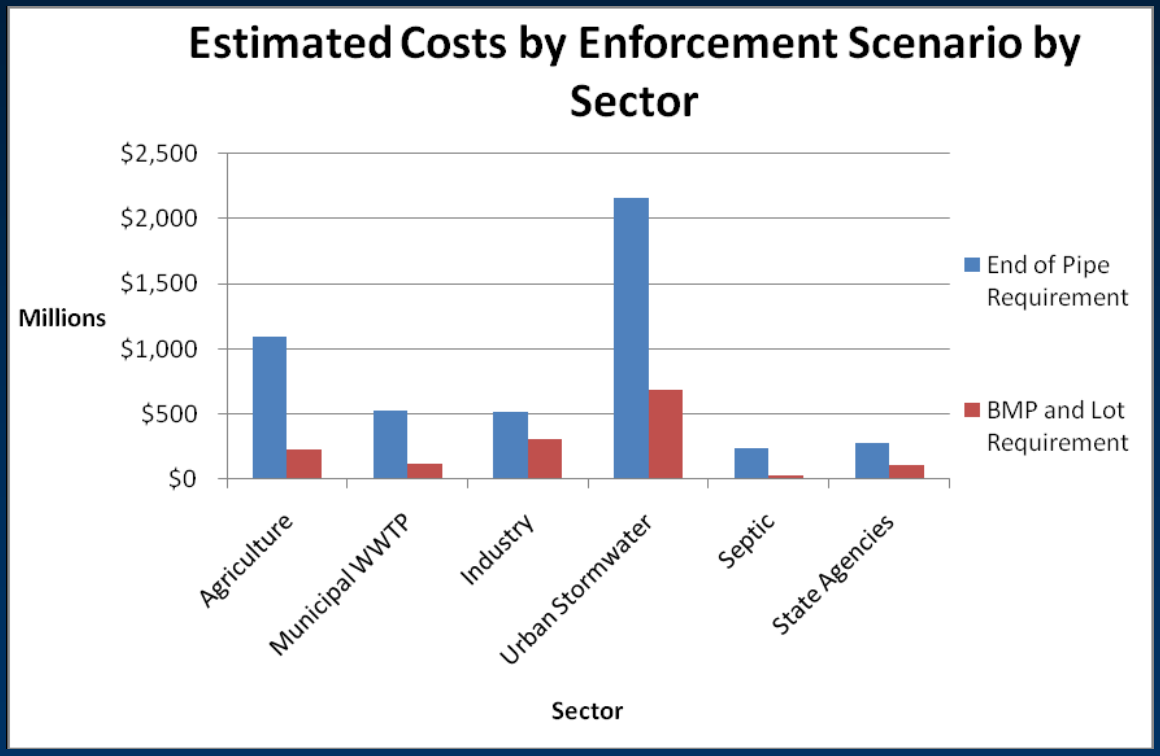
- In 2001 EPA estimated the cost of compliance 20,000 water bodies

Program Type	Cost of Compliance $ in Billions
Least flexible	$1.9 - $4.3
Moderately cost effective	$1.0 -$3.4
Most cost effective	$0.140 - $0.235

TMDL Compliance Costs

- State of Florida November 2010 estimated costs of between $3.1BB to $8.4BB annually for implementation of nutrient rules.
- Chesapeake Bay compliance cost estimate $697 MM annually for nutrients
- Cub River Idaho nutrient TMDL compliance costs of $7MM

Florida Estimated Cost by Sector



TMDL Compliance Costs

- Lake Champlain, VT total $500MM to $800MM

Land Use	Low $ in Millions	High $ in Millions
Agricultural	125	175
New Development	200	350
River Corridor Wetlands	100	150
Wastewater Forestry	75	125

TMDL Compliance Costs

Watershed	Big Otter River, Va	Opequon Creek, Va
Drainage Area	388 Sq. Mi.	200 Sq. Mi.
TMDL's	Bacteria	Bacteria Sediment
Sources	Agricultural Residential	Agricultural Urban Residential
Total Cost for BMP's	$9.6 MM	$41.5MM-$63.1MM
Cost/Sq. Mi.	$24,700	$207.5K-$315.5K

TMDL Compliance Costs

Cost for Agricultural BMPS Big Otter River Basin

Practice	Unit	Cost/Unit	Quantity	Total
SL-6 System	system	$12,400	198	$2,455,200
WP-2T (fencing install)	mile	$18,480	133.5	$2,467,080
WP-2T (maintenance)	mile	$2,640	133.5	$352,440
Hardened Crossings	system	$550	133	$73,150
Pastureland Management	acre	$85	16,097	$1,368,245
Tech. Assistance	person/year	$50,000	15.5	$775,000
Total				**$7,491,115**

TMDL Compliance Costs

Cost for residential BMP's for Big Otter River Basin

Practice	Estimated units needed	Average Cost ($) /Unit	Total Cost ($)
Conventional Septic System (to replace straight pipes)	22	$3,900	$85,800
Alternative Waste Treatment System (to replace straight pipes)	3	$15,000	$45,000
Straight Pipe Subtotal	**25**		**$130,800**
Septic System Repair	*49*	*$2,000*	*$98,000*
Conventional Septic System (to replace failing septic systems)	*239*	*$3,900*	*$932,100*
Alternative Waste Treatment System (to replace failing septic systems)	*33*	*$15,000*	*$495,000*
Failing Septic System Subtotal	**321**		**$1,525,100**
Staff-years	9	$50,000	$450,000
Total			**$2,105,900**

Cost Estimates for Implementation of BMPs Required to Achieve bacteria TMDL in Upper Opequon Creek watershed

Implementation Action	Unit	Units required (#)	Avg cost per unit ($)	Total cost ($)
Fencing with off-stream watering (SL-6 Grazing Land Protection)	linear ft	55,282	17	939,794
WP-2T (fencing)	linear ft	32,208	3.50	112,728
WP-2T (fencing maintenance)	linear ft	32,208	0.50	16,104
Establishment/enhancement of forested riparian buffer zones	acre (linear ft)	21.9 (27,300)	750	16,425
Pasture management	acre	7,726	85	656,710
Repair/replace failing septic systems	system	350	6,160	2,292,500
Infiltration basin/trench (Rain garden/bioretention)	acre	637 (797)	14,520 (19,239)	9,249,240 (15,333,483)
Loafing lot management	system	1	50,000	50,000
Cover crop	acre	1,866	40	74,640
Pet waste education program	program	1	Costs are included in Table 6.4 for whole watershed	Costs are included in Table 6.4 for whole watershed
Geese and duck waste clean-up	sweeper/vacuum	1	Costs are included in Table 6.4 for whole watershed	Costs are included in Table 6.4 for whole watershed
All practices implemented				13,408,141 (19,492,384)[1]

[1]The values shown for infiltration basin/trench and rain garden/bioretention indicate the number of impervious acres from which stormwater would still need to be treated to achieve the required reductions in bacteria loading after all the other listed practices are installed. The range in cost results from assuming that all of one practice or the other was used. A combination of bioretention and infiltration basins would cost in between the two values.

Cost Estimates for Implementation of BMPs Required to Achieve Bacteria and Sediment TMDLs in Abrams Creek

Implementation Action	Unit	Units required (#)	Avg cost per unit ($)	Total cost ($)
Repair/replace failing septic systems	system	44	9,100	409,100
Infiltration basin/trench (Rain garden/bioretention)	acre treated	1,652 (2,066)	14,520 (19,239)	23,987,040 (39,747,774)
Pet waste education program	program	1	10,000	10,000
Geese and duck waste clean-up	sweeper/vacuum	1	15,000	15,000
Establishment/enhancement of forested riparian buffer zones	acre (linear ft)	29 (35,980)[1]	750	21,750
Enhanced E&S[2] efficiency	E&S inspector	–	–	Costs are included in Table 6.7
All practices implemented				24,442,890 (40,203,624)[3]

[1] assumed buffer width of 35 ft

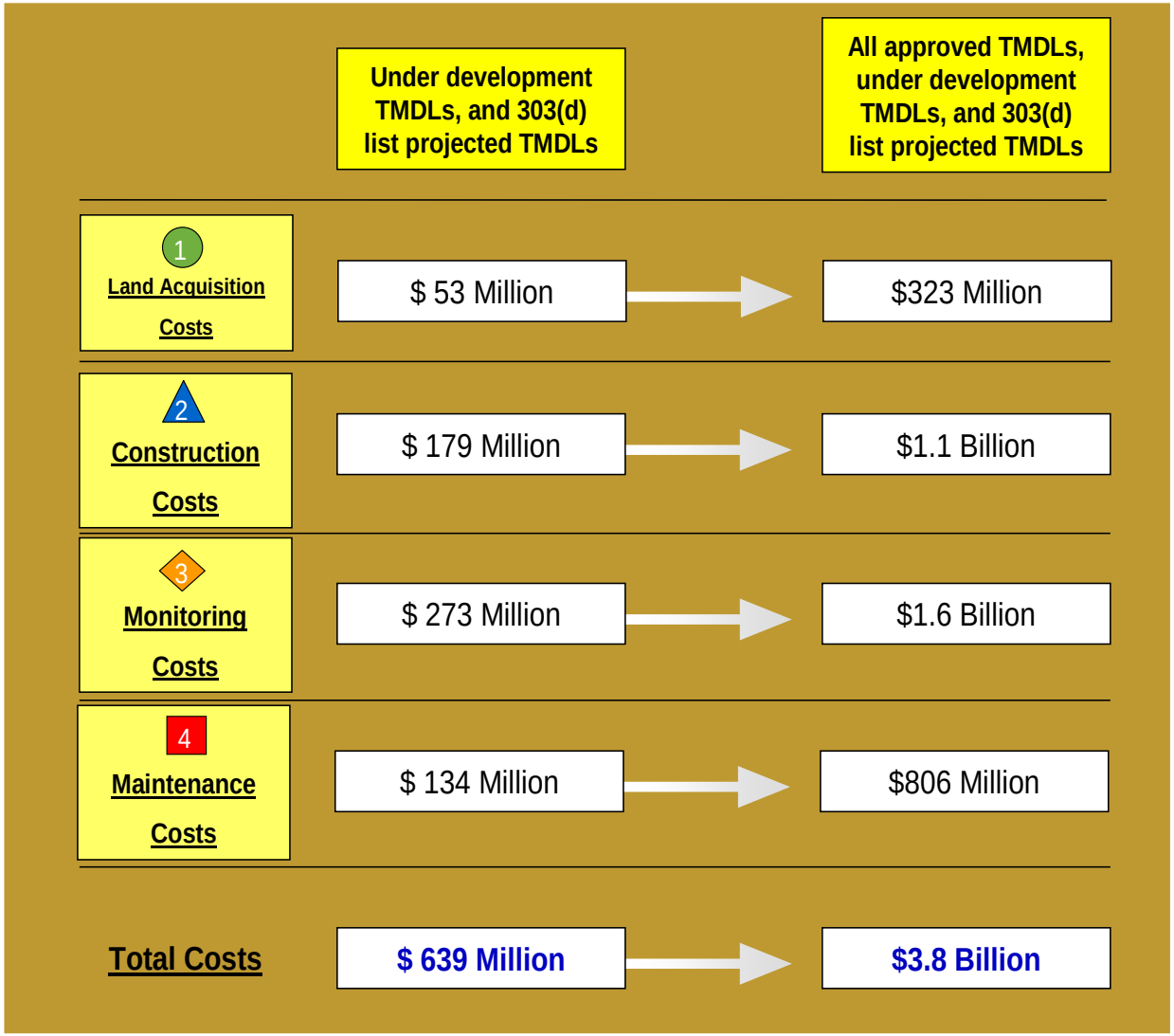
[2] erosion and sediment control

[3] The values shown for infiltration basin/trench and rain garden/bioretention indicate the number of impervious acres from which stormwater would still need to be treated to achieve the required reductions in bacteria loading after all the other listed practices are installed. The range in cost results from assuming that all of one practice or the other was used. A combination of bioretention and infiltration basins would cost in between the two values.

Cost Estimates for Implementation of BMPs Required to Achieve Bacteria and Sediment TMDLs in Lower Opequon Creek Watershed (assuming the TMDLs in Abrams and Upper Opequon Creeks are met)

Implementation Action	Unit	Units required (#)	Avg cost per unit ($)	Total cost ($)
Pasture management	acre	10,323	85	877,455
Loafing lot management	system	1	50,000	50,000
Repair/replace failing septic systems	system	372	6,160	2,436,600
Pet waste education program	program	1	Costs are included in Table 6.4 for whole watershed	Costs are included in Table 6.4 for whole watershed
Geese and duck waste clean-up	sweeper/vacuum	1	Costs are included in Table 6.4 for whole watershed	Costs are included in Table 6.4 for whole watershed
Establishment/enhancement of forested riparian buffer zones	acre	85	750	63,750
All practices implemented				3,427,805

SCDOT Projected Fecal TMDL Compliance Costs



ASSUMPTIONS & CALCULATIONS

Overall:

The construction of the BRC will follow the 5 year cycle of the TMDL development (i.e., 20% each year for the first five year).

IDEAL Run:

1. For Secondary Road, for every 1/2 mile, a 0.02 acre bioretention cell is needed to reduce fecal coliform by at least 64% based on the average load reduction from the existing fecal TMDL for WLAs.
2. For Primary Road, for every 1/2 mile, a 0.05 acre bioretention cell is needed for the required reduction.
3. For Interstates, for every 1/2 mile, a 0.08 acre bioretention cell is needed for the required reduction.
4. Four layers in the bioretention cell.
5. 12 ft buffer around the cell.

1

Land Acquisition Cost Estimation:

1. $20,000/Acre (Source: SCDOT).
2. Inflation 3.5% over 5 years.

Construction Cost Estimation:

2

1. New cell.
2. Assumed minimal erosion control.
3. Digging out the entire area, 6ft deep.
4. Fine grading in the BRC.
5. 30% compaction factor
6. SCDOT standard outlet structure
7. No utility relocation.
8. Each cell requires 3 months of construction.
9. The labor cost included.
10. Inflation 3.5% over 5 years.

Monitoring Cost Estimation:

3

1. $30,000/ BRC/year (Source: Dr. Robert Pitt, Gordon England PE and James Riddle, PE) Includes O&M, Equipment Cost, Lab analysis, Post processing such as data quality, calibration, site visits.
2. WQS will not be met within 10 years. Therefore, continual monitoring will be required.
3. 3.5% inflation for 10 years.

4

Maintenance Cost Estimation:

1. $925/0.02 acre/year (Source: Fairfax County –LID BMP Fact Sheet – Bioretention Cells February 28, 2005).
2. 3.5% inflation for 10 years.

8/12/09

Pollutant	BMP construction cost to reduce pollutant by…			
	1%	20%	40%	80%
Per Major Outfall				
TSS	$ 2,706	$ 54,120	$ 108,241	$ 216,481
Cu	$ 3,305	$ 66,098	$ 132,196	$ 264,391
Zn	$ 3,488	$ 69,757	$ 139,514	$ 279,029
TN	$ 4,513	$ 90,268	$ 180,536	$ 361,071
TP	$ 3,537	$ 70,736	$ 141,472	$ 282,945
Pathogens/Bacteria	$ 3,260	$ 65,207	$ 130,414	$ 260,828
Per USGS Stream Mile				
TSS	$ 2,734	$ 54,677	$ 109,355	$ 218,710
Cu	$ 3,339	$ 66,778	$ 133,556	$ 267,113
Zn	$ 3,524	$ 70,475	$ 140,950	$ 281,901
TN	$ 4,560	$ 91,197	$ 182,394	$ 364,788
TP	$ 3,573	$ 71,464	$ 142,929	$ 285,857
Pathogens/Bacteria	$ 3,294	$ 65,878	$ 131,756	$ 263,513
Per Area (Square Mile)				
TSS	$ 8,811	$ 176,212	$ 352,423	$ 704,847
Cu	$ 10,760	$ 215,209	$ 430,419	$ 860,837
Zn	$ 11,356	$ 227,124	$ 454,248	$ 908,496
TN	$ 14,695	$ 293,905	$ 587,811	$ 1,175,621
TP	$ 11,516	$ 230,312	$ 460,623	$ 921,247
Pathogens/Bacteria	$ 10,615	$ 212,309	$ 424,618	$ 849,236

Pollutant	Total BMP cost to reduce pollutant by…			
	1%	20%	40%	80%
Per Major Outfall				
TSS	$ 9,471	$ 189,421	$ 378,842	$ 757,684
Cu	$ 11,567	$ 231,342	$ 462,684	$ 925,369
Zn	$ 12,208	$ 244,150	$ 488,300	$ 976,600
TN	$ 15,797	$ 315,937	$ 631,875	$ 1,263,750
TP	$ 12,379	$ 247,577	$ 495,153	$ 990,307
Pathogens/Bacteria	$ 11,411	$ 228,224	$ 456,449	$ 912,897
Per USGS Stream Mile				
TSS	$ 9,569	$ 191,371	$ 382,742	$ 765,484
Cu	$ 11,686	$ 233,724	$ 467,447	$ 934,895
Zn	$ 12,333	$ 246,663	$ 493,327	$ 986,653
TN	$ 15,959	$ 319,190	$ 638,380	$ 1,276,759
TP	$ 12,506	$ 250,125	$ 500,251	$ 1,000,501
Pathogens/Bacteria	$ 11,529	$ 230,574	$ 461,147	$ 922,295
Per Area (Square Mile)				
TSS	$ 30,837	$ 616,741	$1,233,482	$ 2,466,963
Cu	$ 37,662	$ 753,233	$1,506,465	$ 3,012,930
Zn	$ 39,747	$ 794,934	$1,589,868	$ 3,179,736
TN	$ 51,433	$ 1,028,668	$2,057,337	$ 4,114,674
TP	$ 40,305	$ 806,091	$1,612,182	$ 3,224,364
Pathogens/Bacteria	$ 37,154	$ 743,081	$1,486,162	$ 2,972,325

Conclusions

- We are unsure of the actual compliance costs
- We know the costs can get very high very quickly on large scale applications
- Is this approach sustainable? What other approaches should be considered?
- What cost effective alternatives should we consider to achieve the same result?
- What should you do now (before the TMDL's are developed) to mitigate the cost of compliance?

Things we can do…

- Develop monitoring programs to determine your contribution to the problem.
- Develop QAPP (quality assurance project plan) for listing and delisting 303d water bodies.
- Closely review draft TMDL's, comment and negotiate where possible.
- Develop alternative compliance techniques
  - Decentralized infrastructure
  - Stormwater harvest and reuse

References

- United States Environmental Protection Agency (USEPA), 2001. *The National Costs of the Total Maximum Daily Load Program (Draft Report)*, EPA 841-D-01-003, Office of Water Washington, DC 20460, August 1, 2001. www.epa.gov/ow
- Big Otter IP Steering Committee, 2006. *Big Otter Watershed TMDL Implementation Plan Summary*. In Cooperation With: Virginia Tech Department of Biological Systems Engineering and Center for TMDL and Watershed Studies, Virginia Department of Environmental Quality, and Virginia Department of Conservation and Recreation, July 6, 2006. www.tmdl.bse.vt.edu
- Opequon Creek IP Steering Committee, 2006. *Opequon Creek Watershed TMDL Implementation Plan Summary*. In Cooperation With: Virginia Tech Department of Biological Systems Engineering and Center for TMDL and Watershed Studies, Virginia Department of Environmental Quality, and Virginia Department of Conservation and Recreation, July 5, 2006. www.tmdl.bse.vt.edu

References

- Vermont Agency of Natural Resources, *Revised Implementation Plan Lake Champlain Phosphorus TMDL,* submitted to the Vermont General Assembly in accordance with Act 130 (2008), Section 2 January 15, 2010
- Steven Smith, Idaho Soil Conservation Commission, *Cub river Watershed agricultural TMDL Implementation Plan,* prepared for the Idaho Department of Environmental Quality in cooperation with Idaho Association of Soil Conservation Districts, Franklin Soil and Water Conservation district, and USDA-Natural Resources Conservation Service, September 2006.
- Cardno ENTRIX, *Economic Analysis of the Proposed Numeric Nutrient Criteria for Florida*, prepared for the Florida Water Quality Coalition, Florida Numeric Nutrient Criteria No. 02953001.00, November 2010
- Hampton roads Planning District Commission, Chesapeake Bay TMDL and Virginia Watershed Implementation Plan, Agenda Item #13 HRPDC annual commission Meeting, October 18, 2010.
- Donna Kaluzniak, Rick Carper, PE, and Grant Misterly, *Meeting TMDL Limits: A cost comparison for mid-sized communities*.

Questions