STATE WATER POLICY ALTERNATIVES FOR T.M.D.L. ALLOCATION AND REALLOCATION

AUTHORS: Vince Williams, Georgia DNR Environmental Protection Division; Curry Jones, U.S. Environmental Protection Agency - Region IV; Shana Udvardy, The Georgia Conservancy; Bill White, Georgia Soil and Water Conservation Commission; Matt Harper, Atlanta Regional Commission; Candace Connell, University of Georgia; and Kathryn Hatcher, University of Georgia.
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Abstract. The question addressed is: How should the TMDL (a resource representing the total allowable pollutant load into a stream) be allocated among the individual pollutant sources, considering both point and nonpoint sources, and present and future users of this resource? What should be the basis for making this decision? How can the Georgia EPD implement the policy?

The panelists present their proposals for what the policy should be, and discuss the advantages and disadvantages of the alternative policies. The panel is intended to provide ideas and information useful as background for the public, EPD and the Georgia Water Council in preparing the state policy component of the Comprehensive State-wide Water Management Plan.

Panel Participants:

Vince Williams, DNR Environmental Protection Division
Curry Jones, US Environmental Protection Agency, Region IV
Shana Udvardy, Georgia Water Coalition
Matt Harper, North Georgia Water Planning Management District
Bill White, Georgia Soil and Water Conservation Commission
Moderator: Emily Perry, South Georgia Regional Development Center
Assistant Moderator: Candace Connell, Public Administration, University of Georgia
Research Assistants: Josh Romeis, Forest Resources, University of Georgia; and Justin Welch, Institute of Ecology, University of Georgia
Panel Organizer: Kathryn J. Hatcher, Institute of Ecology, University of Georgia.

INTRODUCTION

State Water Plan Initiative

The 2004 Comprehensive State-wide Water Management Planning Act (HB 237) requires the Georgia DNR Environmental Protection Division (EPD) to develop a comprehensive state-wide management plan for Georgia, and to submit the draft plan to the state Water Council for review by July 1, 2007. The Water Council may modify the plan and will recommend it for consideration by the Georgia General Assembly for the 2008 session.

Section 12-5-522(a) provides that "The division (EPD) shall develop and propose a comprehensive state-wide water management plan not inconsistent with this chapter and in accordance with the following policy statement:

"Georgia manages water resources in a sustainable manner to support the state's economy, to protect public health and natural systems, and to enhance the quality of life for all citizens."

Section 12-5-522(c) provides that "The proposed comprehensive state-wide water management plan shall set forth state-wide water policies not inconsistent with this chapter which shall guide river basin and aquifer management plans, regional water planning efforts, and local water plans." (underline added)

In the first meeting of the Water Council on March 2, 2005, the Water Council chair and EPD director, Carol Couch, outlined the scope of the 2005 state water plan to included "articulation of state water resources management policy issues" and "recommendations for statutes, regulations, and policies to implement plan" along with guidelines and recommendations for process of sub-state (regional) planning. A list of 42 state water issues to be addressed in the state water plan had previously been developed and recommended by the Joint Comprehensive Water Plan Study Committee (Aug. 2002).

Policy Panels Project

Five panel discussions to address state water policy issues are scheduled for the 2005 Georgia Water Resources Conference. The panels are intended to provide ideas and

information useful as background for the public, EPD and the Water Council in considering several of the key state water policy issues facing Georgia. The panels are not intended to reach consensus or to make joint recommendations....only to provide useful background information about the difficult water policy issues, the policy choices available, and the pros/cons of each choice.

The five panel topics were selected by the EPD director, who also recommended a DNR-EPD staff member to serve on each panel. Each panel consists of five panelists: a DNR-EPD representative; three panelists representing various interest groups to summarize their group's desired policy choice and view of the pros/cons for the policy choices; and a technical or legal expert), plus a neutral moderator acceptable to all the panelists, and an assistant moderator (a graduate student). The panel topics are:

1. Protection of Instream and Downstream Flows
2. Water Quantity Allocation/Reallocation among Users
3. Minimum Aquifer Levels Protection Policy
4. * Water Quality Allocation (TMDL allocation policy)
5. Water Conservation/Efficiency and Reuse Policy

Policy for Water Allocation and Reallocation
Summary of the Issue

Definition. "A TMDL or Total Maximum Daily Load is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources."
www.epa.gov/owow/tmdl/intro.html

Background. The federal Clean Water Act specifies that the U.S. Environmental Protection Agency (or approved states with EPA oversight) will take the following actions to achieve the goal of fishable and swimmable waters by 1983: (a) designate desired uses of each stream segment, (b) set water quality standards (generally maximum instream pollutant concentrations) which allow the desired uses to be sustained, (c) identify and list stream segments having pollutant concentrations worse than the water quality standards, (d) for the listed streams, determine the "total maximum daily load" (TMDL) of pollutants which can safely be put into the stream while meeting the water quality standards, and (e) identify and implement a plan for reducing the existing total pollutant load down to the allowed TMDL.

For a listed stream with multiple pollution sources, the TMDL implementation plan must reduce daily pollutant loads for each source so that the sum of the individual source loads does not exceed the TMDL.

$$WLA + LA + NL + MOS < TMDL$$

where WLA is the sum of the point source loads, LA is the sum of the nonpoint source loads, NL is the natural background load, and MOS is a margin of safety.

The U.S. Clean Water Act authorizes the EPA (or approved states with EPA oversight) to issue NPDES permits to point source pollutant dischargers, consistent with the TMDL plan, but it does not provide federal authorization to regulate the nonpoint sources of pollution.

Policy Question

The question addressed is: How should the TMDL (a resource representing the total allowable pollutant load into a stream) be allocated among the individual pollutant sources, considering both point and nonpoint sources, and present and future users of this resource? What should be the basis for making this decision? How can the Georgia EPD implement the policy?

GEORGIA'S PRESENT POLICY

by Vince Williams, GA Environmental Protection Division

This section describes the current technical and administrative procedures used to address issuance of wasteload allocations to implement TMDLs based on current federal mandates and DNR Rules and Regulations for Water Quality Control.

Georgia's Environmental Protection Division (EPD) is charged with developing and implementing Total Maximum Daily Loads (TMDLs) for waters placed on the state's biennial list of impaired waters (CWA Section 303(d) List). The requirements for this activity are based in the federal Clean Water Act (CWA), and are passed through to EPD as part of its biennial Performance Partnership Agreement with the U.S. Environmental Protection Agency (EPA). This paper briefly describes how the TMDL process impacts issuance of municipal and industrial National Pollutant Discharge Elimination System (NPDES) permits based on TMDLs calculated for individual impaired waters.

The TMDL Implementation Process

The five-year rotating basin and TMDL implementation process begins with collection of water quality data by EPD's Ambient Monitoring Program. These data are evaluated, and waters that violate water quality standards are placed on the state's 303(d) list of impaired waters. TMDLs are developed for these impaired waters using simulation models to determine how much of the pollutant causing impairment could 'safely' be discharged to the receiving water and still maintain water quality standards and designated uses. The TMDL is then divided among point sources (wasteload allocation) and nonpoint sources (load allocation). The next task, the focus of this paper, is the NPDES permitting process undertaken by EPD and how this process can impact wasteload allocations for municipal and industrial point sources discharging to impaired waters.

Final action includes development of TMDL implementation plans either by EPD staff or by the state's Regional Development Centers under contract to EPD. These plans define methods of reducing nonpoint sources on a ten-year timetable.

Wasteload Allocation Procedures

The overall wasteload developed for impaired waters is the lynchpin for issuing NPDES permits to individual municipal and industrial dischargers. If TMDL modeling indicates reductions in point source wasteloads are required to meet water quality standards or designated uses, the wasteloads for each discharger are reduced to meet the new numbers.

Actual reductions are implemented under one of two scenarios. When EPD receives requests for expansion from existing dischargers the new wasteloads issued to them will allow additional flow but will also require reduction of either pollutant concentrations or mass loadings for that facility to meet the TMDL requirement. In the second scenario, wasteload allocations for existing dischargers that do not seek expansion are addressed every five years during permit reissuance for that particular river basin. At this time, the new wasteload allocations based on pollutant reductions required by TMDL modeling are implemented through the NPDES permitting process.

Impacts on New Dischargers

The TMDL modeling and implementation process for wasteload allocations to impaired waters leaves no "assimilative capacity" for new discharges, and thus no additional discharges containing pollutants either causing or contributing to impairment are allowed. New dischargers may take several basic approaches that would enable them to generate, treat and dispose of wastewater. They could possibly become eligible for an NPDES permit by relocating the discharge to another unimpaired water body. They could consider developing an agreement with an existing discharger to accept and treat the new wastewater. Under this scenario, the existing discharger might be required to increase treatment levels to maintain its wasteload allocation. Lastly, the new discharger might seek to acquire all or part of an existing permitted discharge whose wasteload allocation could be transferred to the proposed new facility. This latter example could include industries going out of business or whose need for a wasteload allocation has been reduced due to improvements in manufacturing processes.

"Real World" Wasteload Trading Examples

Following are two examples of 'trading' underway in basins where lack of assimilative capacity prohibits issuance of new or expanded permits.

In the first, an industrial discharger agreed to transfer part of its flow to a municipal discharger that needed additional capacity. The municipality received the same (flow-weighted) biochemical oxygen demand (BOD) loading as the industry, but could treat this effluent more efficiently and apply the BOD 'savings' to increase its municipal service area and overall flow.

The second example is an offer by a municipality to purchase a wastewater treatment plant from a local industry with the intent of building a new advanced treatment plant that would provide a substantially higher level of treatment. The new plant would continue to treat the industrial flow as well as flow from a new municipal service area that is being rapidly developed. This example is in the 'work in progress' category.

Other Possible Approaches

Other states and the EPA are experimenting with 'pollutant credit trading' between point and nonpoint sources. At present, EPD does not consider such requests for the simple reason that accurate measurements of pollutant concentrations and resultant loadings from nonpoint sources are very difficult to obtain. Thus, accurately documenting "trades" between point and nonpoint sources would be very difficult, if not impossible, at the present time. The technical validity and legality of NPDES permits based on wasteload allocations derived from this type of pollution credit trading would likely be subject to debate and potential litigation.

POLICY #2
TMDL ALLOCATION IN GEORGIA:
CONSIDERATIONS AND CHALLENGES
by Shana Udvardy, The Georgia Conservancy

Background

Pollutant allocation is perhaps the most difficult challenge in developing a TMDL because it's contingent upon controlling loads from different point and non point sources. The goal of a TMDL is to prevent pollution in excess of a given level. To determine that level, we must discover how much pollution the river can assimilate without degrading the water quality or its beneficial uses. Once critical concentrations are set for each pollutant, the distribution or allocation of each pollutant is assigned to point (Waste Load Allocation, "WLA") and non point sources (Load Allocation, "LA") so that they do not exceed the maximum allowable load.

Loads are measured in mass/time increments (e.g. lbs/day), however water quality monitoring is typically assessed by concentration (e.g. mg/L). The load then, is concentration of some pollutant times the rate of flow (e.g. cubic feet per second, "cfs").

WLAs and LAs have differing characteristics. WLAs often contain high concentrations of pollutants, have predictable and constant flow rates, pollutants tend toward higher solubility and less particulate matter, and are not

difficult to calculate. LAs on the other hand, often have low concentrations (Combined Animal Feed Operations (CAFOs) are an exception), flow dependent on weather conditions, little available baseline data, difficulty in grab sampling because of natural variability, and high uncertainty in pollution prediction (Jarrell 1999).

The EPD is responsible for developing a template for an implementation plan and hiring a contractor to write the plan. In most cases, the Regional Development Centers (RDCs) are hired to write the implementation plans. The RDCs involve stakeholders and are responsible for education and outreach and submits the plan for EPD review and submittal to court.

The TMDL Implementation Program under EPD's Watershed Protection Branch works with contractors around the state to develop implementation plans and improve local water quality. The program assists with plan implementation and facilitates watershed remediation through education, outreach, and funding.

Georgia is on a 5-year rotating basin schedule for monitoring streams and establishing and implementing TMDLs. The state has been divided into five large river basins: Altamaha-Oconee-Ocmulgee, Chattahoochee-Flint, Coosa-Tallapoosa-Tennessee, Savannah-Ogeechee, and Suwanee-Satilla-Ochlocknee-St. Mary's. Each basin follows a five year process. In the first year of a cycle, water segments (streams, rivers, and lakes) that are on the 303(d) list in a given basin are monitored by the USGS under a contract with EPD for one year. In the second and third year, EPD establishes the TMDL. In the fourth and fifth year, an implementation plan is developed, usually by regional development centers under contract with EPD. The first 5-year rotation was completed in 2003 (Phase I) and Georgia is now in the second 5-year rotation.

Bacteria TMDL Example

Given there are over 800 stream, river, and lake segments that require TMDLs in Georgia and that the largest category of pollutant is fecal coliform (FC), it makes sense to look at what has been done with bacteria TMDLs in Georgia (Radcliffe *et al.* 2005). The Georgia Environmental Protection Division (EPD) has been responsible for establishing all of the bacteria TMDLs in the state (all TMDL documents are available on the EPD website under Technical Guidance Documents, GAEPD, 2005). This process includes calculating the TMDL and the current load. The bacteria TMDL for a stream is an estimate of the number of bacteria the stream can assimilate and still meet water quality standards. The TMDL must be allocated between point source loads (WLA) and all nonpoint source loads (LA). The TMDL must also include a margin of safety (MOS) to account for the uncertainty in the estimate:

$$TMDL = WLA + LA + MOS$$

The first bacteria TMDLs developed by EPD were published in 2000 and covered streams in the Ochlocknee, Satilla, St. Mary's, and Suwanee River Basins. For these streams, EPD published a separate document for each stream (a total of 28 documents) and used a dynamic watershed scale model known as the Hydrologic Simulation Program Fortran (HSPF) to calculate the current loads and to estimate the TMDL. HSPF is part of the Better Assessment Science Integrating Point and Nonpoint Sources (BASINS) analysis system designed by EPA for use in developing TMDLs. Due to the difficulty of gathering the field data required by HSPF, in 2001 EPD developed a simpler approach using USGS data to calculate a geometric mean monthly FC concentration ($C_{geometric}$) for the samples from two winter and two summer months.

The waste load allocation (WLA) to all point sources is calculated as the sum of the allowed monthly discharge rate times the allowed FC concentration (usually 200 CFU/100 mL) for each point source according to its NPDES permit. If there are point sources using combined sewer overflows (CFO's), a method is used to estimate a permitted load for monthly CFO loads and this is added to the WLA. An allocation is made to the margin of safety (MOS) equivalent to 10% of the TMDL. The remaining load (once the WLA and MOS) is allocated to the nonpoint sources.

In the Chattahoochee River Basin (published in January 2003) for example, 79 stream segments were identified for establishment of TMDLs. The average overall load reduction was 58% and ranged from 0 to 99%. The load reduction was not broken down between point and non-point sources. However, since the monthly average discharge and FC concentrations taken from the Discharge Monitoring Reports (DMR's) for 2000 showed that the point sources were staying within their permitted limits, most of the load reduction fell on non-point sources.

The Suite of Challenges Surrounding TMDL Allocation

The challenge for TMDL developers is to manage wasteload allocations, load allocations, the margin of safety (MOS), natural background conditions, and future growth (Frey 2001).

Factors that have been weighed by various TMDL developers when assigning pollution reductions have included:

- magnitude of the polluter's impact;
- probability of success;
- current and available treatment technologies;
- current management controls in place;
- cost-benefit and feasibility;
- equal percent removal;
- equal effluent concentrations;
- timeframes necessary to implement pollution reductions;
- proportional reduction; and
- adaptive management.

These factors raise questions and issues that have been captured by the efforts of Florida's Department of Environmental Protection, TMDL Technical Advisory Council (TAC). Included here are revised TMDL TAC questions that have been grouped in 5 categories: 1) general allocation; 2) NonPoint Sources; 3) Technical/Political; 4) Best Management Practices; and 5) Pollutant Trading.

1) General Allocation

- What is reasonable and equitable?
- Is the goal to "level the playing field" between pollutant sources (particularly between point sources and NPSs)?
- Should we reduce all sources by same set percentage given some sources have gone beyond minimum treatment requirements? Concern here is that we don't want to provide disincentives for proactive treatment.

2) NonPoint Sources (NPSs)

- Should we allocate reductions to NPSs consistent with implementation of applicable BMPs first, acknowledging that point sources have already provided, at a minimum, applicable technology based treatment?
- Would we need to also acknowledge that we can't expect 100% implementation for NPSs
- For NPSs, how do we take into account differing impacts due to location of activity relative to receiving water?
- Do we have enough knowledge about expected reductions from nonpoint source control activities?
- In urban watersheds, should NPS allocation be to local government?
- In rural watersheds, should we even designate who or just allocate to a given activity/commodity group?
- For atmospheric deposition, would not allocate to individual sources unless new direction from Congress/Legislature (no clear regulatory connection between CWA and CAA)

3) Technical / Political

- How do we equate treatment effort between domestic wastewater and various industrial wastewater facilities, and between point sources and nonpoint sources once beyond technology–based treatment?
- What criteria should be used to decide if publicly funded restoration actions are warranted based on relic sources (sediments), alterations to waters, or uncontrollable sources?
- How do we allocate reductions to sources outside of the State?
- Should allocation establish a set margin of safety or should it be presumed implicit in modeling approach that addresses "worst case" conditions?
- Should allocation address future growth, and if so, how far in future?
- How does the EPD take into account economic and technical feasibility?
- Should sources be responsible for providing this information to the EPD?
- How do we take into account and encourage reductions due to source controls, as opposed to structural controls?

4) Best Management Practices (BMPs)

- What if more reductions are needed beyond that reasonably expected from implementation of applicable BMPs?
- Can we quantify expected reductions from BMP implementation.

5) Pollutant Trading

- Are long-term pollutant loading rights needed to allow pollutant trading?
- Would be "long-term" but could change (decrease) if TMDL changes?
- Are statutory changes needed?
- If we allow for pollutant trading, is a multiplier or safety factor needed when trading between point and nonpoint sources? Some have recommended up to 5:1 multiplier to account for uncertainty related to nonpoint source reductions relative to point source treatment.

Florida's DEP 2005 report took three main considerations into account for their allocation development. The first was to establish a level playing field between point and nonpoint sources of pollution. This was based on the fact that much money has been spent on high levels of treatment for point sources over the last 25 years without the equivalent response for nonpoint sources. In addition, Florida encouraged pollutant sources to reduce in proportion to what they contribute and pollution load reduction in the most cost effective manner.

The Georgia Conservancy TMDL Allocation Principles:

Load allocations must protect water quality.

We cannot allow the lack of coordinated planning to justify establishing TMDLs that are done backwards, that is, at levels that can dilute the pollution instead of treating the pollution before it gets to the stream.

Allocation for future growth.

We believe allocations must be developed for future growth. It makes sense to plan for new sources of pollution now rather than allocate the entire maximum allowable load, which effectively prevents any future growth.

Explicit Margins of Safety.

We need to have a contingency plan in place in the form of an explicit margin of safety (with numbers) so that we can ensure that levels of uncertainty are accounted for and the MOS is effective. A MOS is the keystone to a successful TMDL. The Georgia PIRG estimated that 50 of 58% of the

TMDLs developed between 2000-2001 contained vague margins of safety (Coyne et al. 2002).

POLICY #4
Discussion of Status Quo and Alternatives
by Bill White, Georgia Soil and Water Conservation Commission

Background

TMDL development and implantation plans were jump started in Georgia as a result of legal action. As a result, Georgia became one of the first states to struggle with the TMDL issue, especially in the area of non-point source pollution. The time frames initially set by the lawsuit almost dictated TMDL development would be marginal at best. Adequate monitoring and assessment had not and could not be done due to both time and dollar constraints. Early on realizing potential impacts, representatives of the agricultural and forestry industry joined a consortium of Federal and State environmental and resource agencies supported by state universities to work on methods to identify sources, pollution rates, and to allocate reductions in pollutants to meet water quality standards on impacted streams and water bodies. Agriculture developed coefficients related to land cover, nutrients and bacteria. Agriculture and forestry worked on erosion and sedimentation models from a GIS prospective. Armed with untested methods EPA and Georgia EPD attacked the TMDL issue. The consortium kept studying the issues and methods with the result that between 1996 and 2004 EPA has approved some 1,159 TMDLS from Georgia. The methodology continues to advance and more monitoring and better assessment have lead to some "estimated" TMDLs being restudied and removed from the impaired list.

Some 41% of the TMDLs developed have fecal coliform as the pollutant of record. This is giving the technicians and planners considerable heartburn since the source is difficult and expensive to identify as well as control. Sediment TMDLs constitute 14%, total phosphorus 8%, total nitrogen 8%, total organic carbon 8%, mercury 5%, oxygen demand 4%, PCBs 3% and copper 1%. The 2004 202 (d) list shows that some 547 stream segments compromising some 4,807 miles are attributed to rural non-point source pollution while 330 stream segments and 2,216 miles are attributed to the urban environment, both point and non-point sources.

Methodology

The TMDL is the vehicle that recognizes pollutants and assigns reductions needed to the significant watershed sources. The TMDL Implementation Plan is a platform in which pollutants are to be evaluated, re-mediated, and tracked for water quality enhancement, restoration, and protection within the designated water body. TMDL Implementation Plans developed early in the process were very difficult to bring together since the TMDLs were often poorly defined due to limited information and time constraints. Publics attending meetings on plan development were in many cases not provided with sufficient information to make good and rational decisions. Thus, many of the early TMDL Implementation Plans have a first stage dedicated to revisiting the TMDL development to ensure that an implementation plan is needed and a proper one can be developed.

Lesson Learned

Since there are a large number of TMDLs developed from many degrees of supporting information, Georgia EPD is using a tiered approach for developing TMDL Implementation Plans.

Tier 3 plans are developed by the EPD and include impaired streams due to natural conditions, legacy sediment and those partially supporting designated use listed for fecal coliform bacteria.

Tier 2 plans do not support designated use due to fecal coliform bacteria and require more time and detail. These currently are being contracted mostly to Regional Development Centers.

Tier 1 plans are more detailed in that they may revisit the non-point source identification and assessment and identify and direct best management practices to sources of pollution.

The methodology continues to advance and additional monitoring and better assessment have lead to some "estimated" TMDLs being restudied and removed from the impaired list. Since the majority of TMDLs developed are for fecal coliform bacteria, some 385 bacteria related TMDL Implementation Plans have been developed. At the end of 2004, it was expected that some 866 TMDL Implementation Plans would have been developed with another 147 projected for 2005.

The agricultural community continues to support the TMDL allocation process through participating in TMDL Implementation Plan development and implementation of those plans where agriculture has a significant charge to reduce pollutants. Since 1996 Federal Farm Bill dollars have been invested in Best Management Practices (BMP) around the State and directed to specific watersheds. Several agencies through grants are directing Clean Water Act dollars to implement the agricultural component of approved TMDL Implementation Plans. In many cases both financial sources are concentrated in the same watersheds. The 2003/2004 Georgia General Assembly passed agricultural cost share legislation; however, the act was not funded. The agencies involved in TMDL Implementation are working on methods to determine effectiveness of BMP short of very expensive and time-consuming detailed water quality monitoring.

Conclusions

I am not sure what an ideal policy/procedure for TMDL development and implementation would be but it appears that the TMDL process appears to be heading in the right direction. The TMDL process and its results are all about changes to the way we make a living and live on the landscape. Experience has shown that the most sophisticated TMDL development process and implementation plan is not effective unless the watershed populace understands why changes are needed. Included in the why is how it will impact me and that all sources were considered, and all segments of the population is treated fairly in the assessments and resulting charges.

Water quality problem identification and restoration is expensive and limited public dollars need to be directed at pollutant sources that are non-point and/or not covered by an enforceable permit, law, rule or regulation, especially when we look at the magnitude of the TMDL program in Georgia. Based on resources available, we might move toward concentrating on the chronic problem waters with more intensive monitoring and assessment. We might also consider spending fewer resources on fecal coliform impaired streams unless the stream exhibits a chronic condition remaining well above the water quality standard over time. It was not many years ago when Georgia's fecal coliform standards were considerable higher than today's Federal assigned standard and it is doubtful if there were any more incident of human problems relative to the higher standard than to today's lower standard.

Acknowledgments

Much of the information presented was obtained from agency representative from notes recorded in both conversations and prepared presentations given in numerous formal and informal TMDL meetings and workshops conducted over the past 10 years. Specific statistics are attributed to Georgia EPD or EPA.

POLICY #6 – AN EXAMPLE FROM VIRGINIA

by Candace Connell, graduate student, University of Georgia, Public Administration

With regards to TMDL implementation, Virginia has created a "matrix of options" that includes different allocation alternatives for achieving attainment standards (an example with seven allocation options is shown in Table 1 for nitrate). After the matrix is approved by EPA, the stakeholders identify which option they would prefer. This gives stakeholders, including state and local governments, a great amount of flexibility and allows them to design and implement a plan that is tailored to the specific needs of the watershed. If during the development or implementation stages a better scenario in the matrix emerges, the allocation can be changed so long as the EPA is notified of the change (DEQ, 2000).

Table 1. Seven Example TMDL Allocation Options

(allocations shown as percent reductions in loading)

Option No.	Point Source 1	Crop	Hay	Pasture	Loaf Lots	Peak* Nitrate (mg/l)
#1	20	40	40	40	50	9.47
#2	20	46	40	40	50	9.50
#3	30	40	40	40	40	9.50
#4	35	25	30	20	50	9.46
#5	35	27	30	20	50	9.49
#6	45	35	25	30	50	9.46
#7	50	25	25	25	25	9.50

*Predicted Peak Nitrate Concentration (in mg/l) in drinking water segment.

The "matrix of options" is only a guideline and is not mandated by law. However, Virginia code does require Implementation Plans (IP's) to include the following:

- date of expected achievement of water quality objectives;
- measurable goals;
- necessary corrective actions;
- associated costs, benefits, and environmental impact of addressing the impairment

(§62.1-44.19:4 through 19:8 of the Code of Virginia)

Virginia has completed 6 IP's. Some of these simply state best management practices that will be used (Cotactin Creek, 2004), while some utilize a matrix like the one above (Four Mile Run, 2004). Generally, the IP's outline the commitments and actions each of the responsible parties will take over a ten year period. Naturally, the stakeholders and responsible parties identified are unique to each plan.

Implementation of pollution controls can be very expensive to implement. Serious equity concerns exist regarding who will bear the cost of abatement. Because point sources of pollution are easier to identify and control than non-point sources, the administrative costs of controlling point sources are much lower. For this reason, point sources share a much higher burden of pollution reduction. In an attempt to deal with these concerns, the state is providing economic and assistance programs for the farming sector. Included in these programs is the Virginia Revolving Loan Fund for certain CAFO practices and several cost-share and tax incentive programs administered by DCR/NRCS (DEQ, 2000).

In an effort to control costs, Virginia Department of Environmental Quality advocates a phased-in implementation plan. This means the most cost-effective pollution abatement strategies will be implemented first. The major benefit of using this approach is that it allows "cross-benefits" to be measured. For instance, reducing bacteria

runoff from agricultural sources will also lessen nitrate levels in a watershed. It is expected that these mutual benefits will result in the achievement of water quality goals without implementing the more costly measures (DEQ, 2000).

Through all stages of the process, it is imperative that stakeholders be involved so that they accept and understand the problem and its potential solutions. This makes writing and enforcing TMDLs an easier and less divisive process (Jarrell, 1999). Virginia holds both formal and informal meetings with stakeholders living and working in a watershed to discuss and share the development of TMDLs including a breakdown of pollutant loading by category and the recommended reduction (DEQ, 2000). Furthermore, in some cases stakeholders are given an opportunity to work together in formulating an allocation strategy through use of the "matrix of options". This assures that water quality allocations are appropriate to the financial and legal needs of the stakeholders.

Overview of Alternative Policies (Hatcher)

The selection of a TMDL allocation/reallocation policy for Georgia is a difficult decision, and one which will affect Georgia's citizens and the future condition of the state. The Georgia EPD intends to involve citizens extensively in the development of the water policies for Georgia, policies which will be applied in shaping the comprehensive state water plan. To aid the lay citizen in understanding and participating in this decision, it may be helpful to summarize the issue using a decision table, such as the example shown in Table 2, to show a range of policy alternatives for TMDL allocation and to compare the most relevant effects (pros and cons) of each alternative.

Discussion for this panel topic will continue following the conference, with comments received during and after the conference made available.
http://www.arches.uga.edu/~hatcher/TMDL.htm

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Table 2. Decision Chart for Comparing Alternative TMDL Allocation/Reallocation Policies

	Policy #1 EPD Policy	Policy #2	Policy #4	Policy #6
Description Of Policy				
Pros: #a #b #c				
Cons: #a #b #c				