AGENDA NOTE - HRPDC ANNUAL COMMISSIONMEETING

ITEM #13: CHESAPEAKE BAY TOTAL MAXIMUM DAILY LOAD (TMDL) AND VIRGINIA WATERSHED IMPLEMENTATION PLAN

SUBJECT:

The Environmental Protection Agency (EPA) released the Draft Chesapeake Bay TMDL for public comment on September 24, 2010. Comments are due to EPA on November 8, 2010. The Virginia Watershed Implementation Plan was released earlier in September.

BACKGROUND:

At the September 15, 2010 Executive Committee meeting, HRPDC staff briefed the HRPDC on the Chesapeake Bay Total Maximum Daily Load (TMDL) and the Virginia Watershed Implementation Plan (WIP). The briefing was based on the draft WIP and expectations about the Chesapeake Bay TMDL being developed by EPA.

Based on the briefing , the Commission established a Subcommittee to advise the staff in the development of comments. The Subcommittee met on October 4, 2010 with staff representatives from all participating localities. The TMDL, WIP and regional concerns were also discussed with the Joint Environmental Committee at its meeting on October 7, 2010. Regional concerns focus on implementation costs, technical feasibility, availability of information, model accuracy and calibration and issues associated with the chlorophyll a standard for the James River. Both the Subcommittee participants and the Joint Environmental Committee were supportive of the recommended approach.

Staff, working with representatives from the localities and technical and legal consultant assistance, has developed two draft letters for the Commission's consideration.

1. Letter to U.S. Environmental Protection Agency commenting on the TMDL.
2. Letter to the Commonwealth commenting on the Watershed Implementation Plan.

Because of the massive size and complexity of the TMDL and WIP documents and the limited time available to complete this review, the draft letters have been prepared in outline form highlighting the issues of concern. Staff is continuing to work to fill in the technical details supporting the highlighted issues. The HRPDC staff recommends that the Commission approve submission of the two letters, on behalf of the HRPDC and member jurisdictions. A copy of the letter, complete with all technical details and documentation will be provided to the Commission members prior to submission to EPA and the state.

HRPDC Principal Water Resources Planner Whitney Katchmark will brief the Commission on this initiative and its implications for Hampton Roads.

RECOMMENDED ACTIONS:

1. Approve the letter to the U.S. Environmental Protection Agency commenting on the Chesapeake Bay TMDL.
2. Approve the letter to the Commonwealth of Virginia commenting on the Virginia Watershed Implementation Plan.

Attachments

Outline of Hampton Roads MS4 Comments on the Chesapeake Bay TMDLs

I. SUMMARY

Although EPA has failed to provide the public with the documentation needed to review, evaluate, and comment on the proposed allocations, the information and data that are available show that the model and model inputs are lacking in the level of precision that should be required of regulatory action with consequences as significant and widespread as the Bay TMDL. The Phase 5.3 model used to derive the proposed allocations is new, and in its rush to establish the TMDL by an artificial deadline, EPA has proposed draft allocations without first verifying the accuracy of the model predictions. In fact, EPA has effectively acknowledged that the model and model inputs are incomplete by announcing its intention to conduct additional model calibration after the TMDL is established.

The flaws in EPA's proposed allocations are compounded in the James River basin by its use of model results that are poorly calibrated against the basin's chlorophyll a standards. A knee-of-the-curve analysis shows that EPA's use of poorly calibrated model results and a one-percent non-attainment rate for the chlorophyll a standards will have enormous economic consequences for the Hampton Roads localities with no quantifiable water quality benefit.

EPA's proposed backstop allocations for the James River basin provide some relief for urban runoff sector, but not nearly enough to provide reasonable assurance that the allocations can be achieved. **The average 54 percent load reduction needed to achieve the backstop allocation for phosphorus would require treatment of approximately 65 percent of the impervious land area in the Hampton Roads Localities at a total estimated cost of $9.5 billion, plus the cost of land acquisition, between now and 2025.** Although the proposed backstop allocations reflect the difficulty of achieving significant load reductions from the agriculture and onsite septic sectors, they fall far short of reflecting the difficulty of achieving such reductions from the urban runoff sector. EPA appears to simply assume that the reductions can be achieved because MS4s are subject to federal and state permitting authority under the NPDES, but this assumption fails to recognize that the Localities own, on average, only about 20 percent of the land area within their respective jurisdictions. Therefore, most of the retrofits needed to achieve the load reductions will have to be implemented on private lands over which the Localities have no control in the absence of new development or redevelopment requiring local land use approvals.

II. INTRODUCTION

A. The HR MS4s - A descriptive summary of the HR MS4s, including names of localities, total square miles, population, etc.

B. The HR MS4 Programs - A summary of the HR MS4 programs, including program elements, budgets, sources of revenues, etc.

C. Factors Affecting Storm Water Control in HR - A summary of the factors that make storm water control in HR difficult and expensive, including topography, high water tables, high tides, etc.

D. The Socio-Economic Impact of the Proposed Urban Runoff Allocations

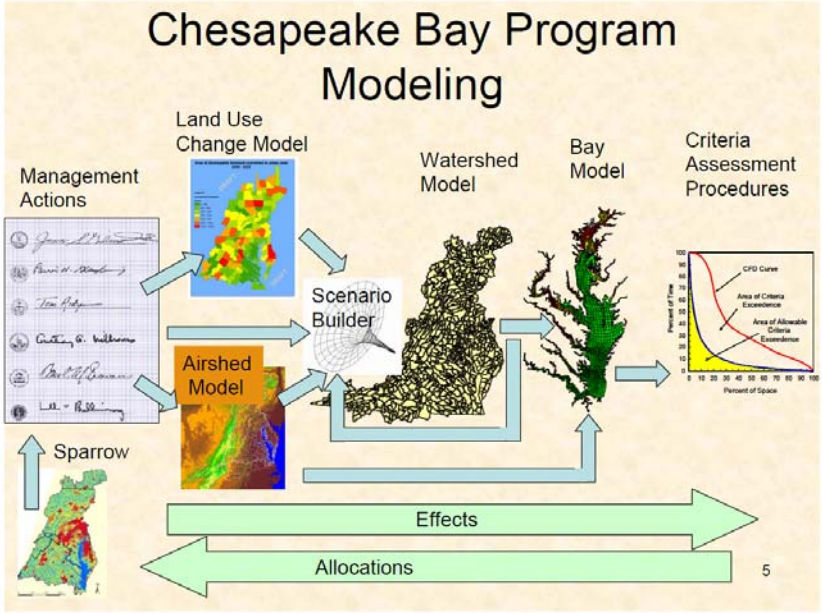
A summary of the socio-economic impacts of the allocations, with emphasis on the limited ability to infiltrate storm water, square miles and percent of area that would have to be retrofitted, the average cost of retrofits, limits on the localities' ability to require retrofits of private property (i.e., localities would have to condemn to acquire easements for retrofits on private property in the absence of redevelopment requiring local land use approvals), etc.

IIL EPA HAS FAILED TO PROVIDE THE HR LOCALITES WITH SUFFICIENT TIME TO REVIEW, EVALUATE, AND COMMENT ON THE DRAFT TMDLs

Describe enormous size and complexity of the TMDL documents released on Sept. 24, the socio-economic consequences of the proposed allocations, and the arbitrary nature of EPA's decision to establish the TMDLs by Dec 31, 2010 when it could have given the public additional time to comment had it taken advantage of the May 2010 deadline in the consent decree.

IV. OVERVIEW OF MODELS AND MODELING USED TO DERIVE THE PROPOSED URBAN RUNOFF ALLOCATIONS

The Phase 5.3 Chesapeake Bay Watershed Model computer model (CBWM) is enormous, and has been described as one of the world's largest environmental models. The 64,000 square-mile watershed spans roughly one-quarter of the East coast of the United States. However, CBWM is only a component in the larger Chesapeake Bay Program suite of models, as indicated in the following figure from EPA:



Four major modeling components are used to develop the input data for CBWM . A substantial amount of nitrogen is deposited from the atmosphere into the Bay, and land use changes have significant implications for nutrient and sediment loading. All of this data is pre-processed in antecedent models, and then aggregated in a tool called the "Scenario Builder."

V. EPA HAS FAILED TO PROVIDE THE HR LOCALITIES WITH ACCESS TO INFORMATION NEEDED TO FULLY EVALUATE AND COMMENT ON THE PROPOSED URBAN RUNOFF ALLOCATIONS

A. CBWM Input Mapping Data

To date EPA has not been able to document the tremendous amount of input data required for the TMDL modeling effort. The Virginia Department of Conservation and Recreation requested mapping from the Chesapeake Bay Program Office (CBPO) that would indicate locations of various urban land use categories (such as Impervious High Intensity, Impervious Low Intensity, Pervious High Intensity, and Pervious Low Intensity) used in the Phase 5.3 TMDL modeling. CBPO indicted that significant effort would be required to produce such mapping. Likewise, there is very little documentation that would allow modelers outside EPA to ascertain how the data was collected and synthesized, which makes working with CBWM a shot-in-the-dark proposition at the state and local levels. Better documentation is sorely needed, not merely on the model, but just as importantly on the data.

B. Scenario Builder

The Scenario Builder was supposed to be available to the modeling community as part of the Chesapeake Bay Modeling Program, but has not yet been released outside EPA. Absent the Scenario Builder, modelers must rely on EPA to process the input data to CBWM, and cannot improve the model with local data. In fact, all of the 'modeling' that has been done by the State of Virginia to date is in essence 'post-processing' of EPA modeling results rather than independent modeling.

VI. FLAWS IN THE MODEL USED TO DERIVE THE PROPOSED ALLOCATIONS

A. The Phase 5.3 CBWM has not been calibrated

EPA claims that the Phase 5.3 CBWM model has been calibrated. Yet 920 square miles of urbanized land have been erroneously entered as 'forest' in the model. A recalibration effort is expected to begin in October 2010, but will be too late to be adequately addressed by the 31 December 2010 mandated deadline for final publication of the Chesapeake Bay TMDL. EPA has promoted an "adaptive management approach" in developing this TMDL, thereby creating many moving goalpost situations. There are inherent problems with any calibration effort, and CBWM is no exception. There are many ways to tweak input variables in a complicated model to make the output approximate a series of observed data—a phenomenon known as 'equifinality'—and CBWM has a massive amount of input variables.

One indication of calibration problems is with sediment loading computations. CBWM cannot adequately match observed data for sediment loading, which held up the release of working sediment limits to the states until a month before their Watershed Implementation Plans (WIPs) were due. To accommodate the schedule, EPA adopted a "pucker factor" approach—to sidestep this problem with the model. If the Phase 5.3 model was adequately calibrated, sediment computations could be handled in a straightforward manner.

Many of the TMDL limits are targeted to pollutant reduction levels that are considerably less than the margin of uncertainty in the modeling process itself. Dr. Kathy Boomer of the Smithsonian Institute has conducted specific research and concluded that the margin of uncertainty in the TMDL models was much greater than the reductions being sought in pollutant loading. Dr. Ken Reckhow of Duke University (who chaired the Chesapeake Bay TMDL Review Committee for the National Academy) has repeatedly cautioned regulators against reporting modeling results without stipulating the uncertainty. Dr. Reckhow notes that TMDL prediction uncertainty is high, and Chesapeake Bay modelers have had issues with political decision makers being able to understand uncertainty. However, Section 5 of the Draft TMDL states:

> *"Models have some inherent uncertainty. Because of the amount of data and resources taken to develop, calibrate, and verify the accuracy of the Bay models, the uncertainly of the suite of models is minimized."*

Quite the opposite is true—the amount of data and complexity of the system work to increase the uncertainty. How could such a statement be substantiated? It is important to note that the mathematical equation for a TMDL is:

TMDL = Sum of Wasteload Allocations + Sum of Load Allocations + Margin of Safety

and the margin of safety is supposed to account for uncertainty in ensuring that the TMDL is effective, but there are errors and uncertainties *in the computation of the load allocations themselves*.

There are very few (perhaps only three or four) knowledgeable technical persons with meaningful CBWM modeling experience in Virginia. For a model that will be used as the basis for billions of dollars in regulatory mandates, the technical community is lacking the checking and validation that comes from widespread use. There is no significant bug reporting and code fixing occurring, and what little modeling is being performed is being done with data that has been distributed from EPA without enough documentation to check its validity. Other computer models, such as the EPA's own Storm Water Management Model (SWMM), have many years of active, widespread use, and debugging and code fixes occur continuously. The user community helps drive improvements that make SWMM a very well understood and reliable model. Conversely, CBWM is a very, very untested and unapplied model in 2010. The development of CBWM is undoubtedly an ambitious and worthwhile undertaking, but reasonable time has to be given to grow and mature CBWM to the point that it can be reliably used to justify billions of dollars of expense.

B. The Phase 5.3 CBWM does not produce reliable modeling results

EPA distributes the CBWM computer program in un-compiled form, meaning that in order to run the model users must obtain a FORTRAN compiler and generate the executable computer programs from the source code. However there is a known and still unresolved problem with CBWM producing different results when compiled on different computers. Identical input data was run on different computers in August 2010 for the James, York, and Rappahannock Rivers, and CBWM produced significantly different results—with variations as high as 36% in the answers. The reliability of CBWM cannot be corroborated until repeatable results can be produced. EPA is working on this problem, but again TMDL schedule demands far outrun the time required to produce reliable models and modeling results.

C. EPA is using the CBWM on a scale that is beyond its predictive capability

Due to the 64,000 square-mile extent of CBWM, there is an inherent problem of scale when addressing BMPs. CBWM is better suited for overarching computations on

larger scales, such as evaluating the effects of fertilizer applications on large segments of the Bay watershed, than it is in evaluating the effects of a particular BMP or group of BMPs on specific sites. EPA staff has acknowledged that the effects of individual, site-specific BMPs cannot be directly addressed in CBWM. Because the model is constructed on such a large scale, numerical effects of BMPs are lumped or aggregated in the modeling input data. This scale problem makes it very difficult for local governments to evaluate the feasibility of costly BMPs such as filtration devices and detention and retention basins that will have to be constructed to achieve water quality improvements. A single retention basin can easily cost millions of dollars, yet its effects cannot be directly isolated and evaluated in CBWM.

D. Existing imperviousness is underestimated in the CBWM

The Phase 5.3 CBWM model was prepared based on satellite photography. Early indications from four Virginia municipalities are that the use of satellite imagery has produced estimates of watershed imperviousness that are approximately 20 percent too low, which has significant implications for the amount of pollution that runs off each watershed. Localities have better imperviousness data in their Geographic Information Systems, but the TMDL development schedule did not allow time for EPA modelers to coordinate and collect this information from the localities. The implication is that if existing watershed imperviousness is underrepresented in CBWM, then so will be the existing pollution from urbanized areas. This inaccuracy could easily result in computed TMDL limits that are unattainable because in order to satisfy their "pollution diet," municipalities will have to reduce pollution based on modeling data that assumes they are substantially (20 percent) less impervious than they actually are. In other words, if their pollution diet starts by assuming that they have 20 percent less pollution-producing impervious cover than they actually have, then in order to meet their TMDL limits they would have to reduce *all* pollution from that 20 percent *plus* the reductions mandated by the TMDL—which are themselves very difficult to achieve.

E. There is no groundwater component in the CBWM

The absence of a groundwater component to the model is significant because groundwater transport of nutrients is a major source of pollution in the Bay. Ironically, many of the Best Management Practices (BMPs) that will be used to satisfy the TMDL are based on removal of pollutants by infiltration, which is not addressed in the modeling. This lack of a groundwater component in CBWM means that pollutants that are routed into infiltration BMPs magically disappear from the computational universe—when in reality they are deposited into groundwater that eventually flows into the Bay.

VII. THE FLAWS AND UNCERTAINTY IN EPA'S MODELED PREDICTIONS DO NOT JUSTIFY JAMES RIVER ALLOCATIONS MORE STRINGENT THAN THOSE ESTABLISHED IN THE 2005 TRIBUTARY STRATEGY

A. Overview of the James River Tributary Strategy allocations and the basis for the allocations.

B. In the absence of an accurately calibrated CBWM, verifiable model inputs, and predictions within an acceptable range of uncertainty, EPA should establish the allocations for the James River watershed in the TMDLs based upon the James River Tributary Strategy.

C. EPA's decision to base the James River allocations on attainment of the numeric chlorophyll-a standards rather attainment of the Bay-wide numeric dissolved oxygen standards is flawed.

1. An analysis of the data show that the Water Quality Model is poorly calibrated against the chlorophyll-a standard. Consequently, the model results used to derive the James River allocations do not accurately predict the load reductions needed to attain compliance with the James River chlorophyll-a standards.

2. EPA compounded the consequences of using a poorly calibrated model when it used a one percent chlorophyll-a standard attainment rate to derive the James River allocations.

3. The model results show that attainment rates between 96 and 99 percent result in changes to in-stream Chlorophyll-a concentrations of between 1 and 2 ug/l, which is well within the 1-4 ug/l margin of error in the EPA-approved Chlorophyll-a test method.

4. The one percent attainment rate used in this case is inconsistent with attainment rates used or approved by EPA in other TMDLs.

5. EPA has failed to offer any justification for its use of a one percent attainment rate in this case, particularly in light its use of a poorly calibrated model.

6. EPA has a certain amount of discretion in determining when models are sufficiently calibrated and in establishing attainment rates. However, EPA abused its discretion when it used a poorly calibrated model and an attainment rate to establish allocations designed to achieve changes in in-stream Chlorophyll-a concentrations that have significant economic consequences and no quantifiable water quality benefit.

(Note – Here we outline and present the results of the knee- of-

the-curve analysis to show that EPA's James River allocations would impose billions of dollars of additional cost while achieving reductions in in-stream Chlorophyll-a concentrations that are within the margin of error of the test method)

VIII. EPA DOES NOT HAVE THE AUTHORITY TO ESTABLISH A DEADLINE IN THE TMDL FOR ACHIEVING THE LOAD REDUCTIONS

The Clean Water Act and EPA's regulations do not give it the authority to establish a 2025 compliance deadline in the TMDL.

Of all the source sectors covered by the TMDL, none is affected more by the 2025 deadline that the urban runoff sector because much of the difficulty and cost of achieving the urban runoff load reductions is associated with retrofits independent of redevelopment. Historic re-development rates in the Hampton Roads region fall far short of those that would be needed to achieve the load reductions without forcing the Localities to acquire the easements needed for the retrofits and assuming responsibility for retrofit installation and maintenance.

IX. CONCLUSIONS AND RECOMMENDATIONS

The Model results that are the basis for the proposed allocations are clearly lacking in the level of precision and certainty required to justify the resulting billions of dollars in costs. EPA professes to be taking an adaptive management approach to the TMDLs; but in reality, EPA is taking an adaptive legal and regulatory approach to the TMDLs by establishing the TMDLs based on incomplete and flawed science and then seeking to supply the missing documentation after the fact.

If EPA is truly committed to an adaptive management approach to the TMDLs, it would adopt them based upon the allocations in the Tributary Strategies and then update the TMDLs when the Phase 5.3 CBWM is fully developed and calibrated to within an acceptable margin of uncertainty. No time would be lost if EPA's accountability framework remains in place to ensure that progress toward achieving the Tributary Strategy allocations continues while work on the Phase 5.3 CBWM and model inputs are underway. In fact, the approach we recommend likely would achieve our mutual water quality goals for the Bay more efficiently, cost-effectively, and quickly by fostering the federal, state, and local partnership that is so critical to an undertaking of this magnitude. EPA's slavish adherence to an artificial deadline for establishing the TMDLs and its heavy-handed approach to date serves only to undermine that partnership and create distrust and resistance on the part of those who will bear the burden.

Outline of Hampton Roads MS4 Comments on the Draft Virginia Watershed Implementation Plan

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I. The Hampton Roads Localities appreciate Virginia's efforts to incorporate flexibility and cost effectiveness into the draft WIP; however, the James River basin urban runoff sector allocations in the draft WIP would impose massive financial costs on the Hampton Roads MS4s in a futile effort to reduce phosphorus loads by an average of 77 percent. As explained below, even with the larger backstop phosphorus allocation proposed by EPA (an average 54 percent phosphorus reduction), **the Localities would still have to expend an estimated $9.5 billion, plus the cost of land acquisition, to achieve the backstop sector allocation.**

A. The draft WIP's reliance on the availability of credits from the point source and agriculture sectors to assist the MS4s in attaining their sector allocations is misplaced.

1. There is no assurance that the credits will be generated when and where needed.

2. The credits would be generated from excess flow capacity and, therefore, would be available to the MS4s on a temporary basis.

3. The reductions that would be required of urban runoff with the draft WIP allocations are so great that the demand for credits could exceed the supply, thus driving up their cost and limiting their availability to the Localities, particularly if the Localities are forced to compete with private developers for the credits.

II. Although the Hampton Roads Localities would fare better under EPA's James River basin backstop urban runoff sector allocations, the average 54 percent reduction in phosphorus required to achieve the backstop allocation is still beyond a level that is practicable of attainment.

A. It is impossible to predict the full extent of the socio-economic consequences of attempting to undertake an effort of this magnitude because such an undertaking has never been tried before. However, we can state with confidence that there is no assurance that the load reductions that would be required to achieve the backstop allocations can be accomplished by EPA's 2025 deadline, and that, on a pound-for- pound basis, the cost would be totally out of portion to any water quality benefit.

B. On average, the Localities and their residents would have to treat approximately 65 percent of the impervious land area within their

jurisdictions in order to achieve the 54 percent phosphorus reduction needed to achieve the backstop allocation. It is estimated that it would cost the Hampton Roads Localities approximately $9.5 billion to reduce phosphorus loads to the levels needed to comply with the backstop allocations after factoring in the added cost of designing BMPs that would function effectively on the flat, low-lying terrain and in the high water tables that reflect the dominate topography and hydrology in the Hampton Roads area.

C. Further, this cost estimate does not reflect the added cost of acquiring the land needed for the installation of BMPs and on-going maintenance of the BMPs.

1. On average, the Localities own or control less than 20 percent of the 65 percent of impervious land area that would have to be treated to achieve the backstop phosphorus allocation.

2. The remaining reductions would have to be achieved with retrofits on private land. Since the Localities cannot force private land owners to retrofit in the absence of redevelopment requiring local land use approvals, the Localities would have to negotiate for the purchase of the land needed for the easements or acquire the land by condemnation. Land acquisition is an expensive and time consuming process that will add greatly to the cost and time required to achieve the reductions.

III. The Hampton Roads Localities encourage Virginia to respond to EPA's backstop allocations by revising its WIP to include the additional commitments needed to demonstrate to EPA that the Commonwealth can achieve the draft WIP allocations for the agriculture and onsite septic systems sectors. Such a demonstration would remove the backstop allocations and allow Virginia to distribute a portion of the allocations now assigned to the agriculture sectors to the uban runoff and point source sectors.

IV. Should the backstop allocations be removed, the Hampton Roads Localities also encourage Virginia to assign a significant portion of the additional allocations in the James River basin to the urban runoff sector. The Hampton Roads Localities recognize the need to assign some portion of the additional allocations to the point source sector to accommodate long-term growth and to generate credits. However, as explained above, the allocations in the draft WIP placed too much reliance on credits to offset the consequences of the small allocations to the urban runoff sector and did not reflect a cost-effective and equitable distribution among the two sectors.