# 9-21-2012
# Response to PADEP Comments

*1. Lack of  a Clear Comments and Response Documentation*

This 56 page chronology constitutes the record of comments and responses as these memos have gone through the Expert Panel, USWG, WTWG and WQGIT process.

*2. Groundwater Nitrate Issue.*

This issue was raised and settled at both the June 11 USWG and August 13 WQGIT meeting, and the record of how this issue was addressed comprises a great deal of this chronology.  EPA , three states (MD, VA, DE) and HRPDC supported the compromise approach to make only one discount factor, with PA dissenting that neither discount should be taken.

*3. PA Retrofit Sizing Policy*

PA DEP should be complimented for having such an aggressive retrofit sizing policy. If PADEP can provide specific language from either PAG-13 or Section 102.8 that links the states new performance standard to the design of retrofits by municipalities, we can insert it into Section 2. We could not find a regulatory definition of retrofits in either document.

*4. Use of jurisdictions rather than policy*

The suggested edits recommended by VA DCR have been included in the 9/20/2012 version of both memos.

# 9-21-2012
# Response to Supplemental VA DCR Comments

*1. Use of Jurisdictions Rather than Local Government.*

The suggested edits recommended by VA DCR have been included in the 9/20/2012 version of both memos. Specifically, the use of the word localities and local government have been replaced by the term "jurisdiction." In addition, specific references to either local or state reporting procedures have been dropped to enable each Bay state to develop their own unique reporting and tracking systems

*2. Deleting details on reporting, tracking and verification*

The details on reporting, tracking and verification were not deleted as requested by VA DCR for several reasons. First, the BMP review protocol specifically charges the expert

panel to "include a description of how the BMP will be tracked and reported and a clear indication that that bmp will be used and reported by jurisdictions."The Protocol further charges the Panels to describe "O&M requirements, and how neglect will alter performance. The Protocol also notes that WTWG will be "responsible for the tracking and reporting data that is needed to receive the credit." The WTWG has approved these at its May 29 and August 1 meetings. In addition, the details of BMP reporting, tracking and verification have been developed in tandem with the overall BMP verification effort that the CBP partnership has been engaged in. Both the expert panels and the USWG have come to consensus on these issues over the last nine months.

The language for the retained sections on reporting, tracking and verification, however, has been modified to make clear that these are panel recommendations, and not a mandate on state and/or local agencies. Wherever possible, references to local or state reporting have also been dropped, given that these procedures will be unique for each state and its reporting jurisdictions.

## 9-18-2012 USWG ERRATA

USWG approved the errata correction in the performance standards memo to reflect the proper equation to deal with defining stormwater treatment volume EP parameter for redevelopment projects in WV.

Larry and Tom – Thank you for the extended opportunity to review and provide feedback on the urban stormwater panel recommendations for performance standards and retrofits. WV is **unable** to concur with the panel recommendations on performance standards at this time.

Dave Montali identified a difference in WV's redevelopment standard that was not originally considered by the workgroup. Unlike the other states in the Bay, the engineering parameter defined under WV's redevelopment standard utilizes runoff from both pervious and impervious cover. We have since had communication with Tom Schueler who agrees that the equation needs to be corrected to reflect WV's approach. Tom recommended, in an email to Sherry Wilkins, that the issue should be brought to the USWG at the September or October meeting for the correction to be made to the final memo.

In light of this, WV is unable to support adoption of the recommendation until this issue is fully resolved. Thank you again for giving us an additional opportunity to review this material. We had no substantive issues with the urban retrofit proposal.
Teresa M. Koon
Assistant Director, Nonpoint Source Program
WV DEP Division of Water and Waste Management

## August 29 and September 18 PA DEP Comments

Pennsylvania – DEP remains concerned with the issues discussed in the message I sent on this topic on August 29, 2012. Essentially, DEP does not believe that the responses to

the questions and concerns we raised have been adequately addressed in the Recommendations of the Expert Panel to Define Removal Rates for New State Stormwater Performance Standards Memo 08/14/12 (Performance Standards Memo) and the Recommendations of the Expert Panel to Define Removal Rates for Retrofit Memo 08/14/12 (Retrofit Memo). This conclusion is based on the following supporting information.

There has not been a clear comment/response process during the development of the memos. The issues put forth by PADEP have not been fully resolved. For example, issues and concerns with intent of particular concepts in the Performance Standards and Retrofit Memos raised in emails sent by Joe Kelly (PA - DEP) on June 29 2012, August 8, 2012 by Ted Tessler (PA - DEP) and myself on August 29 2012, as well as being raised in teleconferences on June 12, 2012 (with the USWG), and August 1st, 2012 (with the WTWG, which resulted in the August 8, 2012 Ted Tessler email detailing those concerns) have not been adequately addressed or resolved. There has not been a clear cross referencing of comments being raised with resulting clarification and/or answers in the Performance Standards and Retrofit Memos resulting from those comments and concerns. For example – our concerns regarding the following issues remain unresolved;

1) Overly conservative assumptions or "stacked" conservative assumptions would diminish the credit due these practices relative to other BMPs/source sectors within the model. Groundwater nitrogen transport is problematic within the model which looks at one-year time frames while true groundwater transport can potentially span decades. There are examples of other source sector BMPs having reduced their N treatment efficiencies due to groundwater loss, although it does not appear that the methodology and application of these losses has been consistent across BMPs such that urban storm water BMPs may be making BMP efficiency reductions beyond those made in other sectors. Additionally, Pennsylvania maintains storm water management design standards that exceed those of other Chesapeake Bay (CB) jurisdictions. Within the CB model, the N loading rate for Impervious Land in Pennsylvania is nearly double that of the other jurisdictions and accordingly, this reduced efficiency will have an especially diminutive effect on PA's SW BMPs credit relative to other jurisdictions and other source sectors.

2) Proposed reductions for retrofits and redevelopment; the existing volume must be reduced by 20% in accordance with Pennsylvania requirements and compliance with a "local" TMDL (including CB TMDL), when applicable. The permittee provides a demonstration of the reduction achieved on the project site from the retrofit. These sites need to be identified by the municipal permittee within the TMDL implementation plan. The Urban Storm Water Workgroup and Expert Panel recommendations allow for new retrofits to not always meet performance standards for BMP sizing that apply to new development, however Pennsylvania's performance standards, as required by PA title 25, Chapter 102.8 do not allow for these standards to be relaxed. By this approach, Pennsylvania storm water retrofits will exceed the crediting standards recommended by the expert panel.

3) We also generally support the comments in the August 28, 2012 e-mail from James Davis-Martin from Virginia regarding the focus on jurisdictions reporting instead of localities in both the Performance Standards Memo and Retrofit Memo.

Pennsylvania – DEP does not have a reasonable assurance that these issues have been or will be resolved with the Performance Standards Memo 08/14/12 and Retrofit Memo 08/14/12 at this time and until these issues are resolved we do not support their proposed actions and finding. I again renew our request and would welcome any discussion you may wish to have to resolve these ongoing issues.

## August 29 Supplemental Comments from VA DCR

In general, these documents contain numerous references to local or locality actions. The primary purpose of expert panels and their review of BMPs is to provided scintificaly defensable recommendations for incorporating BMPs into the watershed model. This may include requirements for juristictional data reporting and verification as well as a description of how the BMP will be simulated in the model once reported. BMP Memos should clearly and plainly address the required BMP protocol elements. Nothing more and nothing less. These memos go beyond that. They are written as guidance to local governments as well as to the Bay juristictions and EPA.

If the panel could develop a companion document that includes the recommended guidance to local governments, for jurisdictions to review, modify and forward to their localities as they choose, that would be welcomed. But using the Memo to establish local guidance through a Bay Program expert panel or workgroup is inappropriate.
Below are some specific recommendations for changes in the Retrofit document that go to this same issue.
Consider replacing "locality" with "jurisdiction" wherever it appears in the document.
In the edits below, highlighted text should be deleted and **bold** text added.

Page 9 of the retrofit BMP document

*BMP restoration* applies to major maintenance upgrades to existing BMPs that have either failed or lost their original stormwater treatment capacity. The method to calculate the removal rate increase depends on whether or not the BMP has previously been reported to the state. **has been previously reported to EPA Bay Program for annual progress.**

If the BMP has been previously reported to the state **EPA Bay Program for annual progress**, a lower removal rate is calculated using the curves that reflects the existing level of treatment, and this value must be reported to the state **EPA Bay Program for annual progress** for at least one progress reporting cycle. After the qualifying BMP restoration is completed, the curves are used to derive a higher rate for the increased treatment volume, and the locality **jurisdictions may** reports the higher rates **and any other required information** to the state in subsequent years **for inclusion in**

**annual progress reporting to EPA Bay Program**. If the BMP was not previously reported to the state **EPA Bay Program for annual progress**, it is considered a new retrofit, and the curves are used to define the removal rate based on the total treatment volume provided.

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*BMP Restoration:* The removal rate for BMP restoration depends on whether the existing BMP has been previously reported to the state **has ever been reported to the EPA Bay Program office for annual progress.**

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If the BMP was previously reported to the state **EPA Bay Program office for annual progress**, then the removal rate for a restored BMP is expressed as an incremental removal rate (restored BMP - existing BMP). The existing BMP removal rate is defined using the curves based on the original BMP sizing and design criteria. The restored BMP rate is defined using the retrofit removal rate adjustor curve for the runoff treatment volume "restored" (i.e., by sediment cleanouts, vegetative harvesting or practice rehabilitation) and/or shifting to RR runoff reduction (i.e., media replacement). **And must be reported for at least one year to EPA Bay Program office for annual progress by the state at the degraded condition before getting credit for restoration and the incremental removal rate increase.**

Delete, move to companion document or modify to represent juristiction's actions or reporting requirements to EPA.

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*What to Submit to the State*
To be eligible for the removal rates in the model, localities need to check with their state stormwater agency on the specific data to report individual retrofit projects, and must meet the BMP reporting and tracking procedures established by their state. The Panel recommended that the following information be reported:
a. Retrofit class (i.e., new retrofit facility or existing BMP retrofit)
b. GPS coordinates
c. Year of installation (and expected rate duration)
d. 12 digit watershed in which it is located
e. Total drainage area and impervious cover area treated
f. Runoff volume treated and identify "type" of BMP
g. Projected sediment, nitrogen and phosphorus removal rates
Localities will also be responsible for other tracking and verification procedures as outlined in Section 6 of this memo.

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4. *Local Retrofit Reporting to the State*. Localities must submit basic documentation to the state stormwater or TMDL agency to document the nutrient/sediment reduction

claimed for each individual urban retrofit project that is actually installed. Localities should check with their state stormwater agency on the specific data to report for individual retrofit projects. The Panel recommended that the following data be submitted:

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a. Retrofit class
b. GPS coordinates
c. Year of installation (and expected duration)
d. 12 digit watershed in which it is located
e. Total drainage area and impervious cover area treated
f. Runoff volume treated and identify "type" of BMP
g. Projected sediment, nitrogen and phosphorus removal rates
A locality may submit aggregate data for all of the on-site retrofits installed on private land each year, and may omit items b and d on the above list (although they must maintain this data in their local records).

5. *Local Retrofit Recordkeeping*. Localities should maintain a more extensive project file for each urban retrofit project installed (i.e., construction drawings, as-built survey, digital photos, inspection records, and maintenance agreement, etc). The file should be maintained for the lifetime for which the retrofit removal rate will be claimed.

6. *Ongoing Field Verification of BMP Performance*. Local inspectors need to look at visual and other indicators every 10 years to ensure that individual retrofit projects are still capable of removing nutrients/sediments. If the field inspection indicates that a retrofit is not performing to its original design, the locality would have up to one year to take corrective maintenance or rehabilitation actions to bring it back into compliance. If the facility is not fixed after one year, the pollutant reduction rate for the retrofit would be eliminated, and the locality would report this to the state in its annual MS4 report. The retrofit removal rate can be renewed, however, if evidence is provided that corrective maintenance actions have restored retrofit performance.

The Panel recommended that localities pool their scarce local MS4 monitoring resources together to create a monitoring consortium that could fund selected retrofit monitoring projects to be performed by monitoring experts (i.e., universities and qualified consulting firms).

In the interim, the Panel recommended that any local retrofit monitoring be conducted under a standard quality assurance project plan (QAPP) developed under the auspices of

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the USWG to ensure the performance data is reliable and accurate. Since several communities may be interested retrofit monitoring, USWG might not have the capacity to review all of the designs. The Panel therefore recommended that EPA CBPO retain a consultant with expertise in "applied" monitoring to develop basic QAPP guidelines and make suggestions to monitoring plans. A possible model might be the 3-tiered QA certification process that increases in rigor with the increased need for data accuracy

employed by the city of Suffolk and other Virginia communities (Details can be found at http://www.deq.virginia.gov/cmonitor/guidance.html).
The consultant would also be charged with identifying synergies among research to avoid duplication of effort and also prioritize monitoring needs. The initial guidelines would be fairly generic cutting across retrofit types and would be flexible to account for local site conditions. Ultimately, the Panel recommended that a standard methodology be established for each type of retrofit practice as long as it allows for local site variability.

Similar edits for the performance standard document.
Consider replacing "locality" or "local government" with "jurisdiction" wherever it appears in the document.

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The Panel then developed specific calculation methods tailored for different development situations. Local governments **Jurisdictions** will only need to report the number of acres treated under the new performance standards and the acreage of non-complying projects. They will no longer have to report a pollutant removal efficiency for each individual BMP or site design credit installed at each development project, which should greatly reduce the administrative burden on local and state agencies. To assist local users (and state verifiers), the Panel has included numerous design examples to illustrate how the removal rates are calculated

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*The Baseline Load Issue*
The Panel decided that localities **jurisdictions** do not need to calculate a pre-development baseline load when it comes to reporting new BMPs that serve future new development or redevelopment sites to their appropriate state TMDL agency. The precise load reduction achieved under the new performance standards is computed by the Chesapeake Bay Watershed Model. Localities **Jurisdictions** need only report the removal rate derived from the new BMP removal rate adjustor curves and the total treated acres for each individual development project.

The Panel acknowledges that many localities **jurisdictions** may want to estimate pre-development baseline loads so they can track the aggregate impact of the implementation of stormwater practices on pollutant loads from the developed land sector over time. This local tracking effort can estimate pollutant load reductions that occur when the new performance standards are applied to redevelopment sites. In addition, this tracking system can estimate the pollutant removal benefits associated with BMP implementation at new development sites. Most importantly, local load tracking can

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help communities forecast trends in local loads due to land use change (and BMP implementation) in the future. Such information can be useful to include in:

1. Local watershed implementation plans

2. Comprehensive land use plans
3. MS4 permit annual reports

Delete, move to companion document or modify to represent juristiction's actions or reporting requirements to EPA.

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*What to Submit to the State*
To be eligible for the removal rates in the model, localities need to check with their state stormwater agency on the specific data to report BMPs for new or redevelopment projects, and must also follow the BMP reporting and tracking procedures established by their state. The Panel recommended that the following information be reported:
a. List of practices employed
b. GPS coordinates
c. Year of installation (and expected duration)
d. 12 digit watershed in which it is located
e. Total drainage area treated
f. Runoff volume treated and BMP "type" (i.e., whether the BMP system is classified as ST or RR)
g. Projected sediment, nitrogen and phosphorus removal rates

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*Basic Reporting Unit*. Local governments will track the number of treated acres each year that fully meet the state's new performance standard. The typical duration for the BMP system removal rate for new development will be twice the prescribed MS4 inspection cycle, which ranges from 6 to 10 years. The removal rate can be extended if a field inspection verifies the BMP(s) are still performing.

*Local Reporting to the State*. Localities will need to submit basic spreadsheet documentation to the state once a year as part of their MS4 annual report. The spreadsheet can be used to tabulate the aggregate acres of new development and redevelopment that were treated to the standard.To be eligible for the removal rates in the model, localities need to check with their state stormwater agency on the specific data to report BMPs for new or redevelopment projects, and must also follow the BMP reporting and tracking procedures established by their state. The Panel recommended that the following information be reported:
• Whether the project is classified as new development or redevelopment
• Total drainage area treated (acres)
• Post development site land cover (e.g., % forest, % turf, % impervious cover)
• Pre-development land cover (e.g., % forest, % turf, % impervious cover)
• Year installed
• GPS coordinates (lat/long) and the 12 digit watershed in which it is located (optional)

*Initial Verification of BMP Installation*. Localities will need to verify that urban BMPs are installed properly, meet or exceed the design standards for its CBP BMP

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classification, and are functioning hydrologically as designed prior to submitting the BMP for load reduction credit in the state tracking database. This initial verification is provided either by the BMP designer or the local inspector as a condition of project acceptance, as part of the normal local stormwater BMP plan review process. From a reporting standpoint, the MS4 community would simply indicate in its annual report whether or not it has BMP review and inspection procedures in place and adequate staff to implement them.

*Local Record-Keeping*. Localities should maintain an extensive project file for each new development project (i.e., LID locator map showing all LID and site design practices employed, construction drawings, as-built survey (for larger practices), digital photos, inspection records, and maintenance agreement). The file should be maintained for the lifetime for which the BMP removal rate will be claimed. Localities are encouraged to develop a GIS-based BMP tracking system in order to schedule routine inspections and maintenance activities over time.

*Non-Conforming Projects*. Local governments should also keep track of any future development projects that are designed under the old standard, or cannot fully comply with the new standards. The lower nutrient removal rate for each non-conforming project can be computed using the new BMP removal rate adjustor curves, and reported separately to the state. The state may elect to use CAST or other similar tools to determine the aggregate nutrient increase associated with non-conforming projects in a locality, and increase their local load allocation target.

*Periodic BMP Inspections*. Simple visual indicators are used during routine maintenance inspections to verify that the system of practices still exists, is adequately maintained and is operating as designed. It is recommended that these rapid investigations be conducted as part of every other routine stormwater BMP inspection required under their MS4 NPDES permits.
Appendix D provides an example of an inspection form to quickly assess urban BMP performance in the field using simple visual indicators. This approach was refined and tested through an extensive analysis of hundreds of BMPs located in the James River Basin of the Chesapeake Bay watershed. More detail on the methods and results can be found in Hirschman et al (2009).
The basic form in Appendix D can be modified, simplified or customized to meet the unique BMP terminology and design criteria employed in each Bay state. Each state may elect to develop or adapt their own indicators, checklists and field inspection procedures. In some situations, localities can reduce the inspection effort by sub-sampling a representative fraction of BMPs at new development sites designed to the new standard to calculate the proportion of their BMPs that are performing or not performing.

Local inspectors should evaluate BMPs once every other inspection permit cycle, as mandated in their MS4 permit to assure that individual LID and site design practices are still capable of removing nutrients/sediments.

# 8-13-2012 Resolution of VA DCR Comments

Approve the memos, subject to the following changes

**1. BMP Restoration (RETROFIT MEMO ONLY)**

revise retrofit memo to include corrected BMP restoration design example to be consistent w/ the revised definition for this retrofit category (text is in my response memo of last week)

Add Bill's two stage BMP reporting requirement for restoration as follows:

"Simply put if the BMP has been reported before at anytime it must be reported at the degraded state for at least 1 progress reporting cycle and the curves are applied to what treatment level is reported. Then the restoration BMP is applied and the gets reported at the new restored state and the appropriate curve numbers thus the BMP gets the incremental improvement and eliminates my concerns on undue credit or the perception of false reporting" (source Bill's friday e-mail text)

Eliminate reference to 2006 and CBWM model in the current text.

**2. Baseline nutrient loading text (BOTH MEMOS).**

Eliminate all reference to the CBWM unit urban loads for states in text and appendices of panel report, as it may be confusing, and is not integral to how load reductions will be calculated under the new recommendations (but include it as a local WIP planning method in subsequent outreach documents to local governments)

**3. Clarification of state BMP and retrofit reporting requirements (BOTH Memos).**

Add clarifying language to each section that refers to local BMP reporting. "*To be eligible for the removal rates in the model, localities must meet the BMP reporting and tracking procedures established by their state'*.

For example, VA may ask localities to provide data on the proposed duration of the BMP or retrofit credit, in addition to the other suggested reporting items .

**4. Dry Detention and Dry ED Ponds (Both memos)**

Drop these two practices from the ST classification provided in Table 2 (retrofit) and Table 4 (performance standards) as they cannot attain the removal rates shown in the curves. Instead, add a note to both tables that the removal rates for these ancient practices shall continue to be at the original low CBP removal rates provided in Table A.5 of the appendix.

This is a technical mistake that CSN just caught last week

**5. Groundwater nitrate migration discount**.

The downwardly revised N removal curves requested by the WTWG shall be retained (along with supporting text in appendix

However, all future panel will be asked to evaluate this issue so that we are consistent across panels and sectors

# 8-9-2012 Response to VA DCR Comments

Thanks for your comments. I wanted to clarify several issues and concerns that you raised in your e-mails relating to the two expert panel reports.

*1. Background on the BMP Restoration Approach (VA).*

The BMP restoration approach was advanced by a panelist from tidewater Virginia (LJ, Hansen) who noted that they had many decades old wet ponds whose performance could be boosted through major sediment cleanouts. Many of these ponds were never reported to the state, although some were.

The retrofit panel was initially concerned, as you are, that crediting incremental nutrient removal for major sediment cleanouts would be inconsistent with the model, and also susceptible to "gaming". However, the expert panel was swayed by the fact that the current CBP-approved removal rates for ponds and wetlands (see Table A-5 in Appendix A of the memo) had already been steeply discounted from actual monitored rates to account for poor design and maintenance in the real world. To put this into perspective, the CBP-approved rates are roughly half of those used in the new Virginia stormwater regulations (see Table A-4 in Appendix A).

Consequently, the panel felt that the new adjustor curve method could be used to derive incremental removal rates associated with this retrofit strategy, that would not be inconsistent with the model. The panel reasoned that the documented increase in stormwater treatment volume would achieve nutrient reductions in the real world, based on their review of the available science.

The panel also established several important qualifying conditions to ensure this retrofit strategy would not be abused, or associated with ongoing urban BMP maintenance. The additional qualifying condition that you proposed will provide further assurance.

In the end, the panel wanted to provide localities a broad range of retrofit options so that they could find the most cost-effective opportunities to achieve desired nutrient reductions. The panel also reasoned that the modest removal rates offered for the BMP restoration credit (9 to 14% for N and P respectively in the design example) would limit the use of this strategy to the few situations where it would produce real water quality improvements (given the considerable expense associated with pond dredging).

Both panels generally agreed that the old urban BMP removal rates (Table A-5) were outdated, and that going forward, the adjustor rate curve approach was preferable for dealing with stormwater retrofits and new LID practices.

I have modified the design example for BMP restoration to reflect your latest comments, as follows:

*A wet pond was installed in Bay City in 1980, which captured 0.5 inches of runoff from the impervious cover of its contributing watershed. Bay City reported the pond to Bay State and it was included in CBWM input deck. Over time, however, the storage capacity of the wet pond was seriously diminished due to sedimentation and growth of invasive plants. The maintenance crew noted that 60% of the pond's storage capacity had been lost, resulting in an actual capacity of a mere 0.2 inches of runoff treatment.*

*Bay City DPW conducted a major dredging effort to clean out the sediments and replanted the pond with native species. As a result of the pond restoration, 0.3 inches of storage were recovered, increasing the total storage in the pond to its original design volume of 0.5 inches of runoff depth captured. Bay County employed the retrofit removal adjustor curves for ST practices to determine the incremental pollutant removal rates associated with the pond restoration, as follows:*

| | *TP* | *TN* | *TSS* |
|---|---|---|---|
| *Restored Rate (0.5)* | *40%* | *25%* | *48%* |
| *Existing Rate (0.2)* | *26%* | *16%* | *33%* |
| *Incremental Removal Rate* | *14%* | *9%* | *15%* |

*2. The CBWM Unit Load Baseline Issue (VA and PA)*

Table C-1 in the retrofit memo (D-1 in the performance standards memo) has created a great deal of confusion, given the variability of pervious and impervious loads as simulated by the CBWM at the river-segment level and the state average level.

Both panel and the CBPO modeling team agreed that the removal rates derived from the adjustor curves would be applied to the actual load simulated for the CBWM river segment in which the drainage area of the BMP resides, regardless of whether it is a retrofit or a BMP system designed under new state performance standards.

Therefore, the unit load tables in the Appendices are not used in the BMP reduction calculations at all. They were included for a simple practical reason. Localities need some kind of baseline load to evaluate which of the many retrofit options in their community will achieve the greatest nutrient mass reductions for their stormwater retrofit investment…or to estimate the magnitude of the redevelopment stormwater credit over time. The panel was very clear that this baseline is only used for local WIP planning and tracking.

The unit loads for urban land may well change when Version 6 of the CBWM eventually hits the streets. All of the expert panels and the USWG are currently making

recommendations to the CBPO modeling team to improve the quality of the urban land situation.

The panels approach of using a geographically and project-specific removal rate for each retrofit or development site will enable us to adjust aggregate nutrient reduction by urban BMPs, regardless of whether unit loads go up or down in the future.

*3. Procedures for Local Reporting, Tracking and Verification (VA).*

Both panels were extremely cognizant of the importance of these issues, and especially the need to recognize the nuances of how each state administers its stormwater programs, and to reduce the administrative burden on localities. The panels had representation from every state stormwater agency (as well as localities that would be affected), and spent more than half of their deliberations going over these recommendations in mind-numbing detail. In addition, the USWG devoted portions of four meetings over the last year to debate on reporting and verification issues.

What is contained in the memos represent the consensus that the panels finally agreed to, and that the stormwater agencies on the USWG subsequently approved. (although the issue of non-MS4 verification was not satisfactorily resolved and is currently being worked on by a work group of the USWG).

*4. Redoing the Legacy BMPs (VA)*

Both Panels were clear that their recommendations applied to new BMPs or retrofits going forward, and that localities would not need to redo nutrient removal rates for urban BMPs that they have submitted up to this point.

The USWG and/or the Verification committee may encourage states to clean up their historical databases, and verify the existence/performance of these BMPs as part of their inspection and verification process, but these decisions are for another day, and not part of the panel recommendations.

*5. Inadequate Review Time (VA).*

While I am sympathetic that both memos are long and complex, and take a long time to review, they have been available to the USWG since April and the WWTG since May. CSN has met twice with the WTWG, and gone back to the USWG and expert panels to address these concerns. The proposed resolution to the WTWG concerns were provided to WTWG in the 7/2/2012 memo.

The CBP and sector experts have put a very high priority on expediting the expert panel process for the simple and important reasons that local and state governments are demanding to know what the BMP "rules of the road" are so they can make intelligent decisions on what combination of BMPs they will implement in the future.

*6. Groundwater Nitrate Issue (PA)*

We solicited comment from the expert panels and the states after the June 11 USWG which went over the two nitrogen discount for the adjustor curves, and these responses were included in the July 2 memo as an attachment. EPA , three states and HRPDC supported the compromise approach to make only one discount factor, with PA dissenting that neither discount should be taken.

I would offer to PA that even with the discount, the N removal rates for both retrofits and new stormwater BMPs will be higher than they were in the past using the old CBP-approved rates in Table A-5. When they are applied to PA higher unit loads for urban lands (TableC-1/D-1), they will result in greater mass load reduction than is available for any other Bay state. Consequently, I don't think the relatively minor change in the N curve would have a great deal of impact on PA load reduction.

**Consolidated WTWG Comments August 9 2012**

***BMP restoration*** applies to major maintenance upgrades to existing BMPs that have either failed or lost their original stormwater treatment capacity. These facilities are eligible for upgrades in removal rate if they were constructed prior to Jan 1, 2006. The amount of the removal rate increase depends on whether or not the BMP has previously been included in the state's CBWM input deck.

The issue that was raised by VA before to Norm and at the WTWG in late May was about this notion of getting increased pollutant removal rates depending upon if the BMP had been included in an input deck at some point in time. Does it mean if reported for an official progress run or just any old input deck? Either way I do not see any technical basis for giving additional credit over what the BMP is designed to do on site based on whether it may or may not have been in a model input deck at some point in time. The request from VA was for the language in the definition be modified to eliminate the concept of restoration as written. That it not be tied in any way to model input decks and dates but strictly be based on the removal rates the restored BMP as it is now functioning. It is not seen as scientifically defensible to this member to tie BMP efficiencies to some date only relevant to a single phase of one of the models used to determine loadings impacts. Especially one with the documented issues as phase 5.x does. It may be determined that in phase 6 we will have a different calibration period. Does that mean we have to re-define the BMP then to modify the date when you can get the benefit?

BMPs in need of restoration of this magnitude should not be eligible for reporting as they are not performing at design specifications. Would the BMP in such need of repair pass a verification audit? Such an audit would likely require them to be removed from the states record of functioning BMPs and any resulting progress run input deck. Once restored they should get the benefit they are actually performing at the time of reporting. I do not see how any state or EPA could allow a year to go by and still report the BMP as functional when we know better considering the potential consequences of not hitting milestone target loadings and the need for transparency. EPA recently disallowed significant cover crop acreage from PA because PA could not document if

they were actually meeting the model world definition of nutrient inputs. EPA had no evidence to say the reported acres were in violation of the definition but basically disallowed half of the reported acres. With this BMP we have documentation of noncompliance with maintenance and reporting of it no longer functioning to standards and specifications. Look at the example on page 21 of the Retrofit document. The BMP was designed and built to treat 0.5 inches of runoff. It is now at 0.2 inches of capture but has been repeatedly reported as meeting specifications since sometime before 2006. It is restored to 0.4 inches of capture or 20% less than original design yet it is to get an additional 11% reduction. When I take the actual original rate of 0.5 inch capture and look a the curves the calculation produces a 15% increase in loadings not a reduction. This is too easily confused by the modelers building phase 6 and as currently written my suggestion is to rewrite this section of restoration of a BMP as a BMP in this document to make it clear what the original reporting specifications were in the example. The current example should label things differently. When is says original does it mean the 0.5 in capture rate that using the curves provides a 52% TP reduction? The calculation is indicating the original rate but it is actually the current or existing condition rate of 0.2 inches of capture. So exactly what was reported before said date in 2006? The BMP as constructed and meeting specifications (0.5 inch capture) or the degraded BMP (0.2 inch capture)? We must assume it has been reported as meeting specifications since installation sometime before 2006. As is the example does not support the argument for incrementally higher benefit if the actual original rate means as originally reported but actually supports a reduced or negative credit be given. And if the example is modified to show returning the BMP to original condition still does not support and incremental increase in reported reductions.

Additionally, I have made it clear via direct communication with Norm and or yourself that the tracking and reporting information as written may conflict with what the state may require from localities. I do not see adequate modification of the retrofit document to address the stated concerns. You cannot say in one paragraph on page 23 that localities need to address the states stormwater agencies reporting needs and then list the things on page 24 they will not be required to report or the format in which they must report. Each state may well dictate what it needs to comply with EPA NEIEN reporting requirements and may require reporting via other formats and in much greater detail than these documents indicate. My suggestions is to simply say localities need to meet the states stormwater or other reporting agencies unique requirements and remove any additional language telling locals what they can or will not be required to report.

I must also agree with PA about the unit area loads in appendices of both documents (Table D-1 in the performance standard and C-1 in the retrofit documents respectively). Using statewide scale unit area loading rates from the 2010 no-action scenario to calculate baselines for a locality does not seem consistent with the TMDLs that were based on segmentshed scale 2009 progress loadings as the baseline. The no-action scenario only exists in the model and has no relation to any situation known to actually ever exist. Virginia has zero faith that the unit area loading rates in any scenario of any phase of 5.x WSM as being accurate or representative of the actual land use or sector situation especially if one is looking at the numbers over other scales. Error increases as

you go to smaller and smaller scales in phase 5.x meaning regional scale models and modeling are not appropriate for local scale planning. When phase 6 is created undoubtedly these unit area loads will be different for the same scenarios like the 2009 or other progress baseline year used in phase 6. Will these tables need to be modified then to reflect the new model world set of numbers? Why would someone use these tables knowing that in a short while they will all change when the new model arrives? Are these tables actually needed? If these tables are to be left I would recommend using the 2009 "progress" year scenario as the base run for planning and at the segmentshed scale so that the table is at least consistent with how the TMDL allocations were established.

There is a tremendous amount of information to go through at a technical level in these 2 documents. The use of the curves is new to many of us and new concepts sometimes take additional time to review and understand. Like how will we use these curves over the history of reporting for the calibration of phase 6? The persons who are members of the WTWG are also doing many other things. I do not understand the need to rush these through the WTWG review considering the volume of information that the workgroup really needs to evaluate. I do not see this as providing the needed difference to them and their technical concerns and does not allow them adequate time to digest the material and develop thoughtful questions. And see those questions answered or otherwise adequately addressed. My comments in no way are meant to diminish the work of you or the panelist involved in these reports and no one including the panelist should take offense at questions being raised considering the amount of information needing to be processed by so many different persons. However, I question sending documents to the WQGIT that still have technical questions and concerns being raised. I think the WQGIT should be getting a product free of any technical questions or concerns as these documents still have.

Regards,

William Keeling
NPS Modeling and Data Coordinator
Virginia Department of Conservation and Recreation

As requested at the conclusion of the Watershed Technical Work Group (WTWG) meeting last week, I am sending you a statement of Pennsylvania Department of Environmental Protection's (DEP) concerns regarding the revised Retrofits and Performance Standards reports.

During the August 1st, 2012 conference call of the WTWG, Pennsylvania Department of Environmental Protection (DEP) expressed concern regarding the proposed Nitrogen (N) reduction and volume reductions for stormwater BMP retrofits.

DEP believes that overly conservative assumptions or "stacked" conservative assumptions would diminish the credit due these practices relative to other

BMPs/source sectors within the model. Groundwater N transport is problematic within the model which looks at one-year time frames while true groundwater transport can potentially span decades. There are examples of other source sector BMPs having reduced their N treatment efficiencies due to groundwater loss, although it does not appear that the methodology and application of these losses has been consistent across BMPs such that urban storm water BMPs may be making BMP efficiency reductions beyond those made in other sectors. PA maintains storm water management design standards that exceed those of other Chesapeake Bay (CB) jurisdictions. Within the CB model, the N loading rate for Impervious Land in PA is nearly double that of the other jurisdictions and accordingly, this reduced efficiency will have an especially diminutive effect on PA's SW BMPs credit relative to other jurisdictions and other source sectors.

DEP is also concerned about proposed reductions for retrofits and redevelopment; the existing volume must be reduced by 20% in accordance with Pennsylvania requirements and compliance with a "local" TMDL (including CB TMDL), when applicable. The permittee provides a demonstration of the reduction achieved on the project site from the retrofit. These sites need to be identified by the municipal permittee within the TMDL implementation plan. The Urban Storm Water Workgroup and Expert Panel recommendations allow for new retrofits to not always meet performance standards for BMP sizing that apply to new development, however PA's performance standards, as required by PA title 25, Chapter 102.8 do not allow for these standards to be relaxed. By this approach, PA storm water retrofits will exceed the crediting standards recommended by the expert panel.

**Ted Tesler, PG** | Licensed Professional Geologist
Department of Environmental Protection | Interstate Waters Office

## July 12, 2012 USWG Response WTWG Comments

### Resolution of Technical Issues Related to the Urban Retrofit and Performance Standards Expert Panel Recommendations

**Background:**

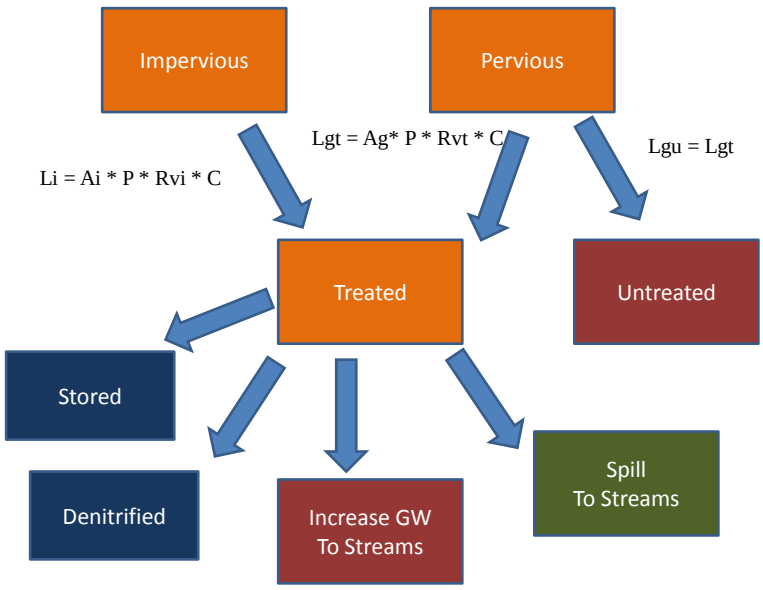
The Urban Stormwater Workgroup (USWG) accepted the recommendations of the two expert panels at its April 30 meeting. The recommendations were then transmitted to the CBP Watershed Technical Work Group (WTWG) at its May 29 meeting, which endorsed the two final reports, subject to four proposed revisions to ensure consistency with the CBWM and other scenario assessment tools.

After consulting with Gary Shenk (CBPO), I drafted a memo on 6/6/12 on an approach to incorporating these revisions, which was sent to both expert panels and the USWG. The USWG met on June 12 to discuss the memo. Whereas there was consensus to accept revisions 2 through 4, the USWG could not reach consensus on the nitrate base flow issue raised by WTWG (see meeting minute excerpts in Appendix A). At the request of

the USWG chair, Gary Shenk drafted a response to the USWG (which is included in Appendix B), and the states were given a week thereafter to provide written comments (summarized in Appendix C). Based on the feedback I received, I have revised the 6/6/12 memo and offer a proposed resolution to the nitrate base flow issue, as follows:

## Revision 1. Revising TN Adjustor Curve to Reflect Base flow Nitrate Movement in Urban Watersheds.

**Issue:** The adjustor curves are used to define a removal rate that applies to both the pervious and impervious areas in the contributing drainage areas for the stormwater treatment practices. The removal rates properly apply to surface runoff and some portion of the interflow delivered to the stream, but may not properly apply to groundwater export of nitrate-nitrogen from the urban landscape. The "missing" nitrate may reflect direct leaching of nitrate into groundwater in pervious areas that is not captured or treated by a down-gradient retrofit or BMP, or it may reflect nitrate that is exits a runoff reduction or stormwater treatment practice via infiltration into soil, or slow release through an under drain (e.g., bioretention). See Figure 1 below:




In the context of the CBWM, BMP removal rates are applied to the total nitrogen load that is generated by surface runoff and groundwater flows (i.e., when watershed modelers say 'runoff' they mean total surface and groundwater export from the land. When stormwater managers say 'runoff' they mean the surface runoff or interflow only that is captured by a retrofit or BMP). On pervious lands, as much as 25 to 40% of the simulated nitrogen load is coming through the groundwater (some fraction may also be delivered by downstream sources such as septic systems or illicit discharges).

If overland flow is diverted to groundwater, the overall load is reduced by using the ground as a filtering medium, but not eliminated. While ongoing research has indicated that it may be possible to enhance subsurface de-nitrification through certain design factors, we lack, as of now, definitive evidence for this effect.

Therefore, the WTWG concluded that current TN adjustor curves may over-estimate TN removal rates, and should be discounted to reflect the movement of untreated nitrate into streams, at the scale of the small watershed. This discounting is not needed for TKN, TP or TSS as these pollutants are not mobile in urban groundwater.

**Rationale:**

The ultimate fate of nitrogen in urban groundwater has been an ongoing concern from MDE representatives on both expert panels, but no panelist could identify a method or work around to satisfactorily address it in the context of CBWM.

**Proposed Resolution:**

The proposed resolution is to develop a discount factor to the existing panel protocols to account for groundwater nitrate migration from runoff reduction practices.

The USWG acknowledges that there is a potential need for a second discount factor to account for "escaped" nitrate up gradient and down gradient of the BMP that is not effectively captured by the BMP. However, the USWG does not feel there is a technical support for a work-around at this point in time and with this version of the CBWM. It recommends that the 2017 model refinements attempt to better characterize more specific contributions of different urban nitrate sources and their relative position in the urban landscape relative to the CBWM river basin segments.

*Derivation of discount factor for nitrate loss exiting from runoff reduction practices*

This discount factor is fairly straight forward to calculate and is simply based on the ratio of nitrate in relation to total nitrogen found in urban stormwater runoff. Stormwater runoff event mean concentration data from the National Stormwater Quality Database (Pitt et al, 2006) analyzed more than 3000 storm events, and the nitrate : TN fraction consistently around 0.3. This sets an upper boundary on the fraction of the inflow concentration to the BMP which could be lost to groundwater or under drains at about 30%.

The next step is to account for any nitrate loss within the BMP due the combination of either plant uptake and storage and/or any de-nitrification within the BMP. Most runoff reduction practices employ vegetation to promote ET and nutrient uptake, whereas the de-nitrification process is variable in both space and time.

Over 70 performance studies have measured nitrate removal within runoff reduction BMPs. A summary of the national research is shown in Table 1. Clearly, there is a great

deal of variability in nitrate reductions ranging from nearly 100% to negative 100% (the negative removal occurs when organic forms of nitrogen are mineralized/nitrified into nitrate within the BMP).

Some well studied runoff reduction practices, such as bioretention and bioswales, have a median nitrate removal ranging from 25 to 45%, presumably due to plant uptake. Initial results for green roofs indicate moderate nitrate reduction as well. Non-vegetative practices, such as permeable pavers and a few infiltration practices, show zero or even negative nitrate removal capability (Table 1). Submerged gravel wetlands that create an aerobic/anaerobic boundary that promotes denitrification appear capable of almost complete nitrate reduction.

Therefore, it is recommended that maximum nitrate removal within runoff BMPs be assumed to be no more than 40%. Although this value may seem generous, it should be noted that some additional nitrate removal is likely after the nitrate exits the BMP and moves down-gradient through soils on the way to the stream.

Given the inflow concentrations, the potential groundwater/under drain nitrate loss would be (0.3)(0.60) = 0.18, or a discount factor of 0.82

The discount factor is then applied to the anchor rates used to derive a new N adjustor curve. The anchor rate for RR practices would be adjusted downward from the current 70% to 57%, and the existing runoff frequency spectrum equation would be used to develop a new, lower curve for TN removal. An example of the how this discount influences the existing N adjustor curve is shown in Figure 2.

Table 1: Nitrate Removal by Runoff Reduction Practices [1]

| Practice | Median Removal Rate | No of Sites | Range | Source |
|---|---|---|---|---|
| Bioretention [2] | 43% | 9 | 0 to 75 | CWP, 2007 |
| Bioretention [2] | 44% | 1 | NA | UNH, 2009 |
| Bioretention [2] | 24% | 10 | NA | ISBD, 2010 |
| Bioswales | 39% | 14 | -25 to 98 | CWP, 2007 |
| Bioswales | 7% | 18 | NA | ISBD, 2010 |
| Infiltration [3] | 0 | 5 | -100 to 100 | CWP,2007 |
| Perm Pavers | -50% [4] | 6 | NA | IBSD, 2010 |
| Perm Pavers | 0 | 4 | | Collins, 2007 |
| Green Roof [5] | Positive | 4 | NA | Long et al 2006 |
| Gravel Wetland | 98% | 1 | NA | UNH, 2009 |

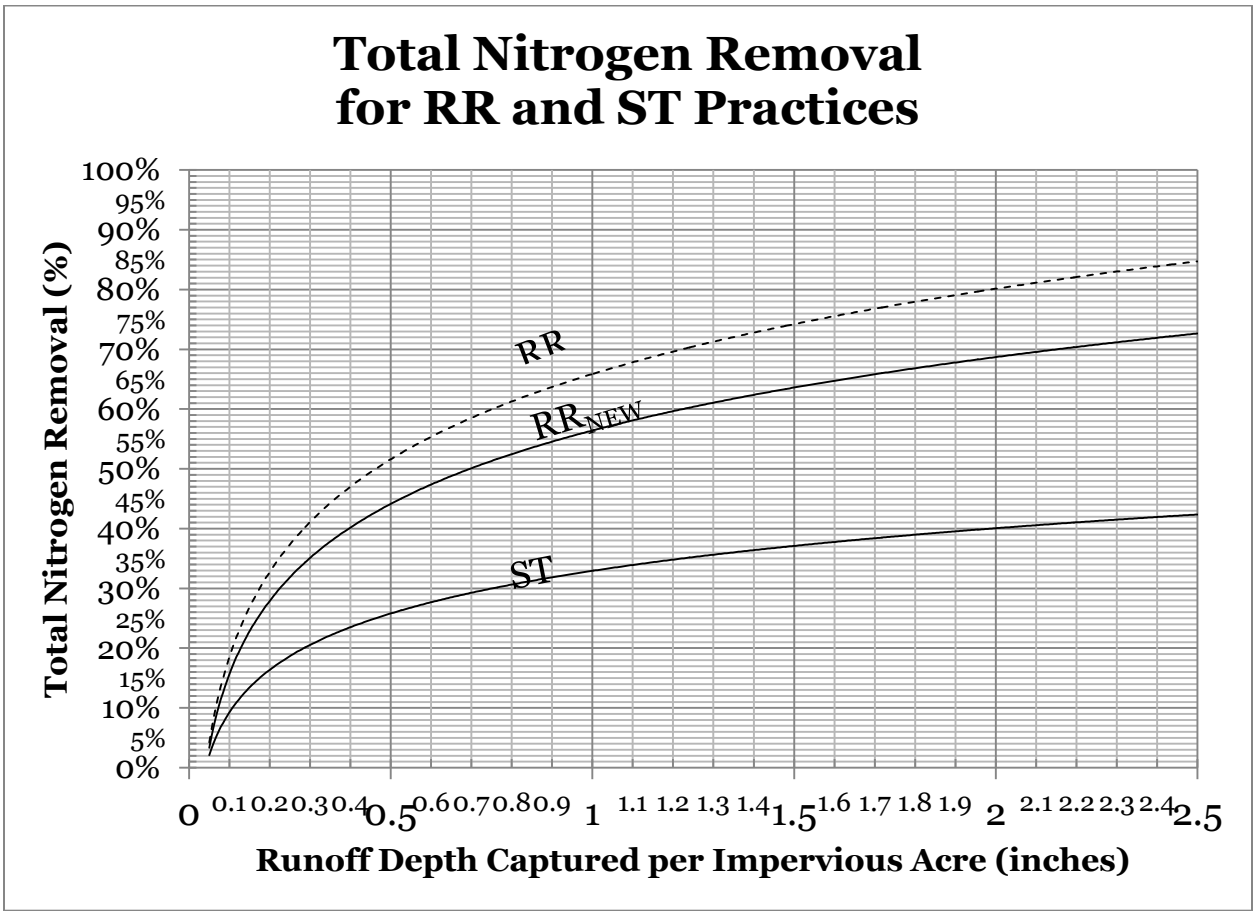
Notes:
[1] As measured by change of event mean concentration (EMC) entering device and final exfiltrated EMC , and involves either or plant uptake or denitrification
[2] For "conventional" runoff reduction practices only, i.e., no specific design features or media enhancements to boost nitrate removal
[3] Category includes several permeable paver sites
[4] A negative removal rate occurs when organic forms of nitrogen are nitrified to produce additional nitrate which is

[5] Test column study

It is also noted that no nitrate loss parameter needs to be defined for stormwater treatment (ST) practices, since inlet and outlet monitoring of these larger facilities already takes this into account (and is a major reason why the ST curve is so much lower than the RR curve)

The de-nitrification process can be enhanced through certain design features (inverted under drain elbows, IWS, enhanced media), Several good research reviews indicate that these design features show promise in enhancing nitrate removal (Kim et al, 2003, NCSU, 2009, Weiss et al, 2010), these features are not currently required in Bay state stormwater manuals. Should future research confirm that these features can reliably increase nitrate removal through denitrification and/or plant uptake, it is recommended that a future expert panel revisit the existing nitrogen adjustor curve.

Figure 2. Revised TN Adjustor Curve



**Option 1 Action:** The USWG supports the modified resolution as provided above, and that the revised N removal rate adjustor curve shown above replace the current one. Design examples would be modified accordingly, and the preceding technical discussion be added to the appropriate appendix that describes how the adjustor curves were derived.

Text would be added to memos that acknowledge the "escaped nitrate" issue up gradient and down gradient of the BMP that might not be effectively captured by the BMP, but indicate that this should be resolved in the next version of CBWM.

**Option 2 Action:** Stick with both nitrate discount factors as originally outlined in the 6/6/12 Schueler memo. Revise expert panel memos accordingly.

## Revision 2. Make a Short Term and Long Term Recommendation on how the new removal rate protocols can be better integrated into CAST.

**Issue:** The WTWG committee inquired how the project-specific removal rates developed by the expert panels could be incorporated into watershed assessment tools such as CAST and scenario builder. If each development site or retrofit project has a unique removal rate, how can this variability be addressed in the watershed assessment tools that localities and states use in their watershed implementation efforts?

**Rationale:** It may take a year or more to incorporate the adjustor curves into the CAST modeling framework, although the CBPO modeling team has expressed a willingness to do so. Until these refinements are made, how should retrofits and new BMPs be expressed in state tools (CAST/VAST/MAST etc.)

**Resolution:** Since these tools are used for planning, and evaluation of alternate BMP scenarios, it is reasonable for the states to select a single rate to characterize the performance of a generic retrofit or a BMP system used to meet new performance standards at a new or redevelopment site. For example:

> *For retrofits:* Assume the retrofits are a 50/50 blend of RR and ST practices and treat 1 inch of impervious area, and then use that generic rate for planning purposes, and then focus on the total drainage area treated by a group of retrofits.
>
> *For new development*: Assume that the projects fully meet the performance standard, and then assign the derived removal rate to the aggregate drainage area. The resulting load can be compared against the pre-development load to determine if the Project is nutrient neutral. States may also want to include options whereby full compliance with the standard is not possible so localities can forecast how these might change their baseline load allocation.
>
> *For Redevelopment*: Assume that the redevelopment project fully meet the performance standard, and then assign the derived removal rate to the aggregate

impervious area that is treated. Since pre and post development land use is impervious, it will provide a quick estimate of the load reduction possible under different future redevelopment scenarios.

As noted, each state would elect to develop its own scenarios to be consistent with their unique requirements

**Action:** The USWG fully supports the recommended resolution.

## Revision 3. Report Stormwater Performance Standards for Redevelopment Removal Credit as impervious acres treated and not pounds of nutrients reduced

**Issue:** It is more precise to have the CBWM compute the actual reduction associated with redevelopment stormwater then to have the state or locality estimate it based on the simple method or the state-wide unit loading rates from the CBWM.

**Rationale**: Reporting the rates and the impervious acreage treated requires less effort by local and state government, and provides more consistent estimates of load reduction via the CBWM. This approach also protects local government if the unit loads change in future versions of the CBWM (e.g., 2017).

**Resolution:** Accept the proposed revision, but still allow localities to estimate their load reductions using the two existing methods referenced in the Appendices. Localities, however, would not report their load reductions to the state for CBWM input deck.

**Action:** The USWG fully supports the recommended resolution.

## Revision 4. Additional Qualifying Condition for the BMP Restoration credit

**Issue:** The WTWG requested that the BMP restoration credit have an additional qualifying condition that the proposed restoration activities be significant enough to achieve the intent of the original water quality design criteria in the era it was built (e.g., sediment cleanouts would need to be sufficient to recover the full water quality storage capacity that was originally approved for the BMP, under historically less stringent standards, regardless of whether the BMP was reported in the CBWM input deck.

**Rationale**: On-going concern that this restoration option was susceptible to gaming, and to have a firmer threshold that the restorative actions bring things back at least to the old design standard.

**Resolution**: add language to the retrofit memo that "the proposed BMP restoration activities be significant enough to achieve the intent of the original water quality design criteria in the era it was built"

**Action:** The USWG fully supports the recommended resolution

# Appendix A:
# Excerpts from June 12 USWG Meeting Minutes

**WTWG Recommended Revisions on Expert Panel Reports: Tom Schueler**

- See also memo: Proposed Revisions to Urban BMP Expert Panel Reports.
- Watershed Technical WG endorsement of the expert panels' retrofit and state performance standards recommendations, pending modifications.
    - WTWG key revisions include making nitrate leaching from pervious land more consistent with the CBP models.
- Reduced N rates also reflect many expert panelists' concerns that the N rates were too generous because of the use of the unitization equation.
- 2 other recommendations from the WTWG:
    - Redevelopment removal rate reporting units changed to impervious acres from pounds reduced
    - States provide generic retrofit and new BMP removal rate for use in CAST and MAST for the short term, and modelers have agreed to develop integration of these tools into the Model for the long-term approach.
    - Qualifying condition that the BMP must at least be restored to the original design/effectiveness of the era constructed.
- Majority of the expert panelists are generally accepting of the changes recommended by the WTWG.
    - These modifications are still under review
    - Next steps to be determined

*Discussion:*

- Norm Goulet- Split feelings on these recommendations. Concerned that this will be a big hit to the removal rates
    - Recommendations may be beyond the extent of current knowledge of the BMP.
- Ken Murin – Finds the WTWG recommendations problematic due to:
    - The orders of magnitude difference between tracking stormwater on the ground (site-by-site basis) and what the Model does. Concerned about accuracy.
    - Wrong message about encouraging BMP implementation and BMPs effects due to overly conservative numbers. Dilutes credits and message about stormwater BMPs.
    - Feels this approach is not consistent with work conducted in other sectors (e.g. other sectors' BMPs are not corrected to this extent in the Model).
- Stu Comstock – Feels these recommendations are a step in the right direction for N removal rates.
    - Similar approach to transport evaluations for loss from drain fields to edge of stream for septic systems.
    - Requests more time to review WTWG recommended modifications.

- Scott Crafton – Tom included a paragraph about the distinction between making this change to improve model results vs. downgrading new BMP specifications. But this distinction? is still not clear.
    - Significant investment in BMP specifications, both financially and in presenting to public.
        - Concern if performance of BMPs is lowered, this will send the wrong message to the public at a critical juncture of local implementation.
    - Feels that other sectors are not held to these standards of refinement.
    - Issues of states making investments, then BMP credits are decreased by EPA.
- Bill Stack – Studies indicate this issue of leakage, but question of where to make the adjustments remains. At or after the BMP level?
- Gary Shenk: Other sectors are also considering these changes in loading rates, as loading is not just from surface runoff, but total runoff including groundwater.
    - Certain amount enters the BMPs; ~30% leaves the BMP through normal flow out of BMP.
        - ~50% of pervious load never reaches the BMP; therefore, shouldn't be reduced by the BMP
        - If specifically designing BMPs to put more water into the ground, it will have some [N].
    - Important to understand that Model is predicting the total load coming off a land use, and these BMPs are only treating a certain amount of that load.
        - For accurate accounting, certain assumptions must be made to avoid biased high estimates.
    - Open to other suggestions, but must conceptually account for the other streams of loading.
- Ken Murin – Feels that other sectors may be looking at this, but not at the same level proposed here.
    - Concerned about adding an additional layer of conservative values.
    - This will decrease interest in stormwater BMP implementation.
    - Doesn't want the Model driving bad decisions.
- Norm Goulet – Agreement on non-Nitrate issues?
    - Ken Murin – Not prepared to vote on other recommendations at this time.

**ACTION:** Gary Shenk will provide examples of how other sector BMPs are handling nitrate leaching issues and evaluations.

**ACTION:** Members will send written comments to Molly Harrington 1 week after receipt of Gary Shenk's information on methods used in other sectors.

- Compiled comments will be reviewed again by the WTWG; options will be developed and presented for the WQGIT's final vote.

## Appendix B
## Gary Shenk Response on groundwater and BMPs.

On the Urban Stormwater Workgroup call of 6/12, two concepts were introduced reducing the estimated effectiveness of BMPs. The first concept was that groundwater

nitrogen from pervious areas bypassed stormwater BMPs. The second concept was that BMPs that increased infiltration also increased the flow of nitrate through the groundwater. The challenge to these points were that (1) this concept was too detailed and not worth the effort, (2) that it took a big reduction from the effectiveness of the BMPs, (3) it didn't fit with current messaging and the desire to implement more BMPs, and (4) other sectors did not consider groundwater in their BMP efficiencies.

The first three are not technical arguments against incorporation of the bypass concepts. The fourth could be a technical argument in that the modeling will be used to choose between implementation in the different sectors. The workgroup chair requested documentation of groundwater consideration in the BMPs of other sectors.

The 2009 Simpson and Weammert document on which many BMP efficiencies are based, Developing Best Management Practice Definitions and Effectiveness Estimates for Nitrogen, Phosphorus, and Sediment in the Chesapeake Bay, offers numerous examples of consideration of groundwater.
http://archive.chesapeakebay.net/pubs/BMP_ASSESSMENT_REPORT.pdf

**Charge to expert panels**
Page 13 – "Experts were also asked to discuss the relative importance of surface water and groundwater flow paths in controlling BMP effectiveness."
Page 24 – "As discussed, the expected spatial and temporal variability for a practice was estimated based on available science and knowledge of the geographic extent of implementation of the practice.
Different reduction efficiencies were established for practice implementation across different physiographic, geomorphic or hydrologic settings. Where possible, efficiencies were adjusted for
surface water and groundwater interactions (permeability), along with geology and soil types
(slope, seeps, floodplain, etc.)."

**A few specific BMP examples – others exist in the document**
Page 101 – the cover crop benefit is primarily a benefit to groundwater nitrate
Page 107-8 – table of cover crop measurements of groundwater changes
Page 121 – discussion of literature on the effect of cover crops on groundwater
Page 325 – forestry groundwater discussion
Page 474 – riparian buffers with explicit consideration of groundwater

**Urban Discussion**
Page 350 – discussing urban runoff reduction BMPs:
"* The proportion of nitrate removal from infiltration and filtration practices is extremely low and the fate of leached nitrate is unknown. Thus, TN removal is low to account for the lack of nitrate removal via infiltration." The discussion continues mentioning groundwater several more times.
Interestingly, the urban storage BMPs did not consider groundwater, but still came out with significantly lower values based on published literature.

***Directly-Modeled BMPs*** –
The phase 5 watershed model has a direct simulation of effects that change the application of nutrients, most notably nutrient management and atmospheric deposition. Since groundwater is explicitly simulated, these changes affect both surface and groundwater runoff.

Groundwater is considered throughout the modeling and BMP processes. For the sake of consistency and to aim toward a fair comparison between BMPs in different sectors, groundwater bypass of BMPs should be considered in assigning an overall efficiency to the total loads from a land use.

## Appendix C
## Summary of State Comments Received on Nitrate Base flow Issue

**Scott Crafton, VA DCR**

Virginia agrees with the position that Randy Greer and Stu Comstock have stated regarding the 2nd proposed adjustment factor for stormwater BMP N removals. We believe as well that soluble N leaching may not be a significant problem in well-established turf areas and that most of the pollutant load from turf lawns is associated with runoff during saturated or frozen conditions. The other adjustments are okay with us.

**Joe Kelly, PA DEP**

Thank you for the opportunity to comment on the Revisions to Expert Panel Reports based on the WTC Comments. Based upon the information provided in the 6/6/12 memo from Tom Schuler regarding WTC responses to the Final Reports and the 6/12/12 teleconference regarding the four WTC comments, PA-DEP does not object to revisions 2 through 4, however, we do have reservations and concerns regarding recommended revision # 1.

As with other jurisdictions on the Expert Panel, PA views the original CPB Model input deck as a more realistic representation of N in groundwater than the alternative in the WTC's proposed revision 1. We do not believe that the WTC's concern of "BMP bypassing" applies to PA because our stormwater regulations require design for no discharge from approximately 2.8" (2yr/24hr) rainfall. In PA we are very careful about "loading ratios" to distribute these runoff, volume and nutrient loads for all BMPs, especially ones that utilize infiltration. For example, a 25 or 40 acre site gets diffused to several BMPs. It is not allowable, with our current regulations, to send an entire drainage area on a 25 or 40 acre site to just one big basin or similar BMP. There are a number of variables that could lead to inaccuracies and should be accounted for before revising the TN adjuster curve as suggested in revision #1, such as the type of BMP, characteristics of the drainage area and BMP failure and maintenance.

As stated during our conference call, we are concerned that the assumptions are too conservative. It is our understanding that there are BMPs in other sectors, such as septic connections, that simply remove loads out of the model. It seems unreasonable

to hold urban stormwater to a different higher standard than what is expected in other sectors. In addition, the temporal scale of the model is a limitation that will not be adequately adjusted by the recommended change proposed in the WTC recommended revision #1, and we suggest continuing with the efficiencies that best characterize what is flowing out of the unit as a function of hydrology as the best and appropriate representation of our delivered stormwater loads.

We believe PA BMPs are based on pragmatic presumptions, plus these conservative values are leading us down a path where the BMPs will not provide an accurate representation on the ground via the model.

**Stew Comstock (MDE)**

I support the proposed revision to the TN adjustor curve to reflect base flow nitrate movement (the first discount factor). However, I am going to echo Randy Greer's position on the second discount factor. There doesn't need to be a further reduction factor for runoff from pervious areas that bypass a BMP. First, as Randy Greer points out, this is not as significant a problem. Also, applying yet another adjustment to the system further weakens and muddies the approach. This was supposed to be simple. This second discount factor accounts for "escaped nitrate" from pervious areas that bypass BMPs and/or nitrate derived from "non-stormwater sources" that enter into groundwater. How these are sorted out in the reporting shouldn't be fixed by another "fudge" factor. Thanks! Stew C.

**Randy Greer Delaware**

I generally support the proposed revisions to the original Performance Standards Experts Panel Report, with one exception. I don't necessarily agree that a portion of the runoff from pervious areas that bypasses a BMP requires yet another adjustment using the "Reduction Multiplier". The article "Lawns as a Source of Nutrient Runoff in Urban Environments" from the Fall 2011 Watershed Science Bulletin notes that turf areas are a permanent ground cover that have the ability to use N earlier in the Spring and later in the Fall than either forests or agricultural crops. One of the studies cited in this article found that cool-season turf grass is able to absorb 70% to 80% of the soluble N within 24 hours of fertilizer application and nearly all of it within 48 hours. Assuming soluble N associated with precipitation itself would have a similar fate, this article seems to imply that soluble N leaching may not be a significant problem in well-established turf areas. In fact, the authors concluded that the data suggests most of the pollutant load from turf lawns is associated with runoff during saturated or frozen conditions.

**Jenny Tribo, Hampton Roads Planning District Commission**

While I appreciate Gary Shenk's response to the concerns expressed on the June 12th Urban Stormwater Workgroup call, I believe he failed to mention/address one of the major concerns I heard expressed on that phone call: a lack of available data to accurately calculate the adjustments necessary to account for 1) increased flow of nitrate

through infiltration BMPs to groundwater; and 2) bypass of nitrogen from pervious areas to groundwater.

On the first issue, nitrate loss within the BMP to groundwater, the July 6, 2012 memo from Tom Schueler provides no references to support the 40% nitrate retention within BMPs. The memo does make a case that this seems to be a reasonable number, but I believe the workgroup expressed concern on the June 12 call that this was not supported by references. I would still like to see some references to support this adjustment. This reduction in efficiency for runoff reduction BMPs could significantly impact the number of BMPs a locality may have to implement to meet their urban nutrient reduction goals of the TMDL. Since this change could significantly increase local costs to meet reduction targets, it must be well supported and justified by existing research. In addition, I think it is imperative that the Bay Program and the urban stormwater workgroup commit to considering a third curve if research shows denitrification occurs due to addition of particular design features, as mentioned in the "Notes" section of the June 6 memo. The Bay Program should encourage/fund this type of research given it is one of the few ways to reduce nitrate delivery to the Bay aside from reductions from air deposition and fertilizer use.

On the second issue, bypass of nitrogen from pervious areas, I think Randy Greer's response highlights at least one of the issues with the proposed adjustment. The July 6 memo only addressed the estimated the volume of rainfall flowing to groundwater from pervious areas, it did not include any discussion on the nitrogen cycling occurring during that infiltration process. According to Tom Schueler's July 6, 2012 memo, "in the context of the CBWM, BMP removal rates must be applied to the total nitrogen load that is generated by surface runoff and groundwater flows." Local stormwater managers do not know that the Bay model assumes that BMPs 'treat' groundwater. If the model cannot realistically simulate the volume of water treated by BMPs, then documentation on the BMP efficiencies should clearly explain the model assumptions and calculations. Stormwater BMPs are not designed to treat groundwater flow, they are designed to treat surface runoff. If the Model assumes that BMPs are treating groundwater flows when they are not, then the BMP efficiencies need to be downgraded; however, this could be confusing to stormwater practitioners who will be installing and reporting these practices. Perhaps this is an issue that could be resolved in the revisions to develop the Phase 6 Watershed Model.

I appreciate the Bay Program's attempt to accurately account for all sources and delivery mechanisms for nitrate, but I think this issue raises more questions about how the model treats "runoff" and transport between surface water and groundwater. Comments regarding the treatment of groundwater by the Bay Model were common during the TMDL review process. However, this question was not adequately addressed by EPA's response to comments. The following response is an example, "EPA agrees that the U.S. Geological Survey (USGS) estimates that approximately 50% of the nitrogen that reaches the tidal water flows through the groundwater at some point in its path to the Chesapeake Bay. Groundwater delivery of water and nutrients is simulated in the Phase 5.3 watershed model. Please see the Phase 5.3 Chesapeake Bay Watershed Model

report at http://www.chesapeakebay.net/model_phase5.aspx?menuitem=26169 for more details."

The watershed model documentation does contain some discussion of how the model deals with interactions between surface water and groundwater in the Hydrology section, but it does not cover the transport of nitrate. If local governments are expected to implement stormwater controls that reduce nitrogen, phosphorus, and sediment, then they must have a thorough understanding of how the model defines runoff, how that runoff is transported to a BMP, and why model efficiencies might be different that State design manual efficiencies. Without this information, local governments will not have the tools necessary to select the proper BMPs for their area or justify to elected officials and citizens the large expenditures of tax payer dollars needed to fund construction of these BMPs. The Bay Program has an opportunity now during the development of the Phase 6 watershed model to adequately explain to local government stakeholders how the revised model differs from Phase 5 and how it will simulate groundwater/surface water interactions. I suggest that EPA work with Jurisdictions and appropriate Bay Program work groups to develop a series of fact sheets or white papers on key model issues that can be distributed to local government partners

## Appendix D
## Groundwater nitrate loss from pervious areas that are not captured by BMPs.

This appendix excerpts the discussion on groundwater nitrate loss from pervious areas that are not captured by urban BMPs. The WTWG raised this issue in this manner to prevents the possibility for double counting with TN reductions associated with other urban BMPs applied to pervious lands in the context of CBWM. This may occur when downstream BMPs are applied, such as enhanced urban fertilizer management practices, septic system upgrades, stream buffers and elimination of illicit discharges.

It is important to note that the proposed second discount to resolve the urban nitrate groundwater issue is more about a proper accounting of urban N sources and pathways in the urban landscape, and less about a "downgrade" of the performance of the new runoff reduction BMP technologies (i.e., what a urban BMP does not capture, and cannot treat).

The 6/6/12 Schueler memo outlined a proposed "work around" method to account for groundwater nitrate loss from pervious areas that are not captured by BMPs (e.g., "escaped nitrate" that is not effectively captured by the BMP (i.e. because it infiltrates into soil (and into groundwater) up gradient of the BMP and effectively by-passes it OR it is nitrate is derived from another non-stormwater source and moves into the stream via groundwater down gradient of the BMP

Gary Shenk has proposed a simple method to define the untreated discounts based on runoff coefficients and urban hydrology. The nitrate load to the BMP treatment area

(either RR or ST) is computed as the produce of drainage area * precipitation * runoff coefficient * concentration.

Given that the NSQD (Pitt, 2009) database shows very little difference in nitrate concentration among land uses, concentration can be assumed to be constant. Therefore, the discount factor can be estimated by comparing the hydrology mass balance on pervious urban land as modeled by the CBWM at the river segment scale.

In general, the CBWM simulates, on average, a pervious runoff coefficient of about 20%.m with about 50% of the annual rainfall volume going to ET, which leaves about 30% to move through groundwater.

Assuming there is a rough split between treated and untreated pervious land, a multiplier can be derived to reduce the efficiency for the part that is never treated, using the equation:

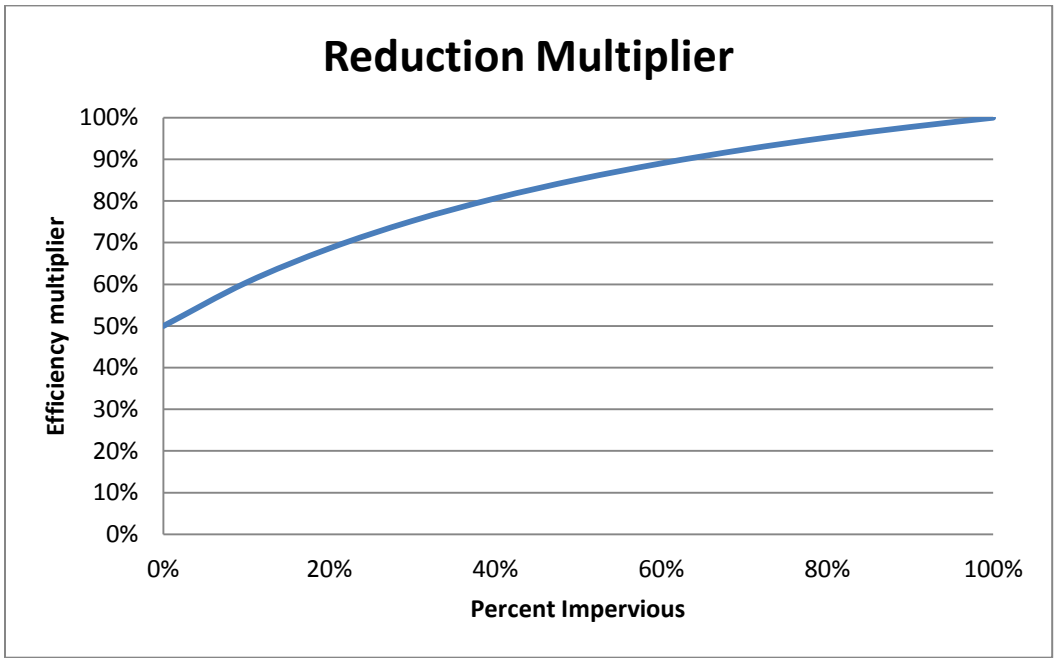
$$\text{Treated fraction} = ( Li + Lgt ) / (Li + Lgt + Lgu )$$

Reducing this by cancelling P and C from each term you get

$$( \%I * Rvi + \%P * Rvt ) / (\%I * Rvi + 2 * \%P * Rvt)$$

As shown in Figure 3, the multiplier would be 1.0 for a practice with a 100% impervious drainage area, and 0.5 for a facility that is 100% pervious. This multiplier is then used to adjust the removal rate determined from the new TN adjustor curve.

Figure 3: Proposed reduction Multiplier for TN removal Rate based on % pervious area into the drainage area to a retrofit or a new stormwater BMP



Some scientific corroboration of the Shenk modeling approach can be found in an analysis of urban stream nitrate loads taken from Baltimore county, which compare the ratio of base flow nitrate loads to total annual loads (See Figure 4, from Stewart et al, 2005)

Therefore, the user would use the following equations to adjust the TN removal rate obtained from Figure 2 to compute the final adjusted rate.

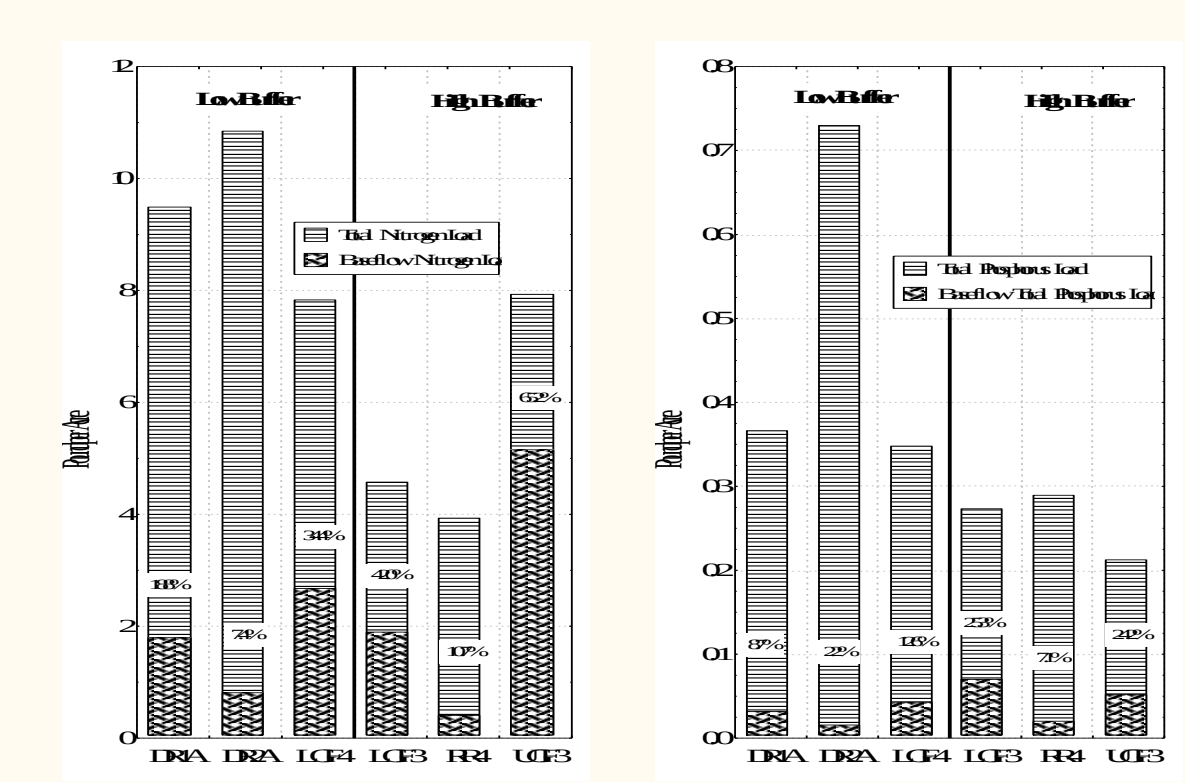
$$\mathbf{N_{adj} = RR_{NEW} \times (1 - P/2)}$$

$$\mathbf{N_{adj} = ST \times (1 - P/2)}$$

Where P = pervious fraction of site area

If it conservatively assumed that all of the base flow nitrate monitored in urban streams represents untreated base flow, and the ratio of the annual base flow nitrate load to total annual stream total nitrogen load represents the discount factor. These watersheds are in the 25 to 50% IC range, so the average ratio of base flow nitrate to total nitrogen load of around 20 to 30% is reasonably consistent with the Shenk multiplier equation (the one stream value of 54%ais an outlier, and appears to reflect the impact of dry weather sewage discharges via illicit discharges and/or sanitary sewer overflows).

Figure 4: Baltimore County Stream Monitoring  Data for Base flow Nitrate and Total Annual Nitrogen Loads (Stewart et al, 2005)

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## June 6 2012 Summary of Watershed Technical Work Group Comments on Memos

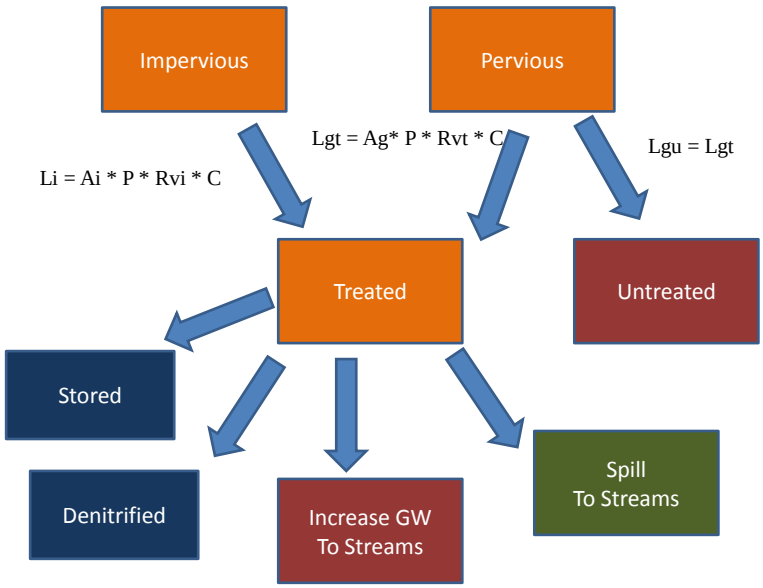
**Date:** June 6, 2012
**To:** Retrofit and Performance Standard Expert Panels
**From:** Tom Schueler, CSN
**Re:** Watershed Technical Committee Response to the Final Reports

The good news is that the CBP Watershed Technical Committee (WTC) approved the two final recommendation reports at its May 29 meeting, subject to your consideration of four proposed revisions. In general, the WTC was very impressed with the quality of your work, and just wanted to make sure your protocols would be consistent with the CBWM and other scenario assessment tools. I have been working with Gary Shenk of

the modeling team on how to address the issues they raised. This memo summarizes the four technical issues they have raised, and the recommended resolution

## Revision 1. Revising TN Adjustor Curve to Reflect Base flow Nitrate Movement in Urban Watersheds.

**Issue:** The adjustor curves are used to define a removal rate that applies to both the pervious and impervious areas in the contributing drainage areas for the stormwater treatment practices. The removal rates properly apply to surface runoff and some portion of the interflow delivered to the stream, but may not properly apply to groundwater export of nitrate-nitrogen from the urban landscape. The "missing" nitrate may reflect direct leaching of nitrate into groundwater in pervious areas that is not captured or treated by a down-gradient retrofit or BMP, or it may reflect nitrate that is exits a runoff reduction or stormwater treatment practice via infiltration into soil, or slow release through an under drain (e.g., bioretention). See Figure 1 below:




In the context of the CBWM, BMP removal rates must be applied to the total nitrogen load that is generated by surface runoff and groundwater flows (i.e., when watershed modelers say 'runoff' they mean total surface and groundwater export from the land. When stormwater managers say 'runoff' they mean the surface runoff or interflow only that is captured by a retrofit or BMP). On pervious lands, as much as 25 to 40% of the simulated nitrogen load is coming through the groundwater (some fraction may also be delivered by downstream sources such as illicit discharges)

If you are diverting overland flow to groundwater, you are probably reducing the overall load by using the ground as a filtering medium, but you are not eliminating it. While ongoing research has indicated that it may be possible to enhance subsurface de-

nitrification through certain design factors, we lack, as of now, definitive evidence for this effect.

Therefore, the WTC concluded that current TN adjustor curves may over-estimate TN removal rates, and should be discounted to reflect the movement of untreated nitrate into streams, at the scale of the small watershed. This discounting is not needed for TKN, TP or TSS as these pollutants are not mobile in urban groundwater.

**Rationale:**

The ultimate fate of nitrogen in urban groundwater has been an ongoing concern from MDE representatives on both expert panels, but no panelist could identify a method or work around to satisfactorily address it in the context of CBWM. CSN and Gary Shenk have met several times since the panel concluded, and have proposed a simple resolution to the issue.

By addressing the urban nitrate issue in this manner, it prevents the possibility of the potential for double counting with TN reductions associated with other urban BMPs applied to pervious lands, including enhanced urban fertilizer management practices, septic system upgrades, stream buffers and elimination of illicit discharges.

It is important to note that the proposed technical resolution of the urban nitrate groundwater issue is more about a proper accounting of urban N sources and pathways in the urban landscape, and less about a "downgrade" of the performance of the new runoff reduction BMP technologies (i.e., what a urban BMP does not capture, and cannot treat

**Proposed Resolution:**

The proposed solution is to develop two discounts to the existing protocols to reflect (1) a factor to account groundwater nitrate migration from runoff reduction practices, and (2) a factor to account for escaped nitrate up gradient and down gradient of the BMP that is not effectively captured by the BMP.

***(1) Nitrate loss from runoff reduction practices***

The first factor is fairly straight forward to calculate and is simply based on the ratio of nitrate in relation to total nitrogen found in urban stormwater runoff. Stormwater runoff event mean concentration data from the National Stormwater Quality Database (Pitt et al, 2009) analyzed more than 3000 storm events, and the nitrate:TN fraction consistently around 0.3. This sets an upper boundary on the fraction of the inflow concentration to the BMP which could be lost to groundwater or under drains at about 30% (in general, the amount of mineralization and nitrification that could create additional nitrate within the BMP itself is negligible due to their relatively short residence times).

The next step is to account for any nitrate loss within the BMP due a combination of either plant uptake and storage within the BMP and/or any de-nitrification within the BMP or down-gradient on the way to the stream. Most runoff reduction practices employ vegetation to promote ET and nutrient uptake, whereas the de-nitrification process is variable in both space and time. Although recent research has shown that the de-nitrification process can be enhanced through certain design features (inverted under drain elbows, IWS), these design features are not currently required in any bay state stormwater manuals.

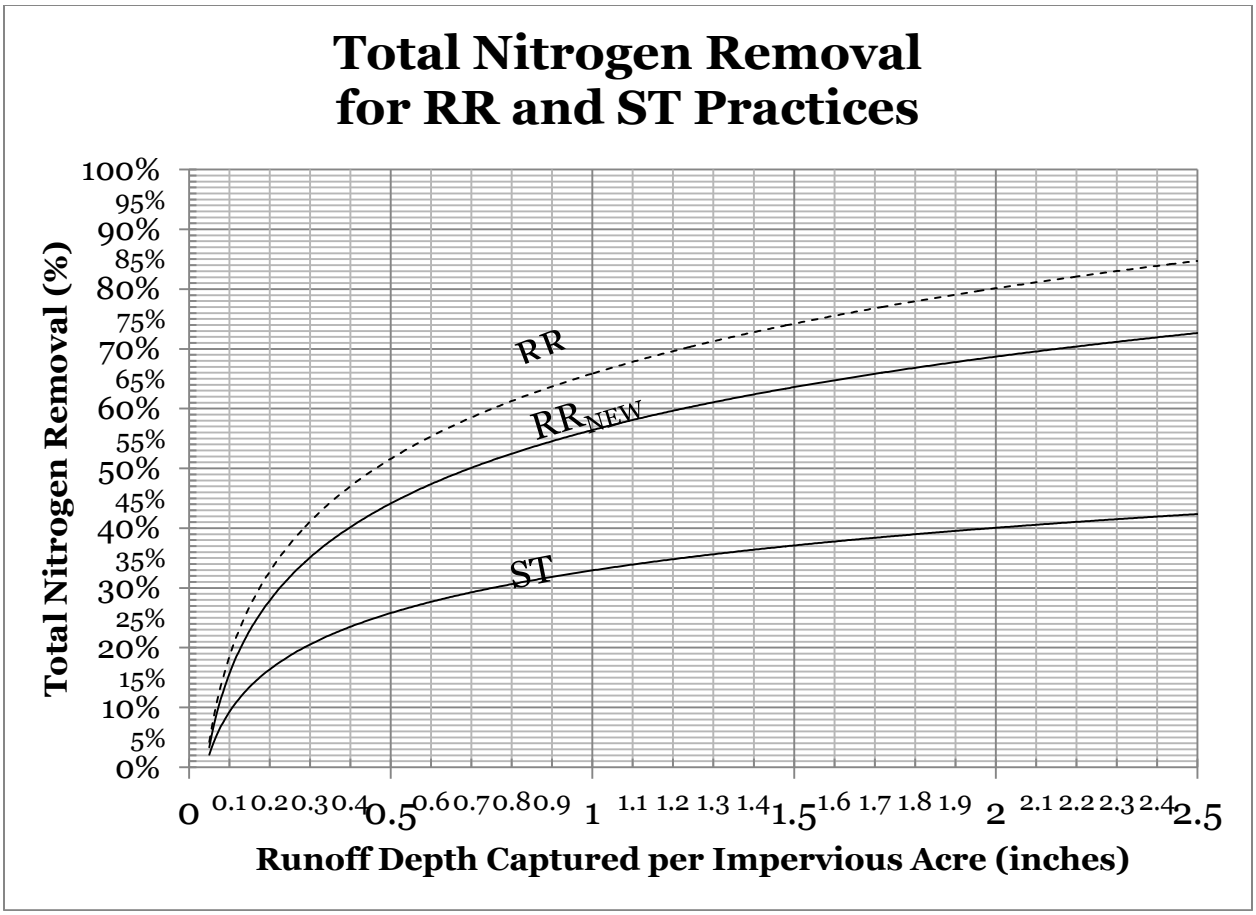
As the panels noted in their original deliberations, there is not a great deal of research to define nitrate retention within runoff reduction BMPs due to these mechanisms. Field studies and laboratory column studies have indicated changes in nitrate EMCs from 25 to 50% from the top of the BMP to the invert of the practice or the under drain ( TRS to provide more references), but do not account for any down-gradient nitrate losses. For septic systems, these losses are assumed to be 60%, but that appears to be generous. Therefore, it is recommended that nitrate retention within BMPs be assumed to be no more than 40%, until more substantive data is available.

Given the inflow concentrations, the potential groundwater/under drain nitrate loss would be (0.3)(0.60) = 0.18, or a discount factor of 0.82

The discount factor is then applied to the anchor rates used to derive a new N adjustor curve. The anchor rate for RR practices would be adjusted downward from the current 70% to 57%, and the existing runoff frequency spectrum equation would be used to develop a new, lower curve for TN removal. An example of the how this discount influences the existing N adjustor curve is shown in Figure 2.

It is also noted that no nitrate loss parameter needs to be defined for stormwater treatment (ST) practices, since inlet and outlet monitoring of these larger facilities already takes this into account (and is a major reason why the ST curve is so much lower than the RR curve)

Figure 2. Revised TN Adjustor Curve




***(2) Groundwater nitrate loss from pervious areas that are not captured by BMPs.***

The second discount factor accounts for "escaped nitrate" up gradient and down gradient of the BMP that is not effectively captured by the BMP (i.e. because it infiltrates into soil and into groundwater and effectively by-passes the BMP. In other cases, the nitrate is derived from another non-stormwater source and moves into the stream via groundwater.

Gary Shenk has proposed a simple method to define the untreated discounts based on runoff coefficients and urban hydrology. The nitrate load to the BMP treatment area (either RR or ST) is computed as the produce of drainage area * precipitation * runoff coefficient * concentration.

Given that the NSQD (Pitt, 2009) database shows very little difference in nitrate concentration among land uses, concentration can be assumed to be constant. Therefore, the discount factor can be estimated by comparing the hydrology mass balance on pervious urban land as modeled by the CBWM at the river segment scale.

In general, the CBWM simulates, on average, a  pervious runoff coefficient of about 20%.m with about 50% of the annual rainfall volume going to ET, which leaves about 30% to move through groundwater.

Assuming there is a rough split between treated and untreated pervious land, a multiplier can be derived to reduce the efficiency for the part that is never treated, using the equation:

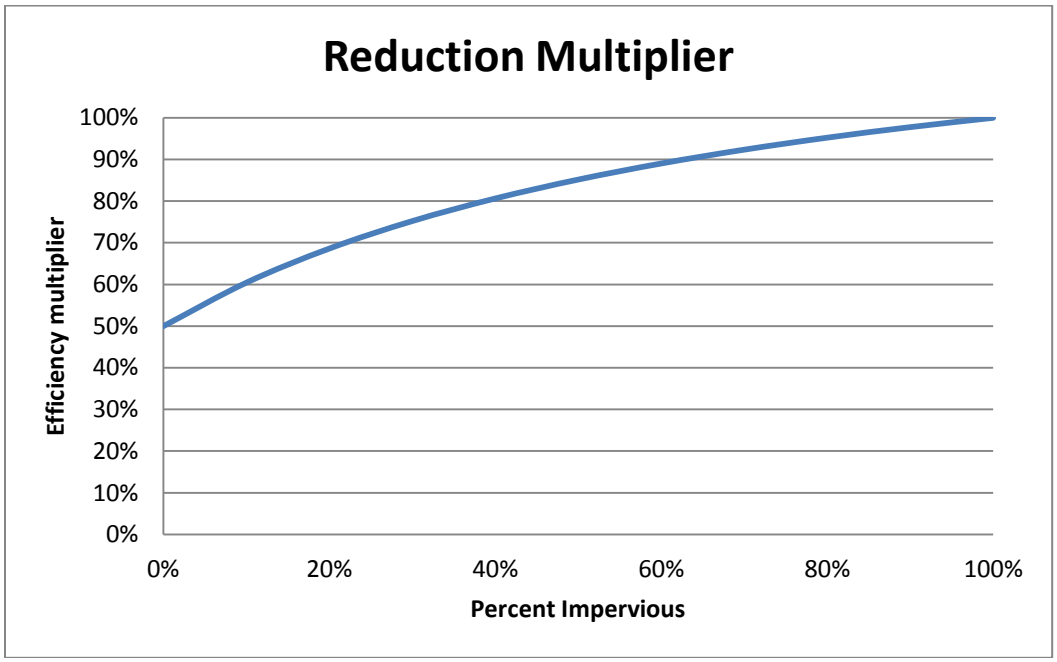
Treated fraction = ( Li + Lgt ) / (Li + Lgt + Lgu )

Reducing this by cancelling P and C from each term you get

( %I * Rvi + %P * Rvt ) / (%I * Rvi + 2 * %P * Rvt)

As shown in Figure 3, the multiplier would be 1.0 for a practice with a 100% impervious drainage area, and 0.5 for a facility that is 100% pervious. This multiplier is then used to adjust the removal rate determined from the new TN adjustor curve.

Figure 3: Proposed reduction Multiplier for TN removal Rate based on % pervious area into the drainage area to a retrofit or a new stormwater BMP




Some scientific corroboration of the Shenk modeling approach can be found in an analysis of urban stream nitrate loads taken from Baltimore county, which compare the ratio of baseflow nitrate loads to total annual loads (See Figure 4, will get the source, but I think it is Baltimore LTER)

Therefore, the user would use the following equations to adjust the TN removal rate obtained from Figure 2 to compute the final adjusted rate.

$$N_{adj} = RR_{NEW} \times (1 - P/2)$$

$$N_{adj} = ST \times (1 - P/2)$$

Where P = pervious fraction of site area

If it conservatively assumed that all of the base flow nitrate monitored in urban streams represents untreated base flow, and the ratio of the annual base flow nitrate load to total annual stream total nitrogen load represents the discount factor. These watersheds are in the 25 to 50% IC range, so the average ratio of baseflow nitrate to total nitrogen load of around 20 to 30% is reasonably consistent with the Shenk multiplier equation (the one stream value of 54%ais an outlier, and appears to reflect the impact of dry weather sewage discharges via illicit discharges and/or sanitary sewer overflows).

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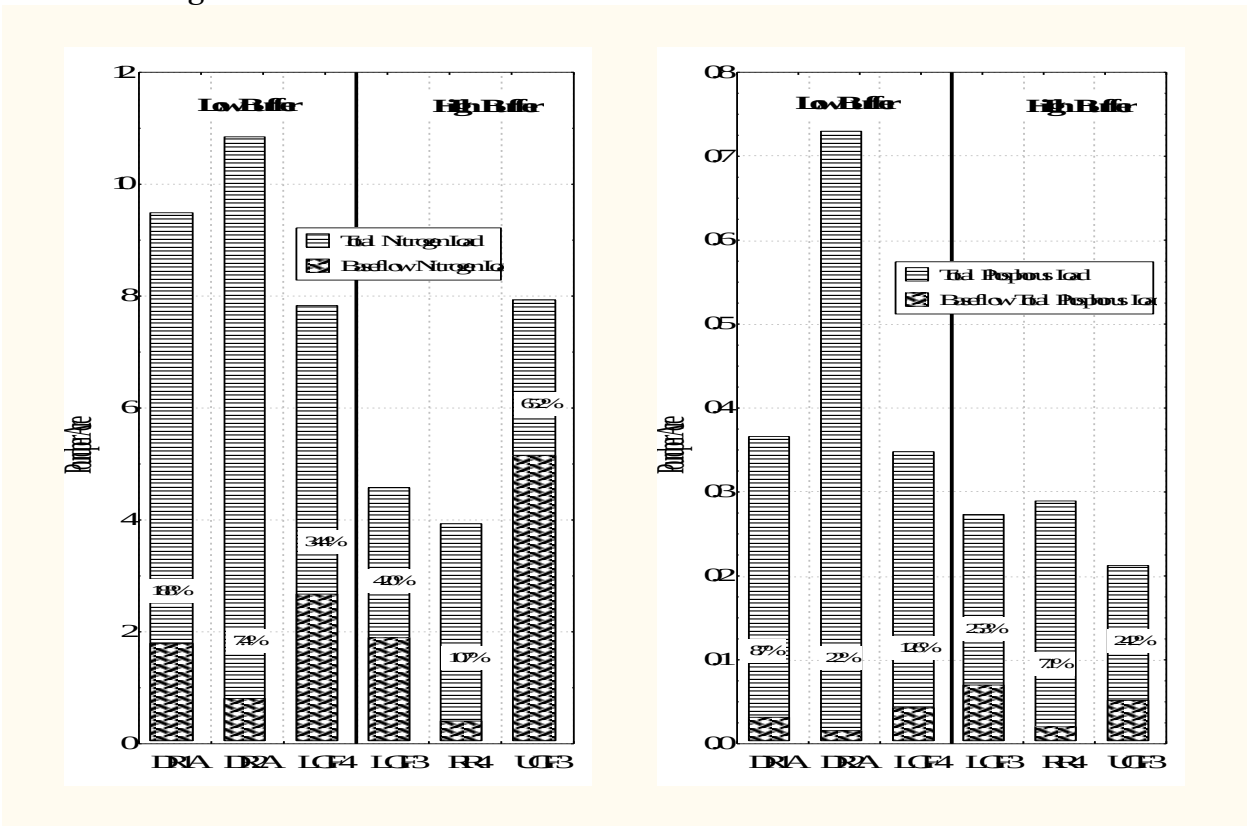

**Other Notes:**

The text would be amended to contain a note that a third, higher, "enhanced RR curve" could be developed by a future expert panel if research showed in-situ de-nitrification was occurring due to new design features.

The text would also note on other BMPs that could increase nitrogen removal from urban pervious areas (septic systems, illicit discharges, reduce N applications, stream buffers, etc). CSN will work with these upcoming expert panels to ensure that the groundwater nitrate issue is consistently addressed.

The text of the expert panel memos will be revised to include new design examples to show the revised protocol, and the preceding discussion would be added as an appendix

## Revision 2. Make a Short Term and Long Term Recommendation on how the new removal rate protocols can be better integrated into CAST.

**Issue:** The WTC committee inquired how the project-specific removal rates developed by the expert panels could be incorporated into watershed assessment tools such as CAST and scenario builder. If each development site or retrofit project has a unique removal rate, how can this variability be addressed in the watershed assessment tools that localities and states use in their watershed implementation efforts?

**Rationale:** It may take a year or more to incorporate the adjustor curves into the CAST modeling framework, although the CBPO modeling team has expressed a willingness to do so. Until these refinements are made, how should retrofits and new BMPs be expressed in state tools (CAST/VAST/MAST etc.)

**Resolution:** Since these tools are used for planning, and evaluation of alternate BMP scenarios, it is reasonable for the states to select a single rate to characterize the performance of a generic retrofit or a BMP system used to meet new performance standards at a new or redevelopment site. For example:

> *For retrofits:* Assume the retrofits are a 50/50 blend of RR and ST practices and treat 1 inch of impervious area, and then use that generic rate for planning purposes, and then focus on the total drainage area treated by a group of retrofits.
>
> *For new development*: Assume that the projects fully meet the performance standard, and then assign the derived removal rate to the aggregate drainage area. The resulting load can be compared against the pre-development load to determine if the Project is nutrient neutral. States may also want to include options whereby full compliance with the standard is not possible so localities can forecast how these might change their baseline load allocation.

*For Redevelopment*: Assume that the redevelopment project fully meet the performance standard, and then assign the derived removal rate to the aggregate impervious area that is treated. Since pre and post development land use is impervious, it will provide a quick estimate of the load reduction possible under different future redevelopment scenarios.

As noted, each state would elect to develop its own scenarios to be consistent with their unique requirements

## Revision 3. Report Stormwater Performance Standards for Redevelopment Removal Credit as impervious acres treated and not pounds of nutrients reduced

**Issue:** It is more precise to have the CBWM compute the actual reduction associated with redevelopment stormwater then to have the state or locality estimate it based on on the simple method or the state-wide unit loading rates from the CBWM.

**Rationale**: Reporting the rates and the impervious acreage treated requires less effort by local and state government, and provides more consistent estimates of load reduction via the CBWM. This approach also protects local government if the unit loads change in future versions of the CBWM (e.g., 2017).

**Resolution:** Accept the proposed revision, but still allow localities to estimate their load reductions using the two existing methods referenced in the Appendix. Localities, however, would not report their load reductions.

## Revision 4. Additional Qualifying Condition for the BMP Restoration credit

**Issue:** The WTC requested that the BMP restoration credit have an additional qualifying condition that the proposed restoration activities be significant enough to achieve the intent of the original water quality design criteria in the era it was built (e.g., sediment cleanouts would need to be sufficient to recover the full water quality storage capacity that was originally approved for the BMP, under historically less stringent standards, regardless of whether the BMP was reported in the CBWM input deck.

**Rationale**: On-going concern that this restoration option was susceptible to gaming, and to have a firmer threshold that the restorative actions bring things back at least to the old design standard.

**Resolution**: get feedback from Retrofit Expert Panel on whether this is a workable qualifying condition, or whether an alternate qualifying condition needs to be developed.

**Combined Meeting Minutes**
**Urban Retrofit Expert Panel**
**Final Review Teleconferences**

**March 12, 2012**
**and**
**April 2, 2012**

| Panelist | Affiliation | Present 3/12 ? | Present 4/2? |
|---|---|---|---|
| Ray Bahr | MDE | X | X |
| Steve Stewart | Baltimore County | X | X |
| Ted Brown | Biohabitats | X | X |
| LJ Hansen | City of Suffolk, VA | X | X |
| Jason Papacosma | Arlington, VA | X | X |
| Bill Stack | CWP | X | C |
| Rebecca Stack | DDOE | X | |
| Joe Kelly | PADEP | X | X |
| Jeff Sweeney | EPA, CBP | | |
| Ginny Snead/Fritz | VA DCR | X | X |
| Tom Schueler | CSN Facilitator: | X | X |
| **Non-panelists** | | | |
| Norm Goulet, chair USWG; Lucinda Power, EPA CBP | | | |

The Panel held two calls and provided extensive written and verbal comments on the Feb 19 and March 12 drafts of the final panel memo. These minutes summarizes the key technical changes made to the method by CSN during this review period, as well as a providing a record for how the Panel resolved its more substantive comments. Based on this, the Panel voted 9-0 to tentatively adopt the final memo, subject to a two week period for errata and state-specific comments, and report out on its final recommendations at the April 30 USWG meeting.

1. **Key Technical Changes to the Method**

***Changes after First draft***

1. *Dropped reference to the Original Retrofit Adjustor Table and replaced with curves*. The tabular data was converted into a series of curves to make it easier for users to define a rate for the unique combination of runoff capture volume and degree of runoff reduction. This was done by fitting a log-normal curve to the tabular data points, which came within a few percentage points of the tabular values for a wide range of runoff capture depths and removal rates.

2. *The technical basis for defining the anchor rates was provided in a new table in Appendix C.*

3. *More accurate estimates of runoff capture were derived using an explicit rainfall frequency spectrum equation, and this supplemental documentation*

*was incorporated into Appendix C*. The new more accurate method has the result of flattening the removal curves for higher depths of runoff capture.

4. *The cut-off threshold for minimum retrofit capture volume was reduced*. A 0.05 inch runoff capture volume was established as the cut-off point for getting any retrofit removal rate, since this roughly corresponds to the depth of initial abstraction that occurs on impervious surface. It should be noted that retrofits in this small size range will require very frequent maintenance to maintain their performance over time.

5. *Suitability of method*. The Panel concluded that the generalized retrofit removal adjustor curves were a suitable tool for estimating the aggregate pollutant load reductions associated with hundreds or even thousands of future retrofit projects at the scale of the Bay watershed and the context of the Chesapeake Bay Watershed Model.

**Changes after 2nd Draft**

1. *Modify HI/LO Designation*. Change the HI runoff reduction designation to RR (runoff reduction) and the LO designation to ST (stormwater treatment). DE recommended this clarification as it is more consistent with how these practices are treated in state stormwater manuals. This would be reflected in the text and on the curve labels in the memo, however, there would be no change in how the current list of stormwater practices are categorized (i.e., Table 2).

2. *Make the following clarifications in the methods section*:

   - Clearly define the x-axis as being "depth of runoff captured by practice per impervious acre."

   - Clearly state that the retrofit storage volume for each site must be adjusted using a "unitization" equation that converts the storage volume into a unit depth per impervious acre at each site.

   - Note that the corresponding removal rate determined from the appropriate curve applies to the entire drainage area of the retrofit.

3. *Change the retrofit storage equation to divide by impervious area rather than site area*. To ensure consistency in how the adjustor curves are used to define removal rates for retrofits, the standard retrofit storage equation needs to be modified. The current equation is:

$$= \frac{(RS\ )(12)}{SA}$$

   The specific retrofit storage volume achieved at an individual site is usually measured or estimated, and is a given (usually acre-feet). The user will need to

interpret how this volume will be adjusted to use on the x-axis of the curves. This is done by using standard retrofit equation which multiplies the retrofit storage volume by 12 to get acre-inches, and then divides by the impervious acres to get the unit "depth of runoff captured by practice per impervious acre." This value is used with the curves to define the retrofit removal rates. The new version of the standard retrofit equation will be:

$$= \frac{(RS\,)(12)}{IA}$$

4. *Provide documentation on why the unitization equation is needed for retrofits in Appendix C.* Add a section in Appendix C that documents why the unitization for impervious area is needed to provide a common basis of comparison among states and drainage areas. The basic reason is that the Rainfall Frequency Analysis used to derive the curve above and below the anchor points is based on the assumption that the runoff delivered to a practice is generated from a unit impervious acre. The runoff storage volumes achieved for individual retrofits, however, are unique, based on the land cover, soils and hydrologic assumptions used in each state. Therefore, these volumes must be adjusted by a unitization equation to get the correct depth to use on the x-axis of the curves.

2. **Resolving Key Comments From the Panel**

**General Comments:** In general, the Bay states wanted to ensure that the memo would protect state prerogatives with respect to their existing and/or future BMP reporting and tracking systems.

**Retrofit Definitions Section**

**Comment:** PA DEP noted that applying more stringent stormwater requirements at redevelopment sites was functionally equivalent to a new retrofit facility.

**Resolution:** the Panel agreed, but noted that a specific BMP crediting system for redevelopment projects was being developed by the Performance Standards Expert Panel. The Panel indicated that the redevelopment should be cross-referenced in the text, so readers would be aware of that option.

**Comment:** PA DEP, MDE noted that the photo illustrating “Storage behind Roadway Crossings" appeared to show a retrofit in waters of the US and would not be allowed under state or federal wetland permits.

**Resolution:** The Panel agreed that the photo and the retrofit sub-category should be dropped.

**Comments** about BMP Restoration category:

- Concern that some localities may interpret this as a chance to claim additional nutrient reduction credit for routine BMP maintenance which is needed to sustain the performance of existing BMPs (for which they are already getting credit).

- For BMP restoration the protocol depends on whether or not the State has included the BMP in its pre 2006 input deck. Based on previous conversations with DCR, this does not seem possible in Virginia.

**Resolution:** The Panel noted that the definition of BMP restoration only applies to major BMP upgrades that produce a substantive recovery or expansion of stormwater treatment volume, as measured by at least a 10% increase. The Panel also recommended that the following text be added to drive home the point: "Important Note: No pollutant removal credit is given for routine maintenance of existing stormwater practices. Routine maintenance is essential to ensure the pollutant removal performance of any stormwater practice." The Panel noted that individual states may want to develop their own more detailed guidance on qualifying conditions for acceptable BMP restoration.

**Methods Section**

**Comment:** MDE requested the removal of the BMP by ERA option from the retrofit memo, for the sake of simplicity, and because the curve method tends to produce a higher removal rate for more retrofit categories.

**Resolution:** The Panel agreed that it should be dropped from the text and the appendices.

**Comment:** MDE and others noted that some runoff reduction practices take surface stormwater and shift it to groundwater, so that it is possible that some fraction of the nitrogen entering a runoff reduction practice may ultimately end up in a stream, and that the nitrogen removal rates shown on the curve may not be as high in the real world.

**Resolution:** The Panel acknowledged the potential for this, but did not have any data to confirm or refute that it exists. The Panel agreed that this issue should be a top retrofit research priority, and indicated that the following statement be added to the existing section on research collaboration: "The Panel expressed a particular interest in defining the fate of nitrogen in retrofits that rely heavily on infiltration or extended filtration to provide runoff reduction".

**Accountability Section**

**Comment:** Various states indicated that their BMP reporting systems are unique, and they did not want a "one-size fits all" approach to retrofit reporting.

**Resolution:** The Panel agreed that states will need to aggregate data on individual retrofit location, year installed, and removal rate for reporting them to EPA, and also have the capacity to remove retrofits that are no longer functioning. However, the Panel agreed the following language should be added to the memo:

"Localities must submit basic documentation to the state stormwater or TMDL agency to document the nutrient/sediment reduction claimed for each individual urban retrofit project that is actually installed. Localities should check with their state stormwater agency on the specific data to report for individual retrofit projects. Some *typical* information that may be reported includes…".

**Comment:** Several states and localities on the panel indicated concerns over the language on initial verification/certification of individual retrofit performance. The concerns ranged from effect on local resources, and that localities should be able to use the existing annual MS4 annual reports as an alternative.

**Resolution:** The Panel agreed and re-drafted the section as follows: This initial verification is provided either by the retrofit designer or a local inspector as a condition of retrofit acceptance, as part of the normal municipal retrofit design and review process. From a reporting standpoint, the MS4 community would simply indicate in its annual report whether or not it has retrofit review and inspection procedures in place and adequate staff to implement them.

**Comment:** Several panelists questioned the process for down-grading individual BMPs, noting that as long as a local jurisdiction has a regular inspection and maintenance program/procedures in place to correct under or non-performance of retrofits, then removal and replacement of credits should be rare. This requirement could be excessively burdensome and the subject of error and confusion not only at the local level, but also at the level of the Bay Program modelers.

**Resolution:** The Panel agreed that downgrading based on field inspection was an important component of retrofit verification. The Panel drafted language on a reasonable time frame for corrective action and that downgrades only need to be reported through MS4 permit annual reports, as follows: If the field inspection indicates that a retrofit is not performing to its original design, the locality would have up to one year to take corrective maintenance or rehabilitation actions to bring it back into compliance. If the facility is not fixed after one year, the pollutant reduction rate for the retrofit would be eliminated, and the locality would report this to the state in its annual MS4 report.

**Comment:** The Panel noted that the field inspection and verification procedures should be more rigorous when retrofits are built for stormwater offsets or load reduction credits are being banked or traded. The prescribed inspection cycle for this special case of retrofits should be shorter.

**Resolution:** The Panel agreed with this, and suggested that the issue be addressed with the trading and offsets workgroup, and recommended the following language be

added to the text: The Panel also recommends more frequent inspection and verification process for any retrofit built for the purpose of stormwater mitigation, offsets, trading or banking, in order to assure the project(s) is meeting its nutrient or sediment reduction design objectives.

**Comment:** If these protocols are accepted by the CBP, then the CAST, MAST, VAST will need to be modified as well. There will be no utility to these programs if they don't effectively predict CBP model results. Coordination with CAST needs to be a priority that should happen in concert with the update of urban BMP removal rates and not as an afterthought.

**Resolution:** The Panel agreed with this, and instructed CSN to share the final memo with the CB Modeling Team to ensure procedures were in place to prior to USWG meeting to address these concerns, They also added the following language to the text: "The Panel acknowledges that its retrofit assessment protocol does not fit easily within the context of assessment and scenario builder tools that have been recently developed to assist states and localities to evaluate BMP options to develop watershed implementation plans (i.e., each retrofit has a unique rate and consequent load reduction, while the CAST tools apply a universal rate for all retrofits).

The Panel recommends that localities use the CAST tools to evaluate non-retrofit urban BMPs to determine how much nutrient and sediment load remains after these cost-effective practices are applied. The retrofit removal rate protocol developed by the Panel can then be used to assess the most cost-effective combination of individual retrofit practices to close the remaining gap. CSN will work with ICPRB and Bay Partners to make improvements to future versions of CAST to improve its ability to handle stormwater retrofits."

**Appendix C**

**Comment:** It was noted that a Table in Appendix C had incorrect units for sediment loading rate from CBWM.

**Resolution:** Table Corrected.

**Comment:** A locality noted that when it comes to defining baseline loads from which the removal rates are applied, the two methods in Appendix C can give different loads for the same scenario (e.g., Simple Method cs. CBWM unit loads). The main issues is that Simple Method computes load solely based on IC, where the CBWM unit load method has employs both IC and pervious cover to compute baseline loads. Depending on the method, this could result in an over-estimate of load removed.

**Resolution:** The Panel noted that the baseline loads are only done for the purpose of enabling localities identify the most cost-effective retrofits and track their load reductions over time in MS4 permits. The actual retrofit load reductions are calculated for each project based on the NEIN location on the CBWM. The Panel

noted that each Bay state should provide guidance to their MS4 localities on which of the two methods they prefer, to assure consistency in their MS4 permit reports.

**Combined Meeting Minutes**
**State Stormwater Performance Standard Expert Panel**
**Final Review Teleconferences**

**March 13, 2012**
**and**
**April 3, 2012**

| **Panelist** | Affiliation | March 13 ? | April 3? |
|---|---|---|---|
| Stu Comstock | MDE | X | C |
| Randy Greer | DE DNREC | X | X |
| Shoreh Karimpour | NYDEC | R | R |
| Sherry Wilkins | WVDEP | X | X |
| Fred Rose | Fairfax County | X | X |
| Peter Hill | DDOE | X | C |
| Dave Hirschman | CWP | X | C |
| Joe Kelly | PADEP | X | X |
| Scott Crafton | VA DCR | X | X |
| Jeff Sweeney | EPA | | |
| Tom Schueler (Facilitator) | CSN | X | X |
| Norman Goulet | Chair USWG | X | X |
| X = present, C= Checked in prior to meeting, R= resigned from panel | | | |

The Panel held two calls and provided extensive written and verbal comments on the Feb 21 and March 13 drafts of the final panel memo. These minutes summarizes the key technical changes made to the method by CSN during this review period, as well as a providing a record for how the Panel resolved its more substantive comments. Based on this, the Panel voted 9-0 to tentatively adopt the final memo, subject to a two week period for errata and state-specific comments, and report out on its final recommendations at the April 30 USWG meeting.

## *3.* Key Technical Changes to the Method

### *Changes after First draft*

6. *Dropped reference to the Original New BMP Adjustor Table and replaced with curves*. The tabular data was converted into a series of curves to make it easier for users to define a rate for the unique combination of runoff capture volume and degree of runoff reduction. This was done by fitting a log-normal curve to the tabular data points, which came within a few percentage points of the tabular values for a wide range of runoff capture depths and removal rates

7. *The technical basis for defining the anchor rate was provided in a New Table in Appendix C*

8. *More Accurate Estimates of Runoff Capture Were Derived Using Explicit an Explicit rainfall frequency spectrum equation, and this supplemental documentation was incorporated into Appendix C.* The new more accurate method has the result of flattening the removal curves for higher depths of runoff capture.

9. *Suitability of Method*. The Panel concluded that the generalized new BMP removal adjustor curves were a suitable tool for estimating the aggregate pollutant load reductions associated with hundreds or even thousands of future BMPs at the scale of the Bay watershed and the context of the Chesapeake Bay Watershed Model.

**Changes After 2nd Draft**

1. *Modify HI/LO Designation*. Change the HI runoff reduction designation to RR (runoff reduction) and the LO designation to ST (stormwater treatment). DE recommended this clarification as it is more consistent with how these practices are treated in state stormwater manuals. This would be reflected in the text and on the curve labels in the memo, however, there would be no change in how the current list of stormwater practices are categorized (i.e., Table 4)

2. *Make the following clarifications in the methods section*:

- Clearly define the x-axis as being "depth of runoff captured by practice per impervious acre."

- Clearly state that the new BMP storage volume for each site must be adjusted using a "unitization" equation that converts the storage volume into a unit depth per impervious acre at each site.

- Note that the corresponding removal rate determined from the appropriate curve applies to the entire drainage area (i.e., the new development or redevelopment site).

3. *Why We Use the Unitization Equation for New Development Projects*

   In order to compare the impact of performance standards of all the Bay states, a unitization equation is used that divides runoff storage volume for the site, by the fraction of the site that is impervious.

$$= \frac{(12 * EP)}{IA}$$

The primary reason is that each state's Engineering Parameter (EP) is calculated as a function of several factors including land cover, hydrologic soils group, predevelopment hydrology baseline and target rainfall depth. This means that each individual site within a state will have a unique EP storage volume over its drainage area. As a result, we need to adjust each unique site EP to get a standard depth of treatment per unit impervious cover to use the curves. By dividing each site's EP by the impervious cover acreage, we are able to define inches of runoff captured per unit impervious acre, and use this value to define the removal rate from the curves.

The removal rates determined from the new BMP removal rate adjustor curves are applied to the entire site area, and not just the impervious acres. Also, the reporting unit for the site is the entire treated area of the site, regardless of whether it is pervious or impervious.

4. *Why We Don't Use the Unitization Equation for Redevelopment Projects:*

   The unitization equation is not needed for redevelopment projects because the EP defined under each state redevelopment standard is computed solely based on site impervious cover (i.e., runoff from pervious cover is not a factor in defining EP at a redevelopment site, which means IA = SA ).

$$= \frac{(12 * EP)}{SA}$$

5. *Change Design Examples*: The original design examples provided data for each of the six Bay states for common development scenarios. The Panel felt that the comparison provided some counter-intuitive (but accurate) results, and indicated that these comparisons served no useful purpose. It was agreed that to prevent confusion, only one state would be utilized per design example, and re-iterate the point that the runoff capture volume derived for the curves will be different from the runoff volume computed (EP) under each state's performance standard.

6. *Provide More Documentation on Unitization Equation*. Add a section in the Appendix C that documents why the unitization for impervious area is needed to provide a common basis of comparison among states and drainage areas. The basic reason is that the Rainfall Frequency analysis used to derive the curve above and below the anchor points is based on the assumption that the runoff delivered to a practice is generated from a unit impervious acre. The runoff storage volumes achieved for individual retrofits, however, are unique, based on the land cover, soils and hydrologic assumptions used in each state. Therefore, these volumes must be adjusted by a unitization equation to get the correct depth to use on the x-axis of the curve.

## 4. Resolving Key Comments From the Panel

### General Comments:

In general, the Bay states wanted to ensure that the memo would protect state prerogatives with respect to their existing and/or future BMP reporting and tracking systems.
To prevent confusion, the memo should be carefully screened to reduce the use of the term "credit" as this has implications for trading and offsets. The term "site design credits" will be employed to refer to runoff reduction achieved through non-structural stormwater practices, such as disconnections and sheet flow.

**Methods Section:**

**Comment:** MDE and others noted that some runoff reduction practices take surface stormwater and shift it to groundwater, so that it is possible that some fraction of the nitrogen entering a runoff reduction practice may ultimately end up in a stream, and that the nitrogen removal rates shown on the curve may not be as high in the real world.

**Resolution:** The Panel acknowledged the potential for this, but did not have any data to confirm or refute that it exists. The Panel agreed that this issue should be a top stormwater research priority, and indicated that the following statement be added to the existing section on research collaboration: "The Panel expressed a particular interest in defining the fate of nitrogen in retrofits that rely heavily on infiltration or extended filtration to provide runoff reduction"

**Comment:** Several Bay states require pollutant load reductions design computations as an integral part of the implementation and compliance of their stormwater performance standard, and were concerned that the proposed method would supersede them

**Resolution:** The Panel agreed that this is not the intent for the protocol to replace or supersede state design standards, and added the following language to stress that point.

Several states in the Bay watershed require a site-based spreadsheet pollutant load calculation as part of stormwater review for individual development projects. The calculations require designers to achieve target post development loads using a series of removal efficiencies for individual LID and site design practices at the development site. Examples include the Maryland Critical Area Phosphorus compliance spreadsheet (CSN, 2011), the Virginia state-wide stormwater compliance spreadsheet (VA DCR, 2011), and the Pennsylvania stormwater manual worksheets (2006).

The Panel considers the technical and scientific basis for these site-based tools to be sound and appropriate for the scale of individual site analysis and BMP design. The Panel strongly emphasizes that the pollutant removal protocol it has recommended for Bay TMDL tracking in no way supersedes these site-based compliance tools. The regulated community in each Bay state must still meet the stormwater regulatory requirements established in each state's stormwater regulations, permits, and design manuals.

**Design Examples Section**

**Comment:** PA indicated that there should be a disclaimer at the beginning of the section to reinforce the point that the design examples simply show how nutrient and sediments removal rates are calculated in the context of the Chesapeake Bay TMDL, and that designers must still follow the appropriate stormwater sizing, design criteria and compliance tools established by each state to implement its new performance standards.

**Resolution:** The Panel agreed that this disclaimer should be added.

**Accountability Section**

**Comment:** Various states indicated that their BMP reporting systems are unique, and they did not want a "one-size fits all" approach to new stormwater BMP reporting.

**Resolution:** The Panel agreed that states will need to aggregate data on the location of BMP systems, year installed, and removal rate to report to EPA, and also have the capacity to remove BMPs that are no longer functioning. However, the Panel agreed the following language should be added to the memo:

"Localities must submit basic documentation to the state stormwater or TMDL agency to document the nutrient/sediment reduction claimed for each system of urban BMPs that are actually installed. Localities should check with their state stormwater agency on the specific data to report for individual projects. Some *typical* information that may be reported includes"

*State BMP Reporting Systems*. Each state has a unique system to report BMPs as part of their MS4 permit. In some cases, states are still developing and refining their BMP reporting systems. To utilize the removal rates in the context of CBWM progress runs, states will need to report BMP implementation data using CBP-approved rates or methods, reporting units and geographic location (consistent with NEIN standards), and periodically update data based on the local field verification of BMPs.

*Local Reporting to the State*. Localities will need to submit basic spreadsheet documentation to the state once a year as part of their MS4 annual report. The spreadsheet can be used to tabulate the aggregate acres of new development and redevelopment that were treated to the standard. Localities should check with their state stormwater agency on the specific data to report. Some typical data they may be asked to report includes:

**Comment:** Several states and localities on the panel indicated concerns over the language on initial verification/certification of the performance of BMP systems at new or redevelopment sites. The concerns ranged from effect on local resources, and that localities should be able to use the existing annual MS4 annual reports as an alternative.

**Resolution:** The Panel agreed and re-drafted the section as follows: Localities will need to verify that urban BMPs are installed properly, meet or exceed the design standards for its CBP BMP classification, and is functioning hydrologically as designed

prior to submitting the BMP for pollutant reduction in the state tracking database. This initial verification is provided either by the BMP designer or the local inspector as a condition of project acceptance as part of the normal local stormwater BMP plan review process. From a reporting standpoint, the MS4 community would simply indicate in its annual report whether or not it has BMP review and inspection procedures in place and adequate staff to implement them.

**Comment:** Several panelists questioned the process for down-grading individual BMPs, noting that as long as a local jurisdiction has a regular inspection and maintenance program/procedures in place to correct under or non-performance of retrofits, then removal and replace of credits should be rare. This requirement could be excessively burdensome and subject of error and confusion not only at the local level, but also at the level of the Bay Program modelers.

**Resolution:** The Panel agreed that downgrading based on field inspection was an important component of BMP verification. The Panel drafted language on a reasonable time frame for corrective action and that downgrades only need to be reported through MS4 permit annual reports, as follows: If the field inspection indicates that the BMP system is not performing to its original design, the responsible party would have up to one year to take corrective maintenance or rehabilitation actions to bring it back into compliance. If the facility is not fixed after one year, the pollutant reduction rate for the BMP system would be eliminated, and the locality would report this to the state in its annual MS4 report.

**Comment:** Several states noted that the BMP visual indicators checklist referenced in the text and provided in Appendix E may not be applicable in their state, and they wanted to reserve the right to develop their own indicators and checklists.

**Resolution:** The Panel agreed, and indicated the intent was to provide a model for what kind of visual indicators are worth looking at in the field, and not prescribe a Bay-wide template. Additional language to be added to address this point.

**Comment:** Several states were concerned that the BMP reporting and verification procedures need to be specially adapted to meet the unique situation of non-Ms4s communities.

**Resolution:** The Panel agreed with the general comment, but felt that this was a larger verification issue that should be addressed by the entire USWG in the coming year. It agreed on the following language to add.

Special Procedures for Urban BMPs Installed in Non-MS4s. Several states such as PA and WV are expected to have considerable development occurring in non-MS4 communities, which tend to be very small in size and fairly new to stormwater BMP review. It is acknowledged that these non-MS4s may not currently have the budget and/or regulatory authority to fully meet the new BMP verification protocol. A committee of the Urban Stormwater Work Group will recommend alternative verification procedures in 2012 for non-MS4 communities

**Comment:** If these protocols are accepted by the CBP, then the CAST, MAST, VAST will need to be modified as well. There will be no utility to these programs if they don't effectively predict CBP model results. Coordination with CAST needs to be a priority that should happen in concert with the update of urban BMP removal rates and not as an afterthought.

**Resolution:** The Panel agreed with this, and instructed CSN to share the final memo with the CB Modeling Team to ensure procedures were in place to prior to USWG meeting to address these concerns. They also added the following language to the text:

The Panel acknowledges that the new BMP removal rate protocol may require adjustments in the BMP assessment and scenario builder tools recently developed to assist states and localities to evaluate BMP options to develop watershed implementation plans (i.e., each development project has a unique removal rate and consequent load reduction, while the CAST tools apply a universal rate for each type of BMPs).

The Panel noted, that with the exception of the redevelopment load reduction, most localities will not need to employ CAST to track implementation of new BMPs associated with future growth and development. CSN will work with ICPRB and Bay Partners to make improvements to future versions of CAST and CBWM to improve its ability to handle stormwater BMP systems associated with both new and redevelopment. In addition, CSN will check with the Bay modeling team to ensure that the new removal rates are properly applied to urban lands in the context of CBWM, and in particular, the appropriate pervious and impervious areas.

**Appendix C**

**Comment:** It was noted that a Table in Appendix C had incorrect units for sediment loading rate from CBWM.

**Resolution:** Table Corrected

**Comment:** A locality noted that when it comes to defining baseline loads from which the removal rates are applied, the two methods in Appendix C can give different loads for the same scenario (e.g., Simple Method cs. CBWM unit loads). The main issues is that Simple Method computes load solely based on IC, where the CBWM unit load method has employs both IC and pervious cover to compute baseline loads. Depending on the method, this could result in an over-estimate of load removed.

**Resolution:** The Panel noted that the actual BMP load reductions are calculated for each project based on the NEIN location on the CBWM. The Panel noted that each Bay state should provide guidance to their MS4 localities on which of the two methods they prefer, to assure consistency in their MS4 permit reports.