pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

MEMO

TO	Urban Stormwater Workgroup, Chesapeake Bay Partnership
FROM	PA Department of Environmental Protection
DATE	January 31, 2013
RE	Comments on the draft Final Report - Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects --submitted to the Urban Stormwater Work Group, Chesapeake Bay Partnership

MESSAGE:

The Department of Environmental Protection (DEP) acknowledges our participation on the Expert Panel and input into the draft Final Report under review by the Urban Stormwater Workgroup. However, DEP's further and more detailed technical review of the report identifies some potential shortcomings that may be resolved only with additional consideration and dialogue. The detailed technical review of the draft Final Report may require potentially longer timeframes than have been provided due to an apparent accelerated review process. At this point, we do not recommend adoption of the Expert Panel draft Final Report by the Urban Stormwater Workgroup until further consideration and dialogue takes place. Specific comments below provide background and support for this recommendation.

Section 2.2 Stream Restoration Definitions

The Big Spring Run experimental site near Lancaster, PA and referenced in the *Legacy Sediment Removal (LSR)* definition was constructed beginning in 2011.

We request a change to the definition of a LSR projects as follows:
Legacy Sediment Removal (LSR) – A class of aquatic resource restoration that seeks to remove legacy sediments and restore the natural potential of aquatic resources, including a combination of streams, floodplains, and palustrine wetlands. Although several LSR projects have been completed, the major experimental site was constructed beginning in 2011 at Big Spring Run near Lancaster, Pennsylvania. For additional information about the Big Spring Run restoration project see Hartranft, et. al. (2011).

Include a definition of legacy sediment as follows:
Legacy Sediment - Sediment that (1) was eroded from uplands during several centuries of land clearing, agriculture, and other intensive land uses; (2) accumulated behind ubiquitous dams in

slackwater environments, resulting in thick accumulations of cohesive clay, silt and sand, which distinguishes "legacy sediment" from fluvial deposits associated with meandering streams; (3) collected along stream corridors and within valley bottoms, burying natural floodplains, streams, wetlands, and other aquatic resources; (4) altered and continues to impair the morphologic, hydrologic, biologic, riparian, and other ecological services and functions of natural aquatic resources; (5) can also accumulate as coarser grained, more poorly sorted colluvial (not associated with stream transport) deposits, usually at valley margins; (6) can contain varying amounts of nutrients which contribute to watershed loads from bank erosion processes. Widespread indicators of impaired watercourses and watersheds due to legacy sediment include a history of damming, high banks and degree of channel incision, rapid rates of bank erosion, high sediment loads, watercourses relocated from their natural position in a valley, low channel pattern development, infrequent flooding in the riparian zone, diminished sediment storage capabilities, riparian zones lacking groundwater at or near the surface, natural habitat degradation, and other diminished natural aquatic ecosystem functions and services.

Section 3.2 Measurements of Bank Erosion Dynamics

This section should consider and provide specific reference to Merritts et al., 2011. The data from Fraley (2006) and Fraley, et al. (2009) were evaluated in Merritts, et al. (2011) who concluded that the bed storage estimates in the Schuylkill River tributary are partially influenced by backwater effects from an existing dam. Some implications from Merritts, et al. (2011) conclusions are that bank erosion dynamics in streams incised into legacy sediment are influenced directly by valley grade controls, time since breaching and location in relation to the breach. They demonstrate that bank erosion dynamics are largely decoupled from modern landuse where streams have incised through legacy sediment because of rapid valley grade control modifications. They also identify the importance of freeze-thaw processes on streambanks comprised of legacy sediment and support the early observations by Leopold (1973) that bank erosion dynamics are not singularly the result of flow scour or related to changes in landuse.

The streambank total nitrogen(TN) and total phosphorous(TP) values reported by Merritts, et al. (2010) are averages. The Panel cites these values as median values in Table 5 and throughout the report. The correct median values from the data used to calculate the average values can be obtained from the Walter, et al., (2007) report titled Estimating volume, nutrient content, and rates of streambank erosion of legacy sediment in the Piedmont and Valley and Ridge physiographic provinces southeastern and central PA (http://files.dep.state.pa.us/Water/Chesapeake%20Bay%20Program/lib/chesapeake/pdfs/padeplegacysedimentreport2007waltermerrittsrahnisfinal.pdf; http://files.dep.state.pa.us/Water/Chesapeake%20Bay%20Program/lib/chesapeake/pdfs/padeplegsedreport2007waltermerrittsrahnisappendicesfinal.pdf). For consistency with other values in the table, the median value should be revised and generated from the 2007 report. Also, ranges for TN and TP can be obtained from the 2007 report.

Section 3.3 Internal Nitrogen Processing in Streams and Floodplains

The series factors that promote greater dry weather(base flow) N reduction should be revised to include more generic language regarding the sources of dissolved organic carbon. In addition to palustrine forested sources already identified in the bullet specific to dissolved organic carbon, other important sources include organic carbon from palustrine emergent and palustrine scrub shrub wetlands adjacent to natural channels. There is ample evidence that natural aquatic ecosystems in the mid-Atlantic Region have characteristic valley bottoms with channels bordered by emergent and palustrine scrub-shrub wetlands (Voli et al., 2009; Hilgartner, et. al., 2010; Merritts et al., 2011; Hartranft et al., 2011) in addition to palustrine forested wetlands. The sources of dissolved organic carbon adjacent to natural streams and representing the restoration goal of many projects, particularly LSR projects, are not exclusively riparian forests.

Section 3.4 Nutrient Dynamics in Restored Palustrine and Floodplain Wetlands

Despite a weak statistical relationship reported by Jordan (2007), the panel highlights a tenuous performance relationship between contributing watershed area and wetland restoration area. While this relationship may get stronger as the contributing watershed area increases relative to the wetland area, there likely is a diminishing watershed area threshold where the relationship becomes invalid. Preliminary post restoration monitoring results from the Big Spring Run site identified by Hartranft et al. (2011) indicate that the relationship is invalid where the wetland area to contributing watershed area is just 0.37 %. Since headwater streams may not support the relationship, applying the relationship to all streams is invalid and may discount reduction credits in places where restoration is very effective.

In the previous Section 3.3, the panel recognizes that streams should be connected to adjacent wetlands and floodplains during both base flow and storm flow to maximize nitrogen processing. This recognition is supported by geomorphic, geochemical, and biological characteristics of natural aquatic ecosystems once prevalent in valley bottoms of the mid-Atlantic Region and frequently buried under legacy sediment today(Hilgartner et al., 2010; Merritts et al, 2011). Natural aquatic ecosystems adjacent to channels that represent the natural restoration potential in many watersheds, predominantly are a combination of emergent, scrub shrub and forested palustrine wetlands. These wetland ecosystems may act as nutrient sinks during both base flow and storm flow. Despite this evidence for maximizing nutrient uptake in restoration projects, the panel's final recommendation in this section is that "...reconnecting streams with their floodplains during <u>stormflow</u> conditions could have a strong influence on sediment and nutrient reduction,...", leaving out the base flow that is so important. The panel should include floodplain and stream reconnection during both flow regimes as important in this section.

Section 3.6 Effect of Riparian Cover on Stream Restoration Effectiveness

The DEP recognizes that forest buffers provide a level of aquatic habitat and water quality benefits and these benefits may be substantial when compared to some pre-restoration conditions that provide little aquatic ecosystem functional support. However, none of the studies compare a forest buffer with other natural aquatic resources like emergent and scrub-shrub palustrine wetlands that also buffer natural streams. There is evidence that natural aquatic resources buried beneath legacy sediment are not simply forested riparian zones and that these natural resources may provide substantial habitat and water quality benefits (Voli et al, 2009; Hilgartner, et. al., 2010; Merritts et. al., 2011; Hartranft et al., 2011). Because natural aquatic resources buried beneath legacy sediment are potentially restored by removing legacy sediment and these restored ecosystems are not exclusively forested, the notion that forested riparian areas are preferential over all other buffers is not supported. Where streams have incised through legacy sediment and the restoration goal is to remove legacy sediment to restore natural aquatic resources, the maintenance of forest cover exclusive of other natural cover types that buffer streams, like emergent and scrub shrub palustrine wetlands, is not appropriate. The specific recommendations related to riparian forest buffers should not apply to streams incised through legacy sediment where the restoration goal is to remove the impairment and restore natural aquatic resources, as in LSR projects.

Section 3.7 Longevity of Stream Restoration Practices

The Panel begins this section by stating their charge is to "...define the success rate and longevity of stream restoration projects." This does not appear to be a specific charge when reviewing the charges identified by the Panel on Pages 6 & 7 of the report. The Panel may have over-reached their charge to define effective stream restoration by including the success rate and longevity of different stream restoration approaches. We believe the Panel charge is to define the criteria that should be used to ensure effective stream restoration and distinguish between projects based on these criteria, not evaluate the success rate of projects or approaches. This Section cites many reports that restoration monitoring is lacking, however, the Expert Panel still provides recommendations related to credit certification longevity later in the report. Our experience and current detailed monitoring results are that the longevity of LSR projects is expected well beyond five years. Annual verification that LSR projects remain stable and functioning will identify projects where credits may be terminated for poor performance. Therefore, a longer term certification may be appropriate for LSR projects.

Section 4.2 Environmental Considerations and 404/401 Permits

See above comments under Section 3.6.

See above comments under Section 3.2

Section 4.3 Stream Functional Assessment

The Panel correctly points out that restoration project designers must understand and apply concepts of ecosystem functions to develop effective and successful projects. The panel does not highlight the fact that if some of the assumptions made during the process of developing a design are poorly understood or documented in scientific literature, or simply are flawed, the use of Functional Assessments to develop restoration designs is flawed. Some long held notions about the natural form of channels in the mid-Atlantic Region and sources of impairments recently have been modified by several studies (Walter and Merritts, 2008; Merritts, et al., 2011). The ramifications of these recent findings are still being vetted through the scientific process, and the outcome of this process may substantially alter the relationship between functional hierarchy categories in the pyramid framework developed by Harman et al., 2011, for example.

For instance, there is no evidence that natural aquatic environments buried under legacy sediment transported gravel sized bedload in the mid-Atlantic Region. If a designer assumes that a restored channel in this instance requires transport of gravel sized particles currently transported by the incised channel, the design discharge and bed shear stresses will be overestimated, potentially leading to a different project goal and ecosystem type. The buried natural aquatic ecosystems do not appear to follow the classic model of a single-thread meandering channel typical of many stream restoration projects (Walter and Merritts, 2008; Hartranft et al., 2011) and there is no evidence that applying this model to the hierarchy will lead to restoring the natural potential of aquatic resources. More specific examples include the notion that substantial erosion and instability may occur after stream restoration, despite evidence that natural aquatic ecosystems remained stable for thousands of years during major storm events, droughts, regional beaver activity, fire and anthropogenic disturbances within the watershed (Hilgartner, et. al. 2010) and that these ecosystems may represent restoration analogs.

Section 5 Recommended Protocols for Defining Pollutant Reductions Achieved by Individual Stream Restoration Projects

We acknowledge the potential limitations of BANCS and this recognition by the Expert Panel. We believe further and more detailed investigation and accounting for potential limitations of the BANCS model are warranted because its suitability, particularly in the eastern U.S., has not been demonstrated. A number of organizations are reported as BANCS-method users, but only two of those referenced (Hanniman, 2012 and Doll et al., 2003) have collected and disseminated (via web or print) eastern U.S. data. The others either reference data from western U.S., or have not publicly distributed their data.

A careful examination of BANCS data from the references cited reveals that the studies were conducted over 1 or 2 year time frames. Some categories of this data are spread over two orders of magnitude and there appears to be considerable overlap among the categories (Hanniman, 2012). A single NBS value is specified for each erosion measurement location. However, different erosion rates for different flood magnitudes should be expected at each of those locations. Therefore, a multi-year study encompassing a wide range of flows is expected to produce variability in the NBS-erosion relationship for each measurement location. Only a multi-year study can reveal the true nature of the correlations and whether they provide suitable predictions. Short duration monitoring to establish these relationships should be considered misleading.

BANCS relationship from western U.S. appears to consist of data from sites where banks are comprised of coarse alluvium. Good correlation between hydraulic force and erosion rate is expected for low cohesive (coarse alluvium) banks; hydraulic force is expected to be a much poorer predictor of erosion for cohesive (clay-silt) banks. Streambanks in the Chesapeake Bay watershed largely consist of clay-silt material, and this is particularly evident in streambanks comprised of legacy sediment (Walter and Merritts, 2008; Merritts et al. 2011).

In summary, the BANCS approach is expected to be unsuitable for erosion estimates where banks are cohesive, and must be tested with multi-year erosion measurements. One dominant bank erosion process that may not be adequately characterized using BANCS is the contribution from freeze thaw process, particularly where streambanks are comprised of extremely cohesive legacy sediments (Merritts, et al., 2011). We recommend that other erosion prediction methods be explored, or recognized with appropriate documentation.

The use of "natural" conditions to estimate post-restoration erosion rates, as suggested on page 33, is reasonable in theory. However, per the BANCS protocol, stable bank reaches are not evaluated and the BEHI/ NBS data excludes estimates from natural conditions. Therefore, if the expected restoration result is stable banks and a natural condition throughout the project reach, the estimated post-construction erosion rate is expected to be zero. If the expected post construction condition is not stable banks, then an alternative design approach must be considered for that project or the project should not receive credits. In consideration of this, 100% of the prevented bank erosion should be credited if the design process effectively removes the sediment from the floodplain or stabilizes the banks.

This Section establishes that only 50 percent of the bank erosion and nutrient credits are generated because of the potential for continued erosion. In many cases, this results because design bank heights relate to bankfull flows and may not access the floodplain until a storm flow typically exceeding the 1.5 – 3 year maximum flow probability. LSR projects may access the floodplain during normal base flow or the 0.25" or 0.5" inch rainfall event. Therefore, the banks of the NCD may be 5 to 10 times higher and have much greater potential for erosion than those of LSR projects.

A well designed and constructed LSR project is expected to reduce nearly 100 percent of the pre-restoration loads derived from channel and bed processes within the restored reach. There are unpublished examples of extreme bank stability and low bed scour following LSR projects. Current and detailed post restoration monitoring at the Big Spring Run site (see Hartranft, et al. 2011) is confirming these observations. In addition to effectively removing the streambank and channel derived sediment within the restored reach of a LSR project, restored areas act as a sink for sediment and nutrients from incoming surface water and groundwater sources. Based upon our observations and current detailed monitoring of LSR projects, we support a sediment and nutrient reduction estimate from the restored reach closer to 100%. We recommend that annual inspections determining that specific projects are not functioning as designed should be the basis for reduction credit suspension or adjustment applied to LSR projects.

Results from studies of internal nitrogen processing in streams are predicated on systems with coarse streambed characteristics (Kaushal et al., 2008; Striz and Mayer, 2008). Parola and

Hansen (2011) suggest that establishing continuity of coarse material as a subsurface floodplain horizon across the valley floor where hyporheic exchange may occur restores more complete hydrologic function during both base flow and flood flow. This condition is representative of natural aquatic ecosystems in the mid-Atlantic Region and represents a component of the natural potential of LSR projects (Walter and Merritts, 2008; Hartranft et al., 2011). However, not all restoration scenarios will result in similar conditions where coarse streambed and coarse subsurface floodplain horizons are connected at the hyporheic zone (Parola and Hensen, 2011).

For example, perched channels are likely to persist where valley grade controls that caused accumulation of legacy sediment remain in place partially or completely (Merritts et al., 2011). Natural stream ecosystems in the mid-Atlantic Region are established on coarse material and bedrock (Walter and Merritts, 2008). The natural floodplain aquatic ecosystems adjacent to streams are underlain by the same materials, however, the course materials are overlain by a relatively thin veneer of organic rich hydric soils supporting a wetland plant community with root zones connected to groundwater(Walter and Merritts, 2008; Merritts, et al. 2011). The relatively thin coarse gravel layer of natural streams and associated aquatic ecosystems are not transported by fluvial processes under natural conditions (Walter and Merritts, 2008; Merritts, et al., 2011). Streams that are showing de-nitrification at depths greater than 5 feet are likely perched above their natural invert elevation. With bedrock and gravels at shallow depths below natural stream channels and floodplains, available carbon for denitrification processes do not exist at depths of 5 feet in natural channels. If natural stream restoration is a project goal, there is no reason to expect a five feet depth of hyporheic exchange underlying a restored channel.

A unit denitrification rate (2.65 x 10-4 pounds/ton/day of soil) is applied in Step 3 of Protocol 2 on page 35. This rate appears to be derived from Kaushal et al. (2008) and may represent the actual post-restoration rate, rather than the magnitude of improvement that should be the basis for credit production. While this unit denitrification rate represents one of the only detailed studies of its kind, it is based on 3 sample events at each of 2 sites along Minebank Run (Kaushal et al., 2008).

Related to Protocol 2 and aside from the variability of the BEHI and Near Bank Stress assessment, likely restoration designs features will be in contrast to desired criteria as follows:

- High width to depth ratio channels, which is not conducive to habitat and prone to temporarily store sediment and nutrients within the channel.
- Artificially raising the stream bed invert above the groundwater and gravel/bedrock to get bulk samples for the de-nitrification box and increase floodplain frequency.
- Installation of artificial downstream valley grade controls (dams) to increase the depth/storage volumes of flow in the floodplain for more frequent flow events.

Key restoration factors to emphasize for maximizing sediment and nutrient reductions for individual projects should include restoring low energy ecosystems where groundwater and surface water interact to the maximum extent, and complete connection and permanent interaction between the floodplain vegetation root zones, groundwater and stream base flow. LSR projects provide the potential for hyporheic exchange during base flow and storm flow. This exchange occurs throughout the entire restored valley width, characteristically including wetland complexes where groundwater is at or near the surface(Parola and Hansen, 2011; Hartranft et al. 2011). Therefore, the entire restored valley width should be considered within the hyporheic exchange zone for LSR projects.

The Panel makes a distinction between practices using qualifying criteria that are different for each practice. If re-connecting floodplains with both base flow and storm flows is recommended for increasing reductions, why not use frequency of flooding or some other criteria related to hydrologic/hydraulic characteristics as a qualifying criteria to distinguish between practices? The use of bank height ratios for qualification of Protocol 2, for example, compared to Protocol 3 where credit depends on the elevation of the stream invert relative to the stage elevation.

Protocol 2 recommends requiring "extensive planting" along the riparian corridor of restored stream reaches. While extensive planting may be advantageous to more quickly recover natural aquatic resource functions at restoration sites, there are examples where seeding and natural regeneration of native plant communities are established absent "extensive planting". We suggest that the Panel should recommend establishing and maintaining natural plant communities adjacent to restored channels to act as a buffer for adjacent sediment and nutrient sources and to provide a carbon supply that will drive denitrification processes.

We object to using the criteria of a minimum contributing watershed area to floodplain surface area (wetland) ratio of one percent (1%) in Protocol 3. See comments above for Section 3.4.

The DEP and our extensive list of partners have taken a methodical and detailed approach to estimating sediment and nutrient removal rates resulting from LSR projects (Hartranft et al., 2011). A partial list of our partners in this effort include; U.S. EPA Region III, U.S. EPA Office of Research and Development, U.S. Geologic Survey, Franklin and Marshall College, Landstudies, Inc., Elizabethtown College, Millersville University, Lancaster Farmland Trust, Chesapeake Bay Commission, and the PA Fish and Boat Commission. The results of pre, syn, and post restoration monitoring at Big Spring Run are intended to be used to establish functional credits for implementing individual LSR projects. Preliminary data from the extensive monitoring at Big Spring Run are available and results are expected to be produced in 2013 (Hartranft, personal communication). It is pre-mature to establish removal rates for LSR projects without inclusion of the Big Spring Run study, particularly since the study may provide insights into the relationships, mechanisms, and processes between functional categories used in Functional Assessments.

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Maryland Stream Restoration Association (MSRA) comments on Final Report of Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects
1/31/13

The Maryland Stream Restoration Association (MSRA) would like to thank the Chesapeake Bay Program Urban Stormwater work group for the opportunity to comment on the Final Report of Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects (Final Report).

MSRA believes that the four new protocols recommended for determining increased nutrient/sediment removal rates are a great improvement over the single removal rate that was originally assigned to stream restoration projects in the bay model. However our interest in the Expert Panel's Final Report goes beyond a simple review of the new protocols.

In 2008 MSRA collaborated with the Maryland Water Monitoring Council to organize a one day Charrette entitled "Effectiveness Monitoring for Stream Restoration". Funding for the effort was provided by the Keith Campbell Foundation. More than 100 stream restoration professionals attended the conference. We are very gratified to see that most of the recommendations in Sections 7 and 8 of the Final Report support or expand upon the consensus of the 2008 Charrette.

The accountability (and evaluation) mechanisms discussed in section 7 of the Final Report were a major topic of discussion during the 2008 Charrette. Since that time MSRA has worked to try to find resources to establish a useful restoration database system. Unfortunately it seems that recent economic conditions have thwarted the development of a truly effective BMP reporting and tracking program. MSRA supports a restoration database and evaluation system that would expand its scope beyond the sediment and nutrient issues which are the focus of this Expert Panel's Final Report. Hydrology, in-stream and riparian habitat and biota are some of the other important factors in a comprehensive evaluation of stream restoration projects.

Section 7.1, page 51 mentions the formation of a new EPA/CBP/Corps of Engineers workgroup to provide more consistent permitting and monitoring guidance for stream restoration projects. MSRA respects the knowledge and regulatory responsibilities of the agencies but believe that the collective experience of a broader stream restoration community such as represented by MSRA could be useful in developing a more targeted and representative monitoring program for a wide variety of restoration projects.

During the December 17, 2012 roll out meeting of the Final Report it was pointed out that approximately 80% of the current stream restoration projects would not receive reduction credits because they are mitigation projects. Although this makes sense in the context of bay restoration goals, we are concerned that the potential value of monitoring data from mitigation projects may be overlooked. We believe that the implementing agencies and their consultants may have a much larger set of stream restoration monitoring data than has been easily accessible to the Bay Program.

MSRA believes that an effectiveness monitoring database should be designed to collect the best information from the most relevant projects. Rather than requiring all projects to collect the same amount of data it could be possible to maximize information utilization by stratifying projects in similar classes based on factors such as design type, stream class, and physiographic region. Then more energy & resources could be focused on particular projects that best represent a class of projects. This selection process would require the collaboration and consensus of a group of regulators, practitioners, managers and researchers. Obviously there would still be a basic set of monitoring requirements that would have to be met for all permitted projects.

We recognize the increased complexity and difficulty with validating the four new proposed protocols however we believe MSRA is in an ideal position to help facilitate identification of projects and collection of data that would be needed during the 6 month test period suggested in Section 8.2. MSRA members include representatives of several of the local agencies that have the most active stream restoration programs. Our membership also includes a wide cross section of the practitioners that design and install stream restoration projects in the Bay region.

MSRA generally supports the recommendations in Section 8 which are consistent with the 2008 Charrette. Recently MSRA has been ramping up our efforts to identify a funding mechanism for a stream restoration monitoring consortium such as one discussed on page 52. We are also interested the development of a practical stream functional assessment. We have a great interest in the assisting the development of protocols and definition of terms for the verification process discussed in Section 7.1.

The BANCS Model has been a topic of lively debate within MSRA. The speed and efficiency with which data can be collected is attractive but there are concerns about the collection methods and application of the model. The potential to overestimate of erosion rates is a big issue that needs to additional study and refinement.

Development Tools for standardizing BANCS model is a good idea MSRA would like offer its assistance with this effort. We do have significant questions about the vague recommendation on page 32 which states: “The BANCS method should only be performed by a qualified professional, as determined by each permitting authority.” What will the qualification standards be and how can comparable data be acquired if each agency has its own standards?

The BANCS model should not be used without regional data converting BEHI/NBS ratings to actual erosion rates. R. Starr has relationships for coastal plain. There is a need for Piedmont, Valley and Ridge and Appalachian Plateau relationships. BANCS is a good tool for ranking sediment supply but not for quantitative predictions unless relationships have been established.

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BANCS model is not useful for incision. It should only be used for lateral erosion rates. Aerial photographs are probably not useful for establishing erosion rate relationships to BANCS

Practitioners should be encouraged to develop methods for validation of BANCS model and efforts should be evaluated on a case by case basis for crediting sediment reduction rates.

The current interim credits should be used for erosion rates except of coastal plain streams where BANCS has been correlated with erosion rates.

Some page specific comments follow:

P. 26 Qualifying conditions for Individual Projects

Second bullet under Urban says that a stream should be actively enlarging or degrading from upstream development to qualify.

Actually the probability of success in an urbanized stream is higher if the adjustment process has already completed. Restoration is more risky if channel enlargement is still occurring. This should not be a qualifier.

P.27 environmental considerations for 404/401 permits

Third Bullet Urban stream restoration is generally only warranted in urban stream reaches that have been or are currently being degraded by upstream watershed development

Same comment as above –for streams **currently being degraded** by upstream development.

P. 29 Non-urban stream that should not qualify for removal credit:

All of these bulleted statements ignore the fact that increased aquatic life diversity and especially restoration of acid mine impacted streams can have dramatic aquatic life benefits. Aquatic life communities process allochthonous inputs and thereby reduce nitrogen, phosphorous, carbon and BOD in streams. We don't have quantification of these benefits but they shouldn't be ignored. Furthermore, efforts to identify and quantify them should be recommended by this panel.

p. 30 Recommended protocols

A fifth protocol for improved aquatic life should be developed, because a healthy aquatic community processes allochthonous inputs. This processing reduces nitrogen, phosphorous, carbon and Biochemical Oxygen Demand. Without this processing these inputs are transported downstream and taken up in anaerobic digestion.

p. 31 Sediment supply has two components suspended and bedload. Bedload is usually stored in the channel and suspended is thought to be transported downstream. The entire benefit is based upon estimates of suspended sediment. Bedload sediment can have a profound impact on aquatic life which in turn affects instream processing of nutrients.

MSRA's Vision Statement:"We are an association of professionals dedicated to healthy streams through the advancement of stream restoration science." MSRA's members began meeting informally in 2003 and became an incorporated 501c (3) nonprofit organization in 2008

Membership in the Maryland Stream Restoration Association provides opportunities for those involved in stream restoration to network with each other and informally share data, protocols and other information, lessons learned and opportunities. Current members include local, state and federal agency personnel, as well as academicians, design consultants and environmental construction firms. Our communications network includes: a web site (http://marylandstreamrestorationassociation.com/), a listserv (https://groups.google.com/forum/?fromgroups#!forum/Maryland_Streams) and a Facebook page. MSRA sponsors three to four seminars and field tours each year. MSRA participates on the steering committee of the biennial Mid Atlantic Stream Restoration Conference.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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SUBJECT: Comments on "Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects –Final Report", December 17, 2012 — February 1, 2013

FROM: Jessica Martinsen, Environmental Assessment and Innovation Division DMfor JM
Dianne McNally, Water Protection Division DM

TO: Norm Goulet, Chair, Chesapeake Bay Partnership Urban Stormwater Workgroup
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Attached please find comments on the report entitled "Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects –Final Report", December 17, 2012. We are providing these comments on behalf of staff members of EPA Region III's Environmental Assessment and Innovation Division (EAID) and Water Protection Division (WPD).

As you may be aware, EPA Region III's EAID has the responsibility of reviewing Clean Water Act Section 404 permits and providing comments to and coordinating with the Army Corps of Engineers. EPA Region III's WPD oversees the implementation and enforcement of stormwater permitting programs under the Clean Water Act Sections 401and 402 in the six jurisdictions in EPA Region III. We believe that this report has a direct impact on our implementation activities and, therefore, respectfully submit these comments with the goal of maintaining strong CWA Section 401, 402 and 404 permitting programs while moving the Chesapeake Bay restoration efforts forward.

Please contact us if you have any questions or would like to set up a conference call or meeting to discuss these issues. Ms. Jessica Martinsen can be reached at 215-814-5144 or martinsen.jessica@epa.gov. Ms. Dianne McNally can be reached at 215-814-3297 or mcnally.dianne@epa.gov.

Technical Comments on "Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects Final Report December 17, 2012" February 1, 2013

INTRODUCTION

We understand and support the goal and benefits of improving stream characteristics to restore historic function and the objective of improving water quality in the Chesapeake Bay. We also understand the complexity of trying to derive values for nutrient and sediment removal. We have both technical experience and program responsibilities that directly relate to these practices. We offer the following comments from those perspectives.

Considerable effort and resources were expended to complete the Final Report. The references and detail of review is commendable. This document provides valuable information for the crediting of practices for the revision of the Chesapeake Bay Watershed Model. We have some recommendations regarding report organization, improvement and expansion of definitions, specific recommendations on appropriate project siting and monitoring, and additional science to support recommendations and conclusions. We believe that it is important that credits for nutrient and sediment removal are substantiated by science. We also recommend a strong emphasis on project proponents evaluating upland Best Management Practices (BMPs) before stream restoration, or in combination. It is unclear how proposed practices account for variation of aquatic systems and landscape positions and if restoration projects will reduced the nutrient and sediment loads satisfactorily. As the science lags behind the on-the-ground efforts of local, state and federal actions, flexibility and revisions to recommendations should be on-going. Criteria for qualifying projects, including those that reflect existing aquatic resource condition and the likelihood of success for engineered designs are important to both regulatory and non-regulatory efforts. We encourage further discussion.

We agree with the Expert Panel's observation (page 50) that the research and literature are not complete enough to provide recommendation without condition. It may be advisable to take early and cautious steps in modeling and endorsement of specific BMPs and collect the needed data (from existing or recently approved BMPs/restoration projects) to inform the model prior to a wholesale endorsement of the practices. We are concerned that making stream restoration an attractive, nutrient reduction credit practice without data to clearly demonstrate the efficacy of the practices may result in a rush to fund and construct projects that may be ineffective or deleterious to the landscape, with limited water quality improvement. We are especially concerned that in-stream projects may be pursued where upland stormwater retrofit projects should be clearly preferred.

SCOPE AND ORGANIZATION OF THE REPORT

Scope of the report

We understand that the task of the Expert Panel was to review literature relevant to nutrient and sediment removal within urban streams. However, we caution against the broad applicability of the recommendations from the small subset of available data from a limited number of streams reviewed to the entire Bay watershed.

Stream or Urban Stream: The title refers to "Stream Restoration", but the report states that the charge of the Expert Panel was to review science on nutrient and sediment removal on "urban streams". The data presented is almost exclusively for urban streams. It is unclear how this foundation can be extrapolated to the larger setting of the Bay. Given this, it may be preferable to restrict the assumptions to restoration projects seeking credit in urban areas. The definition of urban stream, as discussed below, is imperative.

It would be useful to provide data or maps that describe urban systems that are present in the Bay so that practices that apply to those systems can be better targeted. We suggest that riparian buffer enhancement for non-urban (agricultural, suburban, rural, etc) systems be weighted as well. In "Section 3.5 Effect of Riparian Cover on Stream Restoration Effectiveness", the idea of reforestation is stated, and the Panel acknowledges its significance, but it is uncertain if the potential of riparian buffers as a restoration technique for crediting in and of themselves was considered.

Promoting stream buffer enhancement for improvement of stream stability and water quality is appropriate, and well supported in the literature. Though it may be limited in the urban setting, it may have a relevant role Bay-wide. Similarly, riparian or cattle fencing projects also have demonstrated benefits. Even though projects are proposed and built in non-urban settings, the Panel did not discuss these techniques or the incremental benefits of proposed Regenerative Stormwater Conveyance (RSC) and stream restoration practices when compared to other considerations such as tilling practices, cover crops, grass filters, and other BMPs for agricultural areas.

Differentiating streams: The data describing the various types of restoration are not differentiated. As stated in Section 2.4, "The potential sediment and nutrient reduction will always differ, given the inherent differences in stream order, channel geometry, landscape position, sediment dynamics, restoration objectives, design philosophy and quality of installation among individual stream restoration projects." To reduce variability, each type of restoration should be considered separately and an interim rate should be developed for each type based on the existing data. As noted in this section (page 13), planners will need to compare and evaluate different BMP options. Without accurate data, this cannot be done and may wrongly suggest that all types of "restoration" are equal in all cases.

Upland/ephemeral channel projects: There appears to be an inconsistency in the inclusion of upstream methods. The scope of the document is stream restoration projects: it is unclear if ephemeral treatments are being considered stream restoration and why dry channel RCSs are singled out. If zero order streams are being considered, the scope of the document should mention this and also include other BMPs that could be acceptable as projects in that situation. Ephemeral streams may be considered waters of the United States and may also require necessary permits for activities impacting them. It is important to note that not all practices or in-stream work should be considered stream restoration. We strongly support upstream BMPs, though we caution that these are not typically considered stream restoration, and that any conversion of an ephemeral channel to intermittent or perennial flow is not a "restoration" of the functions of an ephemeral channel. This should be discussed to determine its status in the regulatory arena, and what conditions might be appropriate.

One page 7, one charge to the Panel is to define the proper units to report "retrofit" implementation. While upland retrofits are the preferred alternative and should always be considered as the first option in providing water quality benefits to the aquatic resources of the Bay and the Bay itself, it is unclear how retrofits are associated with stream restoration.

Organization

The discussion of whether stream restoration is a "qualifying project" is not discussed until Section 4: Basic Qualifying Conditions for Individual Projects. It seems that the issues identified in this section are critically important considerations that place limits on siting projects. These considerations may best be addressed early in the document. The second bullet under Section 4.2 indicates "Stream restoration is a carefully designed intervention to improve the hydrologic, geomorphic, water quality and biological condition of degraded urban streams, and cannot and should not be implemented for the sole purpose of nutrient or sediment reduction." This could be the definition and/or an opening statement.

In addition, we suggest that a qualifying project should meet more than one of the presumptive criteria to ensure that high- functioning portions of the urban stream corridor are not used for in-stream stormwater treatment.

TERMS AND DEFINITIONS

Urban: A clear definition of "urban stream" seems essential. The report is centered on the discussion of data from "urban" streams but urban is not defined. It would also be appropriate to define other settings in the Bay, including, for instance, sub-urban, rural, agricultural and forested.

Stream restoration: Section 2. The definition for "stream restoration" should be consistent with that typically understood for restoration. Those who define ecological restoration may cite or base their definition on the National Research Council's "Restoration of Aquatic Ecosystems" (NRC 1992) and/or EPA's "Principles for the Ecological Restoration of Aquatic Resources" (USEPA 2000). NRC defines restoration as the "return of an ecosystem to a close approximation of its condition prior to disturbance" and stated, "the term restoration means the reestablishment of pre-disturbance aquatic functions and related physical, chemical and biological characteristics. The USEPA document states "restoration is the return of a degraded ecosystem to a close approximation of its remaining natural potential." Enhancing a single function--possibly at the expense of others--has not traditionally been viewed as restoration. Stream restoration should be defined, and it should be clear that the proposed projects for credit actually meet the definition. In addition, we also recommend that consideration be given to the definition and requirements of stream restoration used in the regulatory arena.

We recommend considering the EPA document *"Principles for the Ecological Restoration of Aquatic Resources"*. This document lists the basic principles of restoration to help build on lessons learned and promote effective aquatic resource restoration projects. The principles are: Preserve and protect aquatic resources; Restore ecological integrity; Restore natural structure; Restore natural function; Work within the watershed/landscape context; Understand the potential of the watershed; Address ongoing causes of degradation; Develop clear, achievable and measurable goals; Focus on feasibility; Use reference sites; Anticipate future changes; Involve a multi-disciplinary team; Design for self-sustainability; Use passive restoration, when appropriate; Restore native species, avoid non-native species; Use natural fixes and bioengineering; Monitor and adapt where changes are necessary. (This document is found at http://water.epa.gov/type/wetlands/restore/principles.cfm) The panel should consider how their recommendations fit within these already established restoration principles.

NEED FOR SCIENTIFIC FOUNDATION

(1) We are concerned that the necessary scientific information upon which to base a credit system on a wide range of stream resources throughout the Bay watershed is not yet available. It is not stated how the Panel or team tasked with following up and implementing accounting and modeling will explicitly monitor the results, especially in reference to nutrient assimilation and transportation. There are many assumptions in the present state of the science.

(2) The specific conditions and make-up of floodplains, hyporheic zones, etc are variable, and will show a large range in function depending on the specific locations. It is of concern that this variability is not accounted for by credit allocations or model parameters. The great variability in denitrification rates calls into question the decision to use one uniform removal rate for the credit system for all streams.

(3) It appears that the original nutrient removal rate (Table 1) was determined from one restoration site in Baltimore County (Spring Branch) and that the rate was not consistent during the period of study. Is the value selected statistically useful to employ on a large scale?

(4) As detailed in "Section 4.4 Applicability to Non-Urban Stream Restoration Projects", while the Panel recognized the shortcomings, they, nevertheless, applied the same removal rates of urban streams to non-urban streams. Given the complexity of understanding nutrient dynamics, we suggest consideration of including a separate removal rate instituted for non-urban streams.

(5) Protocol 3: Floodplain reconnection volume, in itself, seems to be difficult to quantify. Adding the estimate of nitrogen and phosphorus removal compounds that difficulty We suggest that continued efforts be undertaken to assure that these numbers are reliable, and that monitoring be instituted to determine if the BMP is achieving the designated removal rates and volume. Additionally, the report states, "The floodplain connection volume...afforded by a project is equated to a wetland treatment efficiency." It is not clear how the scientific literature does supports comparing these two areas so closely.

Based on these uncertainties, we suggest further controlled testing to add support to defined crediting. We understand a verification process has been established for untested or unsupported BMPs. We believe that stream restoration projects may need to utilize this or a similar verification process, especially as individual stream restoration projects can vary so widely.

We are concerned that modifications to streams to enhance uptake may cause loss of current function or conversion of system aquatic systems. We are also concerned that RSCs may be included as stream restoration techniques.

The report does not seem to fully appreciate the importance of functional uplift with regards to stream restoration and, at times, focuses on utilizing waters of the U.S. as stormwater management BMPs. We believe that stream restoration should strive to reestablish the stream to the extent practicable to its pre-disturbance aquatic function and related physical, chemical and biological characteristics. Focusing a single function of the stream at the potential expense of other functions may yield overall degradation of waters of the U.S.

The Panel concluded that wet channel RSC systems were a stream restoration practice. We do not understand the basis of that conclusion. Based on the information available and the report itself, this method does not actually appear to restore stream functions to a near pre-disturbance state. On the contrary, the practice can impact stream flow, nutrient and sediment transport, as well as other important stream functions and may adversely impact aquatic biota to achieve the limited purposes of reducing nutrient (nitrogen and phosphorus) and/or sediment loads.

One of the studies cited in Section 3.1 is Filoso and Palmer (2010). The conclusion section of the study states that RSCs remove nitrogen but "at the expense of losing some of the fundamental functions" of stream ecosystems. It further states that implementing watershed-scale BMPs. such as improved stormwater infrastructure, are more likely to promote nitrogen removal/retention under stormflows than channel projects. The actual language of the study follows:

> *"Despite evidence from our study that only some restoration projects are effective at reducing the export of N in urban/suburban streams, we have shown that load-reduction efficiency can be obtained, especially if restoration reduces the export of N during high water conditions. However, in order to compensate for the increasing pace of anthropogenic N inputs and the concomitant loss in the capacity of N processing in the drainage area (Bernhardt et al. 2008),* ***streams may need to be increasingly manipulated or highly engineered to manage high N loads, at the expense of losing some of the fundamental functions associated with stream ecosystems. Thus, innovative projects such as those implemented at WIL and HBR could be implemented to reduce N flux in lowland areas if it is acceptable to convert them to dramatically different ecological systems (i.e., more like created wetlands than restored streams)*** *(emphasis added). While it remains to be tested, such designs may have limited effectiveness in the uplands unless increases in hydraulic retention are sufficient to remove not only N inputs from upstream but those from groundwater and lateral inlets. It is more likely that success will come from preventing excess N from being loaded into the stream channel in the first place by restoring the riparian vegetation and implementing watershed scale best management practices such as improved stormwater infrastructure. These actions are more likely to promote N removal/retention under stormflows than channel projects."*

In addition to the above, the study also concludes that "[w]hile streams are part of a continuum on a drainage network, restoration is largely implemented in stream reaches as isolated units, where the proximity and magnitude of sources to the restored reach are ignored. Using a combination of approaches that target the source of the problem (i.e., lowering N inputs to the watershed and subsequent delivery to streams) will in the long run be much more likely to provide nutrient reduction and other restoration benefits than focusing on restoring streams one reach at a time."

In "Section 3.3 Internal Nitrogen Processing in Streams and Floodplains", one referenced study suggests the installation of small dams to create "dentrification hotspots." It is unclear if the Panel wanted to explicitly adopt this measure, as building dams presents its own series of potential issues, including flow modifications, accumulation of sediments, effects on wildlife and aquatic biota, etc. These issues should be addressed in the document.

<u>Need for detailed monitoring and use of current projects to assist data collection</u>

We strongly support the Panel's recommendation that baseline monitoring and post construction monitoring is necessary to learn from these projects. We believe that project design, funding, and construction should incorporate monitoring from the outset. We believe it is imprudent to assume credits are appropriate based on a visual inspection alone of the physical integrity of a design without determining the actual nutrient and sediment removal of the project.

In "Section 7.1 Basic Reporting, Tracking and Verification Requirements", it is stated "The installing agency need to conduct inspections once every 5 years to ensure that individual projects are still capable of removing nutrients/sediments." While acknowledging personnel and funding are limited, we believe that inspections, perhaps limited in scope, should be more frequent in this 5-year period; perhaps annually or after significant storm events. If projects fail in their first 5 years, there will be a better understanding of at what point this took place and how to best to apply lessons learned in future proposals. In addition, if remedy is required due to a failure, it is important to address in a timely manner to minimize unintended impacts. Verification of credits should be tied to more robust post construction monitoring that includes clear measurable or observable criteria.

Section 7.1 also notes that if a project 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. We suggest a shorter time period for compliance. A project failure may have implications upstream, downstream and on the aquatic habitat. Stream restoration projects should include appropriate monitoring and maintenance and or adaptive management plans that will address issues in a more timely fashion.

A draft copy of the report, dated August 31, 2012, included a "Section 7.2 Special Pre and Post Construction Monitoring Requirements". The items listed in this previous Section 7.2 are basic enough that they should apply to every project. We recommend that this more detailed description be included in the report as it is useful for practitioners to have an idea of the scope of monitoring that should be and may be required by other agencies, including regulatory agencies.

In almost all cases, more rigorous, consistent data collection should be required to demonstrate that the projected benefits are realized and to assure cross project comparisons. Defining success criteria is an important step. More detailed monitoring should be required in order to demonstrate that the proposed credit is warranted. We believe that detailed monitoring should at least include Index for Biotic Integrity (IBI) scores, as well as habitat (i.e., Rapid Bioassessment Protocols, or RBP), and chemical parameters, along with stream stability factors.

Upfront or baseline monitoring is also important to better understand the condition and functions of the stream proposed for restoration. This monitoring will also help demonstrate that the geochemical environment is appropriate for nitrogen reduction. The designer of the restoration needs to consider the redox chemistry in these systems. This should include understanding both the abiotic reduction of N and biologically mediated reactions with N, which can affect nitrogen solubility and mobility. These reactions can be complex and knowing whether the system is oxic or anoxic would be important. The pH of the systems should also be considered. The presence of oxidizing or reducing agents other than oxygen (e.g. iron) would also be important.

OTHER SPECIFIC COMMENTS

It is unclear why 19 referenced articles from the August 31, 2012 draft report were removed from the final version of the report. Some of the references were helpful in the balance of the professional discussion on stream restoration.

Section 2.2: Stream Restoration Definitions:

- Page 9: Floodplain Reconnection Volume: the first sentence does not seem appropriate for a definition as it assumes a benefit. The phase is a unit, associated with volume of water.
- Page 9: Functional Uplift: should add: ***and / or*** to the list of functional attributes.

Section 2.4: Derivation of the New Interim CBP-Approval Rate

- On Page 13, it states that local watershed planners will often need to compare many different BMP options within their community. This point is crucial, as this comparison between BMPs is necessary to even determine the proper stream restoration technique and where stream restoration should be most appropriately constructed. This statement calls out specifically "local watershed planners" While local watershed groups may have some influence on the BMP selection and implementation process, the state's Phase I and Phase II watershed implementation plans (WIPs) have requirements at largely a county level, including some specific requirements for certain state agencies, for example Department of Transportation (DOTs). It would be helpful to clarify in this document the intended audience, as well as to address the unit or scale of implementation that is required by the WIPs.
- The document (on page 28) addresses project designers, which seems to refer to stream restoration practitioners. While stream restoration practitioners and designers may be involved in the design of certain stream projects, they should be distinct from funding sources or those involved in the selection process.

Section 2.5: How Sediment and Nutrients are Simulated in the Chesapeake Bay Watershed Model (CBWM):

- On Page 14, we suggest defining size of watershed in discussion of model where ever possible.
- On Page 14 and elsewhere, the report does not discuss the implications that a stream function includes sediment transport. Some reaches of stream are transport reaches, others are storage reaches. How is this addressed in restoration and credit for increasing storage? Has there been evaluation of the potential consequences of creating "sediment starved" streams and channel erosion to be pushed downstream?
- Does "urban" imply municipal separate storm sewer systems (MS4) counties? Defining urban in this document is important.
- The description of CBWM assumptions of sediment load/loss at "edge-of-field"/"edge-of-stream input" is difficult to follow and could be better clarified.
- On Page 16, please describe what is meant by "both types of urban land".
- On Page 16, who determines "regional adjustments factors and reductions due to presence of BMPs"?
- On Page 16, we suggest that to adequately model stream restoration, the detailed information about an individual project is necessary; this necessitates baseline data/verification.

Section 2.6: Stream Restoration in Phase 2 WIPs

- The limitations of the modeling and science require that strategies be revisited or conditioned until better modeling and data are achieved. The Panel suggests a "trial" period for any changes to the input credits, however, beyond this period of time, more frequent check-ins may be necessary to adaptively adjust to on the ground results and additional modifications may need to stay on-going.

- We have concern about one project qualifying for multiple credits. As a project can qualify for credits under different protocols, there may be an unintended opportunity for overstating the benefit of a project, particularly if there is probability that projects will be only partially successful. This is of concern especially as monitoring to determine improvements in system chemistry may not be occurring; the physical stability may not infer success in nutrient uptake.
- Palmer et al (2007) states that channel reconfiguration and other engineering projects should be the last resort. Additionally, this article proposes that stream restoration projects only truly find their value in enhancing the watershed as a whole, engaging multiple stakeholders, and in the restoration of the ecology of the stream. Therefore, the stream should be well understood, project goals should be clear, and funding for post-monitoring should be readily available.

Section 3.1: Measurements of Nutrient Flux at the Stream Reach Level

- On page 19, there is mention of 'upland streams', please provide a definition for this term.

Section 3.3: Internal Nitrogen Processing in Stream, Floodplains and Wetlands

- Manipulating stream form to reduce flow velocity and depth for the purposes of possible nutrient removal (as with some BMPs including RSCs) may be risky as they can result in the loss of stream functions with the uncertain gain in nutrient processing.
- Increasing the retention time in floodplain wetlands may result in an adverse effect on existing wetland hydrology or vegetative community. It is important to recognize that the conversion from one wetland type to another can have regulatory implications and, in certain cases, be categorized as an impact.
- The Panel's identification of factors to promote dry weather nitrogen reduction, such as sand seepage wetlands, need further study to determine efficacy and trade-offs.
- Please provide a definition for sand seepage wetland. It is important to consider the source of the nutrients, i.e. nitrates. Failing or leaking sewage systems may be a significant source of nitrates. Therefore, it may be appropriate to focus on streams that are impacted by sewage first and address infrastructure improvement to reduce exfiltration and pipe leakage.
- It is important to be cognizant that "restoration" in streams and floodplains with high surface area to depth ratio (page 22) likely promote change in function and service of existing ecosystem or possibly lead to inappropriate channel dimensions.

Section 3.4: Nutrient Dynamics in Restored Palustrine and Floodplain Wetlands

- The document should clarify whether its purpose is to solely address streams or if it was also intended to address wetland practices as well. It would be helpful to note if another similar panel or other entity would be addressing wetland crediting.
- This section notes that restored wetlands have significant potential to remove nutrients and sediments. As wetlands often remove these pollutants better than streams, we suggest additional wetlands restoration, perhaps in lieu of miles of stream restoration projects may be appropriate in the WIPs. We suggest that a hierarchy be developed to ensure that the most efficient restoration and proven techniques are clearly laid out and selected.

Section 3.5: Classification of RSC Systems

- Page 23: With respect to the discussion of Dry channel RSC, we believe that if a dry channel is really ephemeral, which could be determined a water of the U.S., it should not be used for stormwater treatment. We raise concern that dry channel RSCs do not always provide "safe on-line conveyance for the larger storm events", as failures have been recorded on several projects. In-line practices are discouraged; stormwater BMPs should be located to the extent practicable in uplands.
- It would be helpful to clarify the purpose of 'wet channel RSC systems', as it is not clear that this practice restores or improves streams. We raise concern that this section lacks the peer-reviewed research and scientific literature that is referenced in other sections. If insufficient peer-reviewed studies exist, this practice may need to utilize the non-approved BMP verification process/methodology.

Section 3.6: Effect of Riparian Cover on Stream Restoration Effectiveness

- On Page 24, we raise concern that the construction of RSCs (as well as some other designs) often disturb, degrade or eliminate the riparian cover within the project area. As the Panel references, this deteriorates the aquatic system and protections to preserve this area should be incorporated. Though the Panel states that the debate over functional uplift associated with restoration is outside their charge, it is important to be cognizant of the frequent need to demonstrate such when being considered in the Section 404 permitting context for projects in waters of the U.S.
- Though the Panel suggests that re-establishment of riparian cover should be included, it is of concern that some designs are for wetland meadows and, therefore, forest cover does not return.
- Orzetti et al (2010) documented a litany of benefits associated with a healthy riparian buffer: trapping or converting up to 75% of nitrogen and 70% of phosphorus from nonpoint source runoff, sediment loads reduced by as much as 50-80%, enhanced habitat for stream organisms by shading stream reaches, stabilized streambanks and in-stream substrate, providing in-stream wood, and contributing terrestrial plant and animal carbon to the stream food web.
- Richardson et al (2011) only saw water quality improvements after the full suite of riparian floodplain, treatment wetland, and storm water/ wetland pond were constructed. The study suggests that there is indeed a strong potential for water quality improvements; however, judging by the study, there is a strong cost attached in terms of pre and post-monitoring as well as engineering and hydrological considerations of the reach and its watershed.

Section 3.7: Longevity of Stream Restoration Practices

- Page 25-26: Please consider providing the recommended changes in design guidelines of the referenced studies; our understanding is that the studies present risks of stream restoration in urban waters.
- Verification of projects is essential, but there is uncertainty in how this is being performed and risk that credits are issued where projects are not functioning as designed.
- What should be done with failed projects? Will credits need to be eliminated? Removal of the structures may be required. It is possible that sediment and nutrients that may have been temporarily removed will become a new source.

- Defined success criteria should be required for each stream restoration project in order for that project to receive credits. These success criteria should reflect real world challenges of completing successful stream restoration.
- Suggest that post-project monitoring be required for a minimum number of years.
- Section 3.7 references several studies (e.g., from North Carolina) that were conducted outside of the Chesapeake Bay Basin and may not accurately reflect land use and other characteristics of the Bay watershed, especially as most of this document focuses on 'urban'. It is beneficial to discuss how the conclusions of the studies are appropriate and applicable to the Bay.

Section 4.1: Basic Qualifying Conditions for Individual Projects

- One of the qualifying conditions for acceptable stream restoration credit includes 'special consideration is given to projects that are explicitly designed to…and in stream habitat features'. Clarify what kind of special consideration will be given and by whom. This point calls out in-stream habitat features, which are key features of stream restoration that are not captured by nitrogen, phosphorous or sediment removal. We raise concern that practices that could reduce nitrogen, phosphorous or sediment do not necessarily lead to improved in-stream habitat. Additionally, we raise concern over projects that reconnect floodplain or create wetlands at the cost of removing forest or altering existing wetland hydrology.
- It may be preferable to assign a "discounted" rate for removal rate as there is considerable uncertainty including concern about success of projects, determination of specific removal rates, and monitoring that is being done by project proponents to determine removal efficiency. Alternatively, it may be necessary to derive a method of providing credits on a case-by-case basis. As the Panel suggests testing protocols for a six month period, we suggest that alternative methods for credit allocation be studied.

Section 4.2: Environmental Considerations and 404/401 Permits

- We strongly appreciate the inclusion of this section, and recommend that Section 4 be moved to the beginning of the report. It would be useful to expand the discussion of upstream alternatives and criteria for qualifying projects prior to addressing how to work in streams.
- Page 27: We recommend restoring the information from the August 31, 2012 draft report regarding the point in the Bullet starting with "In general, the effect of stream restoration…". The sentence: "Therefore, applicants should demonstrate that meaningful upland restoration practice and /or stormwater controls are being coincidentally installed" should be put back in the report. This is a key point that cannot be stated enough.
- Are credits awarded after post-construction success is demonstrated or before?
- The goal of stream restoration is to develop a system that is self-sustaining; therefore, maintenance needs should be minimal and design should be self-sustaining. We understand the need to include verification, but the idea should not inspire designs that require substantial maintenance to function. It should be noted that not all in-stream work can be classified as stream restoration, and that certain projects may constitute adverse impact and, therefore, require compensatory mitigation.
- This section states that a qualifying project must ensure that high-functioning portions of streams are not used for in-stream stormwater treatment. We find the list of criteria a valuable starting point and would like to discuss this approach further. However, it should be noted that no portion of stream, regardless of function, should typically be used for in-stream stormwater treatment.

- One bullet suggests that projects should be directed to areas of "severe stream impairment". Some agencies that have WIP requirements have already begun to discuss stream restoration citing requirements with local, state and federal resource agencies that may not be in these streams. It should not be assumed that completing work in these streams will automatically meet WIP requirements.

Section 4.3: Stream Functional Assessment

- The final report removed the explanation of the steps listed. We believe the details were useful and should be returned. In addition, we recommend that restoration objectives specify that performance standards and project goals be included as a need in development of the project.
- We recommend returning the sentence suggesting use of reference reaches from the August 31, 2012 draft document into the report (page 27).
- We suggest including at least the EPA Rapid Bioassessment Protocol (RBP) assessment and/or relevant state functional assessment methodologies.
- We suggest expanding the first bullet to add 'in order to meet WIPs'. We suggest expanding second bullet to add 'for universe of projects being done in order to meet WIPs'. We suggest adding a third bullet 'compare variety of all techniques that could be used to meet WIP'. It is important to keep the purpose and need for the proposed action in mind, as this is essential when evaluating a range of alternatives.

Section 4.4: Applicability to Non-Urban Stream Restoration Projects

- Why weren't fencing projects considered for removal credits?
- The first paragraph notes data limitations. Shouldn't the lack of data and research point to the need to use the non-verified/approved BMP method, which would require that projects in this category have additional baseline monitoring and documentation to demonstrate the proposed technique will have the desired and stated benefits?
- This section includes a short list of projects that would not quality for non-urban stream restoration credit. It seems necessary for a similar and possibly expanded list of projects that would not quality for urban stream restoration credit or even a project list that could not achieve credits under urban and non-urban.
- Provide a definition for "non-urban". Is this based on percent impervious, land use characteristics, or MS4 designation?

Section 5: Recommended Protocols for Defining Pollutant Reductions Achieved by Individual Stream Restoration Projects

- As stated earlier, we express concern about additive credits using each protocol.
- The equations are missing from the copy available. Please provide.
- Mulholland et al (2009) highlights need for additional work in understanding the denitrication process at work, not just in agricultural streams, but also in suburban-urban and unaltered streams. The great variety in denitrification rates calls into question the decision to use one uniform removal rate for the credit system for all streams.
- For Protocol 3 (reconnecting floodplains), the Panel used a CBP Expert panel from the past to draw up a nutrient reduction rate. Originally, it was meant to be for wetland restoration projects in primarily rural areas. This cites the Jordan (2007) source, which formed the basis of this protocol. There seems to be a clear mismatch between urban floodplains and rural restored wetlands.
- Flores (2011) reveals that the design material and plans for these BMP's are supposed to be specific to the coastal plain environment of Anne Arundel County, but the document

admits that the great majority of their research is based on stream research in the Piedmont. Therefore, there appears to be a potential mismatch between BMP applicability and researched area.

Protocol 1 Credit for Prevented Sediment During Storm Flow

- We understand that bank stabilization may be very useful to reduce additional sediment from entering stream systems. It is uncertain if many stabilization methods do not just move the erosional force/problem to another location on the stream. Should be combined with addressing upstream source of the problem, often flow velocity from impervious surface.
- Wenger et al (2009) cautions against reach-scale restoration as possibly symptomatic of what could be a larger catchment-wide issue. While there have been success stories, most are not properly monitored (i.e., monitoring indicators and thresholds for action). Also, this article again pointed to questions surrounding nutrient uptake and denitrification in streams, the variability of which makes any firm conclusions elusive.
- It is not clear if the Panel is recommending that the "Bank Assessment for Non-Point Source Consequences of Sediment" (BANCS) method be used to compute a mass reduction credit for prevented sediment or if they are promoting that it be used to prioritize stream restoration sites. We express concern that if only prevented sediment loads are used to prioritize potential stream projects than other key stream functions and habitat features may not be considered or decrease as a result of the proposed action.
- A list of consistency and repeatability improvements was given, but it is unclear who is responsible or should be responsible for ensuring that these improvements occur. Step 2- lays out default values for total nitrogen and total phosphorous based on values from one study. We express concern that this was the same study noted earlier in the document for taking place in 'non-urban' agricultural areas that may not be applicable to 'urban' streams. It appears vital that local stream bank and stream bed nutrient concentrations be justified through sampling data. We suggest a condition that this sampling be done in certain instances.

Protocol 2 Credit for Instream and Floodplain Nutrient Processing During Base Flow

- The literature support for the Hyporheic Box should be included in Protocol 2. Though the concept is clear, the rationale and support for specific dimensions is not supported.
- It is a not clear what specific BMPs are recommended to achieve improvements for nutrient processing in the Hyporheic zone.
- The protocol appears to lack a discussion of variation with substrate, gradient, vegetation, stream velocity, etc which would be critical in determining removal rate.
- Protocol 2 (page 34) raises a number of questions. The stated purpose of the protocol is to determine credit for in-stream and floodplain nutrient processing during base flow "where in-stream design features are incorporated to promote biological nutrient processing" as well as in the floodplain. However, the information provided does not make it clear that the approach used is valid.

Protocol 3 Credit for Floodplain Reconnection Volume during Storm Flow

- As noted in comments on Protocol 2, there is a need for scientific foundation in the development of the protocol.
- We recommend providing the sources for curves (e.g., Figures 4, 5 and 6, as well as figures in the examples).

- Nutrient and total suspended solids (TSS) load variation should be stated and we suggest; discussion of consequences of over or under-estimating load in model, which could be likely under different stream conditions.
- Protocol 3 (floodplain reconnection volume during storm flow) is based on Jordan (2007). But Jordan (2007) seems to be based very much on assumptions and models, as much as the article also tries to establish caveats and state that conditions vary widely amongst wetlands. Even if the floodplain wetland is restored, how long will it be viable, and how will the nutrient uptake efficiencies change over time? Why does the panel think a restored floodplain connection will function the same as a restored floodplain wetland?
- Is equating a floodplain reconnection volume to a wetland removal efficiency justified?

Protocol 4 Dry Channel RSC as a Stormwater Retrofit

- As mentioned earlier, we question whether retrofit is stream restoration.
- As mentioned earlier, we question if ephemeral streams should be used for stormwater Management.

Section 7: Accountability Mechanism

- Regarding Removal credit/Verification/Ongoing field verification, as stated above, there is strong concern about a visual inspection being adequate to conclude project function. Restoration objectives need to have specific success criterion, including showing functional uplift.
- As stated earlier, we recommend including Section 7.2 Special Pre and Post Construction Monitoring Requirements from the August 31, 2012 draft document, as stated above.
- This section states "Stream restoration projects are different compared to urban BMPs, in that permit authorities often subject them to more extensive pre-project assessment and post-construction monitoring." It is true that BMPs constructed in uplands may not require as much assessment and monitoring--these projects do not impact waters directly and usually do not require 404/401 permits. In many cases, BMPs constructed in uplands or floodplains are preferable to in-stream work.

Section 8.1 Panel's Confidence in its Recommendations

- We recommend that a work group continue to review studies and data that is being generated from current projects to inform the TMDL program and credit allocation.